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VETERINARY SURGERY

By MAJOR LOUIS A. MERILLAT, Sr., V.S., V.C., U. S. A.

VOLUME I

ANIMAL DENTISTRY AND DISEASES OF THE MOUTH

VOLUME II

PRINCIPLES OF VETERINARY SURGERY

VOLUME III

VETERINARY SURGICAL OPERATIONS

Veterinary Surgery

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SECOND EDITION

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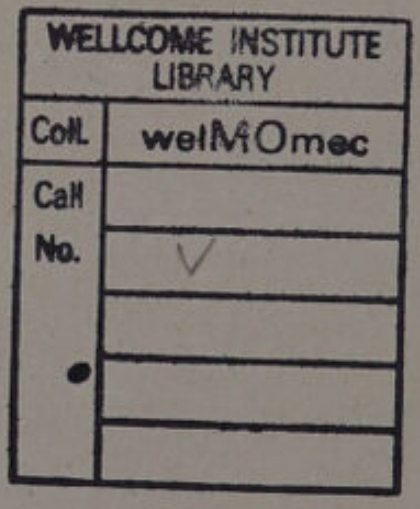

TO MY WIFE

For the inspiration and the help that has enabled me to write this book.

PREFACE TO THE SECOND EDITION

Since the publication of the first edition of this book, Veterinary Surgery has made a great advancement and the author seriously endeavored to embody the same in the second edition as far as possible. This necessitated careful rereading, errors have been corrected and all superflous matter eliminated. More than fifty new illustrations, four full page plates and about forty pages of new matter have been added while several chapters have been entirely rewritten and some of them rearranged.

The favorable reception accorded to this book by the profession, as evinced by the rapid exhaustion of the first edition, of which three thousand copies have been printed, is herewith gratefully acknowledged.

PREFACE TO FIRST EDITION

In writing this book the author has endeavored to explain in a plain manner all a student or practitioner desires to know about the veterinary surgical operations which have been tried and found useful. Untried procedures, passing surgical novelties and classical operations more picturesque than adaptable to our purpose, have been intentionally omitted. Attempt has been made to describe every phase of these useful operations in the minutest possible manner, sometimes at the risk of inviting criticism for apparently unnecessary repetitions. The fact that knowledge of minor details of surgical technique is indispensable to the successful practice of surgery was kept prominently in mind throughout. The methods of performance are those used in our daily work; the conclusions as to the usefulness of the operations are the resumé of our own observations; and the accidents and untoward results are records of actual events.

If it had not been thought more confusing than instructive, and if space had permitted, the opinions and modern methods of others would have been described. The reader is invoked not to interpret this apparent display of conceit as entirely a matter of choice, since the capacity of the volume is already overtaxed.

The illustrations are from photographs taken specially and at random by my colleague, Dr. H. E. Torgeson, from original drawings and from copies obtained by Mr. Eger from the various sources mentioned in the descriptions.

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INTRODUCTION

CARDINAL

1. THE SURGEON'S CARDINAL ATTRIBUTES.—In diagnosis, in preparation of the patient, in performance of the operation and in the post-operative treatment, the careful, painstaking, methodical and studied execution of minute details is consecrated as an absolute law by the experienced surgeon. **Theoretical knowledge, inventive genius** and **practical adaptability** are resources par excellence, but of all these various attributes heralded as essential to success in surgery, **attention to detail** stands conspicuously first. The surgeon who has animals for his patients might also profitably possess the **health of an athlete**, the **strength of a giant**, the **manipulative dexterity of a magician** and **the skill of an artisan**, and as Moller once so aptly expressed it, "He should know how to deport himself in the pig-sty as well as in the parlor."

He will need, also, a keen, almost unerring judgment that will enable him to arrive at correct conclusions, or at least render sane decisions under all circumstances; and while his disposition, owing to the nature of his calling, should be bold, firm and even aggressive, he should display at all times an unaffected abhorrence against the infliction of unnecessary and avoidable pain. His mind must be clear, active, vigilant and resourceful; his temper cool and always under perfect control; and his ambitions for material gain should be constantly overshadowed by an unselfish desire to relieve the distress and alleviate the pain of his patients in the shortest possible time and at the least possible cost.

To qualify for a veterinary surgical practice **a competent knowledge of animals in general** is indispensable. Proficiency in **comparative anatomy, comparative physiology** and **comparative pathology** is not sufficient; a thorough understanding of the habits, the customs, the susceptibilities, the immunities, the endurance, and in fact all of the peculiarities of the different species and of the various breeds should be included in his budget of knowledge.

Personal cleanliness can not be ignored with impunity in the practice of veterinary surgery. The dirty nature of the pursuit is all the more a reason why the animal surgeon should be an habitually clean man, for is there not always

danger of conveying infections to self or patient with the unclean hands and contaminated fomites? Daintiness and fastidiousness are not insisted upon; in fact these qualities, in the eyes of the rural American, usually discredit the practitioner; but the effect of good, sensible efforts in this connection invites personal respect, promotes professional dignity and is manifestly influential in the prevention of wound infections. Clean hands, clean nails and clean clothing are needed in wound therapy, even if the personal appearance is deemed less important.

2. **THE SURGEON'S EQUIPMENT.**—It would require too much space to enumerate all of the instruments, tools, dressings, drugs and paraphernalia needed in veterinary surgery. Let it be known, however, that **an inadequate equipment is a serious obstacle to a veterinary surgeon's progress.** In fact, no man of intelligence and integrity would assume the responsibilities of important operations without a good and sufficient means of performing them. The possession of a well-equipped and well-kept hospital should be the first ambition of every practitioner, and the field and stable surgery should, as far as possible, be renounced for the more thorough nosocomial operations. Although at this day the rural veterinarian is generally required to bundle up his surgical appurtenances and proceed to his patients to perform his operations, much of this arduous and often unsatisfactory work could be avoided by constantly displaying the advantages of a well equipped operating room and hospital. Perfunctory, out-of-door, barn-yard or stable operations degrade animal surgery, while the operating-room procedures of high order, no matter how simple, promote the art of surgery by leaving lasting impressions of its importance and a higher appreciation of the results.

A small, compact and handy hospital is preferable to the large, roomy, barn-like affair whose ground value, cost of construction, and, especially maintenance, is out of proportion to the profits of the average veterinary practice. The more prominent urban practitioners may profitably support large establishments with their retinue of expensive attendants, but the rank and file will find more profit and much more general satisfaction in a hospital of small dimensions. Whatever may be regarded as the proper general arrangement and space allotment for the accommodation of the different species of animals and for the different diseases (the discussion of which would be out of place in a surgical work) an area of not less than 25x25 feet should be given exclu-

sively to the surgical "work-shop." An area of 30x30 feet or 25x35 feet would be still more desirable, as it would allow sufficient room for the construction of a stocks (which the reader will notice is wanting in Fig. 1) and more space could be allowed between the walls and two sides of the operating table; but an area of still larger dimensions would contain superfluous space.

The floor material is of wood, planed and calked or of

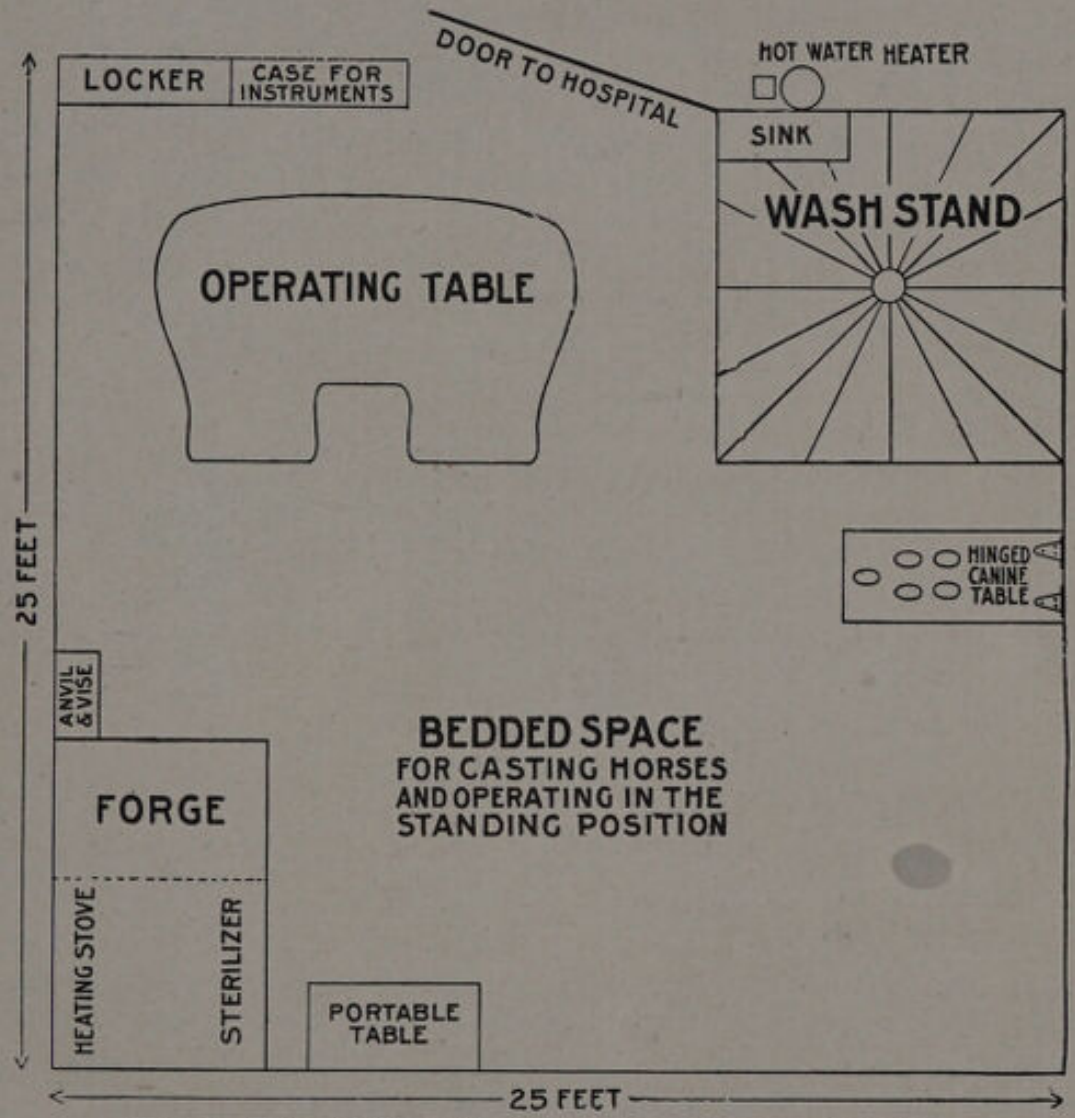

Fig. 1—Plan of Operating Room and Appurtenances.

creosoted blocks. Cement, which is possibly more sanitary, is positively hazardous in an operating room where decrepit horses, often hopping on three legs, must be handled. Its slipperiness and hardness condemn it as unsuited for the purpose, and besides it produces an uncomfortable state of humidity, chilliness, and coldness that can not be overcome except by constant artificial heat and excessive ventilation.

The wash stand at one corner, with its beveled floor leaning toward a central sewer connection, and with its hot and cold water supply directly adjacent, is an important feature. The pre-operative preparation of the field, the post-operative cleansing of the blood-soaked surroundings of the surgical wound, and lastly the after-care of the wound during the patient's sojourn in the hospital, are carried out in this convenient space.

The horse operating table is indispensable, as it excels the other restraining apparatuses in all of the counts by which these are judged. Few assistants are required; the surgical field can be well controlled; the dangers from accidents to the horse and to the operator are reduced to the minimum; accidental contamination of the surgical wound is easily prevented; the operator's position is comfortable; and finally, the operation can be performed in a slow, deliberate, painstaking manner because there is a less formidable opposition to the restraint.

Fig. 2—Operating Table.

This apparatus occupies one corner of the area, sufficient distance from the walls to afford freedom of movements around it. (Fig. 2.)

The open bedded space for casting large animals and for operating in the standing position is also indispensable. To monopolize this precious space by placing the horse operating table in the center of the room is soon recognized as a serious error, not only because it may often be needed as a casting space when rope restraint is thought preferable, but because it affords an excellent place for all the various standing operations: firing, standing neurotomies, lancings, paring of feet, etc. As seen in the accompanying plan, this is a large square space when the canine table is turned against the wall and the portable tables are set aside. The bedding, which may be of shavings, sawdust, peat or tan bark, is spread over

the entire floor excepting the wash stand and the space occupied by the forge, sterilizer and stove, and is kept moist by an occasional sprinkling of antiseptic water. Parts of this

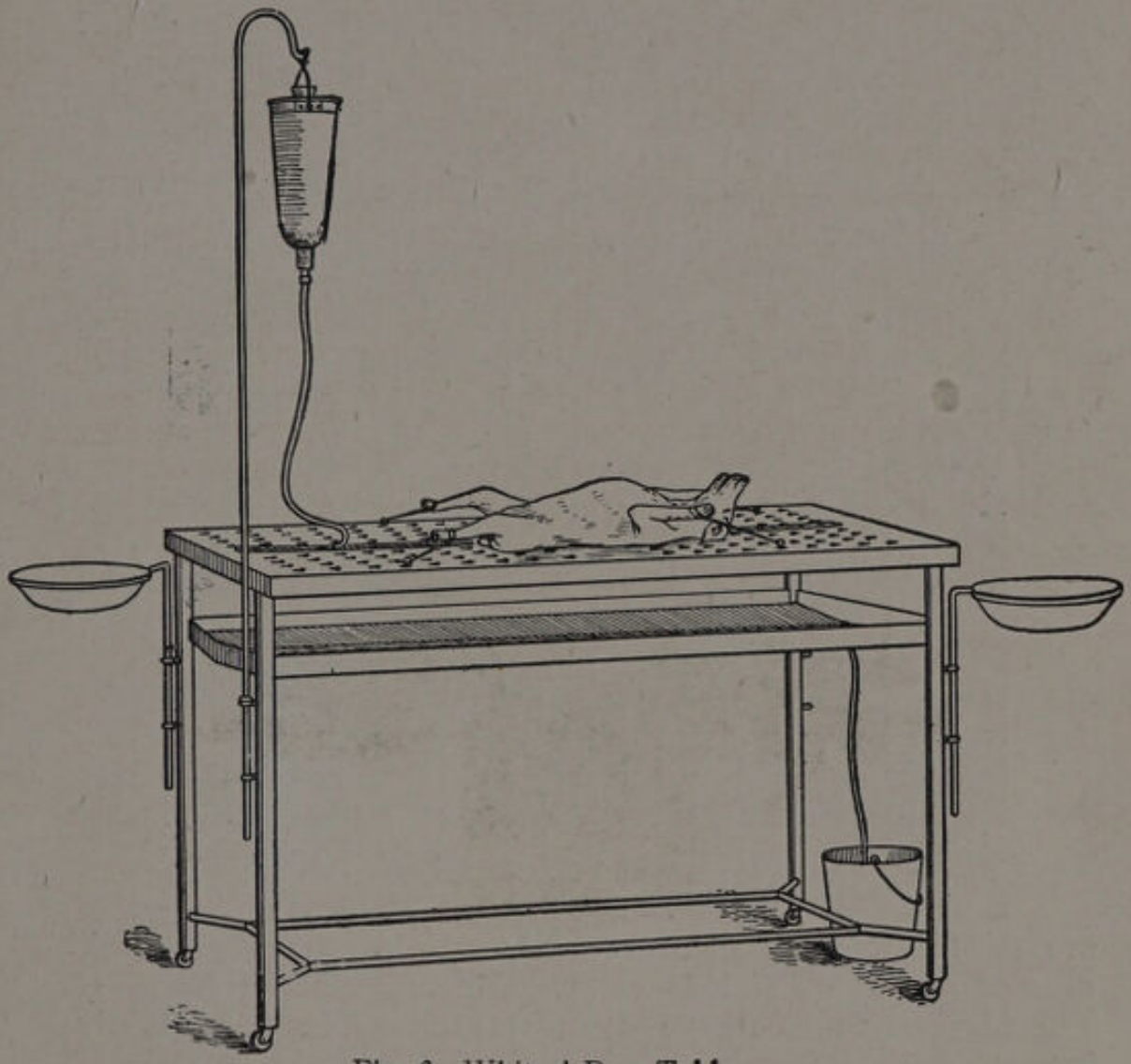

Fig. 3—Whites' Dog Table.

litter that become soiled with droppings, blood or pus are shoveled up and renewed. This plan is preferable to that of leaving parts of the floor bare, because sweeping—the most harmful practice in a veterinary operating room,—is obviated. In an operating room managed in this manner, a ray of sunlight through a window will always show a minimum amount of suspended dust.

In large establishments where the operating room is in daily use, the bedding may be omitted and the floor flushed with the hose before and after the operations have been performed. The one thing to prevent is the raising of dust by sweeping.

The canine table is a smooth, varnished board 2x4 feet, hinged to the wall, where it is fastened with hook and eye when not in use. It has two hinged legs at the free end, which drop into supporting position automatically as the table is turned downward into the horizontal position.

Forge, sterilizer and heating stove occupy a space 2½x6 feet in the corner opposite the operating table. These are elevated one foot from the floor on a cement foundation with

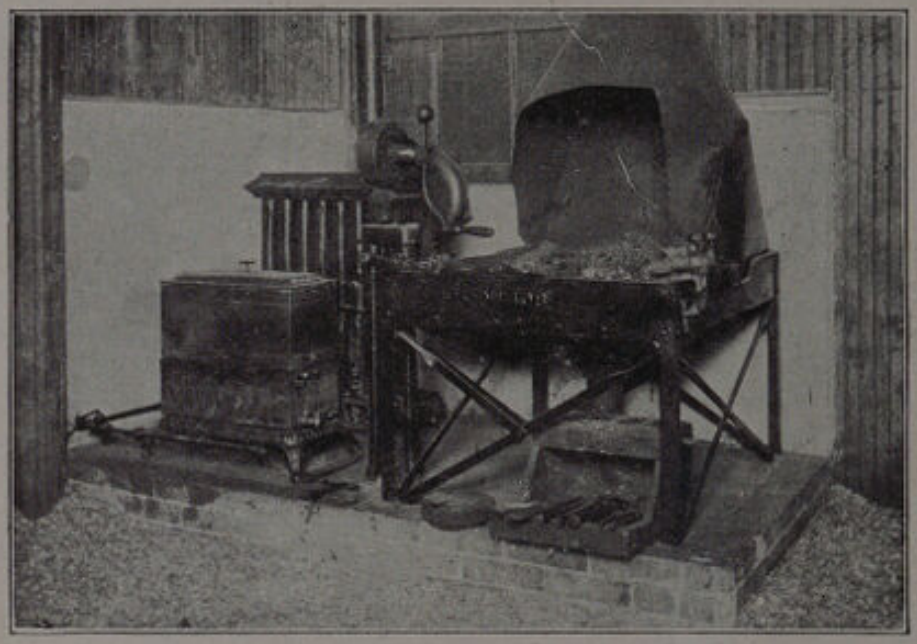

Fig. 4—Forge, Sterilizer and Heater for Operating Room.

pressed brick facing, as a precaution against accidental ignition of the floor, and especially the surrounding bedding. The forge should be a good, substantial affair, fixed solidly into the cement; or it may even be constructed entirely of fire brick, with a sheet iron hood. The position occupied by it (shown in Fig. 1) is convenient to the operating table and floor space where the hot irons are needed, and it also serves as a protection to the sterilizer and stove. **The sterilizer** may be an ordinary metal boiler in lieu of a standard surgeon's apparatus, which contains a lower compartment for boiling instruments and an upper one for steaming the dressings and drying the instruments. Any vessel in which instruments can be submitted to a good boiling will answer, but in no case should this feature of the equipment be ignored. An operating room today without a sterilizer for instruments burlesques the display of polished instruments, and discredits the whole establishment. (Fig. 4.)

The heating stove occupies the space behind the sterilizer, in a position well protected against an accidental collision with a refractory patient. The hot water heater and tank which are placed behind the washstand partition might occupy the space allotted to the stove and thus fill the double mission of supplying the hot water and the heat, but this arrangement is objected to because of the unbearable heat it produces in warm weather.

The portable table is needed as an elevated resting place for the instruments, dressings and antiseptic basins, and is carried within reach of the operator during the operation.

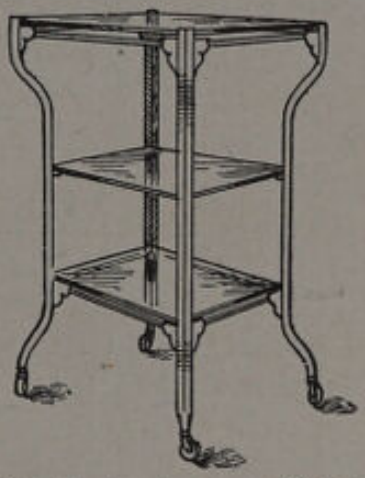

Fig. 5—Instrument Table.

The locker is needed for clothing, ropes and other more or less unsightly objects needed from time to time. The **instrument case** is supplied with shelves enough to hold all of the instruments. The small instruments are classified and kept in separate places or in separate boxes properly labeled.

The anvil and vise are not absolutely necessary, but are nevertheless handy whenever a shoe must be fitted, an instrument must be straightened, filed or curved to meet certain requirements, or to make emergent repairs of various appurtenances.

A small grind stone, an oil stone, a hone and **a razor strop** are absolutely needed in every operating room. These should be kept together in a convenient place specially assigned for them, and in view of the advantages of keen cutting knives they should be constantly utilized. The adage of the wheat cradlers of past epochs, "There is no time lost in whetting," applies here, and besides good "cradling" in the surgical field can hardly be done with dull instruments.

3. GENERAL RECOMMENDATIONS: (a) **Diagnosis.**—By artful attack of the symptoms, medical treatment

can often be carried to a successful issue without an inkling of the nature or even the location of the causative lesion. Surgical treatment, never! **In surgery an accurate diagnosis should precede all interference.** The nature, the location and the extent of the disease should be known. The physician may sometimes cunningly cover up an error in diagnosis, but the surgeon can not, because he uncovers the disease in his work or else exposes his error in the untoward results.

The prospective practitioner is first of all warned against incautious, hasty decisions. The deliberate, cautious, scrutinizing examination must prevail in order to prevent the blundering diagnosis which lead to the performance of improper, unsuccessful and ofttimes harmful operations. No precaution that may in any way improve the results of a proposed operation should be overlooked, and no avenue must be left unexplored in the examination of a surgical patient. The problems presented are often so puzzling, their presentation so deceptive and the circumstances surrounding their inception so misleading that the incautious diagnostician soon becomes fairly swamped in the consequences of his errors. He fires the spavined horse lame from a penetrant nail still hidden in the lateral lacuna of the frog; he performs neurotomy on the navicular case without having discovered the existence of a suppurating corn; he evacuates the antrum without sufficient examination of the teeth to exclude incipient decay of a molar; he leaves a foreign body in the depths of a punctured wound; he treats colic for three days only to discover when too late that the cause is a strangulated hernia; he hastily castrates an animal and learns to his dismay, by the appearance of the prolapsing intestines, that an inguinal hernia has been overlooked; in short, by his constant display of incaution he brings upon himself the everlasting censure.

The wisdom of submitting the foot to a thorough examination before deciding upon the location of a lameness, always held out so emphatically in every instruction on veterinary surgical diagnosis, is unimpeachable. But why stop with lameness? This good sound advice to **look elsewhere** applies to all diseases, and it is obeyed as an absolute law by the experienced.

And moreover, the examination must not end with the disease. The patient must be submitted to critical attention as regards age, sex, general health, pregnancy, conformation, deformities, disease of the skeleton, organic diseases, temperament, occupation and habitat. If these do not often

alter the decision to operate they do very frequently call for an alteration of the modus operandi, and must therefore never be slighted.

(b) **Preparation.**—Before performing an operation certain preparatory steps must be executed, and although their significance varies decidedly with the character and importance of the proposed procedure there is always something to do in this connection.

These steps include (1) **preparation of the patient,** (2) **assembling the equipment and sterilization of the instruments and dressings,** and (3) **preparation of the surgical field.**

(1) **Preparation of the Patient.**—This step includes chiefly dieting, purging, and starving in order to forestall the complications which arise from casting, anæsthetizing and operating upon animals whose abdomens are filled. In intra-abdominal operations its object is to facilitate visceral manipulations; in hernia it facilitates reduction; whereas in the other major operations not connected with the splanchnic cavities it prevents colic, intestinal rupture and chloroform syncope. Sometimes the opposite course must be pursued. Instead of restricting the feed the patient, on account of an existing debility, may need a strengthening and stimulating preparation for the exhausting ordeal. Stomachics, ferruginous tonics, dentistry, laxative and nutritious feeds are sometimes excellent preparatory expedients.

But aside from these, the feet and the shoeing of the patient often need attention. Even when neither the feet nor the legs are concerned in the operation it is always prudent to shape the feet or shoe them in such a manner as to make the patient's sojourn in the hospital or stable as comfortable as possible. A convalescent that must remain standing day after day is ill-prepared for the ordeal if the feet are long, unkempt or badly shod. Excellent surgical operations are sometimes turned into failures through this neglect.

2. **Assembling the Equipment and Sterilizing the Instruments and Dressings.**—The patient having been pronounced ready for the ordeal the attention is now directed to the paraphernalia that will be required to perform the operation: The restraining apparatus examined as to its completeness for the purpose; every instrument known to be required and others needed to meet suspected exigencies; the antiseptics decided upon as the best for the purpose; the sutures and needles and finally the dressings, are assembled and conveniently arranged. While this is being systematically and

thoughtfully carried out the instruments are submitted to some form of effectual sterilization. In preparing for a major operation it is sometimes no small mental task to assemble without omission every little instrument that might be required before the operation is complete, and to avoid embarrassing delays, often at a crucial moment, it is always better to assemble too many than too few. To prevent losing instruments, if not also, as in human surgery, to prevent some of them being accidentally forgotten in the splanchnic cavities, counting is an excellent practice. The lost and forgotten instruments make no trivial item in a veterinary practice where carelessness prevails.

3. **Preparation of the Surgical Field** refers to the disinfection of the spot, space or region about to be submitted to a surgical operation. In animals this includes skin, hoof or mucous membrane, but generally the former. The hairy skin of animals is an excellent harbor for microbes. It affords countless ruffles and recesses for the accumulation of dirt and is constantly contaminated by exposure to filth. Cultural experiments show that the surface, the recesses and the deepest parts of the follicles are fairly teeming with microbes and that even the underlying layers may contain them: Clinical observations as well as the bacteriological investigations indicate clearly that no perfunctory effort is sufficient to entirely dislodge them. **The skin of animals, like the hands of the surgeon, is never aseptic** no matter how thoroughly it has been cleansed, but despite this apparently hopeless situation experience shows that by **thorough disinfection and proper handling** a safe state of cleanliness can be produced and maintained in the skin of animals even better than in that of human beings. In fact, if the skin of animals around a wound or around the seat of a proposed incision is properly managed, very few infections will ever be traced to this source. Skin disinfection must either be thorough or else omitted entirely, as perfunctory lavage tends more to provoke microbian activity than to destroy it. The following steps are recommended when it is desired to take advantage of all available precautions:

First Step—A Soap and Hot Water Lavage.—The part to be operated upon is well lathered with suds, rubbed briskly for some moments with the finger tips and then rinsed off with pure water. This not only cleanses the field of dirt but also softens the hair for shaving. Around this washed area the hairs are moistened to allay dust and prevent loose hairs from flying about as the patient struggles. The amount

of surface to be thus moistened will depend upon the general cleanliness of the patient, the condition of the coat and the location of the wound. In the springtime when the hairs are shedding fast, in dusty, ungroomed patients, and in operations located where dust and hairs will readily fall into the wound, this precaution is of the greatest importance. For example, while operating upon a long-haired yearling colt for inguinal hernia during the shedding season a single struggle and a draft of air in the right direction often sends a veritable cloud of hairs over and into the wound. Such harmful consequences are guarded against in this preparatory cleansing of the field by moistening the surroundings.

Second Step—Clipping and Shaving.—The clipping, so far as the working of the clipper is concerned, is done more easily when the hairs are dry, but to prevent raising unnecessary dust and loose hairs it is postponed until the field has been washed. The clipping is necessary only to facilitate shaving where the hair is long, thick and difficult to remove with a razor. After the hair has thus been shortened with the clipper, large area which might properly be called **the surgical field,** is shaved. The dimensions of this field should exceed those actually required for the incision and sutures sufficiently to prevent invasion of the hairy surroundings with any part of the work and to provide a clean resting place for the fingers while handling the instruments. After shaving the loose hairs are flushed off.

Third Step—Chemical Disinfection.—The first effort in this direction is to submit the shaved field to a good, brisk rubbing with a solution of mercuric chloride, 1-500. The solution is poured upon the field with one hand and rubbed well with the other. The washing should continue for a few moments and end by laying a layer of cotton soaked in the same solution over the field for a few minutes longer. The cotton is then removed and the field dried by rubbing it briskly with pure alcohol.

The disinfection of the skin is then completed by painting the field with iodine in some form. Today we prefer a five per cent solution of iodine crystals in ether. When tincture of iodine is used, it should be diluted with at least fifty per cent of alcohol to prevent unnecessary irritation.

Fourth Step—After-care of the Surgical Field.—The purity of the field is maintained by drying it thoroughly immediately after the operation is complete, and by maintaining a state of absolute dryness throughout the healing of the wound. When secretions are permitted to saturate the

field, especially if covered by bandage and dressings, the microbes (which would have been innocuous in a dry environment) soon multiply and invade the wound. Bandages enclosing a skin soaked with secretions, constitute, with the warmth of the body, an excellent incubator for the microbes that might have otherwise remained harmless in the recesses of the skin.

In short, the success of obtaining and maintaining a safe surgical field in animal surgery depends upon: (1) **ridding the field of hairs by shaving**; (2) cleansing it with a strong antiseptic solution; and (3) preserving a state of dryness.

(c) **Performance.**—Although the successful performance of a surgical operation depends largely upon the proper execution of an orderly combination of minute details, these are nevertheless subordinate to certain dominating rules whose disobedience may end in serious consequences or in total failure. In this connection **restraint** and **position** occupy the first rank. It is not the danger of personal injury nor the danger of injury to the patient, but the impossibility of effectual performance without adequate restraint that renders this feature of animal surgery so important. The veterinarian who is less than an expert in securing the different species of animals and assumes the responsibilities of surgery is seldom successful. He should be perfectly familiar with the minutest detail of the various methods by which animals are **handled, secured** and **positioned** with the greatest safety to self and patient and to the best advantage for the proposed intervention. When the patient has been perfectly tied, the proper anæsthetic administered and the field brought out into the most accessible position, the operation is already more than half done. On the contrary, when the patient is badly tied, kicks with every stroke of the knife, and the field is not well exposed by reason of an improper posture, the operator is seriously handicapped and unable, except in the crudest way, to carry the procedure to a satisfactory state of completeness. In fact, young practitioners often become seriously embarrassed or even give up in despair in the midst of an operation when the only hindrance to a successful end is inadequate restraint or disadvantageous posture. (For special instructions in this connection the reader is referred to the chapter on Restraint in Vol. II., and to the paragraph on restraint accompanying the description of each operation.)

Next to restraint comes **hæmostasia** as an important feature of technique. Blood must not be shed with impunity;

every possible drop should be conserved to the patient. The loss of one to two quarts of blood to a vigorous horse (and a relative quantity in the smaller animals) is not a serious matter, but when the loss exceeds this quantity the operator must work with great caution. Blood loss plus the exhausting effect of a major operation is serious enough to the most vigorous subject, and it is positively disastrous to the debilitated. Sudden loss is much more dangerous than the gradual loss of the same quantity during the progress of a long operation, because in the case of sudden loss depreciation of the blood volume embarrasses the heart, favors syncope from the anæsthetic and is prone to end in shock. Bloodless surgery is the surgery of the day; sanguineous procedures are discredited. But it is not only from this standpoint that blood hampers the surgeon. Invasion of the body with a knife is always followed immediately by a more or less stubborn bleeding that impedes progress by keeping the foreground of the wound constantly masked. In this connection blood produces an annoying impediment that must be met effectively from the beginning to the end of the operation. Otherwise the operator is only groping in the dark throughout the entire procedure, and the quantity lost is unnecessarily great. The use of tourniquets, hæmostats, ligatures and bailing, as controls, is essential to the best results. (See Hæmostasis, Vol. II.) and is one of the most helpful if not always an indispensable element in the performance of an operation.

Next comes the matter of **asepsis.** Throughout the performance of an operation the surgeon must guard against contamination of the wound. Litter might be whirled into the wound by the patient's struggles; the hands, although previously cleansed according to standard regulations, may become soiled in ways too numerous to mention; and, finally, the instruments just out of the sterilizer can easily become dangerously infected by accidental contact with the dirty objects so numerous around a veterinary surgical operation. Warnings as to the dangers of unclean surgical methods are no longer needed; the modern veterinary student and veterinarian are wide awake to the importance of asepsis. (See Asepsis and Antisepsis, Vol. II.)

Further, there is little to say in a general way about the performance of operations; each one must be described as to its own details. It might, however, be mentioned to advantage that a surgical operation, like the execution of any important work, should be previously mapped out, planned,

and then carried out as a careful anatomical dissection. No tissue should be cut before it has been identified. With the scalpel in the right hand, the tissue forcep in the left and the assistant bailing the blood to clear the foreground the operator proceeds deliberately and incessantly, stopping only now and then to cope with a troublesome vessel, until the goal has been reached.

(d) **After-care**—The veterinary surgeon's duty does not end with the completion of the operation. The after-care must be properly planned and executed. There are no trained animal nurses except in the hospitals, and even here much must often be intrusted to attendants who have little conception of the essentials of wound treatment. The surgeon should give plain and explicit directions for the general management of the patient, and then attend to the wound himself during the critical period of the healing process. Only the simplest kind of wound treatment should be entrusted to others. Washings, syringings and irrigations done by stable attendants are always more harmful than beneficial until the wound has protected itself against infection.

The directions for feeding must not be omitted. Animals accustomed to an active life that are suddenly submitted to absolute rest frequently suffer from digestive troubles unless maintained on a restricted diet. When the standing position is ordered for some days the feet and shoeing will require attention. In the summer time flies prove exceedingly harmful in more ways than one, and should be eliminated as far as possible. Good ventilation, an even temperature, appropriate clothing and above all, a clean habitat must be insisted upon for the surgical convalescent.

CHAPTER I

SURGICAL PROCESSES—ELEMENTARY OPERATIONS

Surgical operations consist of the execution of one or more fundamental **processes** or **methods** which, either alone or combined, constitute a completed surgical procedure. The art of surgery is an execution of these processes. They are to the art of surgery what pathology is to the science. They are fundamental; basic.

The common surgical processes,—the so-called elementary operations,—are:—**Incision, dissection, ablation, resection, amputation, ecrasement, aspiration, ligation, cauterization, lancing, setoning, suturing, and firing.**

INCISION

DEFINITION.—Incision is the simple division of tissues with a sharp instrument. It is the loss of continuity with minimum injury and without loss of stubstance.

INDICATIONS.—Incision is the preliminary step of most all surgical operations, and when not constituting a complete operation in itself, it is invariably necessary to **uncover and render accessible** the underlying structures which require surgical interference. It is invariably the preliminary step of **ablations, dissections, and resections. Growths, organs,** or **parts of organs** to be ablated or resected must be first exposed by incisions through the skin and other integuments which cover them. Such an incision is called an **invading incision.** Surgical operations in which incision is the principal feature are usually designated with the suffix "otomy" after the name of the structure incised:—thus, incision of the skin is **dermatotomy,** of a tendon, **tenotomy,** of a muscle, **myotomy,** of a nerve, **neurotomy,** of the scrotum, **oscheotomy,** of a bowel, **enterotomy,** of the abdominal cavity, **celiotomy,** of the flank, **laparotomy,** etc. The great number of this type of surgical operations indicates at once the importance of incision as a surgical process; it enters into every procedure in which the scalpel, bistoury or scissors are used.

INSTRUMENTS.—Incisions are made with various cut-

ting instruments according to the character of the structure to be incised. The scalpel, with a convex edge (Fig. 6) is, however, the most common one. It is of service and generally indispensable in almost all cutting operations. Its size and length should vary according to the character and position of the structure to be incised. The medium sized one is the most serviceable for the various operations on animals. Here and there a very small one may be handy, and occasionally a large, strong one is required to divide tough, thick tissues. Handles of exceptional length are sometimes

Fig. 6—Convex-Blade Scalpel.

required to reach tissues in deep locations, as for example, operations within the larynx. The **probe-pointed, curved bistoury** comes next in importance as an incising instrument. It is used chiefly to cut outward. Its point can be passed safely and easily beneath a structure. This knife should vary in size from a thin, slender blade, cutting to the very end, to a large, strong blade with a prominent probe point, and with

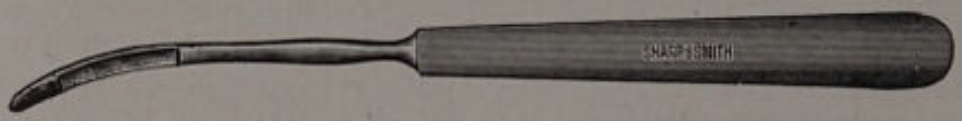

Fig. 7—Special Probe-Pointed Tenotome.

handles of proper proportions, if every demand is to be satisfied. The **tenotome** is of service in dividing muscles and tendons. It is a fine, slender blade, of very slight convexity, so constructed as to make but a small point of entrance. It is used chiefly to make subcutaneous incisions, as in caudal myotomy, and the various tenotomies. The **probe-pointed, slightly curved tenotome,** (see Fig. 7) is of great service in many subcutaneous incisions, owing to the protection it affords surrounding structures which are not to be cut. The **sharp-pointed curved bistoury,** as an incising instrument is less serviceable than the preceding knives. It is somewhat dangerous in many cases. It finds its greatest utility in lancing large abscesses located in safe positions. In the ordinary

surgical operations requiring careful dissection, it is little used. It is more of a lance than a bistoury. The **scissors,** both sharp and blunt pointed, but always curved, are especially useful in making certain incisions and dissections. The **bistoury-cache,** being provided with a protected cutting edge

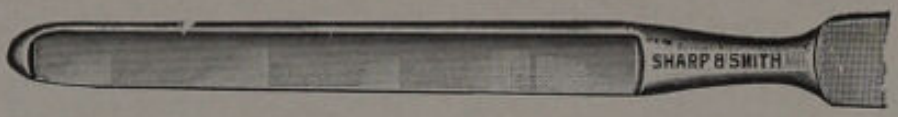

Fig. 8—Probe-Pointed Curved and Probe-Pointed Straight Bistouries.

that can be unsheathed at will, is indispensable in vaginotomy.

TECHNIQUE.—Incisions with the Scalpel.—The scalpel is held in four different positions:—(1) The **pen-holder position** with the blade downward (Fig. 11) to make incisions toward the operator. (2) The **back-hand position** with the blade downward, (Fig. 10) to make incisions from the operator. (3) The **palmar position** with the index finger upon

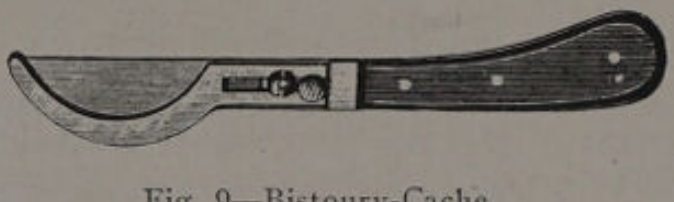

Fig. 9—Bistoury-Cache.

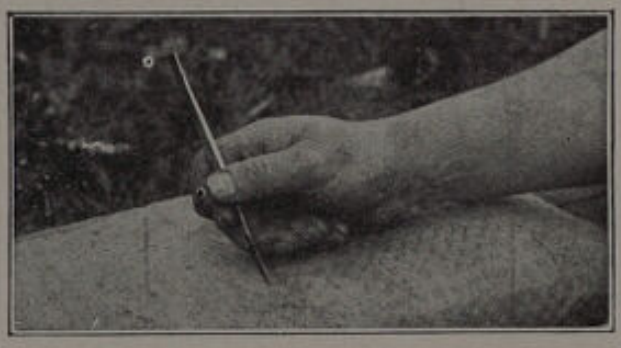

Fig. 10—Backhand Position with Blade Downward.

the back of the blade (Fig. 12) to make incisions where strong downward pressure is required. (4) The **palmar position with the cutting edge upward** (Fig. 17) to make incisions from within outwards. The first three positions meet every

requirement of almost every surgical operation on domestic animals. Other special positions are only modifications of these, acquired by simply bending the wrist or fingers into different angles.

Fig. 11—Penholder Position.

Fig. 12—Palmar Position.

Fig. 13.

Fig. 14.

Blades Held Downward.

It is important always to hold a scalpel in such a position of safety as to provide against a sudden movement of the field. There are certain positions described in works on human surgery that the veterinary surgeon must regard as pos-

Fig. 15—Penholder Position.

Fig. 16.

Fig. 17—Palmar Position.

Blades Held Upward.

itively hazardous. A sudden movement against a scalpel pointing straight at an articulation, synovial sac, etc., for example, ofttimes ends disastrously by plunging the knife into such forbidden structures.

The part to be incised is submitted to as much tension as possible in order to facilitate the cutting process. A loose tissue is difficult to cut even with a keen edge, whilst a tense one is cut with facility even when the edge is quite dull. This desired tension is usually obtained in simple cutaneous incisions by **stretching the skin between the thumb and index finger** (Fig. 18). Areolar tissue is tensed by picking it up with the tissue forcep; the parts to be incised in ablating a tumor are tensed by grappling the tumor and surrounding tissues with strong toothed forceps or tenacula; the tendon is

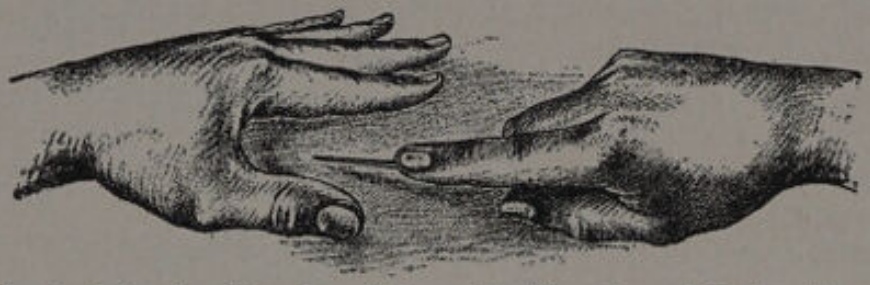

Fig. 18—Incision by Tensing Skin with Thumb and Index Finger.

tensed by extending the articulations over which it passes; etc., etc. This feature of surgical technics is of exceptional importance, both in regards to speed and exactness. Each stroke of the knife is more deliberate and accomplishes more than if the tissues lie lax. It also temporarily arrests bleeding at the seat of dissection, by bringing tension on the divided blood vessels.

Fig. 19—Skin Tensed by Left Hand.

When the skin is once opened by incision, further progress is impossible without the aid of an assistant, who divides his time between bailing out the blood and assisting in maintaining the desired tension here and there as directed, and in accordance with the particular work at hand. The bailing

of blood must be continuous; every particle must be soaked up with the sponges as fast as it masks the anatomical structures to be subsequently incised. Otherwise the surgeon will be "groping in the dark," with little chance of accomplishing a neat isolation of the structure sought.

Incisions with the Probe-pointed Bistoury.—Incisions made with the probe-pointed bistoury are often nothing more than bold outward slashes. Little care needs to be exercised in thus making incisions, because the knife has previously been safely placed under tissue intended to be incised. In the use of this instrument the placing of the instrument is the important part of the process. Placed right, the process may be completed with one reckless stroke in the outward direction, that lays bare the whole hot-bed without further ceremony. Occasionally the probe-pointed bistoury is used more cautiously, as for example in effecting the division of ligaments and tendons.

Incisions with the Tenotome.—The tenotome is usually used to effect the subcutaneous division of tendons or muscles. The knife is passed flatwise under the structure turned against it, and then pressed outward until total division is effected. Such incisions require the assistance of tension of the structure to be divided. A lax tendon is cut with the greatest difficulty; tensed, it is snipped off promptly.

Incisions with the Scissors.—Scissors are useful in snipping cordiform structures, such as nerves, vessels, small tendons, or shreds of lacerated tissues, after these have been perfectly isolated. While not absolutely indispensable in the ordinary surgical operation on the surface of the body, they become very useful in incising parts in remote positions. Guided into a hidden recess with the index finger of the left hand, structures of this nature can often be very conveniently incised with the scissors. Sharp incising scissors should be included in the veterinary surgeon's outfit.

DISSECTION

DEFINITION.—The word "dissection" in surgery is reserved to designate the separation of healthy or diseased structures from their surroundings by cutting or tearing the tissues which connect them. Dissection in surgery is the process of isolating a structure to be ablated or otherwise submitted to treatment. It is the sum of a number of consecutive incisions. It is called **blunt** dissection when tissues are torn apart and **sharp** dissection when they are cut with scalpel, bistoury, or scissors.

INDICATIONS.—The separation of structures from one another, or their complete isolation, has two objects:—(1) the opening of a path to underlying places and (2) ablation or resection. When diseased tissues or organs are deep-seated it is often necessary to dissect through the superficial tissues to reach them, but the principal indications for dissection are abnormal or normal structures to be removed from the body. Thus, a tumor is first dissected from its attachments and then removed (ablated); or a part of a nerve is first dissected from its areolar connections, and then resected.

Dissection is an important surgical process, constituting the major part of many complicated operations. It is generally the most intricate and delicate portion of the technique. When a structure is once well isolated by dissection

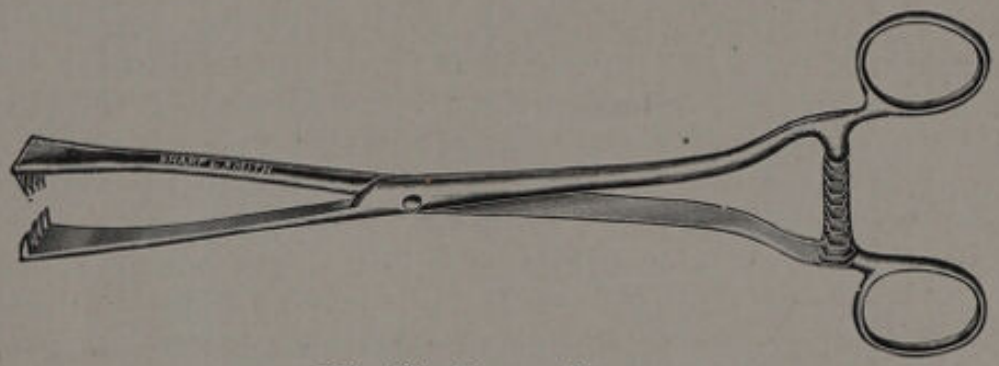

Fig. 20—Tumor Forceps.

its subsequent management is a trifling matter. A nerve tumor, necrotic tissue, or organ, well isolated by a painstaking dissection in which the flow of blood is well controlled, is easily removed with neatness and dispatch, whilst one that is poorly dissected and is masked with blood, is always annoying. Partially hidden amongst its relations the desideratum may be difficult or impossible to execute, and thus leave a cause for an unsuccessful termination.

In fact, dissection is an important, indispensable surgical process in almost every operation. Often it is carelessly or hurriedly done, in the haste to reach the desired end, with unfortunate results. **To dissect well is to operate well.**

INSTRUMENTS.—As dissection is so often but a succession of incisions, the same instruments suffice. The **scalpel, bistouries, and scissors,** to which may be added the **tissue or dissecting forceps, grappling forceps, tenacula** and **retractors,** are the instruments required to execute the various dissections. Sometimes the hands, the finger tips, knife

handles, or other blunt objects can be conveniently and advantageously used.

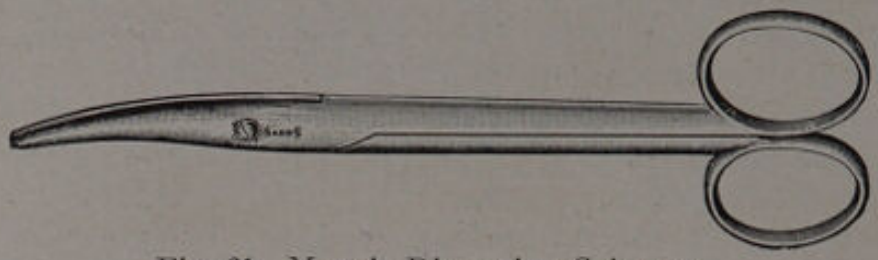

Fig. 21—Mayo's Dissecting Scissors.

TECHNIQUE.—The scalpel in the right hand, held as a pen-holder, the tissue forceps in the left hand, picking up the tissues to be cut, and the assistant energetically bailing out the blood, is the proper manner in which ordinary dissections are executed. If a vessel spurts it is ligated or twisted. If a structure is large, as a tumor, the grappling forceps or tenaculum is used to pull it out or turn it to advantage, and at the same time bring about the desired tension on the parts to be separated. The resection of areolar tissue is very important in dissection. This tissue surrounds and connects everything. Bloodless it is white, and only acts as a transparent screen to underlying structures, but when soaked with blood it effectually masks prominent objects immediately under it, often to the dismay of the unsuspecting sur-

Fig. 22—Tissue Forceps.

geon. In searching for structures to be isolated by dissection the necessity of first picking up and resecting all masking areolar tissue, can not be too frequently mentioned nor too strongly emphasized. By so doing prominent anatomical structures, previously effectually hidden, are promptly brought into the foreground and thus made to serve as landmarks for further progress. Often a structure sought diligently in every direction is right before one's eyes, masked with nothing more than a mere mesh of blood-soaked areolar tissue.

In making extensive dissections it is advisable to search out vessels before cutting them, in order that they may be ligated and thus limit the loss of blood as much as possible. In the course of long dissections the loss of blood may be

Fig. 23—Ferguson's Tissue Forceps.

enormous, and therefore a matter of some consequence. When a large number of small oozing and spurting vessels are cut and threaten the loss of too much blood, besides interfering with the progress of the dissection, the flow may be effectually limited by touching each bleeding spot with the thermo-cautery in the hands of the third assistant. The

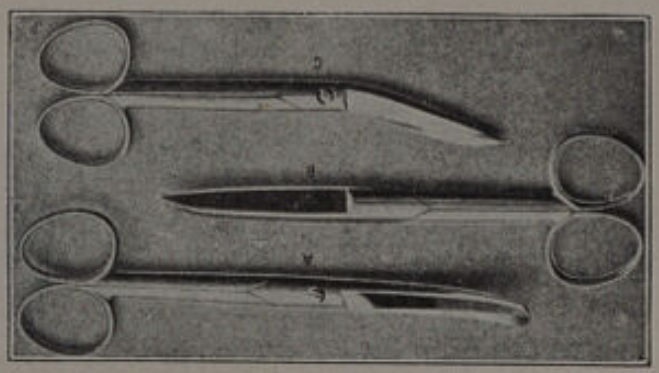

Fig. 24—Three Styles of Dissecting Scissors.

value of the thermo-cautery in this connection is immense. Often an exceptionally extensive dissection can thus be completed with an incredibly small loss of blood.

In making dissections, the surgeon must always "know his ground," in order to avoid transgression upon forbidden structures. The division of a large vessel, motor nerve trunk, or important tendon, or the incision of a synovial sac, or one of the splanchnic cavities, are among the many possible accidents of a careless dissection.

RESECTION, ABLATION, AMPUTATION

DEFINITIONS.—In the literal sense these three words are synonymous, meaning the removal of a part of the body. In surgery, however, each one is reserved to designate a special process. **Resection** is the removal of a part of a

structure or organ, such as a part of a nerve, tendon, muscle or any tissue. **Ablation** at once suggests the removal of an entire structure or organ, such as a tumor, a scirrhous cord, the testicles, the thyroid body, etc. **Amputation** refers only

Fig. 25—Method of Making Ordinary Dissections with the Scalpel and Tissue Forceps.

to the removal of all or part of a projecting anatomical member of the body, such as the tail, an extremity, the tongue, the ears, etc. A nerve is **resected**, a tumor is **ablated**, and an extremity is **amputated**.

INDICATIONS.—In surgical operations the process called **resection** is indicated both on normal and diseased structures. A resection of **normal tissues** may be necessary **to make a path to remote structures** which are the real objects of attack; **to establish drainage orifices or other artificial communications; to effectually destroy the continuity of nerves, tendons, or muscles**; and finally to accomplish a number of objects too miscellaneous to classify. The resection of abnormal structures has for its object the **elimination of harmful elements from the body.** Examples of the former are found in trephining for the repulsion of teeth, the removal of a part of one or two tracheal rings for tracheal intubation, and the various neurotomies. An example of the latter is found in the resection of the ligamentum nuchae for the cure of poll evil.

In veterinary operations, **ablations**, like resections, are often directed alike toward normal and abnormal structures; in fact, the most important ablations of veterinary surgery,—**castration** and **spaying**,—are performed with rare exceptions, upon strictly normal organs. **Growths**, of inflammatory as well as non-inflammatory origin, **(true tumors)** however, furnish the most indications for this surgical process. These defects incapacitate the work-horse

when located at points touched with the harness, and when compatible with health and utility in any of the domestic species they often constitute damaging blemishes; sometimes they are extirpated, because of a justifiable suspicion of malignancy, before they have generalized or have become locally inoperable. The **thyroid body** is ablated in goiter, and the **eye ball** in cancer. **Actinomycotic and botryomycotic growths** also furnish innumerable indications.

Amputations are relatively less important in veterinary surgery. The saving of life by amputating a diseased or seriously injured limb is not a mission of veterinary surgery, except here and there, in a dog or cat whose leg has been crushed, and occasionally in a pregnant mare or cow carrying a precious fœtus as an object of salvage. The large animals, however, seldom ever survive the loss of a limb, and furthermore they are useless without all four, while the small pet animals, being looked upon as objects of pity when a leg is lost, are usually painlessly killed. Hence the small importance of limb amputations in domestic animals.

The tail of the horse, ox or dog is occasionally amputated on account of disease or serious injury. The tail of the horse, sometimes accidentally strangulated by tying its hair too tightly around the stump, especially when tied up too long in shipping or when fired, blistered, may then require amputation above the necrotic line.

The tail of the ox, from treads of neighboring animals, contusions from switching at flies or from wounds sustained in various ways, sometimes becomes the seat of a gangrene that progresses in both directions from the initial injury. Frost bites in cold climates and preventive inoculations of black-leg vaccines have been known to cause formidable gangrenes of the tails of oxen. In these events, amputations are indicated.

The tail of the dog is sometimes accidentally crushed beyond repair from treads of large animals, and sometimes a load of buck-shot accidentally or intentionally fired may terminate in an extensive necrosis, requiring amputation.

Again, it is a prevailing custom in many countries to amputate the tails of coach horses, hackneys, hunters, draft stallions, and even draft show-horses, for no other reason than that of satisfying a well founded caprice over which the veterinarian has little control.

The tails of dogs of certain breeds, notably fox-terriers, Ayersdale terriers, bull-dogs, and some spaniels, are like-

wise sacrificed by fanciers to satisfy an unexplainable whim that does not originate in the veterinary profession.

The tails of the sheep are invariably amputed in nearly every sheep-raising community. But in this species it is justified by the fact that it prevents the accumulation of feces and burrs on the wool of the tail, and that the tail of sheep is of no possible service.

The tongue of the horse is occasionally amputated when its extremity is gangrenous from bit pressure, from laceration, from the accidental or malicious application of a rubber band over its end, or from frost-bites sustained by the tongue-loller. Amputation of the tongue is also recommended as a last resort in the treatment of incurable habitual tongue-lolling.

Actinomycosis of the tongue of the ox (wooden tongue) although seldom ever recognized until too late, and although often located in an impossible position near the base, sometimes furnishes an operable case.

The penis of the horse, ox and dog, afflicted with malignant growths, frost-bites, paraphymosis and stricture of the urethra, gives the veterinarian innumerable occasions to amputate this organ. The horse is most frequently afflicted with these conditions.

The concha of dogs of certain breeds is customarily amputated on the demand of fanciers. Bull terriers, Boston terriers, Great Danes and bull dogs are the ones usually selected for this torture.

EQUIPMENT AND TECHNIQUE.—Resections, ablations and amputations all constitute such special operations that no general recommendation for their perfomance will answer. The reader is referred to the general index, for reference to the detailed description of each operation included within the scope of these surgical processes.

ECRASEMENT

DEFINITION.—Ecrasement is the process of crushing the nutrient vessels and attachments of an organ or growth by means of the ecraseur or other instrument, for the purpose of preventing hæmorrhage. It is one of the methods of ablation, adopted for many veterinary operations, because of its practicability over other more tedious methods of controlling the flow of blood.

INDICATIONS.—Ecrasement is now the almost universal method of managing the blood vessels in the **castration** of the larger domestic animals. The testicles are exposed by a single slash of the scalpel, the ecraseur chain or emasculator is slipped over the spermatic cord, and then with a few turns or a single squeeze the organ falls off and the cord retracts into the inguinal canal. The operation is done; no further attention is given to the large blood vessels that have been divided. Without this valuable process complicated, annoying methods are required to prevent an inevitable, copious bleeding. Ligation, cauterization, torsion, and clamping are among its numerous predecessors. All of these require tedious manipulations which, in the case of castration, favor the development of complications. In the **castration of the large domestic animals** ecrasement meets with the greatest favor, but it is also frequently adopted in the **castration of small animals** and always in the **ablation of the ovaries.** In **vaginal oophorectomy** of the mare and cow, and in **laparo-oophorectomy** of any of the domestic animals ecrasement is the universal method of preventing the hæmorrhage.

In the **ablation of tumors** ecrasement can often be used to very good advantage. After the tumor has been dissected down to the peduncle through which the chief nutrient vessels enter, its ablation can be neatly completed with a few turns of the ecraseur without danger of serious hæmorrhage.

In the **ablation of scirrhous cord** no other good method of managing the bleeding is available, especially when the cord at the seat of ablation is so large and so hard as to render ligation ineffectual.

INSTRUMENTS.—The common crushing instruments used in veterinary operations are the **ecraseur** and the **emasculator.** The former is made in several different types, each

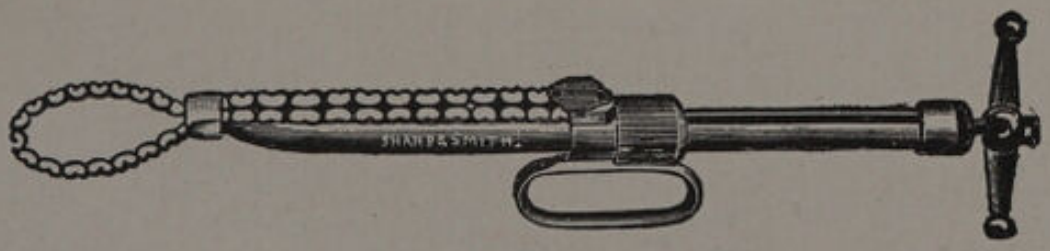

Fig. 26—Ecraseur.

to suit its particular purpose. The vaginal-oophorectomy ecraseur is long, so as to reach the ovaries through this long path; the one for male castration is short and somewhat slender, as no great length nor special strength is required;

while the one for the ablation of tumors is exceptionally heavy and equipped with a strong chain because of the great strain to which it is usually submitted.

Emasculators are also made in different styles for different purposes. The male emasculator is short and stout, while that for the female is long and slender.

Aside from these two special instruments ecrasement is sometimes effected with artery forcep or even by the thumb nails.

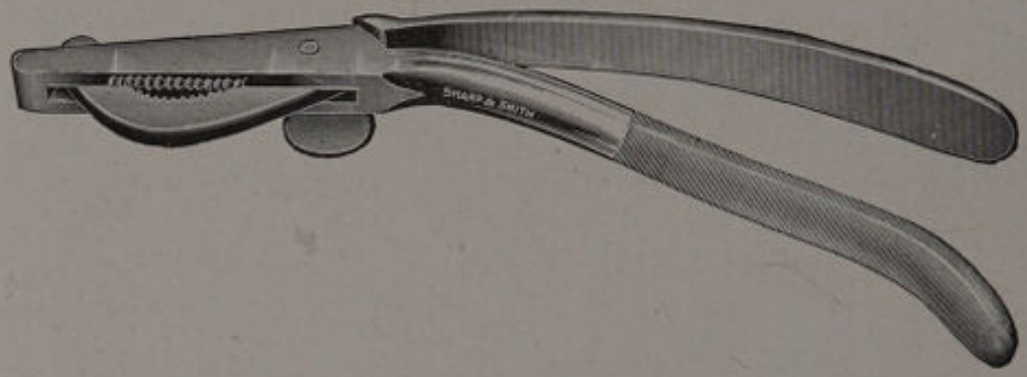

Fig. 27—Hausmann & Dun's New Emasculator.

TECHNIQUE.—The technique of ecrasement is comparatively simple. The organ or part is first exposed, and then the crushing instrument is made to crush it off at the desired point. The bruising to which the vessels and the tissues supporting them are submitted will generally prevent bleeding, and thus obviate ligation, cauterization, compression or any of the other expedients necessary to prevent the inevitable hæmorrhage that follows the division of blood vessels by other methods.

Sometimes it is thought advisable to crush the vessels at two points some little distance apart. The crushing instrument is first made to crush the structure without entirely dividing it, at a point one inch or less above the seat of ablation, and then dropped lower down to effect a complete division. This method assures more perfect hæmostasis, in vessels deprived of their normal hæmostatic propensities from disease of their walls or the tissues conveying them.

ASPIRATION

DEFINITION.—Aspiration is the surgical abstraction of fluids or gases from natural cavities, contusion or organs, by means of a canula. The force required to cause the evacuation may by internal pressure, tension, siphonage or artificial suction.

INDICATIONS.—The indications for aspiration in veterinary surgery are legion. It is indeed frequent that fluids and gases accumulate in this or that part of the organism to the detriment of the health or soundness of the individual. Sometimes the large **splanchnic cavities** become so filled with liquid so as to require abstraction, as in the case of **hydrothorax, sero-fibrinous pleurisy or ascites.** At other times the **synovial sacs** of the great tendon sheaths, the bursæ, or certain diarthroses, become so over-filled as to produce undesirable if not harmful blemishes, which may be modified and often entirely cured by timely aspiration of their contents. **Cysts, serous sacs, sanguineous sacs,** and even **abscesses** under certain conditions, may be thus evacuated, in the effort to prevent the complications that always follow free incision. Aspiration is also very valuable in diagnosis. **Exploratory aspirations** are always justified when other diagnostic methods fail to reveal the exact nature of abnormal fluid accumulations. Sero-fibrinous pleurisy is thus differentiated from chronic solidification of the lung; ascites from abdominal tumors, cysts from aneurisms; and purulent from non-purulent collections. Whilst the usual physical examination and the history are usually sufficient to make such differentiations, certain confusing features may sometimes present themselves and thus necessitate an exploratory puncture to disclose their precise characteristics. **Intestinal gases** accumulated in sufficient quantities to threaten life and which can not be otherwise evacuated, are readily aspirated with the canula and trocar passed through the abdominal wall. The rumen, the folded colon and the cæcum are the organs which may be thus evacuated.

The aspirations include a number of special operations which require description in detail. These are:

1. **Enterocentesis**—puncturing the intestines to evacuate gases.
2. **Celiocentesis**—puncturing the peritoneal cavity to evacuate fluids.
3. **Thoracocentesis**—puncturing the thorax to evacuate the fluid collections in that cavity.

4. **Thecocentesis**—puncturing synovial sheaths or bursæ, to evacuate excessive synovial accumulations.

5. **Gastrocentesis**—puncturing the stomach or rumen to evacuate gases.

6. **Cystocentesis**—puncturing the urinary bladder to evacuate excessive collections of urine during temporary strictures.

7. **Keratocentesis**—puncturing the eye-ball, to evacuate the aqueous humor in purulent inflammations of the chambers of the eye.

ENTEROCENTESIS

SYNONYMS.—Paracentesis abdominalis; tapping; radical operation for acute intestinal indigestion.

DEFINITION.—Enterocentesis signifies puncturing the bowels. In veterinary surgery it is an appropriate name for the evacuation of intestinal gases by means of the trocar and canula. The name "paracentesis abdominalis" is very frequently applied to this special operation, without a qualifying word to indicate that the viscera and not only the abdominal walls are punctured. This phrase being a general one should be abandoned for the more special term "enterocentesis," which identifies the object of the procedure.

INDICATIONS.—Enterocentesis is performed for the purpose of evacuating gases which accumulate in the large bowels during the course of various forms of colics in the horse, and sometimes in the large ruminants. The operation is especially indicated **when the bloating is extreme and threatening**, but is sometimes justified when the intra-abdominal tension is less formidable. When the tension is great, the bowels stretched, the lungs pressed forward, the aorta and vena cava compressed and the cæcum forced into the pelvis, evacuation of the gases through the natural channel is out of the question. The condition must then be met with prompt artificial evacuation by means of the trocar and canula plunged into the bloated bowels through the right flank. Other less formidable degrees of bloating also sometimes justify the operation. Gas in nominal amounts pent up in different sections of the folded colon or cæcum, although not sufficient to cause immediate harm, perpetuate the pain, exhaust the peristaltic force, depress the vital forces by becoming absorbed, and thus often prolong a colic into a critical state of inflammation or impaction which might have been prevented by an early artificial evacuation. Ordinarily these minor bloatings can be dispatched by such simple

remedies as eserine, carminatives, enemas, exercise, intestinal massage through the rectum, etc., but when these fail to effect an early relief enterocentesis must not be too long postponed. In old horses especially, slight flatulence often does irremediable harm if not promptly expelled or abstracted. General intestinal atony or local intestinal dilations of aged animals predispose to total suspension of all peristaltic movements, when these lesions are submitted to further injury by the irritation and pressure of confined gases. Furthermore, the pressure of a bloated section against another very frequently effectually blocks all movements of the intestinal contents. The bloated colon may squeeze the ileum and thus practically arrest all intestinal movements. If the tension is diminished the peristalsis returns and normal evacuation of the remaining gas and gas-forming ingesta soon brings about the desired relief.

These and other critical situations into which the complex intestinal mechanism may be placed by bloating clearly exemplify the necessity of frequently resorting to enterocentesis in the treatment of colics, and especially the importance of not delaying the operation until an incurable damage has been done. In short, the operation must be promtly performed in all cases of extreme tension and in all cases of minor bloatings that can not be promptly relieved by the usual palliative remedies.

EQUIPMENT.—The **intestinal trocar and canula,** preferably Fash's instrument, (Fig.28) a scissors to clip the hairs, an antiseptic solution to wash the field, and a bit of vaseline to lubricate the canula, are the only requirements.

RESTRAINT.—Ordinarily no form of restraint, except a firm hold of the halter by the attendant, is necessary. A restive animal may be twitched; usually however the intense internal pain renders the subject perfectly tractable. The second or third operation, may, however, occasionally provoke a resenting kick as the trocar is plunged into the flank. Although this incident is somewhat rare, the careful surgeon will never so far forget the liability of its occurrence as to expose himself to injury in any case. We once observed a horse, that after having been submitted to the operation a number of times during different attacks of colic, fought viciously at the sight of the trocar and canula and could only be controlled with the twitch and sideline. But such cases are exceptional. By standing at a safe distance in front of the reach of the hind leg no restraint will be found necessary except in these rare cases.

TECHNIQUE.—First step.—Locating the Seat of Operation.—The seat of operation is the right flank at a point equally distant from the anterior angle of the ilium, the transverse processes of the lumbar vertebræ, and the posterior border of the last rib. But this rule must not be followed "to the letter" in every instance; some respect must be given to the **most prominent point** of the distention, irrespective of this classical measurement. The operation may sometimes

Fig. 28—Intestinal Trocar and Canula (Encased).

be performed at the **left flank** when, in threatening cases, it was found impossible to afford sufficient relief from the right side. The relations of the bowels, when bloated, are often changed, and thus leave little assurance that the colon or cæcum will always be punctured by penetrating the right flank. A third seat of operation is **the rectum.** After futile efforts to relieve the tension through either flank the cæcum, whose base pushes into the pelvic cavity when distended with gas, may be punctured **through the rectum** with very satisfactory results in many instances.

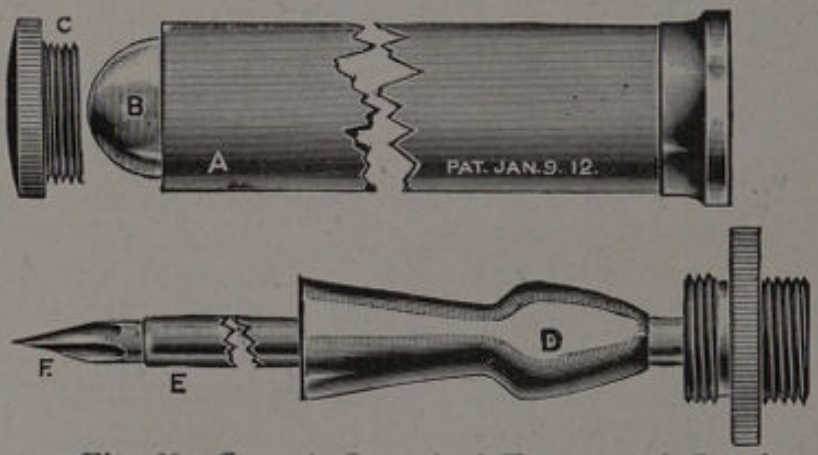

Fig. 29—Crowe's Intestinal Trocar and Canula.

Second Step.—Disinfecting the Field and the Instrument.—Except in instances where the life of the patient is in immediate danger, or when the patient on account of violent pain is too uneasy, great care should be taken to cleanse the field and disinfect the instrument. In the urgent case, a bit of lard, oil, vaseline or any unctuous substance at hand that is reasonable clean is smeared over the seat of operation so that the hairs at the point of penetration can be parted and

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hand, hard enough to send it to its hilt at one stroke. A good, sharp, keen cut is desirable and this can not be obtained by pushing the instrument slowly, and besides the sudden thrust of the instrument reduces the pain to nil; its entrance is scarcely felt.

Fourth Step.—Evacuating the Gas.—The evacuation is usually effected by simply pulling out the trocar from the canula and allowing the gas to escape, without following any special directions. In **severe bloats, and especially in severe bloats of several hours' duration,** some effort should be made, however, to prevent the gas from escaping too rapidly. The too sudden relief of severe abdominal tension may cause **fatal shock.** To cope with this situation the outward gush is regulated with the finger at the end of the canula. The flow may be momentarily arrested from time to time as the tension diminishes, so as to bring a gradual instead of a sudden resumption of the splanchnic circulation.

Sometimes, after a sudden gush of gas, the flow stops as suddenly as it began, before there has been any perceptible relief. The arrest is due to several causes. The canula may slip from the bowel on account of a wide and forcible peristaltic sweep, it may become choked with ingesta, or it may only have penetrated a small intestine; or, worse than all, there may be no free gas to evacuate. The distention very often arises not from gas alone, but from an enormous fermenting mass of semi-liquid ingesta that only bubbles through the canula without affording any relief, to the great dismay of the operator. These deviations from the usual situations are met by first reinserting the trocar into the canula to clear its lumen of a possible choke, and if this is not fruitful it is pulled out about two inches and then plunged in in another direction. If results are still negative this may be repeated two or three times; that is, the trocar is driven into the bowel at different directions in the hope of placing it where gas will flow out. These punctures must, of course, not be too often repeated, because each one leaves a hole the size of the canula in the bowel, through which bubbling, fermenting ingesta in considerable quantities may find its way into the perintoneal cavity. As the puncturing of a distended bowel without relieving the tension leaves an open hole, it is important, once the operation is begun, to diminish the distention at all hazards. Such cases are usually complicated with, and in fact originate in, gastric indigestion, and the remedy should be **catherization of the stomach.** It is only when this fails the operator would be justified in

puncturing the left side or endeavoring to evacuate the gas by puncturing the caecum through the rectum.

Fifth Step.—Withdrawing the Canula.—The instrument is withdrawn with the fingers of the right hand as the first and second fingers of the left one press down upon the skin around it. It is advisable always to first insert the trocar into the canula to prevent the distribution of ingesta along its tract through the abdominal muscles.

Sixth Step.—Protecting the Wound.—When the relief is complete and permanent no special protection of the cutaneous wound is necessary because the elasticity of the skin leaves but a very small, almost imperceptible breach, but when the relief is only partial and the stretched condition of the skin keeps the orifice open, it is well to apply a coating of vaseline over the surface to protect against contamination with the litter during the subsequent colicky pranks of the still uneasy patient.

ITERATION.—In the course of any given attack of colic the operation may have to be repeated two, three, four or even five or more times before the gas formation ceases. The duty of the surgeon here is that of simply resorting to it as often as it is found necessary to rid the intestinal canal of the accumulating gases. In no case should there be any hesitancy of repeating the operation on account of previous performances, if the degree of the recurrent distention warrants.

Since the stomach tube has been introduced into the treatment of bloating colics of horses it is indeed rare that more than one tapping is needed. The re-accumulation of gases in the intestines in any given case of colic is usually an indication that the stomach is the seat of the trouble and that its contents should be evacuated with the stomach tube.

In iterant operations a different point of entrance is selected for each. It is advisable to operate as far as possible from preceding points,—one inch or more,—in order to prevent abscess formation, which would be favored by riddling a small area with a number of punctures.

ACCIDENTS AND SEQUELÆ.—(1) **Hæmorrhage** may occur from two sources; from blood vessels in the abdominal walls or from blood vessels in the intestines. Branches of the **lumbar arteries**, the **circumflex ilii**, their collateral veins, or the colic arteries or veins may be breached as the instrument is plunged into the bowels. This accident is unavoidable and usually not serious. When large vessels of the intestines are breached, blood in considerable quanti-

ties may be forced or splashed out of the canula when the trocar is withdrawn from the canula; it having first flowed into the intestinal lumen and then having been forced out by the outward gush of the gas. It sometimes happens that considerable blood flows imperceptibly into the colon and is only noticed on the second or third day when evacuated with the feces, or that it flows into the peritoneal cavity outside of the intestines, where it is often found post-mortem, or is suspected because of the local peritonitis that often follows the operation. These intestinal hæmorrhages, although sometimes very profuse, are generally harmless. They are unavoidable and beyond the reach of any effectual treatment. Their arrest must be spontaneous.

Bleeding from the abdominal wall by breaching one of its vessels is likewise unavoidable, and whilst not as serious as a hæmorrhage from the intestinal vessels, the blood sometimes dissects its way between the abdominal muscles and accumulates in quantities at certain points, to the decided benefit of any pyogenic microbes that might accidentally enter this favorable environment. Blood from this source may also flow into the peritoneal cavity and cause a local peritonitis. This accident is managed by allowing the blood to flow freely outward on the surface of the body, instead of arresting it by pressure. If exceptionally copious it is even advisable to enlarge the cutaneous orifice and await its spontaneous arrest, in order to prevent it from accumulating between the layers of the ventral wall.

(2) **Shock** sometimes supervenes enterocentesis by the sudden resumption of the splanchnic circulation after the tension, which dammed the blood into other parts of the body, is eliminated. The sequel is favored by general exhaustion of the vital forces that accompanies colic of long duration. A slight distention of long duration is much more dangerous from this standpoint than an extreme distention of short duration. The intestinal blood vessels are very elastic and their capacity is enormous. If the intestinal blood is forced into other parts of the body for hours while the disease undermines the general vitality and embarrasses the heart, the splanchnic vessels which have been stretched, weakened, and paralyzed by the distention, are in no condition to cope with the sudden rush of blood into them. They overfill at the expense of the periphery and still further embarrass the heart. The totality of this disturbed equilibrium is shock with all of its typical manifestation, viz.: coldness of the surface, cold perspiration, accelerated respirations, pallor

or cyanosis of the visible mucous membranes, emptiness of the peripheral arteries, imperceptible or thready pulse, tremors, cessation of the colicky pains, and finally an early death. This accident of enterocentesis is seen often in aged horses, and generally in colics that have dominated for some hours. It is rare in the acute colic of the vigorous subject.

Whilst not always avoidable shock may sometimes be prevented by evacuating the gas very slowly, by applying an active counter-irritant over the whole abdomen and chest and by the prompt administration of stimulants. Mustard well rubbed into the skin, warm blankets held closely to the body by two or three surcingles, a drench of two ounces of aromatic spirits of ammonia in a pint of hot water and finally a good hot enema, is a combination of measures that should not be omitted in the treatment of neglected bloats in aged horses.

Shock is particularly an unfortunate sequel because the operation may unjustly be blamed for having caused it. Erstwhile, the case may have been considered favorable, now it is known to be hopeless, a situation that reflects seriously on the operation.

(3) **Circumscribed peritonitis,** is a very common sequel of enterocentesis. It begins about four days after the operation and is manifested by a pyrexia of 102° to 104° Fahr., tucking of the flanks, more or less anorexia, disinclination to move about, and marked manifestations of pain when the right side of the abdomen is palpated. The cause may be the repetition of the operation, hæmorrhage or the flow of ingesta out of the bowels into the peritoneal cavity through the puncture. It runs a course of about eight to ten days and generally terminates favorably. Laxatives, laxative diet and absolute rest in a roomy box is the only necessary treatment. Antiphlogistics internally and externally fomentations in the form of hot wraps are indicated if not absolutely essential.

(4) **Abscesses in the Ventral Walls.**—The tract of the instrument through the abdominal muscles may be infected and become the seat of a more or less serious phlegmon, varying from a small subcutaneous pus sac to a large, deep-seated abscess with a capacity of several pints. During their evolution these abscesses may cause threatening general symptoms as well as intense local pain, simulating peritonitis. Soon, however, the nature of the trouble manifests itself by the appearance of a hot, extremely painful, and hard tumefaction of the flank at the seat of operation, that later points and discharges its contents over the surface of the region.

The real abscess may be preceded by a discharge of pus from the cutaneous orifice made by the canula.

These abscesses are usually caused by driving infectious matter, (hairs, skin dirt, and dirt upon the canula) into the tract, by not having taken proper preventive measures. The accident is excusable when, in urgent cases, there was not time to spare for the important preliminary disinfection of the skin and instruments. In the less urgent cases, and especially when the operation was only performed once, this sequel should seldom ever be permitted to occur. It savors of uncleanly surgery.

Sometimes, however, the infectious matter is brought into the tract from the intestinal contents as the canula is withdrawn. When the contents of the colon is a churning, fermenting mass, and the distention was not relieved from the operation, there is always much danger that some of the ingesta will follow the canula into its tract as it is withdrawn. It even happens that froth and food particles will bubble from the cutaneous orifice after withdrawal of the instrument. In these incidents prevention of abscess is impossible.

The abscess from intestinal infection is differentiated from the one from external infection by its greater size, its slow evolution, its great depth, its fetid contents, the necrotic shreds in its contents, and by the presence of the colon bacillus. This pus-producing microbe, ever present in the intestines of mammals, finds a favorable environment for growth in the track of a canula, and it is indeed frequent that it finds its way into this channel.

The course of these abscesses is varied. After pointing, or after their contents have been artificially evacuated by lancing, they may cicatrize promptly and cause no further trouble. Sometimes, however, they develop into chronic fistulæ that discharge for months, or that defy every effort to locate their exact direction or perpetuating cause. If the original orifice closes they may point as low as the groin near the mammæ or sheath.

The abscess supervening enterocentesis should be treated by early evacuation of its contents. Whatever may be the proper course to pursue in regard to lancing abscesses in general, this one should be ripped open at once. This early treatment prevents spreading and the formation of fistulæ. A good, liberal incision is made into the forming sac, which is then treated with frequent injections of hydrogen peroxide. Forcible irrigations which would tend to spread out the infectious matter are avoided.

CELIOCENTESIS

SYNONYMS.—Paracentesis abdominis, punctio abdominalis.

DEFINITION.—Celiocentesis is the surgical penetration of the abdominal cavity with a canula. The word is specially adopted as an appropriate designation for the aspiration of fluid from the peritoneal cavity.

INDICATIONS.—Ascites of non-inflammatory origin is the chief, in fact only, indication for celiocentesis in veterinary surgery. It occurs chiefly in aged dogs. It seldom occurs in young dogs and rarely ever in the other domestic animals as a special clinical entity. Abdominal dropsies in herbivora are very rare, except trivial accumulations which co-exist with general anasarca. The accumulation of sufficient fluid to perceptibly distend the abdomen may sometimes occur in an old cow or old horse, but the occurrence is noted chiefly for its rarity. Dropsies are found post-mortem, but are seldom recognized ante-mortem in the large animals. The one exception is the dog, which animal alone seems susceptible to the particular lesions upon which such accumulations depend. Ascites is a secondary condition, a phase, a reflection of some serious abnormality of the splanchnic circulation. It is a transudation of blood serum into the peritoneal cavity, dependent upon a passive hyperæmia which in turn is caused by an obstruction to the portal and sometimes the renal circulation. The obstruction may be in the portal vein, in the liver, in the vena cava and even in the right heart. Any influence that will prevent the free outward flow of the blood that is constantly carried into the bowels by the arteries, will, on account of the great extent of the peritoneum and its natural tendency to secrete fluid, cause more or less fluid to accumulate that the peritoneum is not capable of absorbing. Chronic renal afflictions, but more rarely in dogs than in human beings, sometimes precurse or co-exist with the disease.

Ascites of dogs is chronic; its course is slow; the abdomen gradually becomes larger and larger, it fluctuates, and the subject emaciates slowly but with certainty. The condition needs, to be differentiated only from pregnancy, obesity, tumors and from enormous distension of the urinary bladder caused by strictures of the urethra. Palpation, succussion, the history of the disease, and the age of the patient offer ample opportunity to make a diagnosis, but when there is any doubt the operation itself is a diagnostic measure.

EQUIPMENT.—

1. Razor.
2. A basin of soap and water.
3. A basin of antiseptic solution.
4. A small trocar and canula.
5. A tape muzzle.
6. Two assistants to hold the patient.

RESTRAINT.—The dog is muzzled and held in the lateral recumbent position. The canine operating table is of no special advantage, as the operation is not pain-

Fig. 31—An old Ayersdale Affected with Ascites.

ful and the patient should be placed upright after the canula is inserted.

TECHNIQUE.—The belly around the umbilicus is shaved and bathed with the antiseptic. The trocar and canula, previously sterilized, is plunged slowly through the abdominal wall just in front of the umbilical cicatrix and a little to one side of linea alba. After the trocar is withdrawn from the canula the fluid is allowed to flow until the stream becomes feeble, then the patient is placed on its feet until all has been aspirated. The abdomen may be manipulated with the hands and the direction of the canula changed from time to time when the flow ceases.

SEQUELÆ.—Celiocentesis is not a successful operation. It seldom ever permanently benefits the patient, because it

only removes an effect without benefiting the cause. The original lesion, the primary abnormality, being still active, a re-filling of the cavity is certain to occur sooner or later. Often it refills rapidly and manifestly enfeebles a patient whose general health previous to the operation was fairly good. As a general rule it is more harmful than beneficial, although occasionally it does prolong the days of an old, favorite pet.

THORACOCENTESIS

SYNONYM.—Paracentesis thoracis.

DEFINITION.—Thoracocentesis is the aspiration of fluids from the thoracic cavity with the trocar and canula.

INDICATIONS.—The operation is indicated in any accumulation of liquids in the thorax, whose quantity is sufficient to manifestly interfere with respiration. The exudate of sero-fibrinous pleurisy (inflammatory hydrothorax) or of dropsy of the thorax (true hydrothorax) are the two conditions encountered in domestic animals which call for an evacuation of the thoracic cavity. The former is common in solipeds, complicating almost every case of pleurisy that does not promptly terminate in resolution. It is especially common in broncho-pneumonia complicated with diffused pleurisy, but exists also as a close sequel of plain, uncomplicated inflammations of the pleura.

Often in acute pleuro-pulmonary affections two, three or four gallons of fluid will accumulate in a few days, and on the eight to the tenth days of the fatal cases the lungs are found flooded. As these cases are usually fatal from the extensive inflammation of the lungs, pleura and pericardium, the operation is of little service. The mere aspiration of the fluid accumulated around the lungs has no curative effect. The course of the disease goes on unchecked and the cavity rapidly refils in spite of everything if the patient survives long enough. In this condition the practitioner is, however, justified in resorting to the operation, if for no other purpose than that of demonstrating the accuracy of his diagnosis.

The case of sero-fibrinous pleurisy that passes into subacute and chronic stages is the real indication for thoracocentesis in veterinary surgery.

All of the domestic animals suffer from this complication of pleurisy, but it is in the soliped that the condition is most frequently recognized early enough to render surgical treatment effectual. The condition calling for aspiration becomes

apparent at the end of the usual course of pleurisy, when the patient, instead of convalescing, remains mysteriously indisposed. The fever continues; the appetite is variable; the strength wanes slowly; the respirations, already slightly accelerated, become more and more labored day by day; the general condition becomes more emaciated; frequently a marked œdema develops between the fore legs; the eyes become glassy, staring and anxious; and auscultation reveals an absence of vesicular murmur up to a level that is equal on both sides of the chest. These symptoms develop rapidly or slowly in obedience to the activity of the inflammatory process. The filling process may run a course of one week, two weeks, three weeks or even five weeks, before the symptoms reach the maximum intensity. In rare cases three months of mysterious ill-health following acute pulmonary inflammations is finally accounted for by the appearance of symptoms which point to hydrothorax.

The prognosis depends upon the rapidity of the filling process. As already mentioned, the rapid filling up of the pleural sacs during the acute stage of broncho-pleuro-pneumonia or simple uncomplicated pleurisy, is an unfavorable condition. It is generally fatal. But when the accumulation is less rapid the condition is often curable. The sub-acute and the chronic cases very frequently recover under energetic surgical and medical treatment, and are therefore the favorable indications for the operation. The character of the exudate has also an important bearing upon the prognosis. If composed of pure serous fluid, especially if the accumulation has been slow, a favorable result may be expected; but when purulent or hæmorrhagic and especially if the accumulation was more or less rapid, there will be but little chance for recovery.

EQUIPMENT.—1. Trocar and canula.
2. Scissors.
3. Razor.
4. A yard of small rubber tubing.
5. A small quantity of antiseptic solution.
6. An empty pail or quart bottle.

Restraint.—The operation is performed in the standing position, under no other restraint than that of holding the patient along the side of the stall to prevent moving about while the fluid is being aspirated. As the fluid, for reasons hereafter mentioned, is caught in a pail it is important that the patient be kept in one position during the entire opera-

tion. The twitch may be applied to the nose while the puncture is made, in the exceptionally restive subject, but since the pain amounts to nothing more than one sharp pang as the trocar penetrates the skin, even this precaution is not often necessary. Furthermore, the patient is usally too ill to offer much opposition.

Fig. 32—Seat of Operation and Method of Preventing Aspiration of Air into the Thorax in Thoracocentesis. (Hoffman.)

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The seat of operation is the flat part of the costal surface behind and above the olecranon, on the right side of the body. The puncture is usually made between the sixth and seventh ribs and as near their distal terminations as possible. It is not necessary to count the intercostal spaces, in fact this can not be done except when the patient is in exceptionally poor flesh. (Fig. 32.) It is sufficient to trace an intercostal space in the region as far down as its cartilage (if possible) and then select a spot at the anterior border of the rib bounding it posteriorly. When the animal is fleshy this may not be possible, as the outlines of the ribs can not be accurately traced in that part of the thorax, except in

emaciated animals. In this event, the spot is determined by tracing a rib as far as possible and then making a mental calculation of its course beneath the flesh.

Second Step.—Disinfecting the Field and Instrument.—The point selected is clipped and shaved and then well washed with mercuric chloride solution 1-500. The canula is passed trough the flame of a candle, match or gas-jet if not sterilized by boiling.

Third Step.—Inserting the Trocar and Canula.—The operator stands behind the field, holds the instrument in the right hand (Fig. 33) and then slowly and deliberately pushes it into the thorax, in an oblique direction, inward, forward and upward. This oblique direction of the canula, is one of the salient features of the operation, in that it prevents striking a rib. Ribs are so arranged as to almost over-lap one another roof-like, from before backward. If attacked from behind an object easily finds the space between them, but if attacked from in front the space could hardly be entered at all.

Fourth Step.—Aspirating the Contents.—When the instrument has penetrated safely through the wall, the trocar

Fig. 33—Method of Holding Trocar and Canula.

is removed from the canula and the fluid allowed to flow into a pail previously provided for the purpose. The canula is immobilized with the fingers; otherwise it will move about with the respiratory movements. As long as the stream is free and keeps the canula full, it is allowed to flow without

further ceremony. Later, however, the flow will spurt only during the inspiration, and between the spurts, air will be aspirated into the thorax to the decided detriment of the patient. To prevent this occurrence a rubber tube is attached to the end of the canula and dropped into the pail which now contains a quantity of the liquid. With one end of the rubber tubing attached to the canula and the other buried under the fluid in the pail, the admission of air into the thorax is effectually blocked and the aspiration will continue until all of the contents has flowed out. The author sometimes uses a bottle which is hung by its neck to the surcingle, the tube is dropped into it and the aspiration allowed to go on unattended for hours.

Fifth Step.—Protecting the Wound.—Although the abrasion is a small one, and the chance of infection **ab extra** is slight, it is nevertheless sensible to clothe the breach with an impervious dressing, such as collodion, tar vaselin.

SEQUELÆ AND ACCIDENTS.—Pneumothorax is by far the most serious accident of thoracocentesis. It is caused by permitting the suction of air into the cavity through the canula, after the major part of the fluid has been abstracted. During the inspiration, as the lungs inflate with air, the fluid around them is forced up to the level of the canula and a limited quantity will flow out, but as the thorax contracts for the exhalation a certain amount of air will be drawn in, unless preventive measures are taken. (See fourth step.) Although but little air enters at each respiratory act, a sufficient amount will find its way into the pleural sacs during the entire last part of the aspiration to cause a pronounced distress of the breathing. Normally the pleural sacs should each be a vacuum; in the horse they constitute a single vacuum, being connected to each other through a fenestrated membrane in the posterior mediastinum. When air is admitted into this vacant space an important part of the mechanism of respiration is destroyed and a distressing dyspnœa immediately supervenes and continues for some hours. This dyspnœa, added to an already serious embarrassment of respiratory function, at once deprives the operation of any curative value. In fact, the patient, which now needs vigor more than ever, is striken with a demoralizing distress that leaves little chance for recovery. The operation was, then, more harmful than beneficial. On the other hand if no air has been permitted to enter, the operation is followed by an immediate improvement of the labored breathing. The deep, heavy,

pumping respirations become calm and almost normal as the fluid gradually flows out.

Treatment.—Pneumothorax is easily prevented by attaching a rubber tube to the canula as prescribed above, but is incurable except through nature's own forces, i. e., by resorption of the air by the pleura.

Shock.—Old cases of hydrothorax, where the thorax is full, where the respirations have gradually become more and more labored, without having made a corresponding impression on the general health, are very prone to succumb to shock after the fluid is removed. The acute cases and the sub-acute cases are less susceptible to this sequel. It is the chronic one that is actually dangerous from this standpoint. Dropsy, in the absence of any existing or pre-existing inflammation of the pleura, is the more dangerous. The danger of shock is also augmented by rapid aspiration. If the thorax were lanced and all of the contents suddenly evacuated, shock would be the inevitable result in almost every case. A large canula will give a larger percentage of shock cases than one of smaller caliber.

Treatment.—Shock is prevented by a slow, gradual evacuation of the fluid. The evacuation should be so gradual as to leave no impression that would tend to disturb the equilibrium of the general circulation. In a pronounced case, internal treatment is of little service. Warm clothing, ammoniacal stimulants, intravenous and subcutaneous salt solutions, are among the expedients to be tried.

Refilling of the Thorax.—Thoracocentesis is not often effectual because it attacks only an effect. The cause is often still active. If the disease is due to inflammation of the pleura, as is generally the case, the inflammation, not being benefited by the operation, will again proceed to refill the pleural sacs. This refilling will occur rapidly in acute cases and slowly in the chronic ones. In the latter when the inflammatory process is on the verge of resolution and fails to fill the cavity with exudates faster than the pleura absorbs them, convalescence exceeds the absorption, a refilling, one two three or even five weeks later will occur, according to the activity of the process.

In **true hydrothorax**, that is non-inflammatory hydrothorax, the refilling will follow in strict obedience to the nature of the primary lesion.

Treatment.—The task of preventing refilling of the thorax is that of curing the caustive disease—the pleuritis. The success of the operation in permanently restoring the

health, depends upon the possibility of restoring the pleura to its normal condition. This must be done largely through treatment that will restore the lost vitality. Good supporting food, abundance of fresh air, invigorating, out-door exercise, sun-baths, cheerful surroundings and a medication of strychnia, quinine and bitter tonics, is a combination of treatments that must not be omitted. Ferruginous tonics in the form of small doses of tincture chloride of iron well diluted are also helpful. The emunctories must not be neglected. Frequent doses of oil of linseed to keep the bowels in a state of activity, digitalis to promote diuresis and warm clothing to maintain a normal activity of the skin are appropriate lines of treatment in this connection.

Intra-pleural hæmorrhage.—The pleura in sero-fibrinous pleurisy, both parietal and visceral is carpeted with granulations that are too succulent to stand the friction to which they are subjected after the liquid is removed. The movement of these carpeted surfaces upon each other often cause a very profuse bleeding that still further drains the vitality of the subject, and yields at the second operation a sanguinous instead of a serious issue. This is one of the most harmful results of the operation in that there is no way of preventing it.

Pleural Adhesion.—The cessation of the inflammation of the pleura sometimes occurs only after more or less extensive fibrous adhesions have formed between its parietal and visceral portions. These may be limited or they may be diffused over a large area. Sometimes the two pleuras are held in firm juxtaposition; at other times the union is a loose connection with fibrous bands. The seriousness of this sequel depends upon the extent, the location, and the firmness of the adhesions. Located in the mediastinum they are somewhat more serious than on the costal walls. Animals so affected are "short-winded," pant on exertion, grunt when turned sharply, are very often hopeless roarers, and generally maintain a certain degree of ill health for months and even years.

Treatment.—Pleural adhesions are exceptionally refractory conditions. Once formed they will persist for all time, and the symptoms by which they are manifested can scarcely be palliated. A long run at pasture, healthful exercise or an easy occupation with first-class food and general care may tend to promote a state of fair health with which these formidable abnormalities may remain compatible.

THECOCENTESIS

DEFINITION.—Thecocentesis is the aspiration of **synovia from distended sheaths and bursæ,** for the purpose of diminishing their size.

INDICATIONS.—Lesions requiring this operation exits only in the horse. They are **wind-puffs** of the fetlocks, **thoroughpin** of the hock, **thoroughpin of the knee,** distention of the theca of the extensor pedis tendon in front of the fetlock, and distentions of other bursæ and sheaths provided with more or less extensive sacs which sometimes become distended and produce annoying blemishes. Wherever they are met they constitute appropriate indications for the operation under consideration. Although far from a prompt, radical cure, it has a certain definite value if patiently repeated, and if the after-treatment is carefully managed.

"Wind-puffs or wind-galls" are the two vulgar names for distentions with synovia of the superior cul-de-sac of the sesamoidean sheath. It is a stretching out of the sac from strain, or constant concussion, accompanied with an over secretion of enough synovia to fill up the dilatation. The enlargement evolves through the combined influence of the internal pressure of the secretion and the continual violence inflicted to the sac. Laterally, the sac is not supported by any adequate structures; only the thin skin covers it, to the decided benefit of the process. These enlargements are found more or less developed on nearly all horses submitted to hard work, fast work or constant work, appearing often soon after the young animal is first submitted to exertion. They generally advance gradually, but in rare instances supervene a sudden strain. They usually enlarge with work and diminish with rest, but sometimes maintain a definite size without change in character or dimensions.

Pathologically, a wind-puff is a slight inflammation of the synovial membrane of the entire sesamoidean sheath, together with a dilatation of its uppermost cul-de-sac. If the inflammation is more intense in may cause lameness during the acute stage, but since the great majority of cases develop slowly without any initial period of acuteness, lameness is scarcely ever observed. They vary in size from small, almost imperceptible, fluctuant elevations to large elongated enlargements that greatly disfigure the leg. They are always harder and somewhat larger while the leg is supporting weight.

In an examination for soundness wind-puffs should be regarded as an unsoundness, in spite of the fact that they sel-

dom ever depreciate the utility of the patient. Their tendency to enlarge, although small at the time of examination, and their location on a conspicuous part of the leg, stamps them as redoubtable blemishes.

Thoroughpin is a distention of the tarsal sheath which over-laps the posterior surface of the hock about six inches

Fig. 34—Thoroughpin of the Tarsus.

superiorly, and as far as the middle third of the metatarsus inferiorly. Inferiorly it is bounded by unyielding structures that prevent any extensive distention, but superiorly the

space between the tendo-Achilles and the flexor pedis perforans, which is enclosed laterally only by the elastic skin, facilitates the development of an almost unrestricted dilatation.

Like the wind-puff, thoroughpin generally develops under the influence of a slight, chronic inflammation of the synovial membrane. The resulting excessive secretion and the constant strain to which the part is subjected, gradually enlarge the sac until it becomes a visible, fluctuant enlargement, which can be pressed from side to side beneath the tendo-calcaneus. At first it appears only as a slight, flattened, very soft enlargement externally, and then later shows itself also on the internal aspect of the region. Rare cases, especially those resulting from a single, sudden strain, may appear first on the internal side. In either case the finality is the development of a large, tuberous, fluctuating distention that is much larger internally than externally. The enlargement may assume enormous proportions and become exceedingly hard, especially while the leg is supporting weight, or else it may remain small and markedly fluctuant. In some instances thoroughpin produces an exceedingly obstinate lameness, that yields to firing, blistering and prolonged rest, but recurs again after a brief period of hard work. In these cases, the distention can be traced through the hock downward to the inferior extremity of the sheath at the upper third of the metatarsus, where a pronounced dilatation announces the diffusion and the seriousness of the inflammation.

Thoroughpin often co-exists with bog-spavin, but the two are never directly connected with each other. Each one is a distention of a separate synovial sac, having no communication with the other.

Thoroughpin of the Knee or carpal thoroughpin, quite frequently encountered in the hard-worked draft horse, is to the carpal sheath what thoroughpin proper is to the tarsal sheath. It is, however, much less common, and seems only to occur where there is ample provocation in the form of exceptionally heavy work. A case is met here and there in the high-stepping coach horse, but with this exception, horses other than those subjected to heavy pulling are seldom ever affected. This condition, which is very often accompanied with an obstinate—if not incurable—lameness, is manifested by the appearance of a fluctuating enlargement of the carpal sheath just above the radio-carpal articulation. The dilated cul-de-sac occupies the space between the flexor muscles

and the posterior surface of the radius, bulging rather indistinctly on both sides of the leg. Below the carpus a similar but smaller distention is felt along the upper third of the metacarpus.

Fig. 35—Thoroughpin of the Knees.

Other Synovial Distentions occur in the legs of horses, but they are less serious from every standpoint than the ones previously described. The synovials of the flexors, being concerned in supporting weight and being submitted to the great strain of locomotion, are more frequently affected with distensions than those of the extensors. Bursal enlargements along the extensor tendons, besides being less common, are also less serious. They never produce a chronic lameness and will yield to treatment to which the others are refractory. The more common ones are: (1) Distention of the sheath of the extensor carpi obliquus at the lower third of the radius; (2) Distention of the sheath of the extensor digitalis communis and extensor digitalis longus (extensor pedis) at the fetlocks; (3) Distention of the sheath of extensor digitalis lateralis (peroneus) at the dorso-lateral part of the metatarsus.

(Dropsies affecting diarthroses, although similar in character to bursal distentions generally are not considered appropriate indications for thecocentesis.)

The operation of thecocentesis, as before mentioned, is not a radical cure for these chronic, blemishing abnormalities

which, in fact, are generally classified among the incurable conditions. It is, however, often very helpful as a preliminary step of a course of treatment aiming to banish them. The distentions of the extensors may be lanced, then irrigated and drained for some days until the discharge stops without any danger of complications, but those of the flexors can not be managed with this same impunity. To set up a painful inflammation, infective or non-infective, in the great flexor sheaths by lancing or by injections of irritants, is too hazardous to recommend as a sensible treatment for a condition that previously is regarded as trivial. Although such radical measures are often eventually successful in reducing the enlargement by entirely destroying the secreting membrane, there is always a long and exceptionally painful period of convalescence which many patients do not survive.

Lancing the thoroughpin or the wind-puff is an operation that the practitioner will seldom ever repeat. The escape of the patient from death, especially in the case of thoroughpin, is too narrow to take the chance often. Firing is ineffectual and never satisfactory because it adds to the blemish without permanently reducing its size. Blistering, cooling lotions, compresses, special shoeing and rest do but little permanent good. The resection of a part or of all the sac would always prove effectual if absolute operative and post-operative asepsis never mis-carried, but the great liability of infecting the surgical trauma, especially during the convalescence, makes this recourse analogous to the lancing operation, and hence unwarranted in view of its relative unimportance.

This leaves the veterinarian with no other recourse than thecocentesis. The operation should be performed early; before the distended sac has entirely lost its elasticity. The old, confirmed thoroughpin or wind-puff will not yield; the aspiration of the fluid, the rest and the external irritants (blisters) will not shrink up a sac that has maintained a certain definite contour for years. In the more recent case, the aspiration of the fluid every two weeks followed by the immediate application of a cantharides blister over the entire region, will usually effect a permanent cure if persisted in for a period of from three to six months. The aspiration should be repeated regularly as long as any synovia can be abstracted, but the blisters should be omitted when the condition of the blistered skin demands. The first three or even four treatments may be discouraging, but thereafter, if the plan is persistently carried out, the enlargement will gradually disappear. In the work-horse, where scarring is not objectionable,

a good line firing may be substituted for the first blister. Rest, or at least easy work, is essential to the success of the treatment.

EQUIPMENT.—

1. Aspiration needle or small trocar and canula.
2. Scissors and razor.
3. A basin of antiseptic solution.

The aspirating syringe (Fig. 36) which is often used, is not absolutely necessary, as synovia will flow out freely enough without it until the sac is quite empty.

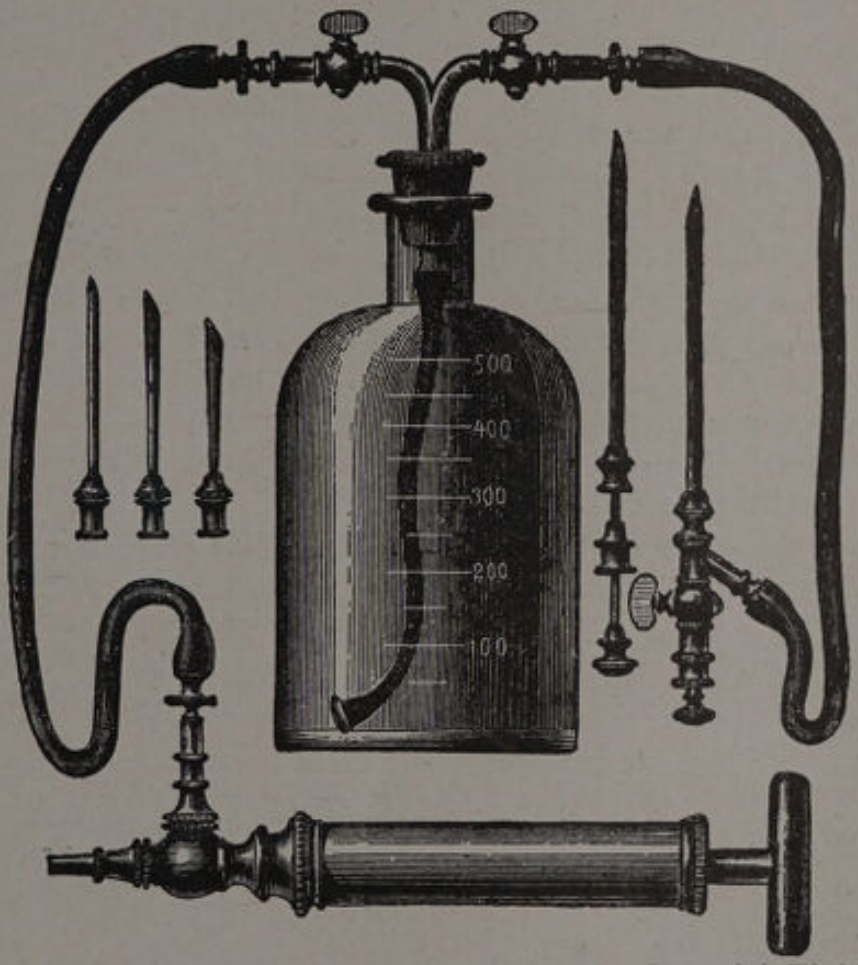


Fig. 36—Special Apparatus for Aspirating Synovial Fluid.

RESTRAINT.—For the thoroughpin and wind-puff operations the standing position is the preferable one. The opposite limb is held from the ground with the side line and the twitch is applied to the nose. By throwing all of the weight upon the affected leg the distended sac is made tense and prominent, and this facilitates both the penetration of the needle and the flow of the fluid. Local anæsthesia is not necessary, because the pain is limited to a single pricking sensa-

tion, and this will pass unnoticed if the twitch is given an extra turn as the needle penetrates the skin.

TECHNIQUE.—First Step.—Disinfecting the Field.—The hair is clipped and shaved from a small spot about one inch in diameter over the most prominent part of the enlargement. The denuded point is then submitted to a washing with the antiseptic solution that will assure a clean skin. A mercuric chloride solution, 1-500, applied with sharp friction, and then a rinsing with alcohol for a few moments is the least that should be done in this direction.

Second Step.—Inserting the Needle.—Before inserting the needle it should have been sterilized by boiling or by a long immersion in a 95% solution of carbolic acid, and then just before inserting it the canula should be passed over the flame of a match. The latter precaution alone is insufficient because the stilletto or trocar within the lumen may not be sufficiently disinfected. The lumen of a canula must be free from needle rust and desiccated particles from previous operations, which may be pushed into the sac during the operation. Once safely cleaned the needle or canula is passed into the sac by one sudden thrust, as the assistant at the head gives the twitch an extra turn to distract the patient's attention from the seat of operation.

Third Step.—Abstracting the Fluid.—As a rule the fluid will immediately begin to evacuate freely, but if it fails to flow the stilletto is passed through the lumen to rid it of a possible choke. Failing in this the needle is changed at different angles within the sac until success is attained. As the tension relaxes from the evacuation the sac is manipulated with the fingers of both hands so as to bring the remaining fluid under pressure at the entrance point of the needle. This manipulation should be continued until all of the fluid has been abstracted.

The abstraction may also be effected by means of a special aspirating apparatus (Fig. 36) which withdraws the fluid by suction, but this method possesses no advantage over the more simple method of siphonage with a needle or canula.

AFTER CARE.—The treatment should be followed by the application of a cantharides blister over the entire sheath. In the case of thoroughpin the blistering is carried upward as far as the enlargement extends, and downward as far as the insertion of the check ligament in the metatarsal region. For wind-puffs the entire fetlock is blistered. The aspira-

tion is repeated every two weeks or even oftener and the blistering as often as the skin recovers its normal state.

The subject is rested, turned in the paddock or pasture or else submitted only to easy work that will not seriously tax the affected parts.

SEQUEL.—Thecal Abscess.—The development of a severe infective inflammation of the whole sheath, which terminates in the formation of an exceptionally painful sero-purulent abscess, is always a possible result of such operations. The danger is, however, not great if ordinary cleanliness is observed throughout, and if no irritants are injected into the sac. The injection of irritants into synovial sacs following aspiration is an exceptionally dangerous procedure, in spite of cleanliness, because they create a favorable field for microbian growth. The inflammatory exudates which fill up the sac after such injections often become infected in some unexplained manner, and produce a chain of serious local and general symptoms which sometimes prove fatal.

The appearance of a thecal abscess of the flexor sheaths following thecocentesis is announced by swelling of the whole region, inability to support weight on the affected leg, extreme local tenderness around the seat of operation, fever, anorexia, injected membranes, accelerated respirations and finally the pointing of abscesses at different parts of the infected sheath, which discharge a sero-purulent liquid in abundance without relieving the local symptoms. These abscesses are indeed serious; the process is of long duration; the patient emaciates; the muscles of the affected side atrophy; and the region is left in a state of permanent tumefaction.

Treatment.—The patient affected with thecal abscess must be placed in a large, roomy stall and nursed well, as the period of disability will be a long one.

The most effectual method of handling these serious conditions is to place the animal under proper recumbent restraint, clip, shave and disinfect the region thorougly, make a free incision into the sac, wash it out thoroughly with an antiseptic solution and then fill up the cavity with an emulsion of mercuric iodine and olive oil, one part to ten. The emulsion is held in by wadding the incision and bandaging the leg.

When operative treatment is not feasible for any reason, the region is bathed in hot water and wrapped up in hot wet clothes until the abcesses begin to form, after which time attention must be directed to the interior. The abcesses should

be lanced as soon as fluctuation appears and then irrigated as recommended in the preceding paragraph.

If the patient lies down too much of the time especial care should be taken to prevent decubitus by using abundant bedding and with the occasional use of slings.

This complication is mostly serious in the tarsal sheath and in the sesamoidean sheath of the hind leg. In the foreleg and in the bursæ of the extensor tendons it is much less serious.

GASTROCENTESIS

DEFINITION.—Gastrocentesis signifies puncturing the stomach. It is applied here to designate the aspiration of gases either from the stomach or the rumen, by means of the trocar and canula or other instrument.

INDICATIONS.—Gastrocentesis is practiced chiefly on ruminants, and is always indicated when the rumen is distended with gases in sufficient quantities to cause pronounced distress. The disease known as acute **tympanites, blown,** and **hoven,** the condition that calls for this operative intervention, is a fermentation of rapidly ingested feeds. Green fodders or grasses eaten ravenously in considerable quantities, indigestible slops or, in fact, any of the ordinary feeds taken in too large quantities, are among its many causes. The disease is in reality an overloading of the rumen with feeds which in turn still further distend the organ by elaborating gases of fermentation. But the rumen is generally found full af semi-liquid, bubbling, churning mass of ingesta, through which the gases are permeated so completely as to prevent their immediate evacuation. That is to say, in acute hoven the gases are intermixed with the mass, and cannot be abstracted through a canula alone in sufficient quantities to afford any immediate relief. (See rumenotomy.) The intra-abdominal pressure in such cases can only be reduced by giving free exit to the ingesta and gas combined through an opening sufficiently large to permit their passage. Gastrocentesis, in the ordinary sense of the term, is, therefore, not always an effectual operation in the relief of distended rumens. When the rumen is not completely filled with food and the upper part contains gas elaborated from the food below, the relief from the operation is prompt; otherwise it is always very unsatisfactory because only a limited amount of the fermenting mass will bubble through the canula. If the relief is inadequate,—that is, if the threatening state continues, rumenotomy must be at once substituted. In the

extremely urgent case it is even allowable to plunge the blade of a large knife directly into the rumen without ceremony, in lieu of a careful, painstaken laparo-rumenotomy.

These operations for the relief of intra-abdominal tension in ruminants, must not be delayed too long. Their success depends largely upon their perfomance before fatal damage has been wrought by the extreme pressure upon the viscera of both of the large splanchnic cavities. Like enterocentesis in the soliped, gastrocentesis in ruminants is not a harmful operation, but is often discredited by performing it after the reactive powers of the organs have been destroyed by prolonged and extreme pressure.

In the soliped, gastrocentesis is never effectual. Although the stomach can with some difficulty be reached with a trocar and canula, the constitution of the contents is never of such

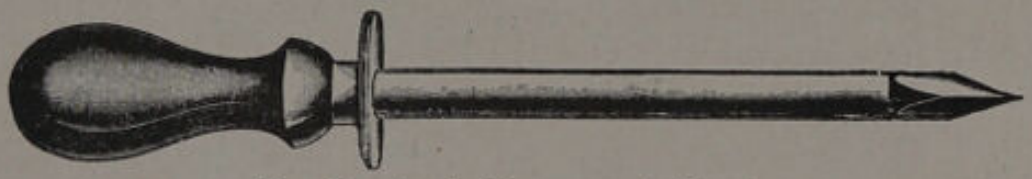


Fig. 37—Cattle Trocar and Canula.

a character as to admit of its passage through the canula in sufficient quantity to afford any relief. In short, tapping the stomach of the horse is not a sensible undertaking. It is uncertain, ineffectual, difficult, absurd. Aspiration by means of the stomach tube is the rational substitute.

In the carnivora, the overloaded stomach takes care of itself by emesis.

EQUIPMENT.—1. Scalpel.
2. Scissors.
3. Trocar and canula of large dimensions. (Fig. 37.)
4. Basin of antiseptic solution.

RESTRAINT.—The operation is always performed in the standing position, unless the patient has already fallen and is threatened with asphyxiation. In the latter event a plunge of the instrument into the exposed flank while the animals is recumbent is justifiable. In the usual case, fixing the head to a pillar, fence or stanchion is the only restraint required. It is advisable to have both sides accessible because in the smaller and medium sized animals the operation is performed by leaning over the body from right to left, in order to avoid a side-sweeping kick.

TECHNIQUE. First Step.—Locating the Seat of Operation.—The operation is performed in **the left flank,** except in rare instances when the animal is down with the right side uppermost and is in danger of death before it could be made to rise. The rumen occupies the left hypochondrium, and is therefore best reached from the left side. The exact location of the penetration is immaterial. The most prominent part of the distended abdomen anywhere between the tuber coxæ and the last false rib, and as near as possible to the transverse processes of the lumbar vertebræ, is the proper position.

Second Step.—Disinfection of the Field and of the Instrument.—Except in the urgent case the hair is clipped with the scissors from the selected spot, and then the region is washed with the antiseptic solution. The instrument, unless previously sterilized, is passed through the flame of a match, candle or gas-jet, or immersed in a strong chemical antiseptic. Although this precaution is less important than in the horse, too much dependence must not be placed upon the traditional immunity of ruminants to serious infections from such sources. A sensible disinfection of everything connected with the procedure is always expected of a careful surgeon.

Fig. 38—Gastrocentesis in the Ox. Position of Surgeon and Instrument.

Third Step.—Inserting the Canula.—A short incision is made in the skin with the scalpel, in order to facilitate the entrance of the instrument, which is then driven into the rumen with one sharp blow of the palm. The operator should stand at the right flank, performing these manipulations by leaning over the body (Fig. 38) unless they are found incompatible with the small stature of the surgeon or

the large stature of the patient. In this latter event the operator stands on the left side, but well forward and at arm's length, or else takes the precaution against injury by securing the left leg with a rope held or tied backward.

Fourth Step.—Evacuating the Gas.—The evacuation is then effected by removing the trocar from the canula and then occasionally replacing it to prevent choking of its lumen with ingesta, which sometimes flows out in considerable quantities. Before the operation is abandoned, the intra-abdominal pressure should be reduced at all hazards, to prevent large quantities of ingesta from flowing into the peritoneal cavity after the canula has been withdrawn. If the rumen remains stretched after it has been perforated, the opening likwise remains stretched wide open, and gives free exit to the contents. The warning already heralded in the description of enterocentesis in solipeds, to make frantic efforts to diminish the intra-abdominal pressure once the evacuation has been attempted by tapping, can not be too frequently repeated. If evacuation is found impossible through the canula, a rapid rumenotomy must be immediately performed. In the urgent case a probe-pointed bistoury is passed into the abdominal cavity along the canula, and an incision two inches long made in the abdominal wall in the downward direction. The rumen, which will then bulge into and even through the incision, is then incised with a smaller incision. After the first gush of ingesta, the edges of the incision in the rumen are grasped with forceps, and held through the opening in the abdominal wall until the flow ceases. Dependent upon the cause, manual abstraction of the contents after enlarging the opening of the rumen may or may not be necessary.

Fifth Step.—Protecting the Wound.—The incision in the skin made at the point of entrance should be protected by the application of an antiseptic powder,—boric acid, iodoform, or tannin. When larger incisions are made the rumen must be closed with two or more Czerny stitches and the abdominal wall with interrupted sutures.

AFTER-CARE.—After ordinary tapping of the rumen an antacid drench consisting of aromatic spirits of ammonia two ounces in a quart of water and a saline purgative of magnesia sulphate, are always indicated, but when the rumen has been incised it is preferable that that organ be left dormant long enough to allow the incision to partially unite. A limited liquid diet for several days is advisable.

SEQUELÆ.—(1) **Peritonitis** in various degrees of se-

verity often supervenes such operations. The inflammation is generally confined to the region surrounding the operation, but affects both the parietal and the visceral portions, often terminating in extensive adhesions of the rumen to the abdominal walls. It is caused by infection carried by the flow of ingesta into the peritoneal cavity through the perforation, by hæmorrhage, or by combination of such causes. Although not serious in the vigorous subject, it may prove fatal to the patient enfeebled by the disease or by previous causes.

(2) **Shock**, pure and simple, sometimes complicates rapid evacuations of the distended rumen. It is prone to supervene the sudden evacuation of a rumen that has been bloated for some hours, especially in aged or emaciated subjects.

(3) **Chronic perforation of the rumen.** (See rumenotomy.)

CYSTOCENTESIS

DEFINITION.—Cystocentesis signifies tapping the urinary bladder with the trocar and canula, for the purpose of evacuating its contents.

INDICATIONS.—This operation, while rather rarely ever required, is nevertheless important under certain circumstances. It is used chiefly as a preliminary step in the surgical treatment of urethral strictures of horses and oxen, which by producing total obstruction of the urine, cause the bladder to become so enormously distended as to expose it to rupture while the patient is submitted to the restraint necessary to perform the operation upon the urethra. For example, a horse, or ox suffering from a stricture of the urethra following an improper amputation of the penis, or from a calculus, is found with an enormously distended bladder. The patient must be moved some distance to the hospital, or possibly for some reason can not be operated upon until the following day, and when operated upon he must be secured and anæsthetized. By aspirating the bladder the suffering is temporarily relieved until the obstruction can be permanently removed at a later and more convenient moment. The urgency of the situation being met, the surgeon may then operate at his convenience. Again, when such a subject is cast and anæsthetized for the operation it is essential that the bladder be not so enormously distended as to expose it to rupture.

Veterinarians practicing where urinary calculi are common in cattle frequently find it necessary to resort to the

operation under some of these circumstances. Amongst horses these indications are not uncommon.

The bladder, in complete urethral obstruction, by distending under pressure of the constant entrance of urine, becomes stretched out of all ordinary proportions. Its capacity may increase to a point that is almost beyond comprehension. It may extend anteriorly as far as the liver, downward as far as the floor of the abdomen and posteriorly it may obstruct the pelvic lumen before the walls give way to the pressure, but usually in the horse and the ox a rupture of the urethra will occur at a point near to the obstruction long before the organ assumes such enormous proportions. In the dog a distended bladder, by enlarging the dimensions of the abdomen, may produce symptoms analogous to ascites. The two conditions are not easily differentiated. Even in making an explanatory puncture the nature of the fluid may escape attention.

The symptoms of complete urethral obstructions at first consist of repeated unsuccessful attempts to micturate; later the straining becomes forcible and continuous, but finally after several days it discontinues and no further attempt is made to evacuate the over-distended organ which now being paralyzed is no longer capable of conveying the necessary impulse. The symptoms henceforth are general, consisting of an accentuating emaciation, poor appetite, anxious eyes, slight fever and a more or less labored breathing. The straining, if any, is an occasional attempt to defecate rather than to urinate; the distended and paralyzed bladder compresses the rectum, which then conveys the wrong impulse.

The diagnosis in the larger animals is never difficult. The straining during the first few days, or a history that such straining to urinate has existed, followed by an investigating rectal examination, at once reveals the nature of the abnormality.

EQUIPMENT.—The only instrument required to perform the operation is an ordinary intestinal trocar and canula and a piece of soft rubber tubing that will fit easily over the canula after the trocar is withdrawn. The tubing is not absolutely necessary, as the urine will flow into and then out of the rectum without such an attachment. It is, however, advisable to prevent straining from the irritation of the rectal mucous membrane, caused by the urine.

TECHNIQUE.—The operation is exceedingly simple. The hand, previously lubricated with vaseline, holding the

trocar and canula guarded in the palm, is passed into the rectum about twelve inches at which point the bladder is found conspicuously bulged and extremely tensed. The point of the instrument is then advanced in front of the finger tips, and then pushed into the bladder in a slightly downward direction, by a sudden forward thrust. The trocar is withdrawn by manipulating it between the thumb and index finger. It is essential that the trocar be well lubricated and loosely fitted into the canula; otherwise its withdrawal with one hand alone would be impossible.

The rubber tube is then worked into the rectum with the opposite hand and then fitted over the hilt of the canula, thus completing a perfect siphon which will evacuate almost the entire contents.

SEQUELÆ.—Cystitis may follow several repetitions of the operation, but no noteworthy inflammation supervenes a single puncture. Jones performed the operation more than ten times on a yearling steer suffering from a urethral calculus, and found on post-mortem examination some months later that the bladder had undergone a severe acute inflammation that became chronic and caused thickening and induration of the whole organ, with a pronounced reduction of its capacity.

Shock.—Fatal shock may supervene the operation within a few hours, especially if the case be one of long standing. An old gelding suffered from a complete stricture of the urethra supervening a neglected frost bite of the penis, sustained by sleeping upon a cold, bare floor on a very cold night. A part of the organ sloughed off and the exposed urethra gradually constricted until only a few drops of urine were voided from the attempts to micturate. The obstruction was, in fact, complete, as the rectal examination revealed an enormously distended bladder. Preparatory to the removal of the patient to the hospital for operation the bladder was evacuated through the rectum, by means of an intestinal trocar and canula; but instead of giving the expected relief an alarming state of collapse almost immediately supervened. Tremors appeared at the shoulders, perspiration broke out about the head, the respirations quickened, the pulse became feeble and the whole body grew cold. These symptoms gradually accentuated and ended in death about three hours later. The examination post-mortem revealed no lesions to which the untimely death could be attributed.

KERATOCENTESIS

DEFINITION.—Keratocentesis is the name we apply to the operation of puncturing the anterior chamber of the eyeball for the purpose of evacuating the aqueous humor or abstracting harmful elements it may contain.

INDICATIONS.—The operation is performed chiefly for periodic ophthalmia, in which disease it is indicated either to prevent recurrence of the attacks or to evacute unsightly and harmful purulent products resulting therefrom. For the former purpose it is performed after the inflammation has subsided and the eyeball has regained its normal appearance. The object is to evacuate the dormant microbes which have now precipitated to the floor of the chamber, and which sooner or later will provoke another inflammatory attack. In this connection the operation is fairly, although not universally effectual. Attacks sometimes recur despite its performance. Notwithstanding these failures, however, it is a justifiable procedure. In the author's opinion, based upon observations, the attacks are made less acute, the intervals between them are lengthened and some cases are entirely cured. The best results are obtained after the first attack, and before serious structural changes have developed upon the iris and the lens. It is contra-indicated during the sojourn of the acute inflammation.

In addition to this indication, keratocentesis is sometimes needed to abstract floating or partially attached flocculent bodies from the aqueous humor, which appear during the declining stage of the inflammatory process. In rare cases, one of which has come under the author's observation, one or more whitish-blue, vermiform, bodies continue to inhabit the anterior chamber, after the disappearance of all other evidences of the attack. This condition has been mistaken for helminthiasis, which is much more rare, but which does occasionally supply an operable case.

RESTRAINT.—Recumbent restraint with the table is the most satisfactory form of confinement.

Local anæsthesia induced by dropping 10% cocaine solution into the conjunctival sac will answer for simple evacuation of the aqueous humor, but when the operation includes any intra-ocular manipulation it is much better to use a general anæsthetic. The powerful movements of the eyeball, which can only be curtailed by destroying all reflexes, prevent accurate execution, and must, therefore, be controlled by profound anæsthesia.

INSTRUMENTS.—1. Cataract knife. 2. Blunt hook. 3. Needle and silk suture, or an eye speculum.

A common, sharp-pointed curved bistoury may be substituted for the cataract knife, and the hook may be impro-

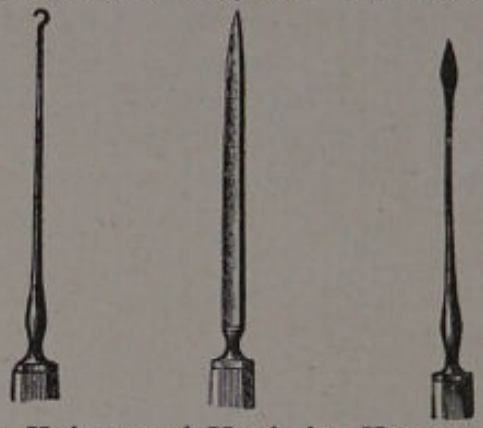


Fig. 39—Knives and Hook for Keratocentesis.

vised from any kind of bendable wire, the only special requirements being a smooth surface and a rounded, non-penetrant point. The needle and sutures are used as par excellence the best substitute for an eye speculum. (See step 1.)

TECHNIQUE.—First Step.—Adjusting the Speculum.—The eye speculum, a spring-wire affair, is placed beneath the lids, which it separates by its tension. When the anæsthesia is a profound one and the patient as a consequence thereof is perfectly still, the speculum will remain in place well

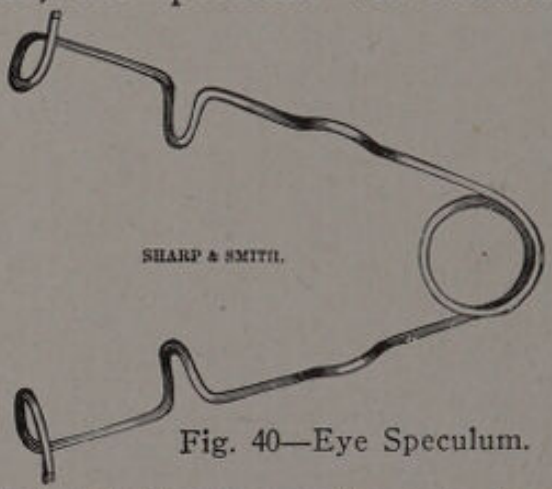


Fig. 40—Eye Speculum.

enough, but when only local anæsthesia is depended upon the movements of the head, the attempts to wink and the rolling of the eye-ball will usually dislodge it from its position and thus prove exceedingly annoying. In this event the author keeps the eye open by passing silk threads each about a foot long, through the center of each lid, and then detailing an assistant to draw the lids apart with them. In this manner the eye is widely opened and the seat of puncture is kept perfectly accessible without hindrance.

Second Step.—Puncturing the Globe.—The bistoury or cataract knife is then thrust carefully through the cornea near the inferior part of the corneo-sclerotic margin. The incision is made perpendicularly, that is to say, at a right angle to the margin and not parallel to it. The corneal vessels which radiate toward the center at right angles from the corneo-sclerotic margin, and which, owing to inflammation, are often perceptible, are thus avoided. Horizontal incision along the corneo-sclerotic margin, in eyes affected with inflammatory conditions, provokes bleeding into the chamber

Fig. 41.—Eye Affected with Periodic Opthalmia. X indicates Location of the Incision in Keratotentsis.

that defeats the purposes of the operation by obscuring the object to be removed.

The incision, which need not exceed one-sixteenth of an inch in length, is made **inferiorly,** because it is here that the morbid products to be removed have precipitated. Incisions made superiorly may answer well enough for the abstraction of helminths or floating particles, but for the treatment of periodic ophthalmia whose aim is the evacuation of precipitated septic products, the puncture must be made inferiorly.

The reader may be profitably warned that the cornea is an exceedingly tough integument, the incising of which requires a keen cutting knife.

Third Step.—Evacuating the Aqueous Humor.—Abstraction of Coagula, Helminths, etc.—In the treatment of simple cases of periodic ophthalmia the aqueous humor is rapidly evacuated by pressure upon the globe while the point of the wire hook keeps the incision open. If pieces of coagulated humor block the incision, they are hooked out and the

evacuation by pressure resumed. Attempt is made to entirely empty the chamber. Fixed coagula lying along the floor of the chamber or upon the posterior face of the cornea are teased loose with the hook if the fixation is not too firm, but when firmly attached the attempt will be futile and will provoke bleeding.

Free bodies are withdrawn by passing the hook around them regardless of the position they occupy in the chamber. The hook may be passed into the pupillary opening or to any part of the chamber which chances to harbor harmful elements.

AFTER-CARE.—The eye is treated daily to a rinsing of boric acid solution and then anointed over the entire globe and conjunctival sac with an ointment consisting of yellow oxide of mercury, ten per cent, and vaseline, 90 per cent.

SEQUELÆ and ACCIDENTS.—If performed with sterilized instruments no untoward results occur, but if septic

Fig. 42—The Eye of a Horse in the Acute Stage of Periodic Opthalmia.

products are deposited in the chamber, a possible inflammatory condition may follow. It is, however, remarkable how seldom serious inflammation supervenes.

The most common accident of the operation is bleeding into the anterior chamber. The cornea in periodic ophthalmia, even after all evidence of inflammation seems to have subsided, bleeds readily from its internal layer and as a few drops of blood dissolved in the aqueous humor immediately transforms the eye into a "blood-shot" condition, there is little possibility of proceeding effectually with the operation. In fact as soon as the blood has disseminated over the whole chamber the proceedings should cease.

PHLEBOTOMY

SYNONYMS.—Bleeding; blood-letting; venesection; blood abstraction.

DEFINITION.—Etymologically, phlebotomy is the surgical incision of a vein, but its meaning in surgery has been broadened so as to also include the abstraction of blood from the incision. The word "phlebotomy" is therefore synonymous in veterinary surgery with "blood-letting" from the jugular vein. The word is never used to designate the intentional incision of a vein during a surgical operation.

HISTORY.—Phlebotomy deserves to be described as the oldest surgical operation. It was a therapeutical measure of the most ancient healer. The oldest description of efforts to cure the ills of man and animals mention the operation, and elaborate upon its efficacy. It was performed alike on the rich, the poor, the young, the old, the thin, the obese, the man, the beast, for every deviation from health, whether a trivial indisposition or a grave malady, and its popularity as a curative measure did not wane until recent years. About the middle of the nineteenth century it began gradually to sink into disfavor. During the last half of the nineteenth century it ceased to be so generally practiced; now its practice is as rare as it was once universal. The better knowledge of pathology claimed by the present generation, the better understanding of the relations between physiological and pathological states, and probably, also, mere caprice, have relegated the operation to oblivion. The new physician, surgeon and veterinarian know nothing of blood-letting, and care less. The operation today is condemned, ignored and ridiculed everywhere. It has no adherents, except a few straggling remnants of the so-called old school,—passing entities.

INDICATIONS.—Let us see whether this manifest prejudice of the modern therapist against phlebotomy is justified, or whether it is only a prevailing fancy.

It is now pretty generally conceded that during the many centuries that blood-letting was universally practiced, many patients, afflicted with debilitating fevers and asthenic organic inflammations, were bled to death by their physicians. That Washington fell a victim to this practice is an American tradition. Among veterinarians it is known that animals likewise frequently were victims of this procedure, but in spite of these facts the operation has had its victories, otherwise an established popularity, lasting centuries, would have

been impossible. The persistency of its popularity was due partly to the fact that it was frequently very beneficial, that it seldom ever produced any perceptible harm, and that better antiphlogistic measures were not known. Depressing antiphlogistic drugs supplanted it, and although these still find some defenders, they too, are surely passing into oblivion as did phlebotomy. We are now living in the day of sanitation, hygiene and biologics. What will be next? While passing adverse judgment on phlebotomy as it was practiced in past and almost forgotten epochs, the operation deserves to be credited with its victories, which were legion. The evil was found in its wholesale application, in its application to enfeebled patients, and the prevailing practice of frequent repetitions as the strength waned. To have discarded it entirely was also an evil, for, in veterinary subjects at least, it is often highly and promptly potent in dispatching certain conditions of a sthenic character.

It is well known that the abstraction of a limited amount of blood, or even a very large amount, has no harmful effects upon a healthy animal. Instead it improves the general health by exciting the vital forces to renewed activity to replenish the loss. In disease, it has various missions, but is especially active in equalizing or regulating the general blood-pressure. When blood flows toward the side of the veins at the expense of the arterial volume and to the embarrassment of the right side of the heart, the abstraction of a limited amount of blood will often set matters right more promptly than any known drug. If the arteries are too full and the pressure high, venesection acts as a prompt corrective. This especially is the case in the first stage of the acute organic inflammations, **pleurisy, laminitis, croupous pneumonia, hepatitis, enteritis,** etc. It is probably a pity that bloodletting has been discarded entirely from the treatment of these diseases, because they often present features in their first stages that certainly call for an action that venesection alone can supply. In **congestions and apoplexies,** the abstraction of a liberal quantity of blood will always decrease the impending damage and limit the subsequent changes in the affected tissues. **Acute cerebral hyperæmia, acute pulmonary hyperæmia, acute hepatic hyperæmia, intestinal apoplexy and similar conditions,** lack a modern treatment as manifestly effectual.

Recently phlebotomy has been recommended in the **last stages of pneumonia** when death from a failing heart be-

comes imminent. Here its action in part, is that of reducing the heart's labors by diminishing the volume of blood. The operation is defended on the hypothesis that the capacity of the lungs being greatly reduced by the hepatization, only a limited quantity of blood can be oxidized, and hence the heart handles much blood unnecessarily. Besides, the heart being burdened with the fruitless task of driving an excessive volume through the impervious, hepatized areas, becomes exhausted and embarrassed. By limited blood-letting at this critical moment, the heart's labors are said to be reduced.

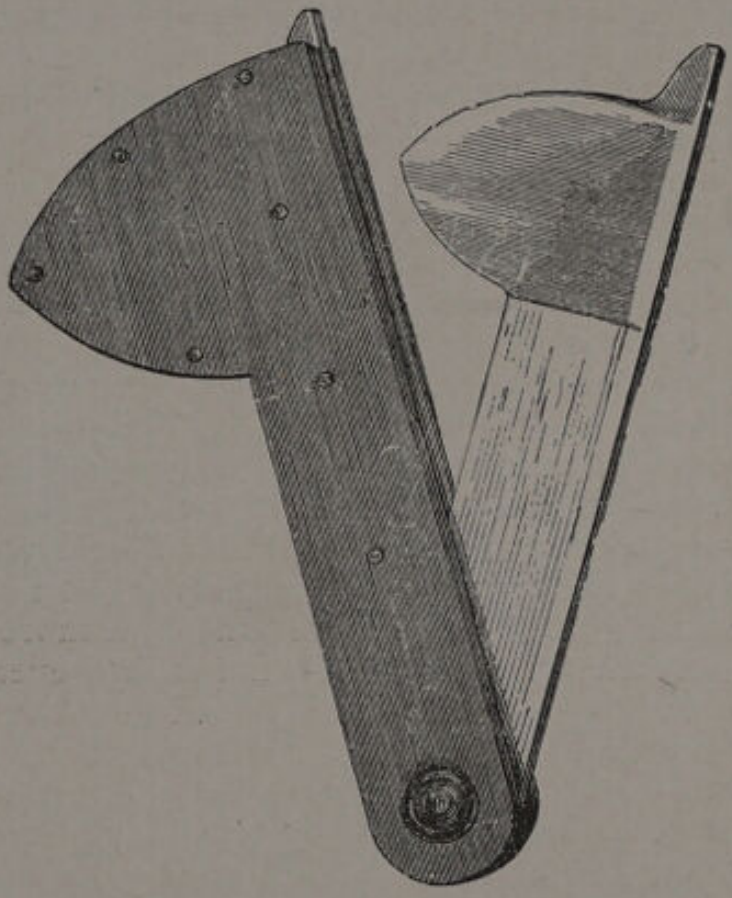


Fig. 43—Fleam.

The heart is given a momentary rest. Its burden is diminished. Its embarrassment is temporarily removed. The hypothesis upon which this treatment is based also includes the benefit derived by the dilatation of the aortas which always follows blood-letting. If the aortas relax, as they always do after venesection, heart's action is facilitated. There is less counter-acting aortic pressure. In their aggregate, these different actions are frequently followed by an immediate improvement in the dying patient's condition. Although

the effect is not lasting a critical period of the sickness is thus sometimes bridged over into the stage of resolution.

The treatment of the sinking pneumonia patient by bloodletting has not been sufficiently tested in veterinary surgery to establish its worth, but, although its theories can not be accepted as absolute laws, its logic is sound. The general prejudice against bleeding, even among laymen, and the fact that it no longer harmonizes with modern therapeutic ideals, prevents its adoption even as an experimental treatment.

Phlebotomy is also indicated when blood in any considerable quantity is desired for **experimental purposes.** It is also the method used in abstracting blood from the antitoxin-producing animals.

EQUIPMENT.—Phlebotomy is performed with the old fashioned **fleam** (Fig. 43) or a **sharp scalpel.** If the former is used a special **mallet** or a **heavy stick** is required to drive the blade into the vein, and as surgical cleanliness is essential, a **curved scissors** to clip the hair and **antiseptics** to wash the seat of operation, must be included in the equipment. A **long pin** and a **long tuft of tail-hairs** to close the incision after the blood has been abstracted, answers every purpose.

RESTRAINT.—Phlebotomy is performed in the **standing position.** The necessary restraint is accomplished with the **twitch** and the **hood-wink.** The twitch may sometimes be dispensed with, in fact it sometimes causes the horse to curve the neck or "set" the cervical muscles so as to obliterate the jugular groove, in which instance it is more of a detriment than a benefit. The hood-wink is, however, essential to prevent dodging as the fleam is struck with the mallet. A thick handkerchief, or even the hand placed over the eye, may be sufficient. The operation is best performed with the neck in the normal position, that is, held leisurely in a slightly upward direction. A high position, a low hanging position, or any strained, cramped position of the neck, renders impossible the necessary palpation of the jugular groove to locate and "raise" the vein.

TECHNIQUE.—First Step.—Locating the Seat of Incision.—The left jugular furrow in the middle of the cervical region, is the most advantageous position for the bleeding. Here the vein is less incumbered with muscles, and the location is in every way more accessible than either the upper or the lower thirds of the region.

Second Step.—Disinfecting the Field.—The hair is clipped from the groove at the point determined, with the curved

scissors and then the field is well rinsed with mercuric chloride 1-500. If the abstracted blood is intended for experimental purposes, or the manufacture of antitoxic serums a much better disinfection of the field is advisable owing to the importance of obtaining only strictly non-contaminated blood. In therapeutic phlebotomy, nominal disinfection suffices, but it must not be omitted. To thrust the fleam through a hairy, unclean field may result in a serious infective phlebitis, which in the ante-antiseptic days was one of the formidable sequelæ of the operation.

Third Step.—Incising the Vein.—The surgeon standing at the shoulder, facing forward, takes the fleam in the left

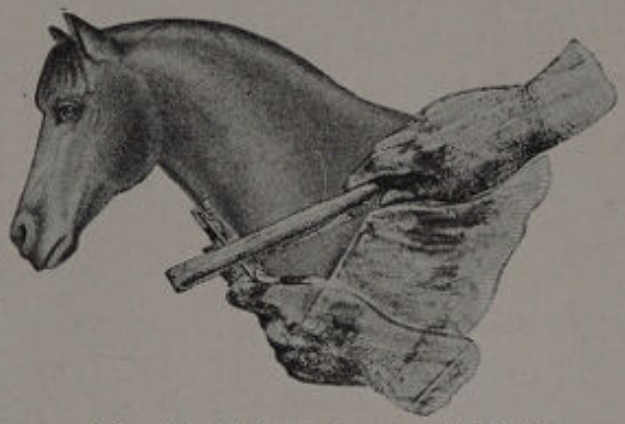


Fig. 44—Phlebotomy. (Frick.)

hand and the mallet in the right. The finger tips of the left hand (holding the fleam) are pressed firmly into the depths of the jugular furrow and as the vein fills up above them the point of the blade is adjusted to its most conspicuous part, the point touching the skin. Now after a glance forward to determine to a certainty that the blindfolding is effectual, the blade is given one quick, bold stroke with the mallet, forcible enough to send it, full depth, into the vein. A timid blow will result in a failure to reach the vein with the blade and will excite the horse, to the detriment of the next attempt.

Fourth Step.—Abstracting the Blood.—The vessel into which the blood is to be drained (a bucket or basin) is then pressed against the jugular two inches below the incision. It thus serves the double purpose of catching the blood and of bringing the necessary distal pressure to force it out of the incision. One, one and a half, or even two gallons may be abstracted, according to the effects on the circulation. Sometimes the flow will even cease before the desired amount is obtained, but more often it can be maintained as long as the vein is submitted to pressure below the incision.

Fifth Step.—Closing the Incision.—The pin is passed through each edge of the small incision and then wrapped in the form of a figure 8 with the hairs previously obtained from the tail or mane.

AFTER-CARE.—The only after-care necessary is the removal of the pin some four or five days later. The wound generally behaves well and requires no attention whatever.

ACCIDENTS AND SEQUELÆ.—A fleam blade in the neck of a small, thin horse might reach the carotid artery, if some judgment is not used in selecting an appropriate size, or in striking the blow. The danger here, however, need not be emphasized, as it is not very likely to occur. It is an impossible accident in a horse of ordinary flesh. Sometimes, after the pin suture is adjusted, the blood will continue to flow subcutaneously until a large sanguineous tumor develops around the seat of operation. Occasionally it assumes large proportions, extending as high as the larynx, as low as the thorax and outward three to five inches. In this event, if the flow is promptly discovered, a firm, continuous pressure above the incision will limit the flow and sometimes promptly arrest it. The patient must be kept quiet above all. If excitable, it is preferable to leave the patient quiet and await the spontaneous arrest of the bleeding. Under no circumstances must the incision be reopened with the intention of effecting direct pressure to the vein, on acocunt of the inevitable danger of infecting the blood clot and thus provoking a serious abscess and possibly a serious phlebitis. Generally, the flow being rather trivial, non-interference is preferable.

The most serious sequel of phlebotomy is phlebitis. This occurs in the form of a serious, threatening inflammatory condition extending along the entire vein, from its confluent to the throat and even into its cephalic and facial branches. The acute inflammation terminates in the formation of multiple abscesses extending toward the periphery but exerting their greatest effects about the parotid region. The course of the disease is chronic, and the prognosis is grave.

MODIFICATIONS.—Blood-letting from other veins besides the jugular is no longer regarded as a "modern veterinary method." The saphenic and radial veins were once bled for local diseases of the feet and legs, and pedal arteriotomy (bleeding at the toe) was once given some attention in the treatment of laminitis; but these measures have fallen into obscurity on account of their uselessness.

In lieu of fleams the scalpel may be used to perform jugular phlebotomy, and although it is a less satisfactory instrument, the operation need not be abandoned simply because a fleam is not available. In performing the operation with the scalpel, the skin is carefully shaved, disinfected and then anæsthetized subcutaneously to prevent annoying jerks of the head. The vein is "raised" by pressure below the field and an incision one inch long is made along its course through the skin and subjacent muscle until the rounded bluish vein appears in its depth. The incision into the vein is then made by a quick stab with the point of the scalpel.

Fig. 45—Laboratory Method of Abstracting Blood from the Jugular Vein. (Bayer.)

In closing this long incision two pins or two interrupted sutures are required.

In blood-letting for **experimental purposes or in the manufacture of antitoxins,** a special apparatus is required to prevent the abstracted blood from becoming contaminated with bacteria from without. The apparatus, appropriate enough for most any occasion, consists of a sterilized salt-mouth flask, a small rubber tube and two canulæ. The mouth of the flask is covered with a sheet of rubber stretched over it and secured around the neck. A canula is fastened at each

end of the tube. In abstracting the blood one canula is plunged into the jugular after everything is well disinfected, and the other one is plunged into the rubber covered flask. In this manner the blood is not exposed to outside influences.

LIGATION

DEFINITION.—Ligation is the application of a ligature, or, in other words, the operation of tying either normal or abnormal structures with a cord that encircles them.

INDICATIONS.—Ligation in surgery has two distinct objects:—(1) The arrest of hæmorrhage when applied to blood vessels; and (2) The strangulation of neoplasms or hernias.

The arrest of hæmorrhage by ligation is an important surgical process, made necessary by the profuseness of bleeding that occurs when large vessels are divided, and when such vessels can not be safely occluded by the more simple methods. In the course of surgical operations, or in the treatment of a bleeding accidental wound, the demands for ligation must be cautiously judged. Large vessels, especially arteries, require ligation to prevent fatal bleeding, serious anæmia, and shock, as well as to overcome the masking effect of blood. Large vessels, although apparently safely twisted with the hæmostatic forceps, may yield a secondary hæmorrhage, whenever the cut vessel is large enough to endanger life by loss of blood, or to discharge enough blood into the traumatic cavity to disturb the apposition of the mended breach. It is contra-indicated when the vessels are small, easily managed by twisting and unlikely to yield a secondary bleeding; or, when buried in a trauma, the ligature might act as a foreign body to the detriment of neat healing.

The strangulation of neoplasms by ligating the base or peduncle, is indicated as a method of ablation when the growth is small, has a more or less constricted base and where for various reasons surgical ablation is deemed inadvisable. **Warts** and other growths on animals that run at large, or that are too wild to submit to daily treatment of their wounds, may be disposed of at one stroke by simply strangulating them with a ligature and then leaving them to slough off without any further attention. The operation has the advantage of not exposing the underlying tissues to infection, as occurs when a growth is dissected out and the wound is sutured. Sutured wounds require a certain amount of

after-care that may be difficult or even impossible to carry out under some circumstances. **Hygroma of the elbow (Shoe-boil)**, located at a movable part that often heals badly when wounded, is sometimes submitted to this form of treatment. In fact many practitioners, owing to the bad behavior of the shoe-boil wounds, have a decided aversion against total ablation of these common lesions by dissection, and prefer to strangulate even the larger specimens. The practice in this case is, however, not a perfectly harmless one, nor is it universally curative, for frequently the denuded abrasion left on the elbow after the sloughing is complete, may heal slowly and even develop into another growth as large as the first. And besides, the strangulation of so great a structure may cause threatening reaction of no small proportions in the sur-

Fig. 46—A Ligature Adjusted to a Neoplasm.

rounding area, which in some instances ends disastrously. The operation should be reserved for small growths.

The radical treatment of superficial **aneurism** and **varicose veins** consists of a ligation of the affected vessels at each end of the dilatation (ligation of continuity), but these abnormalities are relatively rare in domestic animals and hence are of little importance to the veterinarian.

In the treatment of **hernias** ligation is often selected as the best method of destroying the hernial sac. **Umbilical hernia** in particular is best managed by this method. (See page 359) but scrotal hernia (See page 370) and even traumatic hernia, can sometimes be effectually cured by special methods of ligation. Ligation in hernia of animals is preferable to radical herniotomy on account of the greater danger of infecting the peritoneum and viscera in the latter procedure.

CLASSIFICATION.—Ligation is classified into **simple, sectional** and **elastic.** In **simple ligation** the base or pedunc le of the growth is merely encircled with the ligature, while in **sectional** or **multiple ligation** they are divided into two

or more sections by the passage of the ligature through them. **Elastic ligation** is the name given to the application of a rubber band around the peduncle of a growth, which gradually cuts its way through by pressure upon the incarcerated tissues. (Fig. 46.)

EQUIPMENT.—1. Full curved special needles, aneurism needles, and straight needles are sometimes needed to effectually carry ligatures into desired positions. (Figs. 47-48.)

2. Cords of silk or linen thread, the size of which must vary according to the requirement, are the best ligature ma-

Fig. 47.

Fig. 48.

Figs. 47 and 48—Aneurism Hook and Needle used in Ligation.

terial. Exceptionally large strands are needed in ligating large growths, and in every case they must be strong enough to withstand the severe traction necessary to tighten them enough to strangulate the growth. For ligating vessels the ligatures must vary according to the size of the vessels, not on account of strength but because small threads applied to large vessels will cut them off too rapidly—before the coagulum has effectually occluded the lumen of the stump.

3. Common rubber bands of various sizes are utilized for elastic ligatures.

TECHNIQUE.—The Ligation of Blood Vessels.—A blood vessel to be effectually ligated must be isolated and drawn out of the tissues with a forcep, so that the ligature when tied will not slip from the stump. When surrounding tissues are caught in a ligature it is very liable to slip off as soon as the parts are disturbed by movements or manipulations, but this accident can be prevented when the vessel can not be isolated and drawn out, by encircling the spot with a tobacco-pouch stitch, which, when drawn taut, will retain its

position against any ordinary disturbance. The insertion of such stitches is facilitated by a double special needle arranged in the form of a forcep. (Fig. 49.) The needles are pushed through the tissues on either side of the bleeding spot, threaded, drawn back, and then unthreaded, thus leaving the vessel surrounded with a ligature ready to be tied.

In the course of surgical operations it is, however, advisable, when possible, to ligate vessels before they have been cut. Whenever it is known that a certain large artery or vein must be sacrificed in the execution of the steps of an operation its isolation and its ligation, proximally and distally,

Fig. 50.

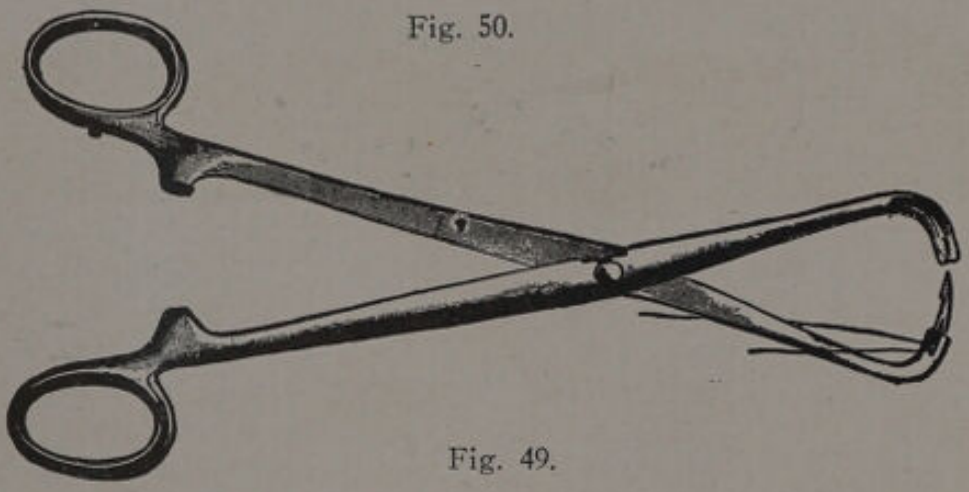


Fig. 49.

Figs. 49 and 50—Forceps for Ligating Blood Vessels.

should be effected at all hazards before destroying its continuity. Superficial vessels, especially subcutaneous veins, which cross the line of incision, should be dissected out and ligated at each edge of the cutaneous incision before being cut, in order to intercept the vexing hæmorrhage. Veins which stand out prominently will collapse and retract into the tissues after their continuity is severed, and will be much more difficult to manage than before they were divided.

When a ligated vessel is in close proximity to the cutaneous incision the thread should be cut long so that its ends may protrude to the surface between the edges of the incision, thus facilitating removal by traction as soon as the stump has sloughed through. Buried ligatures which can not

again be reached on account of healing of the surface wound should be cut short so as to leave only a small amount of irritant substance in the trauma. Absorbable ligatures,—fine silk of catgut,—only are admissible for this latter purpose.

The Ligation of Growths.—A small pedunculated growth, or any one with a narrow base, is strangulated by simply passing a cord around it as close to the surface of the body as possible and then drawing it taught enough to effect a total strangulation of the circulation. The cord should be of good texture so as to withstand the traction. The "double-half-hitch" which can be drawn tighter and tighter without slipping loose is preferable for the first knot, but when tightened to the desired point it must be fortified against loosening by the addition of two simple knots. **Sectional ligatures** are applied by passing a thread through the base of the growth

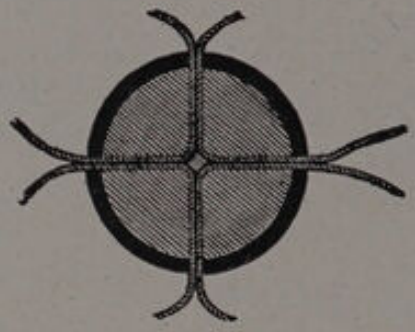


Fig. 51—Quadrisectional Ligation.

with a needle. If it is desired to divide a growth in but two parts a double thread is passed through the center of the base, the needle is cut off, and then each half is tied separately. To apply a quadruple ligature the growth is thus transfixed in two directions so that the threads cross each other at the center of the base. Although by this method each quarter is not encircled by a single thread the result, after the threads are tied, is equivalent to that of real quadruple ligation. By passing threads through part after part as shown in figure 44 a growth of any size may be ligated into as many sections as is thought desirable to effect a perfect strangulation of the integral mass. In order to still further assure total obliteration of all nutrition a second series may be inserted in the opposite direction either above or below the first series.

(For ligations of the rectum and vagina see page 469.)

CAUTERIZATION

DEFINITION.—Cauterization is the burning or searing of tissues with heated metals or chemical caustics. It is called **actual cautery** when executed with a hot iron and **potential cautery** when accomplished with chemical substances. (Actual cauterization of the skin and underlying tissues for the purpose of curing lameness is described under the name of "firing.")

INDICATIONS.—The objects of cauterization are numerous in veterinary surgery. Both actual and potential may very frequently be brought into service to excellent advantage in the treatment of innumerable diseases and to meet many conditions where radical surgical intervention is inadvisable or inexpedient. For example, **a quittor, a fistula of the withers or a poll-evil,** for various reasons may be treated by the introduction of caustics into the fistulous tracts in lieu of the more radical operations, and often with exceptionally good results. In fact, in this day of modern surgery there are still many of the foremost veterinarians who prefer this method of treatment to the modern operations, because of the facility with which such treatment can be carried out as compared with the trouble of performing a surgical operation, and on account of a prevailing aptitude of many practitioners to avoid "the knife" as much as possible. The veterinarian without surgical skill and the charlatan are, however, the chief adherents to the caustic methods of treating chronic fistulous conditions, although the foremost surgeons sometimes adopt it as a convenient recourse.

The benefits of such treatment, often very limited, are sometimes excellent. The caustic substance introduced in a tract destroys the layer of infected granulations, bringing them out in the form of a burned tube—"the pipe"—some few days later after they have separated from the surrounding living tissues. Thus the fistulous tract is widened to the benefit of better drainage, and a healthy reaction is stimulated in the surrounding tissues which bound the tract. But the absolutely satisfactory results are only derived when the **necrotic center** (the necrosed cartilage, bone or ligament) already well separated from its surrounding tissues, is also brought out with the cauterized granulations. Under such circumstances the cauterization of a fistula is at once curative,—cicatrization then supervenes unmolested.

If caustics were used with a full knowledge of the elemental principle that fistulous tracts always direct their

course down to some underlying cause whose removal will thereby, sooner or later be effected, their application might then be defended as rational therapeutics. The removal of this underlying cause as the initial or ultimate object of the treatment, places, cauterization of fistulous tracts amongst scientific measures whilst its use to simply "burn out" tracts discredits it as the recourse of an empiric.

As a **hæmostatic** hot iron cauterization is par excellence the best under many circumstances. In **amputations of the tail** of any of the domestic animals, but especially of the horse, there is no better nor safer method than the hot iron. In the **ablation of exuberant granulations** on any part of the body, but especially about the feet of horses, the copious bleeding is promptly controlled by searing. The same may be said of **keloids of the fetlocks, abnormal growths of hoof** about the coronet and warts and other growths at different parts of the body. In the execution of **extensive dissections** the pointed cautery can be utilized to excellent advantage in touching up small bleeding vessels whose caliber is too small to twist with the forceps but which, on account of their numbers, yield an annoying hæmorrhage.

In the treatment of **non-operable growths** the caustic is the only resort. Carcinomatous, actinomycotic, botryomycotic, and sarcomatous growths are sometimes controlled indefinitely, and even cured, by the judicious application of cauterant chemicals. It is quite customary now-a-days to treat the "lumpy jaw" in this manner, sometimes after a part of the tumor has been resected, but often by simply introducing the caustic into the existing fistulæ. The vascular field in which these tumors are often located, the inaccessible position they occasionally occupy or the indispensable organs they sometimes implicate, may preclude surgical ablation and thus justify the use of caustics.

Caustics may also be used to advantage in the treatment of **indolent superficial ulcers.** By burning out the layer of inactive, unhealthy cells, a new vigorous reaction may be stimulated underneath, with the effect that normal cicatrization will often supervene. **Ulceration of the cornea** in dogs may often be controlled by touching up the ulcer with nitrate of silver, and **refractory sores about the legs** of all the domestic animals very often yield only to cauterization.

THE CHEMICAL CAUSTICS.—There are many caustics available for these purposes and all of them have the same general effect. They vary only in the degree of the

cauterization produced and the time required to completely destroy the tissue with which they come into contact. For example, the strong mineral acids have instantaneous cauterant action while the salts act more slowly. Among the most appropriate chemical caustics for veterinary use are: **Arsenic, cupric sulphate, mercuric chloride, mercuric oxide, mercuric iodide, zinc chloride, silver nitrate, formalin, solution antimony chloride, hydrochloric acid.**

1. **Arsenic and cocoa butter,** one part of the former to four parts of the latter, is probably the most suitable caustic to apply upon the surface of malignant growths, although many other combinations containing arsenic have been recommended. Amongst these are **Plunket's caustic** for the cure of cancer, consisting of ranunculus acris, eight parts; ranunculus flammula, eight parts; and arsenicum trioxidum, one part; **Luke's ointment** consisting of two grains of arsenic to one ounce of spermaceti ointment; and the **French arsenical paste** consisting of red sulphide of mercury, seventy parts, dragon's blood, twenty-two parts, and arsenic trioxide, eight parts.

These cauterant pastes are smeared over the growth and sometimes bound to it with bandages. After several days the dead cauterized surface separates from the underlying living parts and comes off en masse in the form of a blackened, scab-like body. A second, third or fourth application may be necessary to thus remove, piece by piece, the entire growth.

Cupric sulphate is an excellent caustic for fistulous tracts. In its desiccated form it is wrapped into small tampons with tissue paper and packed, tampon after tampon, into the tract until completely filled. The patient will manifest pain after application of copper sulphate, but the pain is not lasting. The cauterization and final separation of the cauterized tissues requires from five to eight days. When this is removed the tract is submitted to ordinary antiseptic treatment until cicatrization is complete. In quittor, fistula of the withers or poll evil if the nectrotic center is still retained in the depths of the tract a second or a third application may be found necessary.

Mercuric chloride.—This chemical may be used dry or in solution. Dry, it is used in the form of triturates or in tampons like cupric sulphate. It is, however, much more powerful than the latter and should be used with much greater caution, especially when the tracts approach synovial membranes. In solution for the purpose of wiping out fistu-

lous tracts, especially of quittor, Hughes recommends the following mixture which has gained quite a local reputation in the cure of that foot disease: Mercuric chloride one-half ounce, hydrochloric acid, C. P. one ounce, and alcohol seven ounces. This strong solution may be freely injected into tracts if the precaution is taken not to allow the overflow to cauterize the surrounding skin. After a few injections at intervals of two or three days the walls of the tract and cavity slough out and leave a healthy surface ready to heal, providing there is no remaining slough to perpetuate the suppurating process.

Mercuric oxide, is a potent caustic, and although it possesses no special virtue as such, it is mentioned here because of its past popularity in the castration of horses with the wooden clamps. **The caustic clamps** of the old "gelders," prepared by smearing them with a paste made of flour, water and red precipitate, may still be retained when the clamp method of castration is insisted upon, as by this paste the clamps are not only made antiseptic but crushed portions of the spermatic cords slough off much earlier than if the caustic is omitted.

Zinc chloride is an effectual caustic, but it is seldom used alone. It is one of the constituents of most all of the popular caustic pastes that are so often reputed as possessing wonderful curative properties in fistulous conditions. Mixed with equal parts of melted Burgundy pitch to which a little linseed oil is added to soften it, it forms a slow but certain caustic for general use in fistulous tracts. In this form it can be rolled into sticks which can be pushed into deep and tortuous recesses, owing to their properties of being both firm and pliable.

Mercuric iodide, dusted upon granulation surfaces is an excellent caustic wherever indicated. In fistulous tracts it is highly recommended by C. A. Cary, mixed with lard and smeared over gauze which is then packed in the tracts. Its behavior simulates that of all other caustic used in this manner.

Formalin, is a powerful liquid caustic. Injected into fistulæ it immediately mummifies everything with which it comes into contact, but it produces an excruciating and lasting pain that renders its use rather hazardous. In weak solutions, even as low as two per cent, its repeated use will bring about this characteristic mummifying effect that is sometimes desirable in destroying infected granulation.

Argentum nitras is one of the oldest as well as one of the

best caustics for general use. It is chiefly used for penciling ulcers and ulcerated surfaces, but may like any of the other ordinary caustics be used for the cauterization of fistulous tracts, either in the form of tampons or in pencils.

Solution of Antimony Chloride.—Among the various liquid substances possessing an active cauterant action solution of antimony chloride is much to be preferred on account of its safety. Applied to diseased surfaces or swabbed into tracts carpeted with granulations, it produces but little pain while at the same time effecting a thorough cauterization of the tissues with which it is brought into contact. It is less apt to destroy tissues beyond point of application, than is the case with the mineral acids.

Hydrochloric Acid.—Among the caustic mineral acids hydrochloric is the most appropriate. It is often applied to nail wounds of the foot by farriers, and generally with very good results. If brought into every part of the wound it effects an instantaneous disinfection and at the same time clothes the breach with an impervious scar against subsequent infection.

Martin's caustic.—A good caustic for general use on wounds and in fistulous tracts consists of mercuric chloride one ounce, hydrochloric acid C. P. one ounce, alcohol seven ounces. To this may also be added one ounce of oil of turpentine.

LANCING

DEFINITION.—The word "lancing" in surgery may be defined as the more or less sudden thrust of a knife into a cavity with the object of evacuating its contents. It must be distinguished from "incision," which is a more deliberate cutting process, and from "paracentesis," which is performed with a rounded instrument.

INDICATIONS.—Lancing is indicated in the evacuation of abscesses, hygromata, cysts, sanguineous sacs, and serous sacs which occupy superficial positions, but only in regions where there is no danger of accidentally wounding important structures, such as large vessels, ducts, nerve trunks, and synovial membranes. In fact and in short, the lance should be used only to perforate the skin. Deep cavities, especially when the physiognomy of the region is changed by swelling and the anatomical relations are probably altered and easily misjudged, should not be submitted to this "reckless" surgical process. Senn admonished his students to "beware of

the lance," and recommended that its use be discontinued except for strictly superficial lesions whose nature has been positively established, and even here the more calculating methods of evacuation were advised.

In dealing with abscesses that have developed to the stage of "pointing" and in all subcutaneous fluid accumulations of animals, lancing may, however, be defended as a safe and suitable process of evacuation. It causes less opposition from the patient than the making of a painstaking incision, since the pain is limited to a single pang that is scarcely felt.

RESTRAINT.—The necessity of providing pre-operative restraint is herewith emphasized on account of the especial danger of sustaining personal injury, if not also to render the aim and thrust of the lance more accurate. The thrust of the lance very frequently provokes an unexpected, sudden blow from an apparently tractable patient. In lancing about the jaws, shoulders, the twitch applied to the nose is sufficient. On the fore legs, in addition to the twitch the affected leg should be lifted by an assistant. It is dangerous to lift the opposite leg in lancing about the knees, fetlock and feet, on account of the tendency of the patient to rear suddenly while the surgeon is in a low, crouching attitude, whence escape is impossible. About the hind extremities, tail, thighs, buttocks, and groins, flanks, hips and abdomen, one hind leg must be elevated above the floor with the side line to assure against injury.

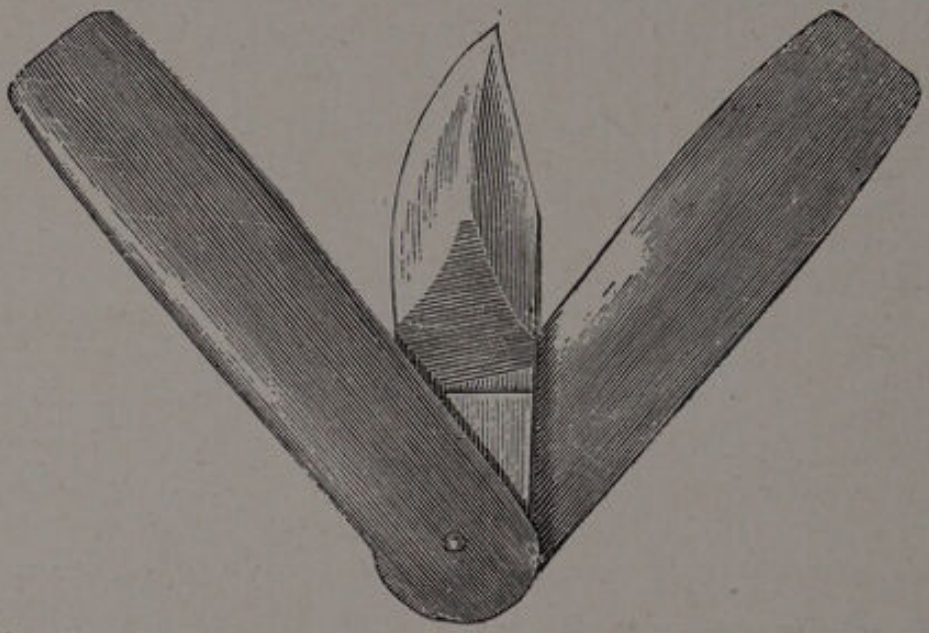


Fig. 52—The Lancet most Appropriate for the Veterinary Practitioner.

INSTRUMENTS.—The common scalpel will answer for

a lancet, although the regulation instrument is preferable (Fig. 52) as the cutting edge extends to both sides.

TECHNIQUE.—Lancing is executed by one, forcible, forward thrust of the lancet. If it is desired to make an opening larger than the width of the blade a well gauged sweep in the desired direction is made almost simultaneously with the forward thrust. The proposed depth of the perforation if first estimated and then accurately attained by guarding the blade with the thumb and index finger.

SETONING

DEFINITION.—Setoning is the application of tape or other fabrics through or between tissues for the purpose of exciting a prolonged state of irritation, or for the purpose of maintaining a drainage.

INDICATIONS.—Setons are specially indicated in the treatment of obstinate, **deep-seated lesions of muscles and articulations,** particularly of the **shoulder** and of the **hip.** When lameness from such lesions persists despite rest and superficial applications, setons are indicated and often ac complish the desired effect promptly. In **muscular atrophy** supervening injuries to motor nerves, setons applied directly over the wasted muscles will stimulate the regenerative process, but only after the nerve itself has already regenerated. In atrophy too much must not be expected of setons before the function of the injured nerve has been restored, because muscle regeneration is incapable of proceeding in the absence of the nerve impulse to stimulate its contractions. But when the innervation has been re-established and the muscle elements become stimulated to renewed activity, the application of setons will materially promote the regenerative process, and thuse soon restore the wasted region to its former condition. In the treatment of **"shoulder sweeny,"**—a typical example of atrophy from suspended innervation,—seton after seton may be inserted without effect and the case may finally be abandoned as incurable, when suddenly at a given time it is noticed that the region is filling up. At this moment, which in fact, corresponds to the time that the function has been restored, setons will hasten the growth of the muscle fibers. If the nerve is injured beyond repair the atrophy will be permanent in spite of all treatment. In the **atrophy of azoturia** an analogous situation is encountered. The muscles waste rapidly and remain atrophied in spite of all treatment as long as the nerves remain inactive, but fin-

ally, after months, they begin to regenerate and are soon restored up to normal size. It is during this period of spontaneous regeneration that the seton is an effectual auxiliary. In other words, setons are incapable of regenerating paralyzed nerves, but will promote the restoration of the wasted muscles when the nerve impulses are resumed. That is to say they promote muscle regeneration in atrophy.

In the treatment of **navicular disease** the **frog seton** was once a standard treatment, but owing to the poor results generally obtained, its use has been discarded by the modern veterinarian. The results once attributed to this method of treatment were probably always over-estimated, and it is quite evident that errors in diagnosis have been the means of giving credit where it was not due.

Setons are also frequently used in the treatment of fistula of the withers, poll-evil, and other deep-seated tracts, for the purpose of preventing the drainage orifice from closing up. This mode of treatment is however no longer thought to be of any service and has been replaced by the use of rubber drainage tubes.

RESTRAINT.—Subcutaneous setons for the most part can be inserted with the patient in the standing position with the aid of the twitch and the side-line. In deep fistulæ of the withers or similar conditions, especially in restive animals, the recumbent position may be found necessary in order to more effectually trace out the depths of the tracts with the long needle, but besides these circumstances the upright posture of the animal is preferable. Furthermore, the subject that is too restive to endure the pain of insertion is no fit subject for the operation, because of the difficulty of properly caring for the setons and the field thereafter. A docile animal is sometimes transformed into an intractable fiend by the pain inflicted in necessary turning of the setons day after day, hence the advisability of avoiding such treatment in other than perfectly tractable subjects.

EQUIPMENT.—1. Seton needle. (Fig. 53.)
2. Sterilized tape.
3. Scalpel or roweling scissors.
4. Clippers and razor.
5. Soap, water and antiseptic solution.

The seton needle for the application of subcutaneous setons to meet every ordinary requirement should be eighteen inches long, and bendable so that it can be shaped to follow the curves of the body. Its point should be sharp and slightly curved outward in order to facilitate its passage

through the skin at any desired point by slightly pressing the threaded end toward the body. Blunt-pointed needles are sometimes preferable to sharp ones in tracing fistulous tracts to their lowest point, owing to the likelihood of the latter leaving the tracts and penetrating the tissues, but when these are used an incision must be made with the scalpel at the point of exit, determined by palpating the blunt point of the needle within.

TECHNIQUE.—First Step.—Preparing the Field.—The hair must always be closely clipped over a liberal surface in the interest of general cleanliness of the operation, as well as to rid the region of long hairs which are certain to be drawn into the seton tract during the after-treatment as well as at the time of insertion. In addition to the clipping the whole area is washed with soap and water and then

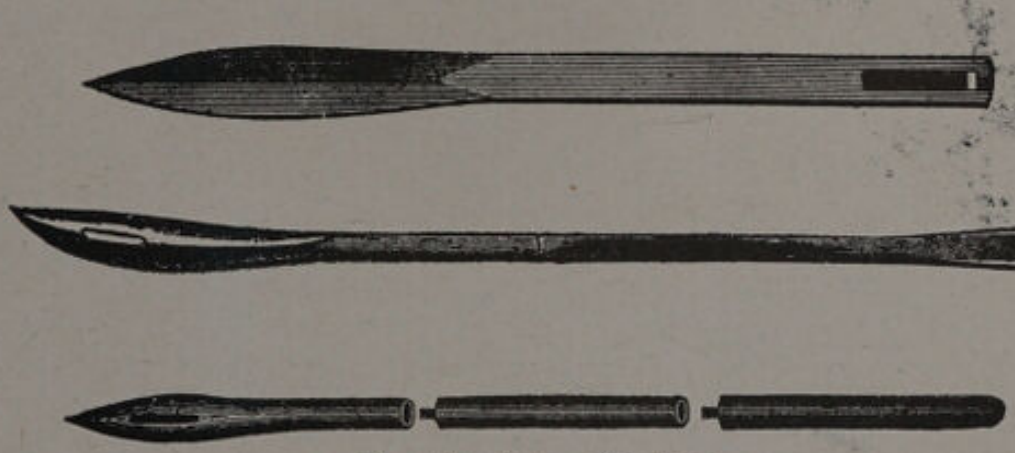


Fig. 53—Seton Needles.

rinsed clean with mercuric chloride 1-500. At the points of entrance and the points of exit the hair is shaved closely with the razor.

Second Step.—Incising the Skin at the Points of Entrance.—The skin in each of the shaved spots representing the entrance points, is picked up with the thumb and finger of the left hand and incised about one-half inch with one plunge of the scalpel.

Third Step.—Inserting the Setons.—The needle, previously armed with tape of necessary length, is passed into the incision and then forced downward through the subcutaneous areolar tissue with a firm but gentle pressure. The curved end of the needle, being pointed outward, must be guarded against a premature puncture through the skin by pulling the uppermost end from the body as it passes downward and until the sharp point is felt beneath the skin at the shaved

point of exit; then, with a sudden thrust, the needle is forced through and the tape is drawn into the tract.

Fourth Step.—Tying the Tape.—There is the choice of two methods of preventing setons from being pulled out; one being that of tying the two ends together into a loose loop, and the other is that of tying a light, rounded stick of wood at each protruding end far enough from the points of entrance and exit to admit of considerable movement of the tape. The former is preferable because during the after-treatment it admits of a thorough washing of the tape with

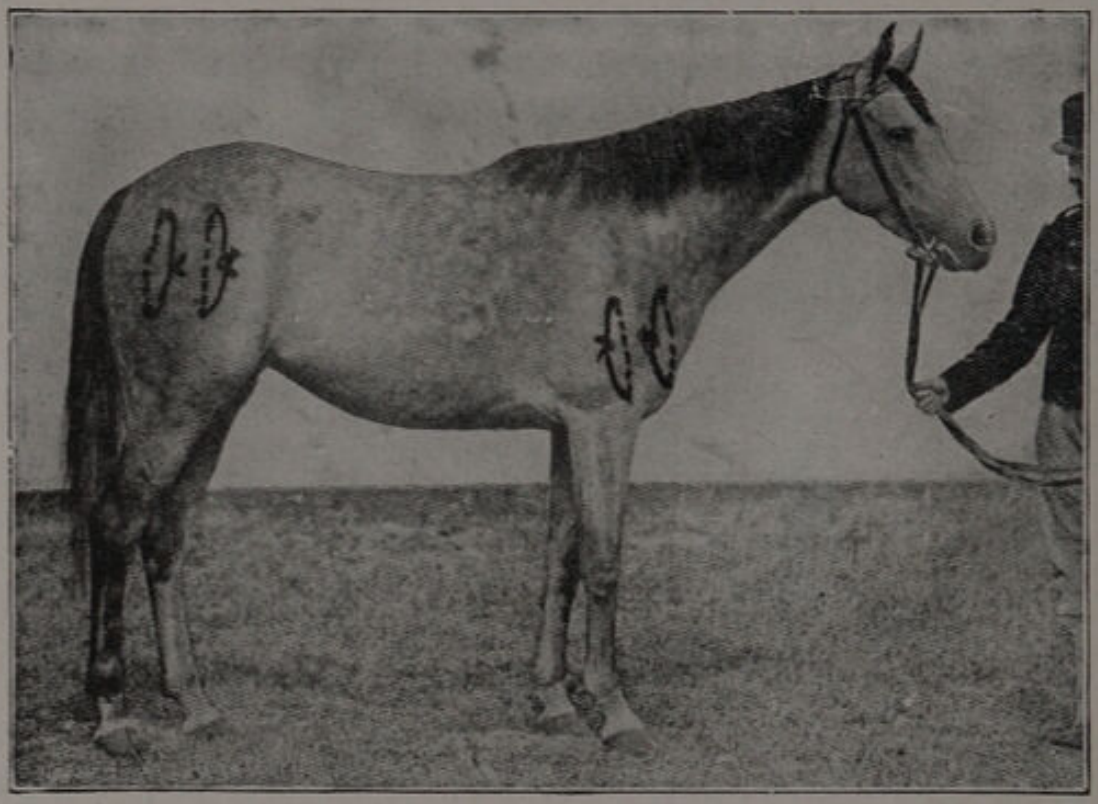


Fig. 54—Setons of the Shoulder and Hip.

antiseptics before it is drawn into the wound, although it leaves the tape in danger of being torn out by the teeth or by accidentally catching upon protruding objects,—accidents which should not be permitted to occur. The latter method although leaving the tape protected against accidental tearing out, is objectionable because the same portion of the tape is always in the tract and hence cannot be effectually cleansed during its entire sojourn in the tissues; and, furthermore, its surface being constantly soaked with sleek, slimy pus, its movements do not cause the same amount of irritation as a newly-washed tape.

AFTER-CARE.—Subcutaneous setons inserted against

a muscular atrophy or a deep articular lesion are usually retained for twelve to fourteen days, after which they will be found to have caused a putridity that necessitates their removal. Beginning with the end of the first twenty-four hours the whole region, including the tape, must be submitted to a good antiseptic washing. The buried part of the tape, after the exposed part has been well cleansed, is drawn out and washed, and then a little iodoform is dusted over each incision. This washing, cleansing and turning of the tape is repeated daily until its removal. At no time must a seton be allowed to remain in the tissues for more than twenty-four hours without being moved because of the danger of serious infections. Tetanus, malignant œdema and septicæmia, frequent enough sequelæ, seldom follow the operation unless the tape is permitted to lie unmoved in the fructuous microbian incubator that the subcutaneons seton creates. After several days there is less danger, because the tissues constituting the boundary of the tract have then protected themselves against the invasion of microorganisms.

At the end of twelve to fourteen days the tape is removed, the tract irrigated with antiseptic water, and the points of exit and entrance are treated with strong astringents to prevent blemishing. Abscesses which may have formed along the tract, and which do not discharge their pus into it, are lanced and irrigated. At the end of twenty days the region is normal and ready for a second operation if necessary.

When setons are inserted for drainage or to prevent the premature healing of chronic fistulæ they maye be retained indefinitely, but it is advisable to replace the tape with a new one occasionally to prevent undue putridity of the fabric from its constant contamination with the pus.

SEQUELÆ.—Setons create a favorable field for the propagation of **anærobic bacteria**; the sheltered environment they supply is favorable to bacterial growth. This fact alone is sufficient warning as to the possible dangers of this simple operation, and at once suggests to the operator the importance of inserting only strictly sterilized setons and only in a field that has been disinfected in no perfunctory manner. The insertion of septic setons and then allowing them to remain unmoved for several days, must be avoided. Despite the fact that a seton tract always becomes infected, which in fact is the desideratum, the infection should be allowed to occur only after the tissues have protected themselves against a spreading of the infective inflammation into

the surroundings. The mere presence of the sterilized seton in the tissues stimulates the formation of a barrier against microbian invasion, and the moving of it will prevent the incubation of dangerous anaerobes that may have accidentally been drawn into the tract.

Septicæmia, malignant œdema, and tetanus are so many formidable complications liable to supervene the insertion of setons, that whenever there is any suspicion of the development of such serious diseases the tract must be laid bare and submitted to an energetic antiseptic treatment.

FROG SETONS

The term "frog seton" is applied to a tape inserted along the course of the perforans tendon, from the pit of the heel to the anterior end of the frog. Its course is between the plantar cushion and the tendon along the entire long axis of the former. Its object is that of combating lameness due to navicular arthritis. In past decades this mode of treatment was commonly practiced by veterinarians, but during recent years it has fallen into disuse through the introduction of better modes of treatment and the general unsatisfactory results usually obtained. The theory upon which the frog seton was defended is that of counter-irritation, which was thus accomplished as near to the seat of the disease as possible, instead of depending upon the application of irritants to the coronet which are too remote to exert a beneficial effect.

The frog seton is inserted in the standing position with a needle about six inches long, which is passed by one sudden thrust from above downward. To facilitate its safe passage through the tissues at one single pang the needle should be exceptionally sharp and penetrant. The operator holds the foot with the one hand, and as the assistant is directed to give the twitch an extra turn to divert the horse's attention, the needle, already carefully adjusted in the pit of the heel directly against the tendon, is sent through the foot with one hard thrust. To facilitate its exit through the sole at the point of the frog the hoof should previously be pared thin, otherwise the hard hoof would block the course of the needle at its destination. The skin at the point of entrance and the hoof at the exit are the only obstacles against the free passage of the needle. Between these two points the needle traces its way with but little resistance along the perforans tendon and its plantar aponeurosis.

It is customary to remove such setons in about two weeks, during which time they are washed and turned daily and protected from stable filth.

SUTURING

DEFINITION.—The word suturing in surgery refers to the temporary repair of lost continuity in tissues by means of the needle and thread. Sutures are referred to as "temporary" in their action because they only serve to hold separated parts in contact while the tissues themselves construct the permanent uniting object, the cicatrix. Thus sutures perform the function of the scar while the latter is forming into a substantial structure.

INDICATIONS.—Except in wounds of cordiform structures, such as nerves and tendons, in tubular organs, such as bowels and blood vessels, and into natural cavities, sutures are not absolutely indispensable, as the most serious breech of continuity will be restored without them. Any ordinary gap in tissues will be repaired without their transient assistance by filling up with granulations which soon transform into a firm connective tissue, but when the edges or walls of a breach are brought into closer apposition with them the amount of tissue required to fill the traumatic cavity is reduced to the minimum, to the end that the process will be shortened and the amount of constructive tissue required is diminished. Hence the chief object of sutures in veterinary surgery is to limit the size of the scars, that supervene all wounds. A scar may be small, almost imperceptible, or it may be large and unsightly, according to the amount of formative tissue that was required to fill the gap. To make the gap small, which in turn diminishes the volume of the granulations and finally the size of the scar, restores the surface to a condition as nearly approaching the normal as possible.

When soft tissues are divided their natural elasticity, their tension, and also the swelling that usually follows injuries, all acting together or separately, always produce a gap the width of which will vary according as these influences chance to operate. Thus an incision of the abdomen, if compared with one of similar constitution in the forehead, will be found to be more widely separated, although both of them will gap to a certain degree, as will all wounds which destroy continuity in soft tissues. It is to bring such gaping parts into apposition, or at least to approximate them as near

as possible, that sutures are used in veterinary surgery. They are indicated to prevent avoidable blemishes and also to promote a more rapid repair in all of the innumerable surface wounds, surgical and accidental. Mucous membranes, serous membranes, laminæ of fascia, aponeuroses, muscles and skin may all be submitted to suturing but it is the latter that is most frequently approximated by sutures because it is this integument that determines the physiognomy of the wounded region after the reparative process is complete. To heal the skin by primary union prevents the indelible hairless blemish that otherwise always succeeds wounds on the surface of the body.

Sometimes sutures are indispensable. A severed nerve trunk will much sooner restore the lost innervation if the two cut ends are held in perfect apposition and the tendons will repair much more rapidly and are never in danger of permanently losing their continuity if thus approximated. In surgery of the intestines and of blood vessels sutures cannot be omitted; the life of the patient depends upon them. Whenever an intestine or any other tubular organ (ducts, etc.) is accidentally or surgically incised, the lost continuity must be at once restored artificially. Here, the breach cannot be left to nature's regenerative forces, as in the case of fixed structures, such as skin and muscles.

CONTRA-INDICATIONS.—Sutures are very often contra-indicated in wounds on the surface of the body. When a wound has been or is certain to become infected with virulent microorganisms, sealing it over by suturing the skin or other integuments is only "shutting up the wolf in the sheep pen." They may thus be applied to the advantage instead of the hindrance of microbian growth. By preventing secretions, harmless in themselves, from flowing out, food is provided for bacteria which might have died from want of sufficient nourishment or by having fallen prey to the leucocytes. In short, infected wounds or wounds which on account of their nature will discharge more or less profusely, must never be sutured; it is always preferable to leave them wide open. Sometimes, in order to diminish the size of the scar the uppermost part may be closed and the dependent part left open as a drainage orifice.

It is also not advisable to attempt suturing where swelling or the profile of the region will bring great tension upon the sutures. The taut suture, by pressing upon the tissues, cuts them and soon defeats the purpose for which it was applied; by strangulating the circulation it prevents instead of

promotes healing; and by causing pain it adds discomfort to the patient.

Conclusions.—(1) Sutures are indicated in all aseptic incised wounds where the discharges will be limited, imperceptible. (2) Where the importance of restoring the lost continuity is paramount. (3) Where, as in the case of intestines, nerves, etc., they are indispensable. (4) Where an adequate drainage can be provided beneath them.

(1) They are contra-indicated in all soiled and septic wounds where adequate drainage is obstructed by them. (2) In all anfractuous traumatisms that will discharge profusely. (3) Where great tension is required to bring the edges together.

EQUIPMENT.—Needles and suturing material. Nee-

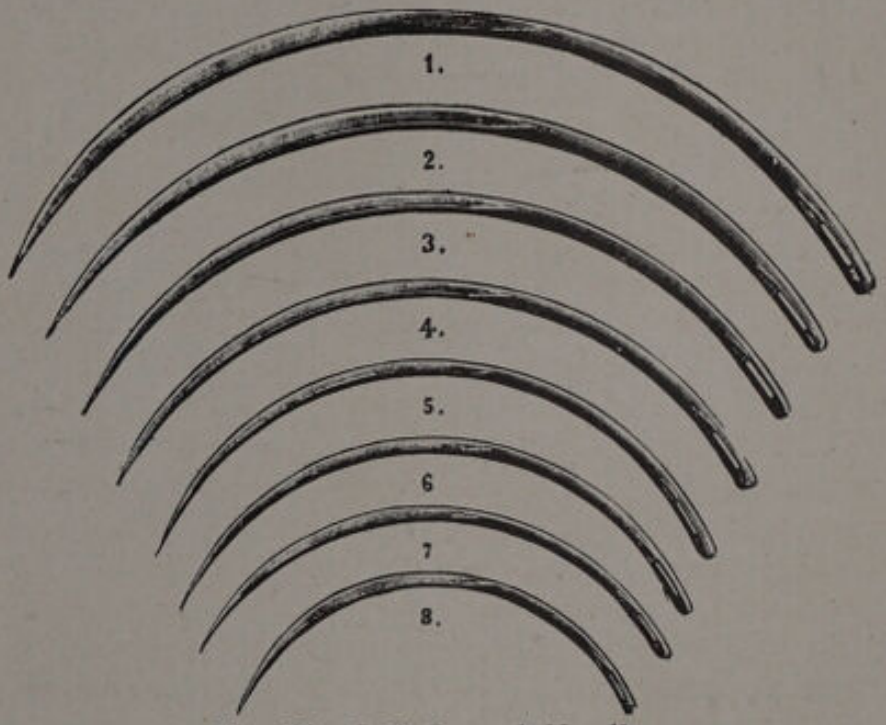


Fig. 55—Full Curved Needles.

dles should be of various sizes and shapes to meet every requirement. They are straight, (Fig. 57) full curved (Fig. 55) and half curved (Fig. 56) and the shaft may be flat, (Fig.57) or round (Fig. 58). The half curved needle is the principal needle of the veterinary surgeon; it fills almost every ordinary purpose. In deep, inaccessible places the full curved one, however, often facilitates the insertion of stitches which the length of the straight or half curved one would prevent. The round needle is made use of in suturing intestines, mucous membrane and serous membrane, or in any other work demanding the smallest possible perforations.

Suture Materials.—The suture materials which will fill every demand in veterinary surgery are: braided silk twisted silk, cat-gut, silk-worm gut, and linen thread.

Braided silk, on account of its great strength, is a very commendable suture material. Even in the smaller sizes its strength is ample. With no objectionable feature, except that of the price, braided silk deserves first place amongst veterinary suture materials. Its tensile strength, its flexibility, its softness and its durability amply fill each essential characteristic. However, when small threads are needed it may be found too large, even in its smallest sizes, and its high cost is no small item when promiscuously used in a large practice.

Twisted silk, has all the properties of the braided variety except that of strength, and may be adopted as its universal

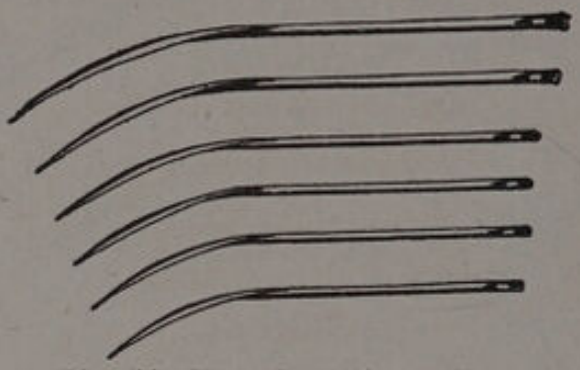


Fig. 56—Half Curved Needles.

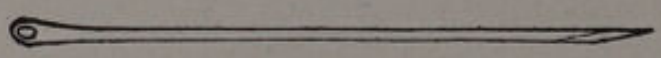


Fig. 57—Straight Needle.

substitute where the use of a small thread is desirable. It is slightly absorbable and may, as a consequence of this property, be adopted for buried sutures when in emergencies the more appropriate absorbable thread (cat-gut) is not available. Its absorption is, however, too slow for general use as buried sutures.

Catgut, in veterinary operations, is used only when an absorbable material is required. It is the standard absorbable material for all kinds of buried sutures. By treating it with chromic acid by special processes its absorbable properties are lessened to definite degrees. It will absorb, according as it has been chromatized, in one week, two weeks, three weeks, etc., which property is indispensable where there is danger that the rapid absorption of the non-chromatized variety might precede the safe union of the sutured edges.

Linen thread, although possessing no property superior to silks, is easily the most suitable suture material on account of its cheapness. Its tensile strength, durability and facility of sterilization, together with its inexpensiveness, at once suggests its universal fitness for nearly every surgical operation performed upon animals. The yellow variety of Barbour's Irish Linen Saddler's Thread has especial value from every standpoint. Although only one size is obtainable, the single thread will be found suitable for general use, and when the use of a larger thread is deemed advisable it is only necessary to double the strand according to the tensile strength required.

Sterilization of Suture Materials.—The importance of sterilizing all sutures perfectly is sufficient to warrant frequent reiteration. The prefunctory method in vogue, consisting of transient immersion of previously exposed threads

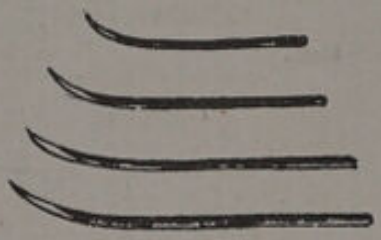
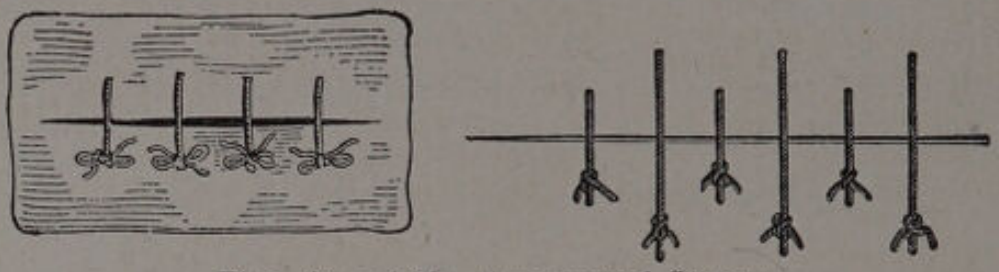


Fig. 58—Round Needles.

in the ordinary antiseptic solutions, is palpably wrong, positively inadequate and grossly illegal. It should be an absolute law with every veterinarian to insert into the bodies of animals only threads that are known to be perfectly aseptic. Contamination during the operation by being handled or by resting upon the tray, table or other object while waiting to be used, is much less frequent than might ordinarily be supposed. The suture that is septic before being handled cannot hurriedly be sterilized, while the one that is aseptic before being handled seldom becomes soiled during the operation if ordinary sensible precautions are taken to prevent.

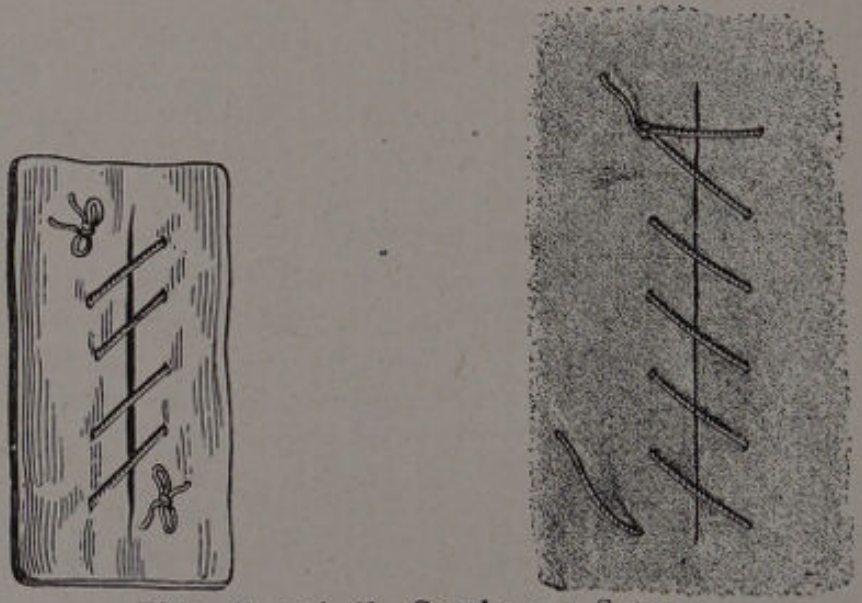
The supply of abundant suture material for field operations may be economically maintained by keeping the silk and linen in salt mouth bottles filled with ether or alcohol, well corked, ever ready for use in any ordinary quantity. Cat-gut should be purchased only in hermetically sealed bottles furnished by manufacturers who vouch for their asepsis. Raw cat-gut will not yield to any practical yet safe method of sterilization that the veterinary practitioner could carry out in his adequate laboratory. For hospital operations

silk and linen threads are best, sterilized in the sterilizer—an equipment that should no longer be absent from the modern operating room. It is preferable to thread as many needles as there will be stitches required, and place them in the steam compartment of the sterilizer in a small basin. Compact balls of thread may be placed in the water compartment, but loose threads become entangled from the turbulence of the boiling water. By using a separate needle basin, the thread, the needles and the basin are brought out perfectly sterilized when needed; then, if each needle is picked up with a thumb forcep and inserted with the needle-holder, stitch suppuration will become an exception instead of a rule.



Figs. 59 and 60.—Interrupted Sutures.

CLASSIFICATION.—We will describe only those sutures especially useful in veterinary operations which are: (1) Interrupted sutures, (2) uninterrupted sutures or continuous sutures; (3) mattress sutures; (4) button sutures;



Figs. 61 and 62—Continuous Sutures.

(5) interrupted crucial sutures; (6) removable buried sutures; and (7) Czerny-Lembert sutures.

Interrupted sutures consist of a series of single loops, each tied by individual knots. (Fig. 59-60.) These are far

the most common sutures used in veterinary surgery, being in fact almost the universal sutures for ordinary surface wounds. They possess the advantage of preserving contiguity even when component parts of the integral work give way here and there; of effecting a more perfect and more uniform independent apposition at all parts of the breach; and of admitting of a variable tension according as the character of the wound necessitates.

This simple suture is inserted by picking up first one edge and then the other with the dissecting forceps as the needle held in the other hand is pushed through the integument from without inward on the first side and from within outward on the other. The stitches may all be placed one after another along the whole wound before tying any one of them, or else they may be tied as fast as they are placed.

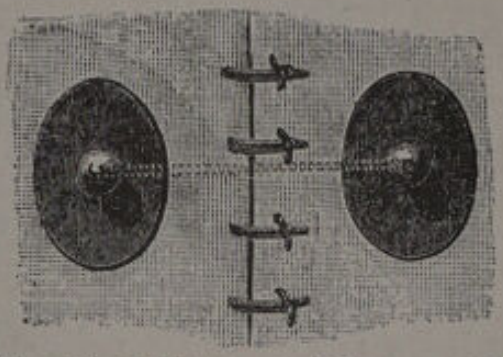


Fig. 63—Combined Button and Interrupted Sutures.

The latter course is preferable in all large or irregular wounds, in the interest of exactness. When primary union is of capital importance the needle should be made to penetrate from within outward only through both edges so as to forestall the carrying of infection from the outer layers of the skin into the subcutem. This course necessitates the rethreading of the needle for each penetration, but the additional trouble is worth while under certain circumstances, especially when sewing an unshaved skin where hairs are liable to be inverted into the needle tract by the thread.

The **continuous suture** is made by a simple sewing process after the thread has been knotted at the end to prevent slipping through the first perforation. (Figs. 61-62.) This suture is particularly desirable where the rapid closure of a wound is essential, or where the only object is the temporary retention of dressings in the traumatic cavity.

Mattress Sutures and Button Sutures.—Each of these is but a slight modification of the other. Both of them are simple interrupted stitches that do not cross over the

wound externally, and the latter differs from the former only in that a button is interposed at each point of entrance. (Figs. 63-64.) These sutures are placed some distance from the borders of the wound, and are supplemented by interrupted or continuous sutures which effect the direct apposition of the edges. (Fig. 64.)

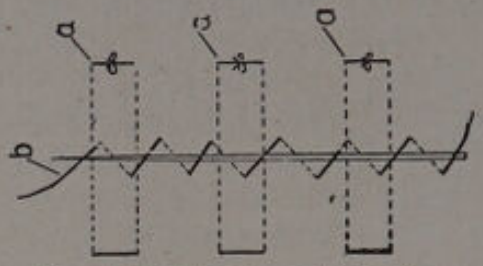


Fig. 64—Combined Mattress and Continuous Sutures.
a, *a*, *a*—Mattress Sutures. *b*—Continuous Suture.

Interrupted Crucial Sutures.—In this stitch the thread crosses externally, (Fig. 65) its object being the prevention of pressure,—stitch necrosis. No part of the incarcerated tissues is subjected to severe pressure, as in the case of the simple interrupted suture.

The stitches are inserted as follows: The needle first penetrates from without inward, crosses to the opposite, penetrates from within outward, then is brought back to the original side some small distance from the first point of

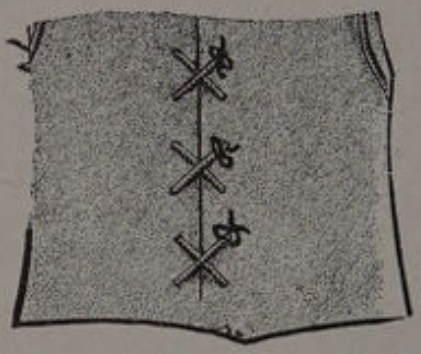


Fig. 65—Interrupted Crucial Sutures.

entrance and passes through both edges as above. When the two protruding ends are tied the completed stitch forms an "X" over the surface. As many of these individual stitches as necessary to close the breach may be consecutively placed, but the greatest value of the method is found in short incisions (plantar neurotomy) where only one is required to close the gap.

Removable Buried Sutures.—The insertion of the removable buried stitches is an entirely new procedure; it has never

been described in veterinary literature. The reaction which so frequently precedes the absorption of buried sutures in veterinary operations is obviated by the removal of the deep suture without opening the wound to search them out. In the various laparotomies, where skin, aponeurosis, muscle and peritoneum must need coaptation; and in incisions on the

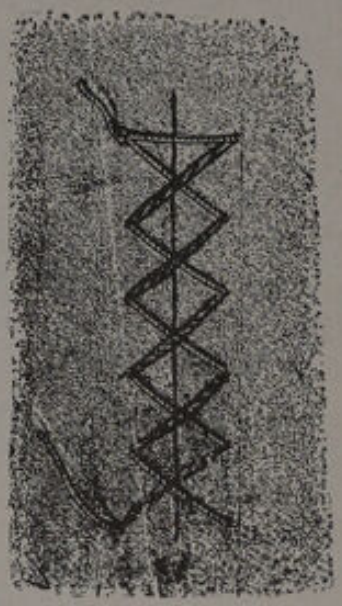


Fig.66—Continuous Crucial Suture.

extremities where skin, fascia and muscle are divided, these sutures are indeed valuable expedients. They are individual sutures inserted as follows: The needle passes from without inward through the outer integument, from without inward through the inner integument of the opposite side, from

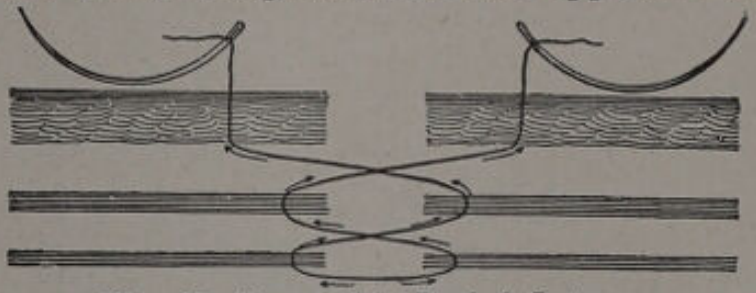


Fig. 67—Removable Buried Sutures.

within outward through the inner integument of the first side and finally from within outward through the outer integument of the opposite side. The protruding ends are then carefully drawn taut and tied externally. When tied they resemble the simple interrupted suture. (Fig. 67.)

Mayo's running loop is utilized in wound treatment of animals to prevent skin flaps from separating from each other or from the body by re-carpeting the skin to the under-

lying tissues. It is a series of continuous loops that cross the wound-line at a right angle. They are made to extend from about 3 inches on one side to about the same distance on the other side of the wound-line. A full curved needle is armed with about two feet of single thread. Beginning about three inches from the wound line the needle is passed subcutaneously or even deeper toward the wound, coming out three fourths of an inch from the point of entrance. One

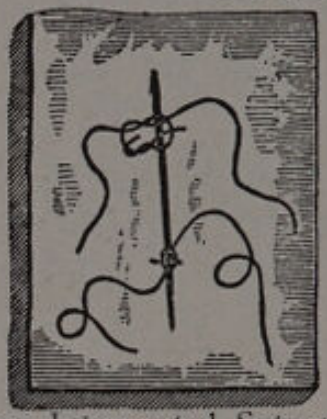


Fig. 68—Mode of Tying Interrupted Sutures, Each with a Reef Knot, using Silk Thread.

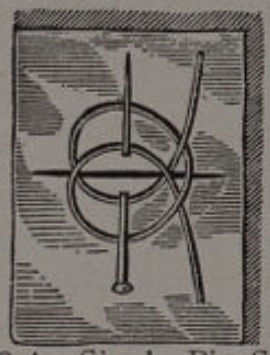


Fig. 68-A—Single Pin Suture.

foot of thread is drawn through. The dangling end is then tied with a double knot at the exit point, the knot lying upon the hole, letting the end dangle again the needle is now inserted through the exit point and brought again three quarters of an inch near the wound where the dangling end is again tied in the same way. These are continued across the wound to about the same distance on the opposite side. The loops are not tied tight enough to block circulation but just tight enough to lie straight. When one is completed another is put in one, two, or three inches away, and so on, until the whole field of skin is firmly re-carpeted to the body.

It is almost a physical impossibility for a skin flap to break away from the body when so fixed, even where active inflammation follows.

Czerny-Lembert Suture.—This double suture is the most appropriate to adopt in veterinary surgery for suturing the

hollow abdominal and pelvic organs,—intestines, stomach, rumen, uterus, bladder, etc., when these are accidentally or surgically divided. The combination of these two sutures consistutes the most reliable method of closing intestinal wounds, whether for circular, transverse or longitudinal enterrorraphy. The two sutures are placed consecutively in the order indicated in the name. The Czerny suture, which is a series of interrupted stitches, is placed as follows: The needle is passed through the serous and into the muscular

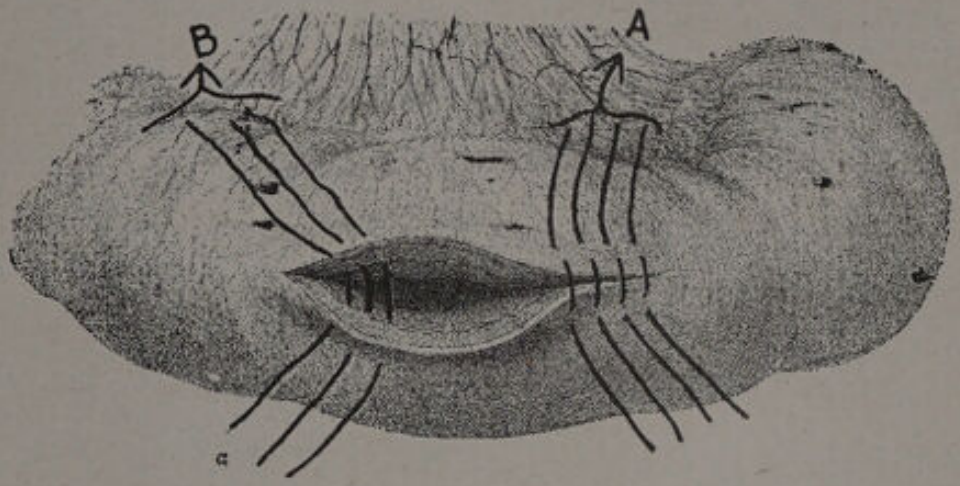


Fig. 69—Three Czerney Sutures and Four Lambert in Enterorrhaphy. *A*—Lembert's Suture. *B*—Czerney's Suture.

coat and then out of the cut end of the organ (bowel, stomach, etc.) between the serous and muscular coats; Fig. 69) then it is brought over the wound to the other edge and passed between the muscular and the serous coats to the surface. They are placed from 7 mm. to 10 mm. apart and tied after all of them have been placed. When this has been completed the work is fortified by the addition of a second series of Lembert sutures as follows: (Fig. 70) The needle is passed through the serous and muscular coats about 2 cm. from the edge of the groove now made by the Czerny, and then out again about 1 cm. from the groove. It is then brought over to the other side of the groove and entered through the serous and muscular coats 1 cm. from the groove and out again 1 cm. farther (2 cm. from groove). These individual stitches are placed around or along the whole wound 10 cm. apart, and then tied. These latter sutures infold the former deeply into the lumen, and the totality of the process brings a large area of peritoneum into juxtaposition, to the end of assuring a union in the greater number of cases.

Hints on Suturing Wounds.—1. Suture materials and needles must be aseptic because they sojurn so long in the trauma to the advantage of microbian growth. They favor necrosis of the tissues about them by obstructing circulation in the vessels pressed upon by them. They prevent the outward discharge of secretion by closing the wound, and thus harbor food for microbes. If, in addition to these presents,

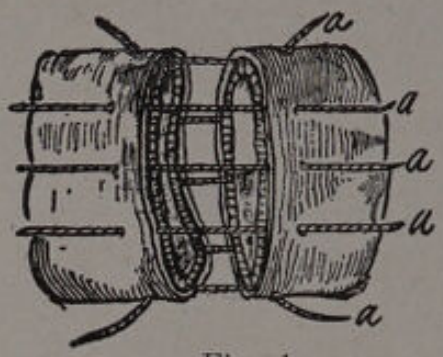


Fig. 1.

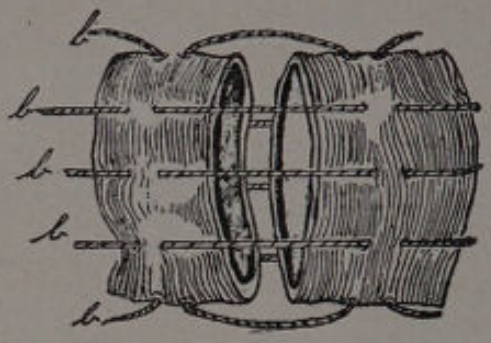


Fig. 2.

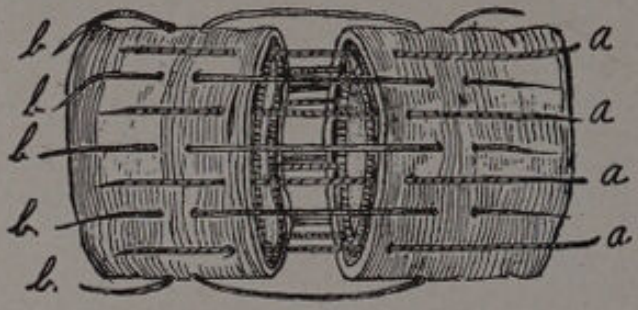


Fig. 3.

Fig. 70—Czerny-Lembert Sutures in End-to-End Anastomosis.

Fig. 1—*a*, *a*, *a*, Czerny's Sutures. Fig. 2—*b*, *b*, *b*, Lembert's Suture. Fig. 3—*a*, *a*, *a*, Czerny's; *b*, *b*, *b*, Lembert's.

they act as infection carriers, putridity of the sutured trauma is inevitable.

In addition to sterilizing sutures by boiling we recommend that they be immersed in pure tincture of iodine while the operation is proceeding. This notion of immersing an already aseptic material into an antiseptic chemical finds defense in the fact that they can be more carelessly handled with the fingers and can accidentally trail about in unclean parts of the patient's body with minimum amount of harm, and besides an antiseptic suture will yield fewer cases of stitch suppuration from the micro-organisms that are always found in the recesses of the skin. Since using these antiseptic sutures we have had more cases of primary union than formerly when only aseptic sutures were used.

2. Especial pains must be taken with each part of the wound to bring the edges into neat apposition. As each stitch or each part of the suture is being fixed, care must be exercised to prevent infolding the skin. The skin edges should be "heaped up" rather than infolded, because union of the horny layer of the skin will never occur. (Figs. 73-223.)

3. Whenever tension is required to bring a breach into apposition, primary union is very unlikely to occur; the stitches will soften the tissues incarcerated in the loop and will loosen in a few days. Sometimes mattress sutures or button sutures, placed some distance from the edges, may be inserted to forestall tension at the edges, and at other times lateral incisions (Cherry's operation) may be made to ad-

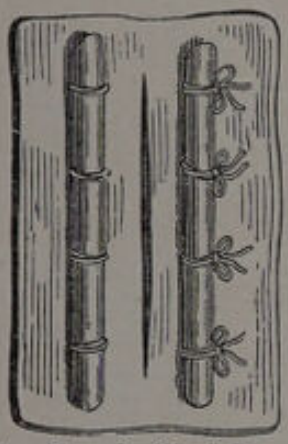


Fig. 71—Quilled Suture.

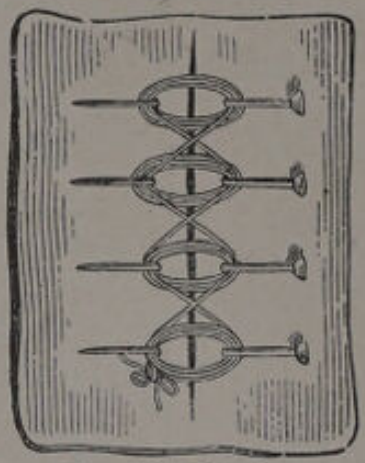


Fig. 72—Pin Suture.

vantage. It is, however, generally preferable to treat traumas as open wounds whenever for any cause great tension is required to bring the edges together.

4. The recommendation, mentioned elsewhere, to thread a number of needles with short threads just sufficient for one or two stitches, while preparing for an operation, will bear frequent repetition in view of its significance. The thread of a needle threaded with a strand long enough for a number of stitches too frequently becomes contaminated with filth from handling; from coming unavoidably in contact with dirty parts of the patient, operating table or bedding; and from being drawn so frequently through the skin or other wounded tissues. In fact, a long strand of thread used to suture any ordinary wound is sure to become unsafe before it is entirely consumed, while short strands, inserted one after another on separate needles, or even carefully threaded on the same needle, may be placed and tied without being exposed to contamination.

5. To assure absolute asepsis in placing a stitch or two the following technique is excellent: Place a strand of thread long enough for one stitch and threaded with a needle at each end, into the sterilizer; or in lieu of a sterilizer thread a strand of previously sterilized thread with a sterilized needle at each end; then, when the aseptic wound (a neurotomy incision, e. g.) is ready to be closed, pick up one needle with the thumb forcep, place it between the jaws of the needle holder and push it through the skin from within

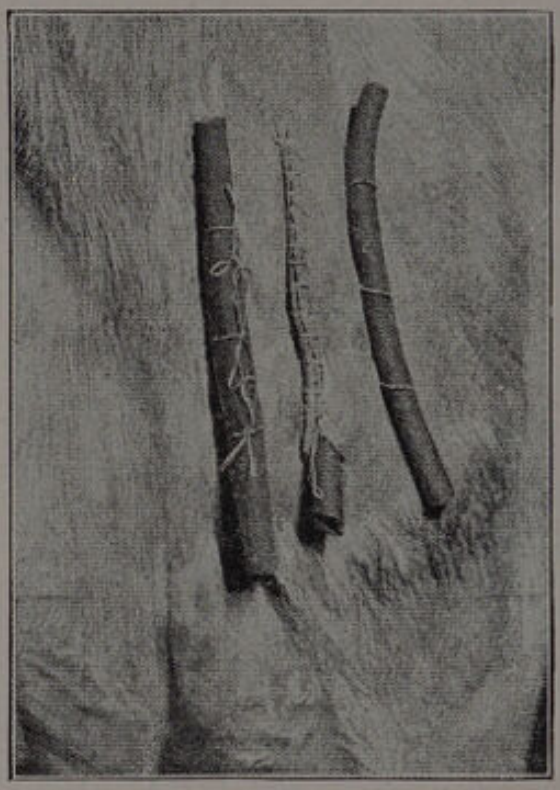


Fig. 73—Quilled and Continuous Suture and Drainage Tube.

outward and then take up the other needle in the same way and push it through the opposite edge also from within outward. In this manner the absolutely sterilized needles and absolutely sterilized thread are not manually soiled and no microbes have been drawn into the wound from the surface layers of the skin which (the reader might be reminded) is never absolutely aseptic. The only chance of infecting the stitch is while tying, but as the parts handled remain external, there is no danger of infection therefrom.

6. The impossibility to control every movement of wounded animals or of any part of their bodies, works to the disadvantage of sutured wounds. The friction between the edges of sutured wounds, even when trivial, interrupts the

construction of the first delicate fibers which must cross over from one edge to the other to lay the foundation for a substantial union. Hence the immobilization of the very edges

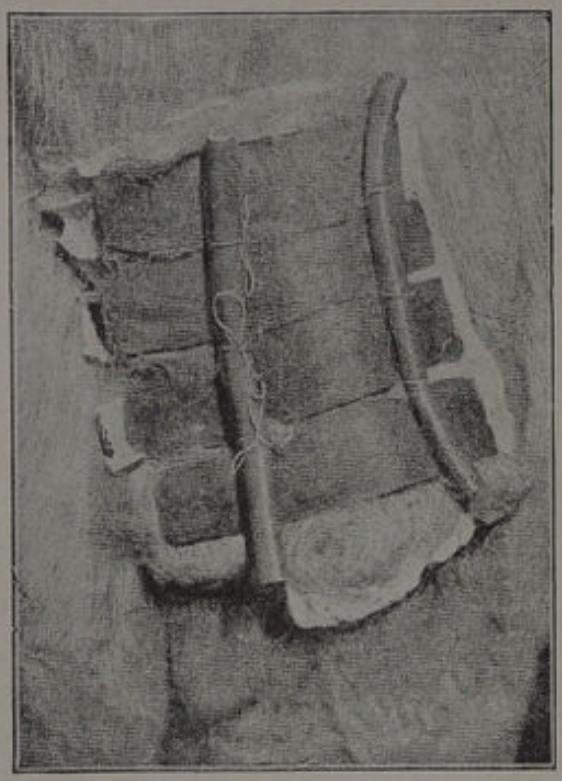


Fig. 74—Bayer's Method of Suture and Protection with Quilled Sutures.

of the wound is of capital importance in every case, and although it can not always be accomplished perfectly, much can be done in this direction by resorting to ingenious expedi-

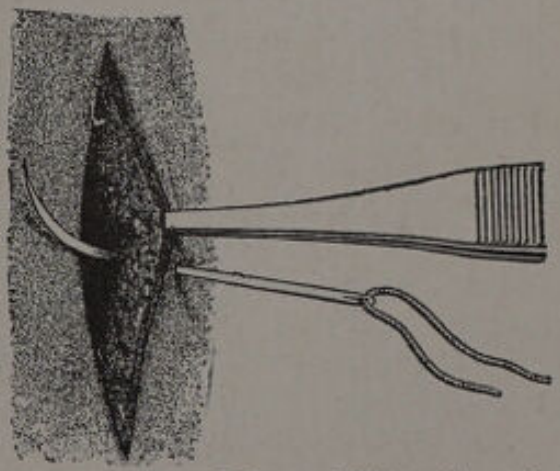


Fig. 75—Method of Holding Edge of Wound as Suture is Inserted.

ents to suit the circumstances presented in each case. Amongst there are:—(1)Tying the patient so as to prevent decumbency. (2) The use of slings. (3) Immobilizing

bandages, casts, and splints. (4) Button or mattress sutures placed some distance from the breach so as to create an immobilized area between them.

7. In fine, **motion, tension, sepsis,** and **obstruction to drainage** are the **four great banes** of suturing that the veterinarian must combat intelligently.

FIRING

DEFINITION.—Firing is an equine surgical operation consisting of branding or stabbing the skin that surrounds lesions of bones, tendons, ligaments, or sheaths in the form of more or less symmetrical arranged lines or points, for the purpose of curing or preventing lameness. It is a cutaneous, hot-iron cauterization, aimed at underlying disease processes. The word "firing" has a definite meaning in veterinary surgery. It refers to a special operation, in distinction to "actual cautery" which signifies the method of cauterization. For example, the cauterization of the amputated tail or the ablated keloid is actual cautery, but it is not firing. The word "firing" is reserved by the modern hippologist as the appellative for the branding or puncturing of the skin in the treatment of lameness.

The surfaces of the loins, the buttocks, the throat, the withers, in other days were fired for deep seated lesions within them, but these treatments are now little used by veterinarians. They have been discarded as worse than useless. Deep firing accomplished by first exposing diseased tissues by incisions (subcutaneous cauterization) has also passed into a well-deserved obscurity.

HISTORY.—Firing is too old to determine its origin. It has been described in all books touching upon the diseases of the horse, from the earliest days of veterinary history. In all epochs it has been favorably mentioned as an effectual method of treatment of various diseases and injuries affecting the limbs of horses, but has been seldom ever mentioned as a treatment for the other domestic species. It has always been, and undoubtedly always will be a strictly equine operation, because of the dearth of suitable indications in the other species. In the early days of modern veterinary medicine it was somewhat more popular than today, having been supplanted by other more rational treatments in many instances. It has always been more or less objectionable, at all times, because of the indelible blemish it always produces, especially in the horse that will sooner or later be offered for sale. On

the American farms it is seldom ever tolerated, because the horse blemished with lines or points is seriously objected to by purchasers even though no traces of the original lesion remain. A spavined horse, still lame and already fired, is regarded as useless, whilst one showing no traces of having been submitted to this blemishing treatment whether lame or not, is generally more salable. The cicatrices of firing are

Fig. 76—Design for Puncture Firing.

always regarded as an unsoundness in examinations by veterinarians, even though the lesion was trivial and now entirely cured. A splint, unfired, is readily over-looked, while a fired one is always considered sufficient reason for condemnation.

In spite of this adverse result, firing continues to hold a manifest popularity amongst veterinarians. It is still regarded as the standard treatment of many lameness-produc-

ing lesions, wherever veterinary surgery is practiced. It is alike the weapon of the empiric and scientific practitioner. It is urged by the practitioner and sometimes demanded by the client, but it finds its greatest popularity in cities where the value of a horse depends upon its ability to work and not upon its salability. It is very often demanded in horses whose value depends upon speed.

The firing of horse's legs reached its highest popularity in England, where it is practiced as a precaution against possible injury. Hunters and thoroughbreds imported to America from England are frequently found to have been fired, evidently for no other reason than that of preventing them from straining or wrenching the flexor tendons.

INDICATIONS.—Rationally, firing is practiced only as a cure for lameness due to some local inflammatory disease of joints, bones, sheaths, or tendons. When the inflammation has become chronic or has left a structural alternation in its trail, and after other less severe methods of treatment have failed, firing is practiced as a severe counter-irritant and to prolong the period of rest. The benefits of the operation lie largely in the fact that a protracted rest becomes necessary, owing to the severe local inflammation it produces in the skin and subjacent tissues. Kept from arduous work, the lesion will heal. Resolution of local inflammations is also favored by the rest or immobilization of the affected part. The strained tendon submitted to a severe firing is kept partially out of commission during the domination of the pain in the fired skin; and a hock joint fired for spavin is scarcely flexed from the same cause and thus hastens the desired ankylosis. Firing also excites local nutritive activity to the benefit of the slow, chronic, persistent morbid process, especially when the pointed iron is carried directly to the diseased tissues.

The claim that line-firing supplies a permanent supporting envelope to the flexor tendons in the form or ribbed cicatrices around them, is defended by some veterinarians, while others deny that this effect is produced by firing. It is barely possible that prominent cicatrices extending around the tendons do have some such action, but that they effectually protect them against future injury is rather far-fetched. Firing of ordinary severity does not permanently destroy the elasticity of the integument sufficiently to construct an adequate supporting envelope. Besides, such a bandage could have but little influence in preventing strain, unless it transferred some of the burden of the tendons to the column

of bones by diminishing the phalangeal inclination, and this of course is never accomplished by firing the skin.

The benefits of firing may be summarized as follows: (1) Puncture-firing accentuates local nutritive activity and thus hastens the termination of chronic processes: (2) Both line-firing and puncture-fiiring cause more or less immobility of the diseased structures; (3) Both line-firing and puncture-

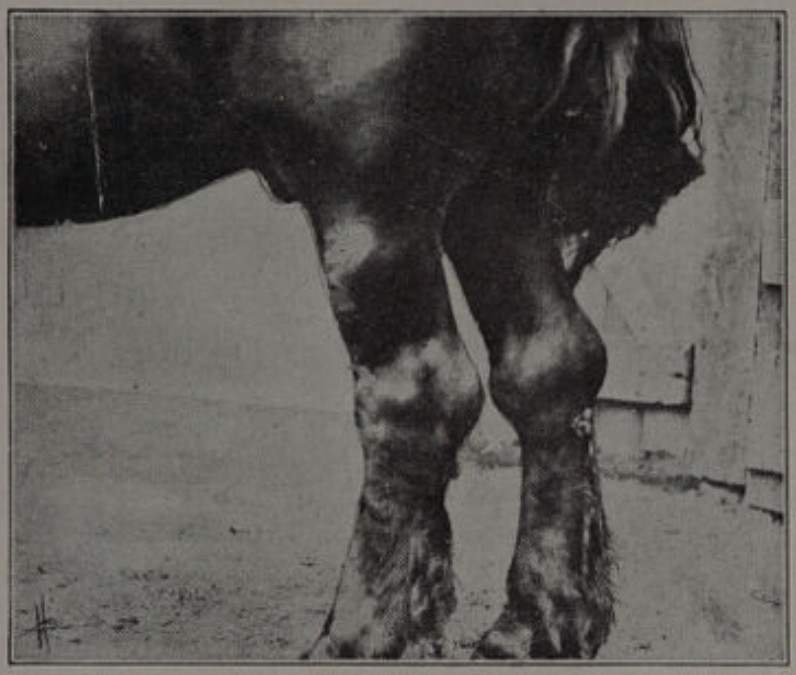


Fig. 77—General Tarsitis.

firing operations necessitate protracted rest to the decided benefit of the defective organs.

Firing is contra-indicated in recent injuries, new inflammations, or in any lesions accompanied with an active inflammation of the skin. If the skin is sound and not implicated with the underlying inflammation, it may be fired with impunity even though the latter be very acute, but if the inflammation extends into the integument the cauterization may cause both local and general complications. (See sequelæ.)

For Spavin.—The firing of a spavin can always be defended on the grounds that it is the standard treatment of this serious disease of the tarsus. In this condition **line-firing** gives the best results in the case of **long standing**, while **puncture-firing** is most effectual in hastening resolution in a **recent one.** For those serious cases of **general tarsitis,** in which almost every structure of the whole articulation is involved, line-firing is also the most effectual. For **bog-spavin,** large enough or painful enough to require treatment, line-

firing gives the most satisfactory results. In line-firing the hock, the lines are carried around the entire articulation, and from the level of the os calcis superiorly to that of the metatarsus inferiorly. (Fig 78.) Firing a limited area directly over the bone spavin or bog-spavin, or only firing one side of the joint, is absolutely ineffectual except in the case of deep puncture-firing, and even in this instance the stabbing of a

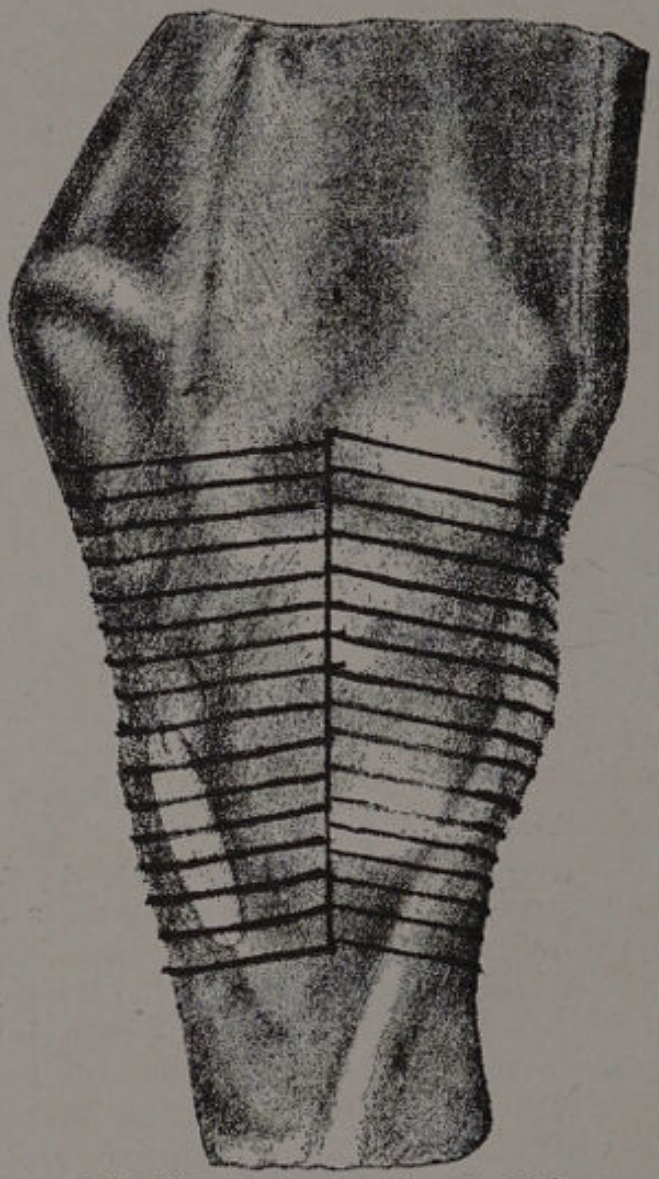


Fig. 78—Design for Spavin Firing.

liberal area is desirable in order to cause as much local disturbance of the skin and underlying structures as possible.

For Tendinitis.—For **tendinitis, "bowed" tendons, or sprains of the tendons,** line-firing is preferable. The firing should be carried from the level of the accessory carpal superiorly to the first phalanx inferiorly. The operation is most effectual for such conditions when followed by suf-

ficient rest to permit all of the inflammation to subside. That the rest is not alone the curative factor is shown, however, by the poor results obtained when firing is omitted. In **draft-horse tendinitis** manifested by a characteristic, painful tumefaction at the level of the inferior check ligament line-firing is beneficial but not always curative. Sometimes two

Fig. 79—Design for Firing Knee and Tendons.

or three firings and long rest will fail to entirely correct this refractory lesion, yet no other treatment is half as beneficial. For the so-called **bowed tendon** of speed horses firing is sometimes futile on account of the seriousness of the lesion and the severe strain to which the tendons of such horses are afterwards subjected. Many race-horses, however, have been markedly benefited and many have been cured entirely by the treatment.

For Sesamoiditis.—Lesions about the sesamoids, either in the pectoral or pelvic limb, often furnish suitable indications for the operation. Strains, osteophytes, synovitis, calcification of the tendons and sesamoidean ligaments can be given no better treatment than a thorough line-firing extending from some distance above the fetlock to the middle of the pastern. (Fig. 79.) Puncture-firing is much less effectual for sesamoidean lesions.

For Ringbone.—The treatment of Ringbone, by firing, is always more or less unsatisfactory, especially when the osteophytes engage the coronet or extend beneath the hoof. In these events nothing seems to help them until the inflammatory process has spontaneously subsided, then firing or any other treatment is often unwittingly credited with the results. Puncture-firing is the appropriate form of treatment, but as much of the diseased bone is hidden beneath the coronet and hoof, its effects are limited lindeed. The osteitis of ringbone continues in spite of firing, in spite of blistering, in spite of rest, in spite of special shoeing, and in spite of all of them combined. The lameness of ringbone may finally

Figs. 80 and 81—Specimens of "Bowed" Tendons, in which Line Firing is Indicated.

diminish or even entirely disappear, but the cure can seldom ever be attributed to the treatment administered for its relief.

Firing for ringbone, while appropriate enough as a step in the right direction, is well known to generally end in disappointment. It was practiced before there was a better treatment available. In order to take advantage of every additional helpful measure, the firing is preceded by the application of a roller-motion shoe, raised slightly at the heels and succeeded by a protracted period of rest, during which time one or two strong blisters should be applied.

For Curb.—The lameness of curb usually yields to epispastic treatment and a rest of two or three weeks. Some-

times, however, it returns with work, even after several blisters and six weeks of rest. In this event a severe line-firing is indicated and generally it terminates the lameness most satisfactorily. Puncturing is less effectual.

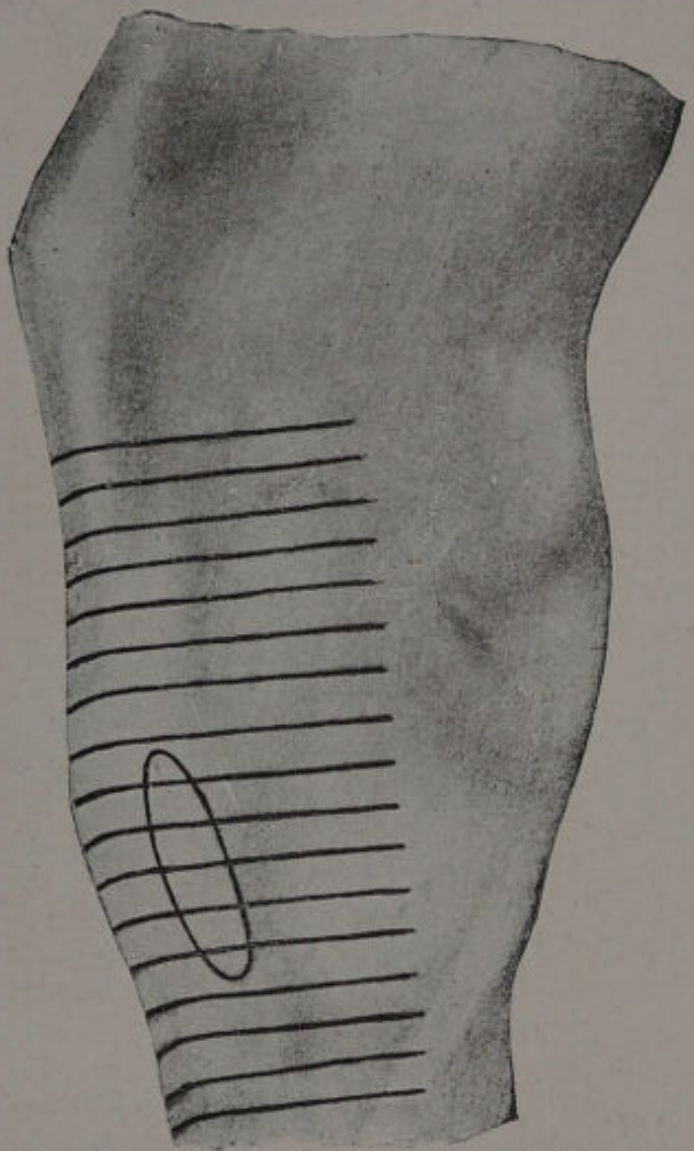


Fig. 82—Design for Firing Curbs.

For Carpal and Tarsal Tendo-Synovitis.—We apply these names arbitrarily to inflammations of the carpal and tarsal sheaths accompanied by more or less distention of the synovial sacs. In the tarsal sheath the name **"thorough-pin"** is usually applied. In the pectoral limb the name "knee-thorough-pin" is sometimes used. These conditions, while sometimes perfectly compatible with normal locomotion, often cause very obstinate lameness that will yield to no other treatment than severe line-firing. In addition, the accumulated synovia may be aspirated, with aseptic precaution, im-

mediately after the operation and again two or three weeks later, with very flattering results. When these synovial inflammations and distentions produce lameness it is always an obstinate one that willl not yield to treatments less harsh than very severe firing, and not infrequently a second firing is found necessary before a permanent cure of the lameness is effected.

EQUIPMENT.—Firing irons, forge, clippers, single side-line, and a cantharides blister, 1 part to 8, constitute the essential appliances. Firing irons are of many different patterns. No two veterinarians seem to use the same pattern. Figs. 83-84 exhibit the various types used by the modern vet-

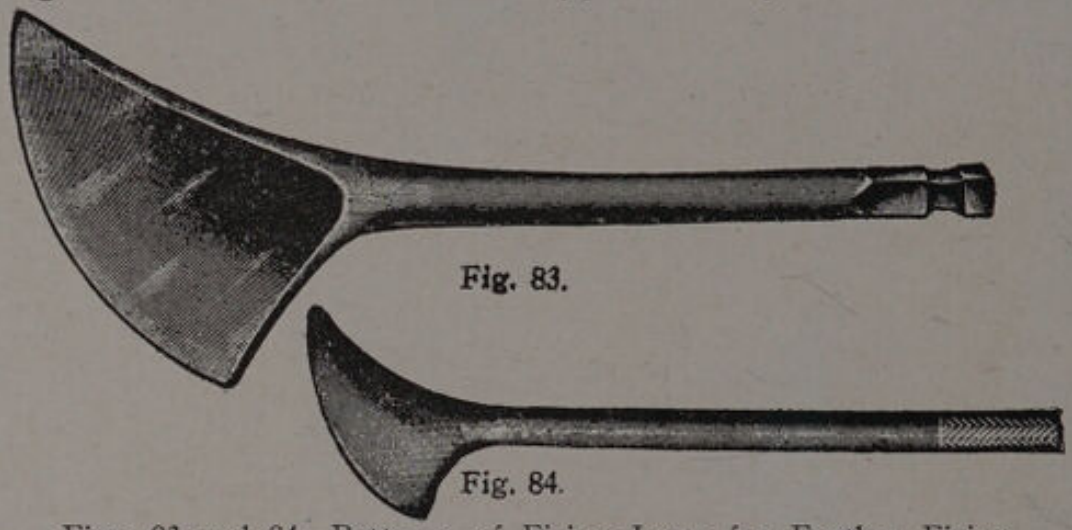


Fig. 83.

Fig. 84.

Figs. 83 and 84—Patterns of Firing Irons for Feather Firing.

erinary surgeon. Some prefer large irons, some small ones, but in every case the edge should be curved and blunt enough to prevent cutting through the skin. The head should be heavy enough to retain heat well and the handle of handy length. For puncture-firing the ether (Fig. 85) thermocautery is par excellence the best apparatus, but in lieu of this, the pointed irons will answer. The large point of the thermocautery are now used also for line-firing by most veterinarians instead of the irons heated in a coal forge.

The lines are made from one-half to three-quarters of an inch apart.

In puncture-firing, the point of the cautery is made to penetrate through the skin, and even directly through the subjacent ligaments to the bones. The depth of the penetration must be judged according to the character of the structure beneath. Synovials and bloodvessels must be especially considered. The points are made from one-half to three-quarters of an inch apart over the entire surface. (Fig. 76.)

RESTRAINT.—Firing should always, when not prevented by an exceptionally intractable horse, be performed in the standing position. By simply applying the twitch to the nose and elevating the opposite leg from the floor with the side-line, almost every horse can be fired with little difficulty during the operation. Occasionally, however, an individual is encountered that will oppose every touch of the iron by plunging into the air and otherwise preventing effective work. In these events the recumbent position will be necessary. The standing position is preferable, also, on account of the fact that the lines can be drawn more symmetrically,

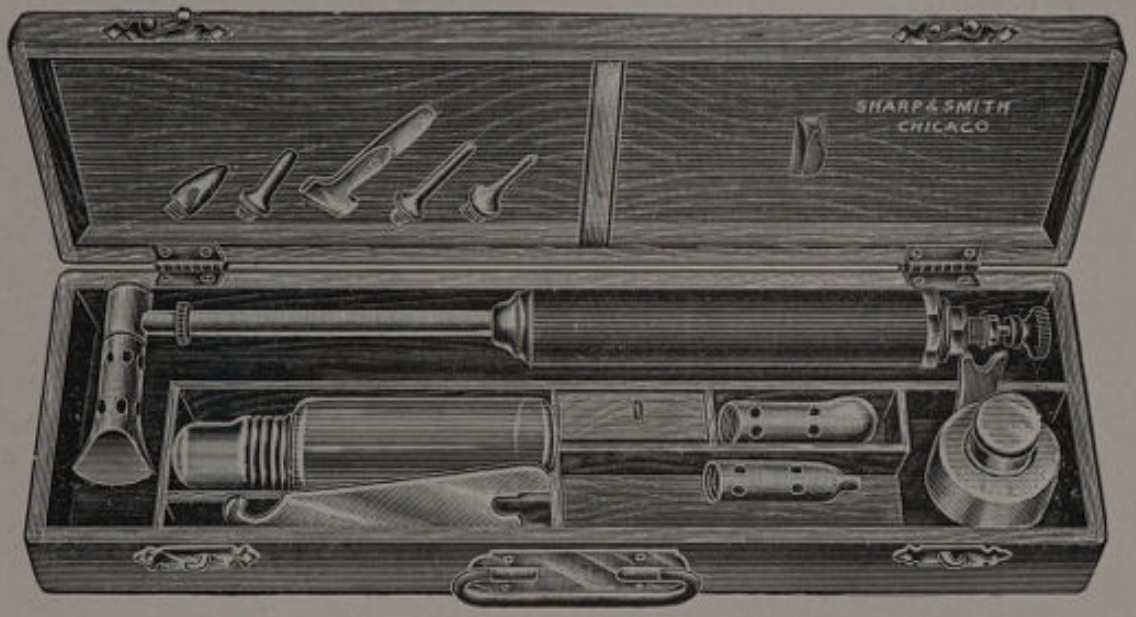


Fig. 85—Sands' Thermo-Cautery.

and can be made to conform more gracefully and artistically to the shape of the joint or region fired, than is possible in the recumbent position. The same artistic effect is seldom ever possible in recumbent restraint.

TECHNIQUE.—First Step.—Preparing the Field.—Although it is not customary with most practitioners, disinfection of the surgical field is as necessary before firing as before any other surgical operation, in fact more so, because of the severe and extensive inflammation it causes in the skin and underlying tissues. Sloughing of the skin, acute cel-

lulitis, chronic cellulitis, laminitis, and even fatal septicæmia and tetanus, are among the complications traceable to uncleanly methods of firing. About the coronet and pasterns **necrobacillosis** is a common complication where no pains are taken to disinfect the field. A too severe or too deep burning is often blamed for sequelæ caused only by such infections. These two evils combined are especially to be avoided.

The skin over the surface to be fired and a liberal area above and below, is closely clipped, well brushed out and when washed well with a soapy antiseptic water, it is rubbed with alcohol. This step may precede the operation several

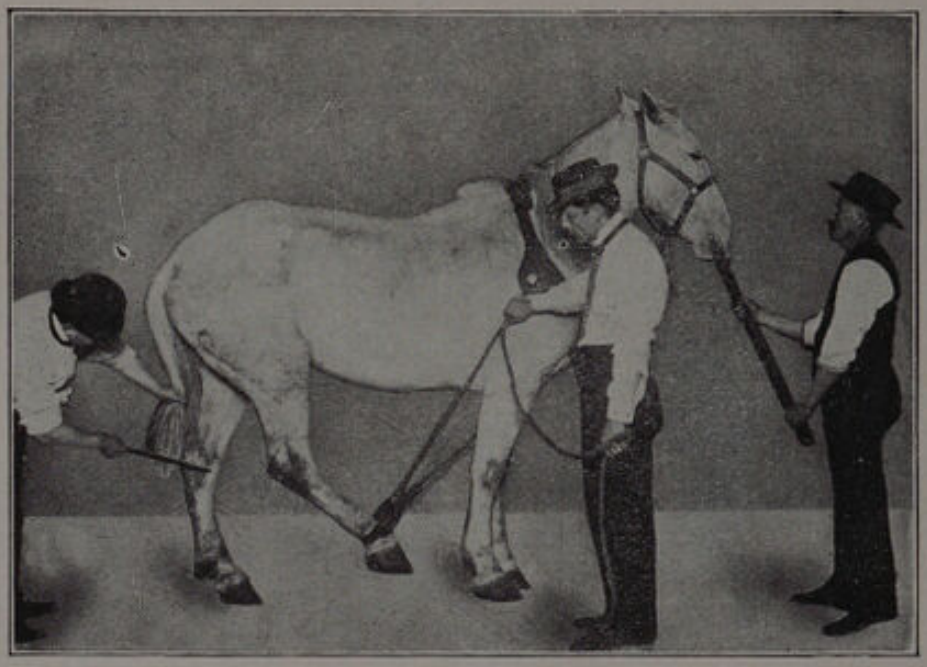


Fig. 86—Restraint for Firing Hind Legs.

hours to allow the hairs to dry thorougly; otherwise the surface must be dried with the rub-cloths.

Second Step.—Firing.—In line-firing the irons are heated to a cherry-red, and when brought out of the fire the detritus on their surface and edges is filed off with a worn out file. The edge must always be rid of projecting particles which, when cooling, will cut keenly into the skin and often cause an annoying bleeding as well as a prominent indelible scar at the point cut through. The lines are drawn almost at arm's length and with a graceful swing, bringing almost every part of the curved edge into use at each sweep. **The speed of the iron is gauged according to the degree of heat,** so that the degree of cauterization at every part is exactly equal. As the iron turns dark it is replaced with another already heated and filed smooth as above directed. The first

firing is scarcely more than a marking out process; the skin is not much cauterized, especially where the hair is thick and coarse, as around the fetlocks. The second firing over the same lines, by the same rules governing the speed of the iron, brings a brown effect to the skin and thus indicates a slight degree of cauterization. If it is desired not to mark the horse conspicuously, passing the irons twice over the same lines is sufficient. If a greater degree of cauterization is desired the iron is passed over the same lines three or four times, and for severe cauterization five times. These recommendations may be followed as absolute laws if the irons are always heated to the same degree and then passed over the lines with decreasing speed as they gradually cool. It requires some experience and some care to accomplish a given amount of cauterization in a given number of times the iron is passed over the lines, but the attainment is one worth possessing. In order to earn a good reputation in this operation the surgeon must take into account the relative delicacy of the skin of different regions and of different individuals; he must be able to judge the amount of cauterization produced by an iron of certain heat and drawn over the skin at a certain speed; and thus assure a given amount of reaction.

Third Step.—Applying the Blister.—A blister of cantharol (Abbott) or powdered cantharides one part, and lard seven parts, are by far the most reliable epispastics for the fired surface. They are much less painful than mercurial blisters, more uniform in the effects, much less liable to produce sloughing of the skin, and may always be depended upon to produce sufficient irritation, Mercurial blisters are painful and treacherous on fired legs.

This blistering ointment is applied with nominal friction immediately after the firing. When the cauterization has been slight, as for example when conspicuous branding is to be avoided, the ointment is rubbed in for five to ten minutes and when the cauterization has been severe, it is only smeared over the surface.

The parts below the fired and blistered region are anointed with vaseline to prevent blistering beyond the desired limits.

AFTER CARE.—The horse is placed in a single stall and tied closely to prevent lying down for forty-eight hours. At the end of this time the surface is submitted to a thorough washing with soap and hot water in which is dissolved a small amount of mercuric chloride or carbolic acid, and then, when dry, liberally smeared with vaseline. Thereafter, for

the next two weeks, the vaseline is applied every day with sufficient friction to disseminate it through the scabby surface. On every third or fourth day the inunction may be preceded with a washing of soap and antiseptic hot water. At the end of fourteen to eighteen days, the scabs having loosened from the underlying surface, an astringent lotion, consisting of acetate of lead one ounce, distilled extract of witch-hazel eight ounces, and water one quart, is applied twice daily until cicatrization of the lines or points is completed and all of the swelling has subsided. At the end of the fourth week the horse is ready for work, exercise or the pasture.

In view of the fact that firing is always performed for more or less serious conditions, protracted rest is always found exceedingly beneficial. Two, three, or even four month's rest is desirable in almost every case, and during this time a second blister can often be applied to good advantage.

SEQUELÆ.—It is possible to broil the skin between the lines in line-firing and thus cause extensive **sloughing**. In puncture-firing the point may accidentally be plunged into an articulation, bursa or sheath and thus cause an **articular** or **thecal abscess** that may terminate seriously and even fatally. **Necrobacillosis** or other infections of the whole fired area, often extending deeply into the subjacent textures and in every direction around it, followed by sloughing, multiple abscesses, and general systemic disturbances occur occasionally from severe firing and blistering of a dirty skin, or from filthy methods of after-treatment. Dirty water, rancid lard, or filthy oils may carry infection into this favorable field for microbian growth. When both fore legs are submitted to a severe firing **laminitis** sometimes follows, and in some instances it is serious. **Chronic cellulitis** followed by the production of much new connective tissue may supervene and thus produce a permanent tumefaction of the legs. **Unsightly scars** follow severe cauterization, sloughing and abscesses. **Flexion crevices** behind the carpus, in front of the tarsus, and behind the pasterns follow severe cauterizations of these parts or failure to properly lubricate them during the convalescent period. The author has seen two cases of **tetanus** follow puncture firing and others have made similar reports.

In the light of all of these sequelæ it is very evident that firing is by no means a simple, harmless operation, but is instead, one that requires good judgment in diagnosis, skill in performance, and precision in after care.

CHAPTER II

NEUROTOMY

DEFINITION.—The word "neurotomy" in its strict literal sense denotes the surgical division of a nerve trunk. In veterinary surgery it is the name used for the removal of a small portion of a sensory nerve trunk with the purpose of permanently destroying its continuity. For a time, the word "neurectomy" was quite generally substituted on the grounds that it more clearly defined the operation as performed in veterinary practice. This stand was, however, erroneous, because the word "neurectomy" when preceded by the name of a nerve trunk (e. g. plantar neurectomy) readily led the unsuspecting reader to suppose that the operation sacrificed the entire nerve named. The qualified name would easily lead to the impression that the nerve operated upon was inimical to the patient's well-being and therefore required total ablation. The fact that the purpose of the operation is that of destroying the nerve's continuity, that of simply interrupting the communication between periphery and center, at once suggest the word "neurotomy" as the appropriate appellative.

HISTORY.—Neurotomy in veterinary practice until very recently was but a synonym for "plantar neurotomy" of the present day. The operation included but a single procedure,—that of dividing the plantar nerve a short distance above the fetlock joint. At first the operation was called "nerving" and "nerve operation," names still in vogue among laymen. It was first performed by English veterinarians during the second decade, and was introduced into France during the third decade, of the nineteenth century. Professor Sewell is tendered the credit of priority in its performance. He performed first the plantar and then later introduced digital operation. During the same years Moorcroft performed the operation in India, apparently without knowledge of its previous invention in England.

Sewell, by giving publicity to the operation and by improving it so as to include only the posterior digital nerve, is undoubtedly entitled to the full credit ordinarily given him of originating this principle in the treatment of incurable claudications of horses. During the first three-quarters of

the nineteenth century these two operations (plantar and sometimes digital neurotomy) were not, however, universally adopted. They were performed in the most desultory manner imaginable. Sometimes they were credited as being capable of accomplishing wonders, and at other times they were condemned as being nothing short of malpractice. Some defended them and others, equally prominent and capable, condemned them as harmful, ruinous, cruel, ineffectual and unreliable surgery. The discrepant opinions expressed from time to time since the beginning are still found among the veterinarians of the present day. The two operations are also condemned by some from the ethical standpoint, it being argued that lame horses are thus prepared for sale and that the veterinarian is a conscious co-conspirator to the fraud. Others continue to condemn them from the standpoint of unreliability, and still others because of the unfortunate sequelæ that often follow.

The tendency today is toward a more careful selection of proper indications; toward a more painstaking effort to arrive at an exact diagnosis of the morbid process causing the pain; toward the exclusion of such operations where the chances of doing harm are great; and toward a greater effort to divide only the nerve that contributes the sensation to the very seat of disease.

Median neurotomy which was first given publicity in this country by Pellerin and whose small manual on the subject was translated into English by Liautard in 1896, still meets with much favor and seems prone to retain its popularity. It may be described as the third neurotomy operation introduced into veterinary surgery. About the same time tibial neurotomy, peritoneal neurotomy and ulnar neurotomy were attempted and performed by veterinarians all over the world, in a frantic endeavor to cure the various lamenesses commonly affecting the horse. Like all markedly effectual lines of therapy, they were all so much over-done and over-lauded that they left a trail of discreditable failures and havoc in their wake, with the result, again, of meeting with condemnation from many sources. Their history during the past twenty-five years is not unlike that of plantar neurotomy before better pathology and more common sense dominated the veterinarian's actions in resorting to them.

The various neurotomy operations are now largely performed by urban practitioners, owing to the greater prevalence of proper indications for them in cities and towns. They are not resorted heedlessly to all kinds of diseased

conditions, nor as universal cures for the lameness of any one disease. Today they are recommended as routine measures with unequivocal restrictions. The extent of disease, the nature of the disease, the function of the diseased structure, the occupation of the diseased animal, and the usefulness of the animal before and after the operation, are all taken into account before any particular neurotomy is recommended. Then when it is decided to operate, an attempt is made to unnerve only the seat of disease instead of sacrificing the sensation of a large region.

GENERAL INDICATIONS.—The ideal indication for any neurotomy is a **chronic unchangeable, slight lameness,** due to a disease that has produced but little damage. In such circumstances if the affected spot is accurately located and the nerve supplying it with sensation is accessible to division, neurotomy is a strikingly effectual, commendable and a perfectly satisfactory operation. It prolongs the working life of the animal, relieves its pain and leaves no destructive sequel in its wake.

In every case the inflammation must be of a chronic, inactive character; the structures implicated must be capable of supporting the strain to which they will be subjected after their sensibility has been destroyed, either alone or by artificial assistance; and the unnerved parts thereafter must be submitted only to such strain as they will be capable of withstanding.

These restrictions markedly curtail the number of indications, and with the limited means at hand for making the accurate diagnosis demanded by them, they often leave a doubt as to whether a given case is really an indication or a contra-indication. It is therefore very evident that even though neurotomy be preceded with a very careful and intelligent meditation over its prudence, the errors in judgment, exemplified by post-operative sequelæ and failures, will still be legion. The best judgment of the best diagnostician may be found wanting in one case, while the luck of a novice may bring crowned success in another. Withal, there are incurable lamenesses in which the operation is justifiable, even when the chances of failure are great; there are cases and cases in which there is always some degree of certainty as to its success; and there are the small number of ideal indications all of which in their totality create a no small demand for the neurotomy operations in a veterinary practice. To urge, to recommend, to perform these operations at every turn is undefensible and a disastrous practice. But

by selecting suitable cases, wisely weighing every circumstance connected therewith, and acquainting the interested persons as to the possible outcome, the practitioner's usefulness can be manifestly enhanced, by resorting to them cautiously.

GENERAL CONTRA-INDICATIONS.—Neurotomy must never be advised for new, acute, changeable, or severe lamenesses; for any lameness due to an active inflammatory process; for lameness due to an exostosis encroaching upon a ginglymoid articulation; for lamenesss accompanied by extensive alterations of important structures whose diminished strength will prove inadequate to support the added strain; for lameness in horses submitted to violent exercise; for lamenesses in horses afflicted with a rarefying disease of the bones, whether directly due to the condition or not.

A review of these innumerable conditions shows at once the great number of restrictions to be placed upon neurotomy operations. These restrictions must be respected absolutely. It matters not how eager is the desire to effect a cure; how obstinate any given condition is certain to prove with the ordinary palliative lines of treatment; or how vigorously the operation is urged, neurotomy is forbidden under circumstances above mentioned. It seems that every veterinarian with a penchant for surgery, has yielded at one time or another to this burning desire to cure every lame horse by neurotomy, until brought to the realization of his error by numerous disasters, such as casting off of hoofs, breaking down of supporting tendons or failures to relieve the lameness.

Active inflammations of severe lamenesses must be carried along with palliative treatments until they pass into a chronic stage before they become indications for any kind of nerving operation. The exostosis that is just beginning to encroach upon a hinge diarthrosis is exceptionally hazardous. It is only when the exostosis has completely or at least almost completely, ankylosed the joint, that neurotomy becomes at all safe. Whenever there are extensive structural alterations, such as degenerated tendons, deformities of the feet, especially dropping of the soles, the operation is positively forbidden, because in these instances the strength of the feet unprotected by lameness is insufficient to withstand the strain after the sensibility is removed. Horses submitted to violent exercise, whether racing, fast road work, fast street work or heavy draft work, are not ideal subjects for neurotomy under any circumstances. These animals will seldom

survive the ordeal for any great length of time. Often the first day's work will prove their undoing, but more often they break down a few weeks after the operation. Such horses become suitable subjects only when they are given more favorable occupations after the operation. In districts where osteoporosis is prevalent the surgical subject must be selected with greater caution, as in this instance dissolution of the unnerved parts is certain to occur early after the operation. Mules are less welcome subjects than horses, other things being equal. Wrenching of the attachments of tendons is a common termination of the neurotomized mule.

SEQUELÆ AND ACCIDENTS.—The sequelæ and accidents of the various neurotomies are (1) breaking down of the diseased unnerved parts; (2) return of the lameness; (3) unsightly and painful cicatrices; (4) neuromas, so-called; (5) hæmorrhage; (6) shock; (7) failure to cure the lameness.

1. Breaking Down of the Diseased Unnerved Parts—This sequel is by far the most serious incident attending neurotomy. It is the feature that has so often brought the operation and operator into disrepute. The sequel appears at any time from two days to two years after the operation. In the acute lameness, severe lameness of the flat-drop-sole foot or the foot affected with laminitis, it comes early and runs a short, fatal course, while in the chronic lameness the accident may be long delayed and develops gradually. In the former event it takes either the form of shedding of the hoof or loosening of the plantar aponeurosis. The hoof first loosens around the coronet and then finally is cast off entirely, leaving only the keratogenous membrane to support weight. When the plantar aponeurosis loses its attachment the condition is manifested by a dropping of the fetlock, which continues rapidly until the ergot touches the floor and the toe is turned upwards, or upwards and to one side. There is also considerable swelling of the leg upwards and more or less lameness and suppuration of the damaged structures. The patient sickens and dies from exhaustion if not destroyed to end its misery. In the chronic form of break-down the condition presents an entirely different picture. The skin and hoof remain attached. The first appearance of the chronic case is tumefaction of the tendons and synovials beneath the fetlock, followed by lameness of greater or lesser severity. If the patient continues to work sometimes it develops into a break down, the tumefaction accentuates and soon becomes enormous. The fetlock is

held in volar flexion, in its normal position, or in dorsal flexion, according to the amount of pain and the strength of the supporting tendons. If there is much pain the volar position of the fetlock will delay the eventual breaking away of the tendon attachments, while on the other hand if the pain is not much in evidence the dissolution will rapidly follow under the strain of ordinary work, and soon render the patient useless.

After the higher neurotomies, median and tibial, the sesamoidean ligaments are often the sole seat of dissolution. This form is manifested by marked dorsal flexion, swelling of the region and early ruination of the subject. In these events, the occurence usually follows soon after operation, generally when the horse is first given severe work.

The following is a fair example of break-down after tibial neurotomy: A draft horse affected with chronic sesamoiditis of one year's duration supervening thecal abscess, was unnerved above the hock. Twenty days later he was put to light work and seemed to progress favorably. On the thirteenth day, while working in a team hitched to a heavily laden wagon, the fetlock suddenly gave way and descended to the ground. The horse was killed, and post-morten dissection showed that the suspensory ligament, the distal sessamoidean ligaments and the tendon of the superficial flexor were wrenched from their attachment.

The delayed sequelæ are preventable to a certain extent by giving the unnerved horse a less arduous occupation, by the application of supporting bandages and by shoeing with high heel calks. The acute forms are not preventable, as they may occur under the strain of merely supporting the weight of the body.

The **cause of break-down** of the acute variety is always traceable to the indiscreet use of neurotomy to acute inflammatory conditions, or else to lameness accompanied with deformed, weak hoofs. In the chronic variety it is generally the result of continued hard work.

These accidents are due strictly to the mechanical violence (supporting weight, trotting, pulling, etc.) inflicted upon structures too weak or too diseased to withstand the strain. They have sometimes been attributed to mysterious **trophic disturbances** incident to the removal of the innervation, but this theory is not well founded, because strictly sound horses unnerved experimentally or accidentally do not break down, nor is paralysis ever followed by such results. In the case of divided motor nerves the muscles

supplied by them will rapidly undergo simple atrophy from disuse but no degenerative changes are ever observed. Disease, deformity, and weakness are the essential causes to breaking down conditions following neurotomy. The removal of the nerve supply has only the indirect influence of leaving the diseased parts exposed to increased strain. The interrupted nerve supply is not directly causative. The lesions never exhibit any evidence of progressive degenerations to which the term "trophic disturbance" could be appropriately applied.

2. **Return of the Lameness.**—The return of the lameness following neurotomy occurs at variable times after the operation. Sometimes the first two or three days of work will bring back a lameness more marked than the previous one, and at other times two years may elapse before there is a recurrence. The cause of increased lameness or its early return is spreading of the inflammation from the initial seat under the influence of the added strain or concussion to which the inflamed area is subjected. Sometimes this new inflammation will persist and leave the patient permanently lame; and at other times it will subside and leave the subject permanently relieved of the lameness. Lameness occurring a few days after the nerved horse is returned to work is not always serious nor an indication of failure. Longer rest or return to pasture very often turns into success what at first appears to be a failure. The return of lameness from every point of view is a spreading of the inflammation and **not a restoration of the nerve supply.** Nerve supply once interrupted by removing a section of a nerve trunk is destroyed forever. It can not be re-established by reunion of the cut ends of the trunk, because nerve regeneration is not so effected. (See regeneration, Vol. II.)

3. **Unsightly and Painful Cicatrices.**—The incisions into the skin and underlying structures often leave indelible blemishes in the form of prominent unsightly scars, which are not infrequently permeated with highly sensitive nervous elements. Aside from their unsightly appearance these scars are harmless unless sensitive, in which case they are capable of causing a very acute and lasting lameness. They are caused by the error of allowing exuberant granulation to form within the wound. They are prevented by aseptic methods of operation, careful stitching, stretching the nerve before dividing and keeping the patient quiet during the week following the operation. When the sensitiveness con-

tinues, ablation of the scar and a portion of the nerve trunk above it may be necessary to relieve the lameness.

4. **Neuromas.**—The neuromas following neurotomy operations appear in the form of small pea-like nodules attached to the proximal end. When they follow a well healed wound they are found to be movable and not attached to the skin, while in the badly healed incision they are naught but the sensitive scar previously mentioned. They are not true tumors as the name given them would indicate, but the result of a futile effort to re-establish communication. They are analogues of the **amputation neuroma** of human surgery. They consist of new-formed neurolemma infiltrated with axones vainly attempting to grow, but which become lost in the more rapidly formed connective tissue. As to special cause the neuroma is an enigma. They appear as sequelæ of any technique that may be tried to prevent them. As in the case of the sensitive scar the lameness they cause may call for their ablation. The author recommends stretching of the nerve so as to bring a considerable length out of the wound before cutting it off. The stretching probably causes an ascending degeneration and reduces regenerative activity. They can always be prevented to a certainty by pulling the nerve out bodily instead of cutting it off, but this method is very painful and often causes a very intense pain in the legs for some days after the operation.

5. **Failure to Cure the Lameness.**—Neurotomy may fail to cure lameness from various causes, but more often it is due to error in the diagnosis. Sometimes the diseased process is rather too wide-spread to admit of unnerving, and at other times the motion of a joint is mechanically obstructed and this prevents any possible amelioration of the lameness.

6. **Fracture of the navicular bone** sometimes constitutes the injury sustained in breakdown, and the accident indicates that the bone had undergone a too serious structural disintegration to perform its weight-bearing function.

6. **Hæmorrhage.**—The hæmorrhage that occurs during the ordinary neurotomy although troublesome, is always trivial except when one of the collateral vessels is accidentally divided or incised in the course of the operation. The plantar or digital vessels are sometime wounded in the course of the dissection or else divided transversly after being mistaken for the nerve. The posterior radial vein and artery are so closely related to the median nerve at the seat of operation as to expose them to the same danger. Serious hæmor-

rhage results from cutting these vessels should be controlled by prompt ligation.

GENERAL TECHNIQUE.—Only the principles will be considered under this head as the details will be given in the description of each special neurotomy.

Restraint..—Neurotomy is a very painful operation, necessitating an adequate form of restraint. The incision through the skin, the dissection of the nerve, the elevation of the nerve from the surgical wound, and its final division are so as to demand restraint or anæsthesia or both. Depending upon the temperament of the patient and the particular operation to be performed, either the standing or recumbent position may be selected. Some veterinarians recommend the **recumbent position** with complete **chloroform anæsthesia** for all of the neurotomy operations, while others prefer the **standing position** with **local cocainization** for the plantar operations and the recumbent position with local cocainization for the higher and deeper operations. In this connection the practitioner should be guided largely by certain circumstances. **Median, tibial, peroneal, and ulnar neurotomy** require the recumbent position. The standing position is unsatisfactory in some of them and out of the question in the others. Median neurotomy, for example, can only be properly performed when the patient is in lateral decumbency with the leg well stretched from the body. The dissection in these deep operations is facilitated greatly by the use of cocaine solution subcutaneously, immediately before the operation begins. In the case of the plantar operations either the standing or the recumbent positions may be selected. If the horse is inclined to be gentle and the operation is only to be performed upon one limb, the standing position will often answer, but when the patient is intractable or when both limbs require the operation the recumbent position will give the best general satisfaction. After one, two, or three nerves have been dissected out and divided the patient will very often become so uncomfortably wild as to prevent further progress. Sometimes the restive state is due partially to the exhilarating influence of the cocaine, which at this stage is becoming evident, and at other times it is due to the combined influence of the cocaine and the uncomfortable duration of the procedure. Aside from the cocaine exhilaration, which is very frequently noticed, the terrible agony of dividing two or three partially cocainized large trunks consecutively, will often cause a state of frenzy in the most tractable horse. **Standing neurotomy**

as it is vulgarly called is acceptable only in the unilateral case. The practitioner may also be guided by other circumstances; scarcity of help, unskilled help, lack of a suitable place for casting, extreme age of the subject or pregnancy.

The recumbent position gives a much better opportunity to thoroughly disinfect the field, to perform a neat and clean dissection and to approximate the edges of the incision, than the standing position. The operating table is par excellence the best restraint, everything considered. Aseptic operations are easily performed in the position attained upon the table. In the ropes there are always more dangers of soiling the wound, hands and instruments from the close proximity of the field to the litter upon which the horse is cast. This adverse element is eliminated entirely with the table. Furthermore the parts are much better immobilized than with the ropes; however, the latter can be utilized to very good advantage when the table is not available. The horse is cast in the usual manner and the affected leg released and fixed in the extended position, where it is held by strong assistants. The use of a small amount of cocaine at the seat of operation will still farther facilitate matters. When one side is finished the horse is rolled over for operation on the opposite side of the leg or for the opposite leg as the case may be. On the table the bilateral operations are somewhat prolonged because of the necessity of casting the horse twice to expose the surgical fields, but this disadvantage is one of time only.

The standing position as before stated, is specially commendable for unilateral operations. Only the plantars and digitals can be properly divided in this position. A tourniquet is applied to the skin, the seat shaved and disinfected, the twitch applied, the field anæsthetized by subcutaneous injections of cocaine, and the leg held up into a comfortable position for operation by an assistant. In adddition to the cocaine the shaved surface may be still further anæsthetized by spraying with ethyl chloride. When the nerve has been exposed cocaine solution may be applied directly to it on a small pledget of cotton. With these precautions the plantar operations can be nicely done without much ceremony. Here and there, however, a patient is met that will defeat the operator and will need to be placed under more adequate control.

THE TECHNIQUE OF NEUROTOMY.—Neurotomy is a simple operation. It is performed upon strictly healthy tissues; the tissues are only incised, divided; there is no necessity for mutilation; there is no drainage required; the skin

is thick and well nourished at the various points of operation. In fact everything is favorable for prompt healing of the wound, providing the technique is made to conform to the ordinary rules of surgery. The field of operation requires thorough cleansing with antiseptics after having been shaved; the instruments are sterilized; the hands are kept clean and digital manipulations avoided; the sutures used for closing the wound are always sterilized sutures removed from the sealed glass containers only at the time of use; the blood is bailed from the wound with sterilized sponges or cotton; and finally the wound is protected with appropriate surgical dressing recommended for incised wounds requiring no drainage.

The Incision and Dissection.—The exact seat of the incision is located and its length decided upon after a careful and patient palpation and inspection of the region. Legs of horses differ somewhat in ther profile, in their conformation, and they may be abnormal from disease to the extent of actually deceiving the casual operator unless the parts are carefully surveyed. The aim should be to make the incision exactly over the nerve trunk. When the location is decided upon the skin is held tense with the left hand without disturbing its normal relations, while the incision is carefully carried through it with the right one. When the skin is cut through throughout the whole length of the incision the dissection forcep is taken in the leit hand to be used as a retractor of one of the edges of the skin. At this stage some operators have recommended the use of various retractors to dilate the incision. The tine retractor and the elastic retractor (Fig. 99) are chiefly mentioned in this connection. These instruments are necessary only in the deep neurotomies (median tibial, peroneal, etc.). In the plantar operations the dissection forcep is quite sufficient to open up the wound to facilitate the division of the subjacent tissues, unless some unexpected situation arises.

The technique that usually gives the best satisfaction and shortens most of these operations to the minimum is to grasp one edge of the wound with the dissection forcep, instruct the assistant to bail the blood thoroughly and then make a stroke or two with the knife parallel with the incision, through the areolar tissue covering the underlying structures. This will generally bring the anatomical structures into view for easy identification. If the areolar tissue is bathed with blood it is picked up carefully here and there with the forcep and dissected away with the scalpel. All of

the time the assistant is keeping the blood from masking the work. When the nerve comes into sight (and no further step is taken until it is fully identified) it is partially loosened along a small part of one of its edges so as to give a point of entrance for the nerve elevator. The elevator is then taken in the right hand and passed beneath the nerve to the opposite side of the surgical field and held firmly to prevent its disturbance by struggles of the animal, which are quite certain to follow at this point of the operation. The nerve is then dissected from its adjacent structures along the whole course of the wound and then pulled out with some force as the probe-pointed bistoury divides it at the proximal commissure of the wound. Dividing it at the distal commissure, sewing the incision and dressing it with appropriate dressing completes the procedure.

Nerves are sometimes difficult to find and sometimes they are not easily differentiated from the other cordiform structures,—aponeuroses, arteries and empty veins. The operator must remember, as a general principle, that nerves are, on the whole, quite superficial, and that failure to immediately locate them is no reason to dig deeply into the wound. Deep digging into the wound leads to more confusing situations than all of the other errors and deficiencies combined. **The nerves of horses usually operated upon are not deep.** When they are not promptly found it is generally because they are hidden in a mesh of blood-saturated areolar tissue. Always dissect away carefully the superficial areolar tissue with the forcep and scalpel before searching elsewhere for the nerve. By shifting the skin to and fro a very wide range of underlying tissues can be explored, and these must be thoroughly examined before the dissection is carried deeper. A nerve denuded of its sheath reveals itself in the form of a glistening flattened ribbon, closely blended to an adjacent vein in nearly every instance. After it has been dissected free from its neighboring structures it appears more cylindrical, and may then be mistaken for an artery, which is always round, even on first sight and before it has been loosened from its surroundings. An artery is bluish and roughened, and never presents the longitudinal fibers so characteristic of the nerve trunk. It is also more elastic and lifts from its trough more easily than the nerve trunk. It has not the same substantial attachment to its adjacent structures as the nerve. The differentiation between nerve and artery, if difficult to the casual operator, is quite easy

for the experienced surgeon, from inspection. When there is any doubt, after taking its physical appearance into account a prick of a pin above the cocainized portion will serve to make the differentiation more certain.

The **length of the incision** is not restricted so long as the technique is so directed as to assure primary union of the skin, but when the wound suppurates the smaller the incision the smaller will be the scar. About one-half inch is sufficient for the plantar operations, and one and a half inches for the higher and deeper neurotomies. It is possible to elevate the digital and plantar nerves through very small dermal incisions, but there is no notable advantage in the method where cleanliness prevails.

Control of Blood-flow.—The flow of blood in neurotomy is controlled chiefly for the purpose of facilitating dissection. It is accomplished by the application of a rubber tourniquet above the seat of operation and by bailing the oozing blood from the incision with the sponge . In neurotomies above the tarsus or carpus the tourniquet is not applicable, and only the latter method applies, with the occasional twisting of a spurting vessel with the forcep. When any of the large vessels are accidentally cut they must be promptly ligated before the operation is carried into the advanced steps. It is never admissible to arrest such hæmorrhage by compression. With a little effort these vessels can always be isolated and properly ligated, to the decided benefit of the healing process, in contra-distinction to the harmfulness of the wadding or the compressing bandage.

Suturing the Wound.—The wound is always closely sutured so as to heal without drainage, with the exception of that of median neurotomy, which will be considered later. In applying the stitches the edges of the wound are lifted consecutively with the dissection forcep and the needle passed through with the needle holder, instead of manipulating them with the hands, which at this stage of the operation are liable to have become soiled. The crucial stitch (Fig. 65), the mattress stitch (Fig. 64) or the simple interrupted stitch (Fig. 59) may be decided upon. The crucial stitch gives somewhat the best results in that it leaves no scars.

After-Care.—Immediately after the operation, as soon as the horse has returned to the standing position, the region is well rinsed with mercuric chloride solution to rid the parts of accumulated blood and litter, that may be attached to

the field and surroundings, then a liberal wad of cotton well saturated in mercuric chloride solution 1-500 is loosely bound to the wounds with a muslin bandage. The horse is then kept in the standing position for twenty-four hours, when a liberal dry dressing of boric acid and iodoform is applied and retained with cotton and bandages. This dressing is left undisturbed for five days, when it is removed to remove the stitches. These are cut closely to the level of the skin on one side of the wound and gently removed. The dry

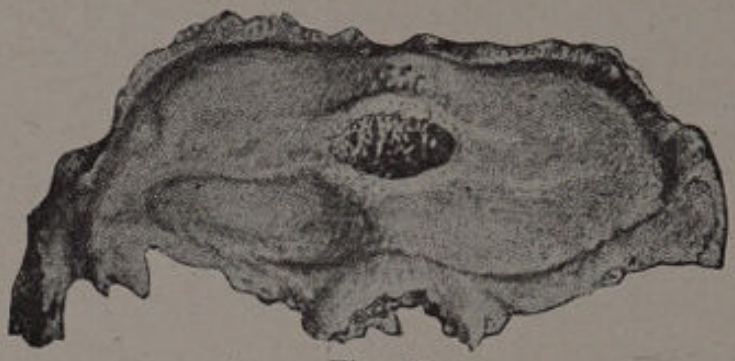


Fig. 87.

Fig. 88.

Figs. 87 and 88—Structural Changes in the Navicular Bone in Navicular Disease. (Reeks.)

dressing is re-applied for several days and then discontinued entirely.

The neurotomized subject is ready for work in fourteen days, but more time is advisable. In fact three or four months' absolute rest in a paddock or pasture is none too long if the best possible results are desired. The unnerved parts are thus given ample time to accommodate themselves to the new condition, the disease itself is given an opportunity to heal, and all of the neuritis incident to cutting the nerve trunk will have subsided. Plenty of rest under favorable conditions is highly advantageous after any of the neurotomy operations. The immediate return to heavy work is generally disastrous.

BILATERAL AND UNILATERAL PLANTAR NEUROTOMY

SYNONYMS.—Plantar neurotomy; high plantar neurotomy; metacarpal neurotomy; the high operation.

DEFINITION.—The surgical division of one or both of the volar nerve trunks a short distance above the fetlock joint, performed for the purpose of destroying the sensibility of diseased structures related or belonging to the articulations beneath.

HISTORY.—The history of plantar neurotomy is that of neurotomy in general, owing to the fact that this was the first of the neurotomy operations introduced into veterinary surgery, as well as the only one that was performed to any extent for more than half a century after its introduction. (See page 129.) During the past decade, that is during the real evolutionary cycle of veterinary surgery in America, it was the only neurotomy operation performed by the rank and file of the profession. The so-called "low operation," although generally known and understood, was avoided, except possibly here and there by certain well known practitioners and teachers in some of the leading colleges. Slowly, however, the digital operation gained prestige and largely supplanted it in the treatment of navicular disease, except as a kind of last resort operation when all other lines of treatment, including the low operation, had failed.

When first introduced into this country it was given an entirely too wide range of application. A number of European graduates, some of the earlier American and Canadian graduates and some few of the bolder empirics of which the profession was largely constituted, encouraged by the magical cure of various forms of lameness, perhaps laudable enough in their intentions, performed the operation right and left, anywhere and everywhere, for the trivial lameness and the severe lameness, for the acute case and the chronic case, for corns, ringbones, sidebones, and in fact for almost every diseased condition that is capable of causing a lameness. The result of this unwise application is easily foretold in view of what is now known of the effect of neurotomies. Horse after horse was ruined. Feet disintegrated, hoofs were cast off, tendons were loosened from their bony attachments to the extent of bringing a justified prejudice against the very thought of the word "nerving." Experienced horsemen justly condemned the procedure and the phrase "nerving a horse" became synonymous with "ruining a horse."

With a better understanding of the pathology of disease and a better judgment of what might be the result of depriving a diseased structure of its sensory innervation, the scientific veterinarian discarded the operation, except for certain special indications and for certain specific conditions not taken into account by the earlier enthusiasts. The result has been that high plantar neurotomy has again become a common operation, from which certain results may be depended upon, without any great danger of disaster.

Fig. 89.

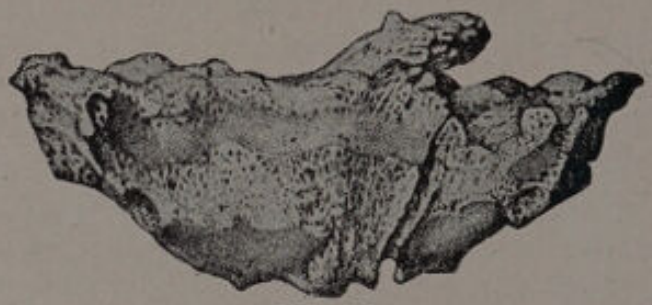


Fig. 90.

Figs. 89 and 90—Fracture of the Navicular Bone Following Neurotomy. (Reeks.)

INDICATIONS.—In the treatment of **navicular disease,** (Podotrochleitis Aseptica), which has heretofore been the chief indication of the operation, the low operation is recommended as par excellence the best one. It is only as a last resort that the high operation can be judiciously recommended. When the diagnosis is certain and the low operation has been given a fair trial, then and then alone should this operation be mentioned in the treatment of navicular disease. It is not always advisable even under such circumstances, as a lame horse or a stiff horse is generally more valuable than a hopeless broken down one. The most striking feature of digital neurotomy is the frequent disappearance of the lameness, even after several months. Sometimes the lameness is increased in severity and then gradually subsides week after week. All of the possibilities must be weighed deliberately before the performance of plantar can be justi-

fied. It is not in navicular disease that this operation finds its greatest usefulness. In this common affliction it might be truthfully said that any horse that does not receive a marked benefit from the digital operation is too badly diseased to long survive the plantar operation. While there may be some exceptions to this rule, the practitioner will seldom encounter them. The practitioner who will take a positive and firm stand against the too free resort to this operation for incurable navicular disease, will in the end gain more favor than the one who enthusiastically recommends it at every turn.

Sidebones present by far the best indication for plantar neurotomy. In these lesions it is a specific remedy, espec-

Fig. 91—Sidebone.

ially the **unilateral operation for the unilateral sidebone.** Here the operation is almost universally helpful. It does not matter whether the patient is a heavy draft horse, a coach horse, a roadster, a hunter, or even a race-horse, the results are satisfactory. The exceptions are found only in the general contra-indications. Acute lameness is, of course, a restriction, as should be the case under any similar circumstance, and in very large sidebones the lameness may not always be entirely cured because they may mechanically obstruct the motion of the phalangeal articulations and thus cause a defective gait even when all of the pain is banished, but even in this event the lameness is improved. The operation is equally beneficial for the large and the small sidebone, for the one located anteriorly as well as the one

situated at the posterior aspect of the lateral cartilage. The most important precaution is the examination of the heels for corns. The corn is often a serious complication of side-bone, in fact, frequently the latter has its origin in the former. This fact warrants a careful inspection of the heels to determine whether the corn is in fit condition for the operation. Sometimes the heel is intensely reddened, painful, threatening suppuration, or even fissured along the wall, so as to readily admit infections. Under these circumstances the operation is hardly advisable. It should at least be postponed pending a marked amelioration of this feature of the lameness.

In regard to side-bones Prof. O. Owen Williams truthfully says: "Neurotomy is more successful in removing this

Fig. 92—Sidebone. Bilateral. (Reeks.)

form of lameness, and it is attended with more permanent beneficial results than when performed for navicular disease." Reeks does not mention neurotomy in an exhaustive description of this disease, and like Moller gives his readers the impression that side-bone lameness is not important because it is trivial and transient. These tenets are a direct contradiction to our own observation among hard-worked horses and fast heavy-harness horses, both of which we have frequently found suffering from a chronic, troublesome lameness from side-bone that proved refractory to any of the ordinary lines of treatment, but which yielded finally and permanently to plantar neurotomy. If the condition chances to be unilateral, the division of the plantar nerve on the affected side may always be depended upon to effect a lasting relief of the lameness.

For **ringbones** the operation is not as successful, in fact it is sometimes very treacherous. This indication must be more carefully judged. When the lameness is recent and pronounced it is strictly contra-indicated in every case, but in the old case in which the motion of the joints is already manifestly limited by a more or less firm ankylosis, plantar neurotomy very often transforms a useless animal into a fair worker although some lameness remains. The cure is seldom complete, but the degree of relief is often satisfactory. Ringbone of the fore extremities may also be included among the indications for plantar neurotomy when all other remedies have failed. Here it is defended as an operation of last resort; the patient being worthless, any expedient may be tried. Quite frequently horses lame from very large ringbones are much improved by plantar neurotomy followed by the application of a roller-motion shoe to compensate for the obstructed joint action. In the hind extremities tibial neurotomy is preferable.

Lesions following nail pricks are sometimes suitable indications, but in no case must the operation be performed too early. It is only after a year or more that plantar neurotomy is a safe procedure in such cases, and then only when the lameness is not too pronounced. Too frequently the seat of mischief is located at the tendinous attachment at the semilunar ridge. If the stability of the attachment is weakened rather than fortified by the inflammatory process, there is always considerable danger of dissolution of the union, which, of course, would complete the ruination of the patient. On the other hand, when the inflammatory adhesions are stable, the removal of sensibility by neurotomy is perfectly safe and palliates or entirely cures the lameness. High heel calks are additional needs.

Chronic lameness following quittor sometimes offers a suitable condition for unilateral plantar neurotomy, but here too, some times must elapse before the operation may be safely resorted to. A year or more after the quittor has healed is the appropriate time for intervention. In no event should it be performed earlier, on account of the grave danger of degeneration of the affected area.

Osteophytes of the os suffraginus, sometimes referred to as high ringbones, frequently produce an obstinate lameness that will yield to no other treatment then the division of the nerve on the affected side. However, these cases are more effectually reached by the medium and the ulnar operations

than by plantar. The latter nerve is somewhat too near the seat of disease to account for all of its innervation.

CONTRA-INDICATIONS.—The contra-indications for plantar neurotomy have already been mentioned under general contra-indications for neurotomy. It might, however, be advantageously repeated here that the operation is positively dangerous under many circumstances. Too often it is followed by casting of the hoof, or wrenching of the tendons and ligaments of the pedal articulations, to warrant a too liberal recommendation under any circumstances. In pronounced lameness of navicular disease, in any recent acute disease process or in subjects with weak, flat, deformed feet, its exclusion must be made an absolute law. Plantar neurotomy is an operation to be recommended with great caution. The practitioner must use the greatest discretion in the selection of every case, and the owners should always be made cognizant of the possible disastrous results. To fail in this is to invite discredit. **Chronic laminitis, recent ringbones** and **acute navicular disease** are the three principal conditions in which the operation is most likely to be misapplied. Feet affected with serious corns, especially those which have suppurated or threaten to suppurate, are likewise unwelcome subjects, whether they are causing lameness or not. In fact, the foot itself, aside from the disease for which the operation is to be performed, must be known to be sound and strong, and in no way predisposed to new dangers; otherwise it must be considered as a contra-indication. **Weak hoofs, hoofs with rough, friable horn, hoofs** affected with serious **corns, cracks, seedy toes, or convex soles** are sufficient reasons to exclude neurotomy in every instance. Another undesirable condition is the pastern that slopes below the normal angle in aggravated dorsal flexion. The straight pastern is much more favorable for neurotomy than the one excesssively sloped; although the former will sometimes favor stumbling, the latter creates a greater susceptibility to degeneration.

Plantar neurotomy is always contra-indicated in the **hard-worked horse.** The nerved horse that is slammed recklessly along the stone-paved streets will never survive the operation for many months, and precisely the same may be said of the **horse occupied in pulling very heavy loads,** and the **one engaged in racing** or in very fast road work. While these facts can not be considered as absolute rules, the exceptions are very few.

RESTRAINT.—The recommendations made for digital neurotomy may be applied bodily to plantar neurotomy, with the difference that the latter, being so much more easily performed, is much more favorable for the standing posi-

Fig. 93.

Fig. 94.

tion. The plantar nerve is easily found on dissection, it is superficial, it is located in an accessible place, its environs are easily cocainized. The standing position suffices in most cases, especially when only a single leg is to be operated

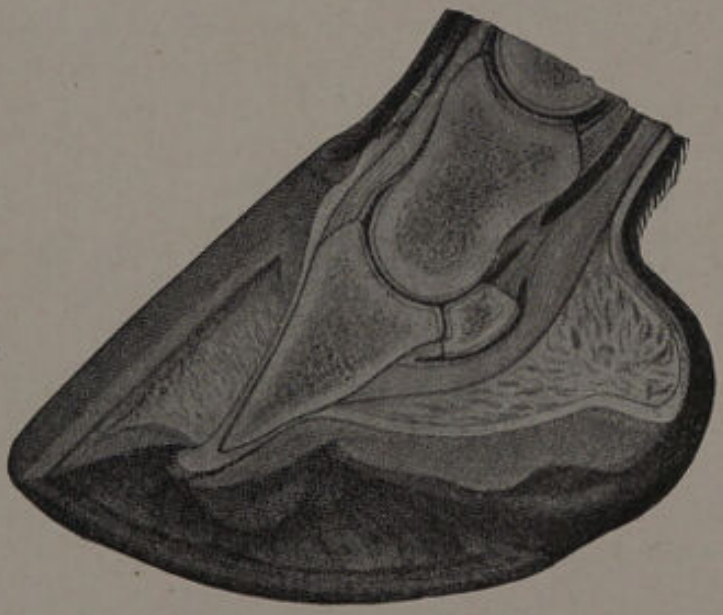


Fig. 95.

upon. The cocainization of four seats of operation and the dissection and division of four separate nerves, required in operating upon two legs, sometimes causes a troublesome

restiveness that is objectionable to a careful and particular surgeon. These facts suggest the standing position for the single-nerve or single-leg operation, and the recumbent for the double operation. The temperament of the patient may,

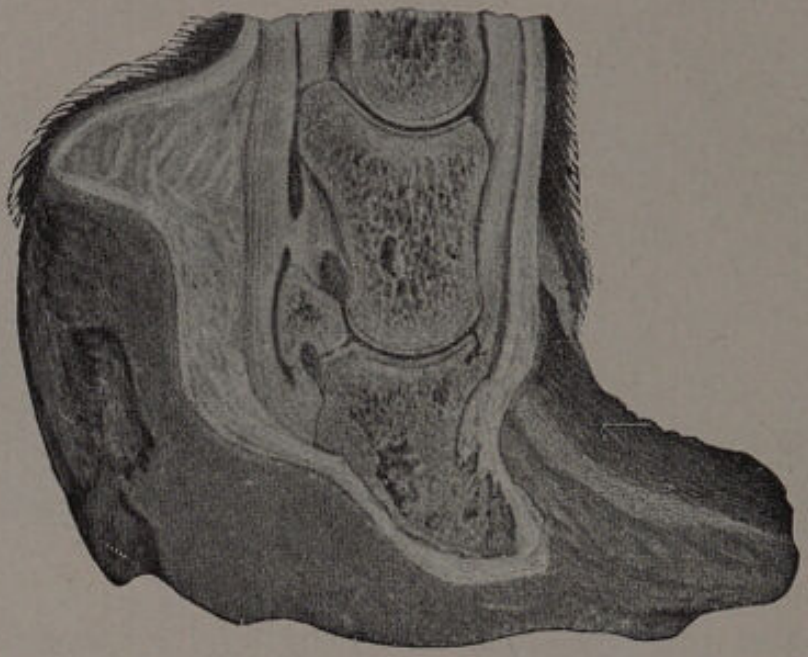


Fig. 96.

however, be regarded as sufficient reason for reversing this order.

EQUIPMENT.—The equipment recommended for digital neurotomy will answer, without addition or change, for

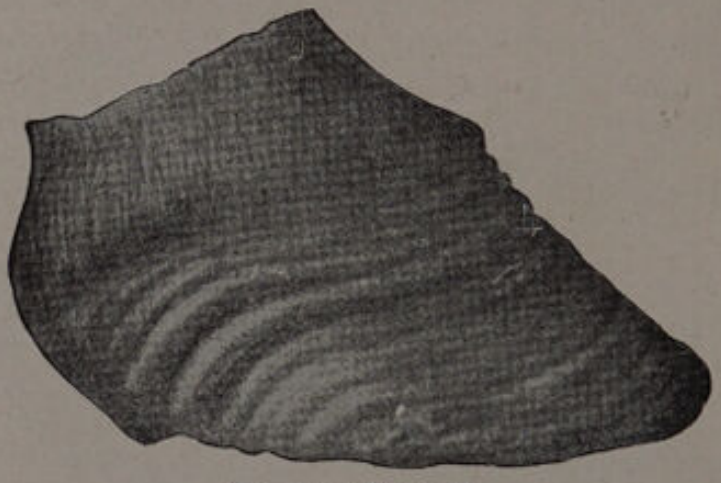


Fig. 97. (Reeks.)

this operation. The elastic wound retractor (Fig. 99), not previously mentioned, is sometimes recommended as an effectual instrument to facilitate the dissection after the dermal incision is made. It is of no special service if the incision is made directly over the nerve, and besides the ten-

sion it brings to each edge of the wound is often so unequal as to draw the wound out of range and thus confuse rather than facilitate subcutaneous dissection. However, if the leg is enlarged from disease so as to require a long wound, and especially if the surgeon is without an assistant to bail blood, the elastic retractor is of service.

TECHNIQUE.—The operation proper is not unlike the digital operation in general, yet there are enough important

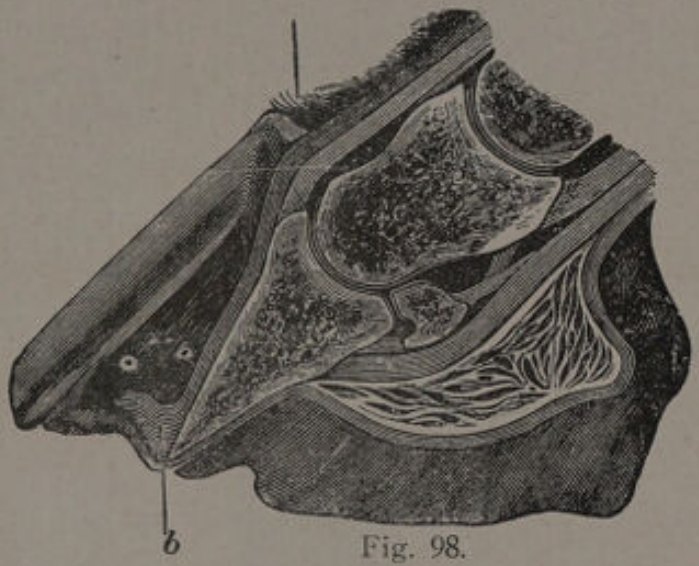


Fig. 98.

Figs. 93, 94, 95, 96, 97 and 98—Forms of Feet in which Neurotomy is Strictly Contra-Indicated. (Reeks.)

differences in the details to demand a separate description.

First Step.—Locating the Seat of Incision.—The incision is made over the groove dividing the tendon of the flexor pedis perforans from the great suspensory ligament. It is

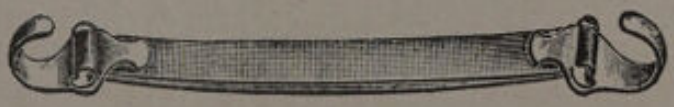


Fig. 99—Elastic Retractor.

made near the tendon rather in the midddle of the groove or too near to the suspensory ligament. The dorso-volar range of the incision must vary somewhat with the proximo-distal location selected. That is, if the nerve is to be divided high the incision is made in the middle of the groove some distance from the tendon, but if a lower location is decided upon it is made near the tendon, in fact almost over its level. At the low position (Fig. 102) the nerve lying in close contiguity to the vein is easily felt with the fingers and thus immediately suggests the exact location. There is always

more danger of making it too far anteriorly, than too far posteriorly, because the nerve is located posterior to the vein. If the incision is made so as to carry the wound in front of the vein, confusion immediately arises because no landmarks are disclosed in the subsequent dissection, but if made so as to bring the wound immediately behind the vein, the nerve will promptly come into the foreground. The aim should be to make the incision about two millimeters behind to the center-line of the vein. The proximo-distal location varies according to circumstances. For the great majority of cases a certain location, just above the fetlock, at the very point where the round contour of the perforans tendon becomes indistinct, may be universally selected. Sometimes, however, it must be made higher an account of some abnormality at the usual point. A large windgall, or a large cicatrix from interfering, will necessitate a higher location;

Fig. 100—Highest Position of Incision in Plantar Neurotomy. The Elastic Retractor Applied.

and again, when the operation is decided upon for a lesion some distance above the foot, a higher division of the nerve may be thought expedient. When the high location is decided upon the lower part of the middle third of the metacarpus is selected as the most appropriate spot. Here, where there are no synovials to injure, the nerve can be found quite as easily as at any other point except at the one already described, just above the fetlock, where the nerve is located by palpation.

Second Step.—Preparing and Disinfecting the Field.—As the wound in this operation occupies a rather conspicious position on the leg, special effort should be made to heal it with an invisible cicatrix. The preliminary requisite to such a result is a painstaking disinfection of the field. It is advisable to clip and shave a rectangular space one and

a half inches long and one inch wide around the seat of incision, flood the region with water to wash off loosened hair, bathe the denuded spot with a strong solution of mercuric chloride (1-500) for some moments, and when dry, paint the surface with tincture of iodine. The rubber tourni-

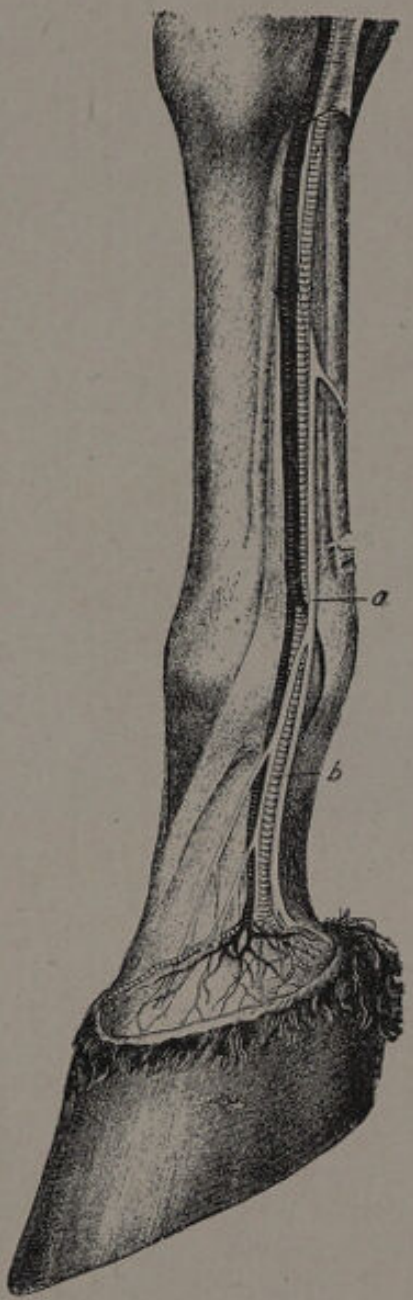


Fig. 101—Course of the Internal Plantar Nerve.
a—Seat of Section in High Plantar Neurotomy. *b*—Seat of Section in Low Plantar Neurotomy.

quet is then wound tightly around the upper third of the metacarpus and the operation proper is begun.

Third Step.—Locating and Dissecting the Nerve.—An incision through the skin one-half inch in length is sufficient if

the lower position (just above the fetlock) is selected, for here the nerve is superficial and easily found. The exact location is determined by palpation, as mentioned in the preceding step. At the point thus indicated the scalpel is carried through the skin, exposing the subcutem at one firm, deliberate stroke. The skin must be cut completely through from one angle of the wound to the other so as to expose

Fig. 102—Position of Incision for High Plantar Neurotomy.

the underlying tissues throughout its entire length, and thus allow as much space as is possible for the subsequent dissection. When this incision is perfected one edge of the wound is stretched to the side with the dissecting forceps, and as the assistant bails out all of the blood, a few gentle longitudinal strokes with the scalpel will usually bring the glistening whitish ribbon-like nerve into view. If this result is not immediately forthcoming, similar search is made at different points of the wound whose range is widened at will with the dissecting forcep. If these manipulations are not fruitful the depth of the wound must not be increased until all of the blood-soaked areolar tissue in the foreground is picked up and dissected away. Most always this procedure will unmask the nerve, which is then loosened along one edge preparatory to its elevation.

Fourth Step.—Elevation and Resection.—The elevator is forced under the trunk from before backwards or vice versa

according to which edge was loosened in the preceding step, and then taken with both hands or between the second fingers of one hand and pulled quite forcibly outward from the superior commissure of the wound. This pulling process brings out one and a half and often two inches of the trunk, causes it to degenerate a considerable distance upwards and thus prevents the formation of a sensitive scar or neuroma. When thus stretched the bistoury is passed beneath it as near to the superior commisssure as possible, dividing it with an outward stroke. The divided trunk is then picked up with the dissecting forceps, loosened along the whole length

Fig. 103—The Author's Nerve Elevator.

of the wound with the scalpel and then divided at the inferior commissure.

Fifth Step.—Suturing.—The needles previously threaded and retained in an appropriately clean container are then picked up with the forceps, and needle holder. One edge of the wound is held with the dissecting forceps as the needle is inserted through the skin at the proper location with the needle holder held in the other hand. When the needle is pulled through this edge of the wound the other one is similarly elevated with the dissecting forceps as the needle, which has again been picked up with the neeedle holder, is passed through it. This manipulation of the suture, a recommendation belonging to the domain of general surgery, is repeated here because of the great importance of healing these conspicuous surgical wounds without the contamination that is certain to follow digital contact. During the course of such an operation the fingers are generally soiled in one way or another, and are at this stage unfit to handle the needle and thread that were so carefully sterilized. If the needle holder is not used, the operator should don a pair of sterilized rubber gloves to handle the needle and sutures, and at the same time prevent the thread from trailing about over unclean places. The single interrupted suture is generally sufficient except for long wounds where two might be required to assure perfect coaptation throughout the whole length. The crucial, recommended for digital neurotomy, may also be used to advantage.

Sixth Step.—Applying the Dressings and Wound Treatment.—Before the permanent surgical dressings are applied

the whole region is rinsed liberally with the mercuric chloride solution to rid the surface of all blood or other attached particles. Then a large antiseptic-soaked piece of cotton is bound to the wounds with an appropriate bandage. This dressing is removed at the end of twenty-four hours and substituted by a dry antiseptic powder,—boric acid or iodoform,—which is renewed every day without molesting the wound with washes of any sort whatever. At the end of six or seven days the sutures are removed, but the wound is sub-

Fig. 104—Correct Method of Suturing Neurotomy Incision.

mitted to the same treatment during the subsequent week, after which it will be found well healed.

AFTER-CARE.—The after-care of horses submitted to this neurotomy is special, owing to the grave danger of disaster to the feet from various causes. The feet of the neurotomized horse must be kept under a constant surveillance. They must not be submitted to the same insults as the healthy feet. Protection against wounds, bruises, nail-pricks, corns and cracks must not be omitted. Although these do not always develop into serious conditions if promptly placed under appropriate treatment, they nevertheless always cause to the experienced observer some anxiety because of the serious complications that may arise from them. In this connection it may be concluded that these lesions to neurotomized feet are always much more serious affairs than

similar ones in healthy feet, in spite of the fact that they sometimes heal with more or less rapidity and without encroaching beyond the initial seat of injury. The greatest danger seems to come from their late discovery. The nail-prick or corn for example, escapes notice until manifested by a grave and extensive inflammatory condition that has passed the curable stage; and besides these acute infections, often serious enough in healthy feet, are accentuated, insulted, abused by the reckless use of the affected part, which is no longer protected by pain. It is advisable as a protective expedient, to clip all of the hair from the coronet of the neurotomized horse so that wounds, bruises and cracks in that region may be more promptly discovered. To protect against nail-pricks suitable **sole-leather or metallic pads** covering the sole and frog, are nailed beneath the shoe, and the feet are examined daily for a possible penetration of these protective coverings. **Tar and oakum** packing beneath the pads will preserve the moisture of the hoof, as well as a more healthful condition of the hoof structure. Shoeing with **rubber pads** and iron tips answers very well where this style of horse-shoeing is available.

A protracted rest at pasture after the operation is always admissible, but is by no means as essential as after digital neurotomy. Exceptional care of the feet, preservation of their natural moisture, good shoeing, and a constant lookout for accidental wounds, are so many precautions to keep inviolate.

But, above all, the neurotomized subject, if this usefulness is to be preserved for any length of time, must be given an occupation that harmonizes with the seriousness of its pedal infirmity. Otherwise the whole affair is certain to terminate unfavorably. Racing, speeding or heavy traction will not long be survived. A neurotomized, large draft horse will soon become absolutely useless from pulling a large dray or coal wagon, but the same subject, hitched only to a light express wagon at slow work, will often prove an exceptionally useful horse for many years. The speedway horse, in the same manner, makes a useful roadster or family horse, and so forth through the whole category of equine types.

SEQUELÆ AND ACCIDENTS.—Operative and post-operative accidents are more numerous from high plantar than from any of the other neurotomy operations. It was this operation that brought "nerving" into disrepute during the early days, and in many communities at the present time, but these need no repetition here, having been dis-

cussed at length in a previous paragraph under "Neurotomy." The most common unfavorable termination, described under the head "Breaking down of the diseased unnerved structures" follows in the wake of this operation with great frequency. Unless all of the recommendations govern-

Fig. 105.

Fig. 106.

Figs. 105 and 106—Wrenching of the Flexors (Break-Down) Following Planta. Neurotomy. (Bayer.)

ing the selection of suitable cases, and unless all of the postoperative precautions are respected, high plantar neurotomy will prove more of a bane than a blessing to the veterinary practitioner and his clients. This sequel occurs in both an **acute** and a **chronic** form. In the former, it sometimes pre-

sents itself before the surgical wound has healed, or as soon as subject is returned to work, and may be manifested by wrenching of the plantar aponeurosis from its attachment, followed by turning up of the toe or by a rapid shedding of the hoof after two or three days of tumefaction around the coronary cushion. In the chronic or delayed form its encroachment is gradual, appearing first in the form of a tumefied, painless condition of the tendons above the hoof, and ending either in a severe lameness with volar flexion, or in only slight lameness with a gradually developing dorsal flexion. A delayed break-down is sometimes seen to follow the accidental wounds previously mentioned.

Among the accidents sometimes occurring during the operation is the accidental opening of the superior cul de sac of the sesamoidean synovials. This occurs during the dissection, as the result of a careless wielding of the scalpel or from a sudden jerk of the improperly restrained leg. It is a harmless incident if infection does not enter into the situation, at the time or during the healing of the wound.

BILATERAL DIGITAL NEUROTOMY

SYNONYMS.—Low plantar neurotomy; digital neurotomy; the low operation.

DEFINITION.—Bilateral digital neurotomy is the surgical division of the volar digital branches of the volar nerves a short distance below the level of the fetlock joint.

HISTORY.—Digital neurotomy, so far as we are able to ascertain, was first performed in the London Veterinary College by Professor Sewell about the year 1817, some years after he had demonstrated the results of division of the whole plantar nerve above the fetlock joint. There is little available history of the procedure during the succeeding years, beyond record of isolated cases here and there, performed throughout civilized countries where scientific veterinarians were located. It was introduced in this country by graduate veterinarians from English colleges. The operation was mentioned by lecturers on veterinary medicine and surgery in the first American colleges, but it was little practiced until the '70's, when scientific veterinarians became more numerous throughout the American cities. During later years when colleges adopted better methods of teaching surgery, it gained more favor than any of the other nerving operations. It has been given precedence over the other operations, and was always recognized as the most valuable of

them all, but being somewhat more difficult to perform than the high operation, there was some delay in its general adoption by the veterinary profession. Veterinarians who would have performed it in preference to the high operation avoided it because it is more difficult to perform. Today digital neurotomy is a standard veterinary operation, performed without ceremony by almost every veterinarian who makes any pretense to practice surgery.

INDICATIONS.—Digital neurotomy is performed for the single purpose of curing lamenesses due to painful diseased processes located in the volar aspect of the second interdigital articulation. Lesions of the plantar aponeurosis, the navicular sheath, the navicular bone, described generally under the name of "navicular arthritis" are the indications for the operation. The volar digital nerve, the largest branch of the volar, distributes its end organs largely to the solar aspect of the foot. It is the sensory nerve of the perforans tendon as it nears its strong attachment to the semilunar ridge; of the synovial apparatus that furnishes lubrication to the bursa interposed between the tendon and the fibro-cartilaginous face of the navicular bone; of the navicular bone itself; of the major portion of the velvety tissue and plantar cushion, and of the volar and internal parts of the third phalanx. These structures are the seats of many of the morbid conditions which produce lamenesses of variable degrees of intensity in horses working upon paved streets. Sometimes the disease is an osteitis, sometimes a synovitis, sometimes a tendinitis, but more often it is a combination of all three. As to its cause, it is generally attributed to concussion, strain, rheumatism, etc., but from the very nature of its inception, course and termination there is every reason to suspect the existence of a mysterious predisposing diathesis, skeletal disease, that contributes more to the cause than the traumatisms previously enumerated.

Aside from the disease known under the name of navicular arthritis, digital neurotomy is indicated in lesions of the same structure from direct wounds of the feet (nail-pricks) which have left a chronic lameness behind. In these cases the lesion is usually a partial adhesion of the plantar aponeurosis to the navicular bone, due to destruction by suppuration of the navicular synovials. In these cases it is only effectual when the lameness is not severe and when the lesion is not very extensive. Some surgeons recommend digital neurotomy very highly in side bones, for which dis-

ease they resort to the operation freely and without fear of disastrous consequences under any circumstances.

The value of digital neurotomy depends upon the fact that the superficial foot structures are not unnerved, and that the hot bed of foot lesions is centered generally within the structures receiving sensory impressions from the volar digital nerve.

The ideal case of navicular disease for the operation is the one with a slow progress that has never at any time been manifested by severe lameness, with a tendency to point the foot in the stall, and with a lameness marked enough when first going out but gradually diminishing with exercise. The foot may be somewhat smaller than normal and somewhat contracted at the heels, without distracting any of the prospects of a cure. The patient should, however, not be too old. Digital neurotomy is much more effectual in the young animal.

RESTRAINT.—The operation can be performed in either the standing or the recumbent position. The former is advisable only when but one leg is to be operated upon, as many patients become rather too restive before each of the four nerves have been exposed and divided. The seat of operation is anæsthetized subcutaneously by injecting about thirty minims of a five per cent solution of cocaine hydrochloride along the course of the nerve, some five to eight minutes before the incision is made. A twitch is applied to the upper lip and an assistant supports the leg, flexed backward as shown in Fig. 107. The operator sits upon a low stool, kneels or leans forward at a comfortable distance from the leg.

The recumbent position is advised for operations upon both legs and in restive animals. Either the casting harness, the hopples, or the operating table will answer. The latter is, however, preferable, owing to the elevated position of the field of operations, the perfect immobilization of the leg, and the possibility of performing the surgical work much more cleanly than is possible upon a litter of straw, shavings or peat. To take the best advantage of the table restraint, the two legs are first tied tightly to each other with a strap of rope arranged in form of a figure 8 just above the knees, or if in hind legs, above the hocks. (Fig. 22, Vol. II.) the affected leg is released from its hopple and fixed forward with a smaller strap fastened around the coronet and passed over the heel. This places the fetlock in dorsal flexion and brings a desired tension upon the region to be incised. Co-

cainization of the field completes the restraint. When one digital nerve has been divided, the wound is covered and the legs reversed, to similarly secure the other leg for division of the opposite nerve on the opposite leg. When this has been done the patient is returned to its feet and placed end for end upon the table and the same plans repeated. This form of restraint requires careful protection of the previously made surgical wounds against bruising in the hopples and contam-

Fig. 107.

ination with dirt while the operation is proceeding and while the patient is being reversed upon the table.

If the casting harness is used, several methods are available for immobilizing the leg. One of them consists of fixing it at a right angle from the body by a rope extending from the knee to the hopple of the hind leg, and another around the coronet to the hands of one or two strong assistants, who pull forward. Another method adopted to advantage by many surgeons consists of fixing the leg along its entire length to a board. This method fixes the leg quite thoroughly by preventing flexion of the knee. The board may be made to extend outward some distance from the foot so as to give the assistant holding it more advantage.

The English hopples are not as applicable to this operation as either of the above apparatuses, although they are very often used. The best advantage is taken by releasing

the affected leg from the hopple and then fixing it tightly to the hind leg with a strap or rope. The disadvantage here is found when the patient is rolled over to expose the opposite side. The operating field will be found hidden beneath the horses's body and is only made accessible after it is released from its fixed position, far enough to bring it from under the body. The leg is then found to have too much freedom for careful surgical work. The board method above described

Fig. 108.

Figs. 107 and 108—Digital Neurotomy in the Standing Position. Fig. 107—Position of Operator and Assistant while Operating upon the External Nerve. Fig. 108—Position of Operator and Assistant while Operating upon Internal Nerve.

may, however, be resorted to with some degree of safety, but on account of the extended position of the three hoppled legs the operator may be constantly molested.

Whatever restraint is selected, the operator should see to it that the seat of operation is perfectly fixed, or at least perfectly controlled, because a badly secured leg will often demoralize the whole affair, especially with a young, inexperienced surgeon at the helm. With a good restraint and with a good tourniquet to eliminate the blood from the surgical wound during the dissection, the operation itself will be found a very simple one.

In casting horses upon litter some precaution must always be taken to prevent soiling the wounds with flying par-

ticles whirled about by the patient's struggles. On this account cocainization should not be omitted, and when the patient is rolled over the sutured wound on the opposite side of the leg requires some protection. A clean cloth or rubber sheet may be placed beneath the leg to very good advantage from this standpoint. The operation can be performed by rolling the patient over but once by operating upon the external nerve of one leg and the internal one of the other consecutively. It is, however, preferable to operate first upon one side of a leg, roll the patient over for the other side, apply the permanent bandage, fix the leg to its original position and then repeat the same procedure on the opposite leg. This course prevents any unnecessary exposure of the wounds and saves some time required in tying and releasing the legs, but necessitates rolling the patient over twice. Either course may be selected.

General anæsthesia is never an absolute necessity in digital neurotomy, because pain is fairly well controlled with the local anæsthesia. The latter, from the standpoint of humanity, should, however, never be omitted in the recumbent operation. In the standing posture it is essential, as few horses would submit to the pain unless the seat of operation is partially or completely anæsthetized.

EQUIPMENT.—The following are the essential articles required to perform the operation in the proper fashion:

1. The securing apparatus, harness, ropes, hopples, table, or twitch, according to the kind of restraint decided upon.
2. Rubber tourniquet to control the hæmorrhage.
3. A basin of warm water containing soap, razor and sponge to wash and shave the field.
4. A basin of mercuric chloride solution, 1-500, containing sponges or cotton pledgets to disinfect the field.
5. A small bottle of tincture of iodine to complete the disinfection.
6. A basin containing sterilized water or a clean solution of mercuric chloride 1-2000, to be used by the assistant to bail blood from the wound as the dissection proceeds.
7. Bandages and cotton to temporarily protect the wound on one leg as the other one is being operated upon. (Necessary only in table restraint.)
8. Bandages and cotton to protect wounds permanently when operation is complete.
9. Scalpel, tissue forcep, nerve elevator and needle holder.

10. Tray for the instruments.
11. Needles threaded with sterilized silk or linen, one for each wound.
12. Hypodermic syringe and 5 per cent solution of cocaine.

TECHNIQUE.—The technique of the operation, beginning after the horse has been secured and the leg brought into the appropriate position, is as follows:

First Step.—Locating the Seat of Operation.—The line of incision extends along the border of the tendon of the deep flexor just below the fetlock joint. (Fig. 109.) The volar digital nerve, the digital artery and the digital vein are located superficially in the groove intervening between this tendon and the border of the first phalanx. These three anatomical structures are grouped together in a sheath of areolar tissue, the nerve occupying the posterior location closely related to the vein. The artery occupies the anterior position in the group, located somewhat deeper than the nerve and on the opposite side of the vein. Counting from before backwards these structures are arranged as follows: artery, vein and nerve.

Second Step.—Disinfection of the Field.—The hair is clipped with the clippers or scissors, well lathered with soap and water and then shaved over a surface one inch square. The field thus shaved is well rinsed with water to rid it of loosened hairs, washed for some moments with the mercuric solution, 1-500, and then painted with iodine.

Third Step.—The Incision.—The incision is made through the skin three-fourths of an inch long, at one stroke if possible, made slowly and deliberately. The nerve can often be elevated through a much shorter incision, but since the wound will heal by primary union there is no object in a too short incision.

Fourth Step.—Locating and Dissecting the Nerve.—The incision is held apart with the dissecting forceps holding one edge, the blood is bailed out and the scalpel is stroked cautiously through the underlying subcutaneous areolar tissue. If there is any blood-soaked areolar tissue to mask the anatomical elements it should be picked up gently with the dissecting forceps and cut away. Usually this dissection exposes the **ligament of the ergot**, an aponeurotic structure that may be mistaken for the nerve. A close inspection, however, readily discloses its identity. The nerve will be found lying just beneath the border of this aponeurotic structure, which is now pulled aside with the tissue forceps and dis-

sected from the nerve beneath. One or two longitudinal strokes through this stroma will usually bring the glistening nerve trunk into view in the form of a whitish ribbon very closely attached to the round blue vein. If the nerve is not immediately discovered the incision must not be immediately carried deeper. The blood must first be well bailed out and the masking areolar stroma must be picked up with the forceps and cut away as before. Sometimes, when the region is abnormal from disease, or when the incision has not been accurately made, the ligament of the

Fig. 109—Position for Incision for Low Plantar Neurotomy (Digital Neurotomy.)

ergot may not be observed in the dissection. In such an instance superficial search of the parts is made to locate either the nerve or the vein. If the nerve remains hidden the vein can be used as the land-mark for further search. In every case the nerve will be found adjacent to its volar aspect, never far beneath its outer level and never dorsal to it. In some rare instances anomalies of these relations may exist, but these are so very rare as to require no consideration whatever. Suspected changed relations are generally found to be non-existent when the nerve is finally discovered.

Fifth Step.—Elevation of the Nerve.—Once discovered the trunk is loosened at one part of one border to give a point of entrance for the nerve elevator, which may then be easily slipped beneath it to the opposite side of the wound. Unless this is respected the elevator, if pointed, might perforate the vein, and if blunted the parts are unnecessarily mutilated. When once the elevator is safely passed beneath the trunk, a little tension is brought upon one end so as to draw the trunk outward as the scalpel loosens it from its loose areolar attachments from one angle of the incision to the other. This done the elevator is grasped with both hands, one at each end, and drawn firmly outward until about one inch of the nerve trunk is dragged out from above.

Sixth Step.—The Neurotomy.—The nerve thus stretched and now hanging loosely out of the wound, is divided first at the proximal angle and then at the distal angle. The object of thus stretching the nerve trunk before dividing it is to encourage a degeneration as high up as possible. Any divided nerve trunk will degenerate several nodes proximally; if stretched the degeneration will extend much higher and as a consequence no neuroma nor painful scar will supervene the operation.

Seventh Step.—Suturing the Wound.—The incision is freed from all blood and examined for hairs that might have possibly floated into it, and is then sutured with a single interrupted stitch, or preferably the crucial stitch, which is par excellence the best one for the small incision of neurotomy. (Fig. 65.)

Eighth Step.—Applying the Surgical Dressing.—In the recumbent operations the patient might advantageously be allowed to regain the standing posture before the dressings are applied. When they have been already applied, as a matter of protection as the operation is proceeding, their removal and re-adjustment is advisable. The lapse of a few minutes between the completion of the operation and the application of the first permanent dressings is also advisable, because all of the hæmorrhage will then have stopped and no blood will saturate the bandage. It has been the writer's practice, when performing the operation with table restraint, to first return the patient to the standing position and then rinse the region well with liberal quantities of mercuric chloride solution to rid it of all blood, dirt and hairs that are certain to contaminate the parts more or less during the surgical work. After this rinsing, a large pledget of cotton,

well soaked in the same solution, is bound to the wounds with muslin bandages.

AFTER-CARE.—The horse just operated upon is placed into a single stall and tied to prevent lying down for at least five days, at which time union will have become firm enough to resist the molestation caused by flexing the legs in the act of lying and rising. At the end of the first twenty-four hours the mercuric chloride pack applied at the completion of the operation is replaced by a potent antiseptic powder (iodoform) held in place by cotton and bandages. This may be renewed every day, but always without disturbing the wound. Washing, wiping, or any form of cleansing is prohibited because of the great danger of molesting the agglutinating edges before stable tissue has formed between them. It is only when there is evidence of infection that washing is needed. At the end of six days the stitches are removed, the dry dressing applied for several days more and then discontinued. On the fourteenth day the healing process is well advanced, in fact completed.

To obtain the best possible results from digital neurotomy for navicular disease the horse should not be immediately returned to work, but instead should be given a protracted rest lasting at the very least one month. If kept in the stable the shoes must be replaced and the feet kept moist by occasional tub baths, swabs and clay or oil meal packing. The soles should be pared thin, the toes shortened moderately and the heel-calks slightly elevated. It is, however, preferable to turn the neurotomized horse into a large paddock to pasture, there to remain for several months, and when finally returned to work the occupation should not be an arduous one. The subjects thus operated upon and managed remain sound and useful for a whole life-time at light occupations, while those worked hard will become lame again.

ACCIDENTS AND SEQUELÆ.—While digital neurotomy is much less hazardous than any of the other neurotomy operations, it is not entirely free from dangers. (1) During the operation there is some danger of accidentally opening the inferior cul-de-sac of the sesamoidean synovials with the scalpel. A sudden jerk of the poorly secured leg or a slip of a sharp scalpel when this sac is highly distended is sometimes the cause of this unfortunate incident. If the wound thus made is aseptic and does not become infected, afterwards no bad results follow, but on the other hand, if the sac becomes infected, severe lameness of long

duration, the formation of numerous abscesses at different parts of the sheath with a final tumefaction of the fetlock, will follow. (2) Wounding or division of the volar artery or vein occasionally occurs during the dissection, or by deliberately cutting them through when mistaken for the nerve. When this accident occurs the cut vessel should be dissected loose and ligated proximally and distally, leaving the ends of the ligature threads to protrude through the incision to facilitate their removal. (3) Neuromas and painful scars sometimes supervene. The former is prevented to some extent by stretching the nerve well before dividing it, and the latter by promptly healing the wound. (4) Break down, so-called, does not often follow this operation, although it does occasionally occur, in the form of a partial dissolution of the plantar aponeurosis from the semilunar ridge, manifesting itself in the form of a very acute lameness, and a pronounced tumefaction of the tendinous structures at the heel of the foot. Loss of the foot has never been reported from this operation.

MEDIAN NEUROTOMY

DEFINITION.—Median neurotomy is the surgical division of the median nerve at the level of the elbow joint, (the point where the nerve passes superficially over the medial tuberosity of the radius).

DISTRIBUTION OF THE MEDIUM NERVE.—The medium nerve is a radicle of the great brachial plexus, although its course in a dissection is easily traced beyond this aggregation of nerve trunks, to the eighth cervical and the two dorsal spinal nerves, from the plexus of which it is an important component part. It accompanies the brachial artery along the arm to the medial aspect of the humero-radical articulation. Descending from this point it first becomes very superficial on traversing the level of the medial radial tuberosity, but soon turns rather sharply in an outward direction to take its place behind the radius in company with the median artery and vein. From a point one inch below the radial tuberosity it is quite deeply imbedded between the radius anteriorly and the flexor muscles posteriorly, which position it maintains to the level of the carpal sheath, where a large branch is given off to join the ulnar in forming the lateral volar nerve, while the main trunk continues on the inner aspect of the leg as the medial volar nerve. In the region of the arm it gives off a large branch—the antibrachial nerve, which, after supplying the surround-

ing muscles, passes down the dorsal aspect of the leg, losing itself in the skin and antibrachial fascia as far down as the carpus. At the level of the elbow a large branch is supplied to the flexor muscles, passing backward to an obtuse angle from the trunk, to reach the fleshy portion of these muscles.

In the region of the arm the median nerve is a mixed one, its branches furnishing both motor and sensory impressions to the adjacent structures, but after passing the elbow, and probably at some small distance above, it contains only sensory fibres. The antibrachial branch proceeding from the region of the arm is mixed, but is chiefly concerned in furnishing sensation to the skin and fascia of the forearm. The branch to the flexor muscles is largely sensory, as its division leaves no depreciation of the function of these muscles. Its most interesting and important behavior occurs at the carpus, where it contributes to the formation of both volars, a small part only going to the ulnar to form the lateral volar, the major portion continuing in its downward course as the medial volar. The median nerve, therefore, contributes to the innervation of the lateral aspect of the leg and foot below the carpus, as well as furnishing all of the sensation to the medial aspect. When divided at the elbow, sensibility is banished from the medial portion of all of the structures from the lower third of the metacarpus to the sole of the foot with absolute regularity. The tendons, the bones and the skin of the middle and upper thirds of the metacarpus are only partly unnerved— a certain part of their sensibility retained. On the lateral portion of the leg the insensibility is incomplete throughout, for here the ulnar nerve contributes largely to the innervation. Complete loss of sensibility by dividing the median nerve is limited to parts of structures; no entire articulation, bone, tendon or synovial is entirely deprived of its nerve supply. The greatest effect is upon the medial half of the sesamoidean apparatus and the skin covering that region. The lateral half of the sesamoidean apparatus and the skin covering it are but partially benumbed. The skin of the heel and the part of the navicular apparatus, medially lateral cartilage, third phalanx and the laminae are unnerved but the lateral portions of the same structures, like those of the fetlock, retain a part of their sensibility.

HISTORY.—Median neurotomy is a comparatively recent acquisition to the surgery of horses. It was first performed by Peters in the year 1885 at Berlin Veterinary College, and was introduced into America during the 90's, being

performed for the first time in this country by Prof. Harger, of the University of Pennsylvania. Its introduction to the profession generally occurred through the medium of a translation of Pellerin's small manual entitled "Median Neurotomy," translated from the French by Prof. Liautard. Following the instruction given in this small book American veterinarians practicing in the large cities, promptly began urging the operation as recommended. At first, like almost all new lines of treatment, it was credited with rather extravagant results, but experience subsequently simmered this fallacy to a sensible level. It was championed as an absolute cure for the lameness of draft-horse tendinitis, coach-horse carpitis, splints, osteophites, ringbones, sesamoiditis and navicular arthritis, but later it was proved that its range of usefulness was somewhat more limited, and for a time it was not practiced to any great extent. It has, however, been re-introduced as a valuable routine measure for the cure of chronic claudications of horses.

INDICATIONS.—Median neurotomy removes sensibility from such a wide range and from so many important structures other than those implicated in the disease causing the lameness, that it should never be hurriedly resorted to. But in spite of this fact it is seldom harmful like plantar and tibial neurotomy.

The operation has many redeeming features. In fact, it has a sphere of usefulness in cases of lameness where chronicity and diffusion of the lesions render other lines of treatment ineffectual; where the lameness, in spite of everything, persists. It sometimes occurs that horses have a **combination of diseases** along the course of the leg. Thus **navicular arthritis** may be complicated with **lesions in the bones, synovials and tendons** as far upwards as the carpus. When such an aggregation of lesions continue to cause lameness after the usual palliative methods of treatment and have failed to yield entirely to digital neurotomy, very often median neurotomy will promptly give relief. The acme of its value is reached in this particular instance. When the operation is performed for a definite lesion, it may be disappointing in that all of the lameness may not be removed.

Osteophytes located on the medial aspect of the first phalanx, after having resisted the usual treatment of firing, blistering and rest, require the operation in lieu of any other treatment. In these cases a lasting benefit is sometimes derived, but when the lesion occupies a lateral position or extends across the entire bone, the benefit is only a partial

amelioration of the lameness. Periosteal inflammations often produce osteophytes at different points of the legs, on the first phalanx on the metacarpus, or in the region of the splint bones. These may or may not implicate the articulations. When such diseases are non-articular and located on the lateral aspect of the leg, median neurotomy will effectually, and often permanently, dispatch the lameness resulting from them. On the other hand when located laterally, or when transgressing upon ginglymoid articulations, the operation is less effectual.

Tendinitis.—The circumscribed lesion of the tendons of the draft horse, located at the level of the upper third of the metacarpus due to severe traction-strain or rupture, and manifested by a painful tumefaction, lameness and volar flexion that often persists after firing and rest, has been from the start, regarded as one of the chief indications for this operation. Peters, Pellerin, Harger, Adams, McKillip and others have recommended it for this condition during the earliest days of its history.

In nearly every case the relief while only partial is usually satisfactory because it is always safe and is the only neurotomy available for this particular purpose.

For the **"bowed tendon"** of the race horse, whether located in the distal third or the middle third of the metacarpus, median neurotomy cannot be recommended in the horse intended for racing purposes, although quite effective when the horse is given but slow work thereafter. The unnerved "bowed tendon" will not long withstand the severe strain to which it is subjected in racing. Firing and blistering is a much better treatment, all things considered.

Carpal synovitis or **carpal osteitis** (knee spavin) is seldom sufficiently benefited to warrant a further recommendation of the operation in their treatment. The knee structures receive innervation from other nerves and from branches originating above the seat of operation. Purely carpal inflammations must, therefore, not be submitted to median neurotomy with the expectation of pronounced relief.

Ringbones, after having been treated unsuccessfully by the usual palliative treatments, are suitable indications in very many instances. Here median neurotomy is preferable to the higher plantar operation because the entire nerve supply is not cut off from the seat of disease. The ulnar nerve, through its volar fibers, still preserves some of the sensation, and thus leaves the parts less exposed to injury, but

prevents a complete cure of the lameness. Often, however, the benefit is ample, in that the subject is made more serviceable. The ringbone that is confined largely to the medial aspect of the phalanges is the ideal one, especially if old and if no longer in the siege of an active inflammatory process. It is preferable that the bony deposit has already obstructed the motion of the articulation. A bony prong or two transgressing upon a joint without mechanically limiting its motion will grind into the surrounding soft structures and promptly cause a breaking down of the latter, when sensation has been destroyed from the region. Thus new ringbones or the rather trivial periarticular osteophytes are seen to be much more unfavorable conditions for neurotomy than the old or more diffused lesions of the same class. The lameness of ringbone may be marked without distracting from the results, but in no case should the operation be performed when the lameness is acute or changeable.

Sesamoiditis.—Inflammatory conditions localized in the sesamoidean apparatus,—sheath, bones or ligaments,—of known chronicity, are ideal indications for median neurotomy. The cure of the lameness from such lesions is an absolute certainty in almost every case. The median nerve seems to supply the sensation for this region. The ulnar nerve seems to have relatively less influence in the sesamoidean apparatus than in the other structures it assists the median to supply. It is essential that the process be chronic, and preferable that it be confined to the medial aspect of the region. Diffuse sesamoiditis, however, yields to the operation in almost every instance, but if any lameness remains the ulnar operation will perfect the cure.

Sidebones.—Unilateral sidebones are best treated with unilateral high plantar neurotomy, but it sometimes happens that the medial one is large and the lateral one small, or that the former causes proportionately more of the lameness than the latter. In this event median neurotomy is advisable over the bilateral plantar operation because some of the sensibility of the foot is retained.

CONTRA-INDICATIONS.—Although a fairly safe operation median neurotomy should not be resorted to with impunity in any severe lameness and any acute inflammatory process because like other neurotomies it has its casualities. It is most dangerous in impinging osteophytes about the fetlocks. Acute, recent, serious, painful disease processes constitute so many forbidden conditions, and like in plantar neu-

rotomy the legs and the feet should be strong enough to perform their function.

A serious sesamoiditis must especially be avoided for here breaking down is a quite certain termination. The sesamoidean ligaments will tear from their attachments and the whole joint will develop a destructive inflammatory process.

When performed for navicular disease that is uncomplicated there must be assurance of its chronicity, otherwise breaking down may follow. It is, however, less dangerous than plantar in this disease.

RESTRAINT.—Median neurotomy is performed in the **lateral recumbent position,** with the affected leg undermost and **pulled out at an obtuse angle from the body** so as to plainly expose the internal level of the elbow joint. The more the leg is pulled out from the body the more accessible is the seat of operation. The casting harness, the casting ropes, the English hopples or the operating table may be used, each with good advantage. Whatever apparatus is used the leg to be operated upon is released from its tie and brought out at an angle of forty-five degrees from the long axis of the body and there held or fastened firmly. The seat of operation is anæsthetized subcutaneously with a five per cent solution of cocaine hydrochloride. General anæsthesia is unnecessary, although it greatly facilitates the work of retaining the leg in the indispensable position above mentioned. The operator none too confident of his ability, or the practitioner who operates only occasionally, should administer a general anæsthetic (chloroform) with the object of securing perfect immobilization of the seat of operation. **In performing median neurotomy, it is found that the relations of the structures of the region change considerably with different positions of the leg.** An incision made directly over the nerve with the leg in a given position may be found some distance to one side or the other when the leg is drawn to another position. This fact necessitates keeping the limb at a certain given point from beginning to end, which is not possible if the animal struggles. This circumstance may be of no importance to the experienced surgeon, but it is always certain to greatly confuse the novice. When the casting harness is being used the leg is secured by first fastening it at the proper angle with a stay rope extending from the knee to the hopples of one of the hind legs, and then looping another rope around the pastern to be held forward either by passing it around a convenient post or ring, or directly to the hands of one or two strong assistants.

The latter is preferable because if the horse changes position by struggling the assistants can more easily change theirs than if the rope is stayed by a post or ring. On the operating table, which is the most satisfactory apparatus for this operation, the fixation of the leg is simple. It is released from the hopple, brought forward to the proper angle and re-fixed with straps that will prevent any movement.

The uppermost leg should be drawn backward and upward with a rope passed through a ring in the ceiling. This gives an unobstructed access to the field.

EQUIPMENT, necessary to perform the operation of median neurotomy:

1. Securing apparatus.
2. A basin of water containing soap, razor and sponge.
3. A basin containing mercuric chloride solution, 1-1000.
4. A tray for the instruments.
5. One needle armed with silk enough for two stitches.
6. Scalpel, small probe-pointed bistoury, nerve elevator, hemostatic forceps, and tissue forceps.
7. A pair of wound retractors (useful but not always essential).
8. Hypodermic syringe and 5 per cent solution of cocaine hydrochloride.
9. Cotton pledgets for bailing and washing.

TECHNIQUE.—After the subject is cast and the leg brought to the appropriate position already described, the technique is as follows:

First Step.—Locating the Seat of Operation.—Median neurotomy is performed over the medial radial tuberosity, the level of which is brought prominently into the foreground by securing the leg in the proper position. This bony protuberance is easily located by palpation. If the finger tips are pressed into the groove between the medial border of the radius and the flexor muscles, and gradually slid upward with firm pressure, a hard, rounded obstacle will be encountered as they approach the level of articulation. This is the radial tuberosity, over which the median nerve passes rather superficially, and upon which it can be felt by lateral movements of the finger tips. The exact seat of incision is a line passing vertically over the radial tuberosity, exactly parallel to the medial border of the radius, but about one-half an inch behind it.

Second Step.—Disinfecting and Anæsthetizing the Field.—The region is washed, shaved, well rinsed with mercuric

chloride solution, and then anæsthetized with subcutaneous injections of cocaine.

Third Step.—The Incision.—The skin is tensed with the first and second fingers of the left hand, care being taken not to disturb its normal relations. The skin here is so loosely arranged that it is likely to be carried in one direction or other while tensing it, and thus leave the incision some distance from the desired location when the tension is removed. The incision through the skin is then made with the scalpel by one firm stroke from above downward. Only the skin is divided at this time. The underlying areolar tissue may then be picked up here and there and cut away in search of one or more rather prominent veins which

Fig. 110—Position of Incision in Median Neurotomy, showing Median Nerve and Flexor Branch. End of fourth Step. (Bayer.)

cross the field. When these appear upon the foreground, they are twisted with the forceps to avoid a masking but trivial bleeding.

The **subjacent muscle** now exposed is divided from one commissure of the skin incision to the other by a number of cautiously directed strokes of the scalpel. As this incision proceeds the tissue forcep in the left hand is used to separate the divided muscle in search of the underlying antebrachial fascia. This fascia must be brought into clear view without accidentally wounding it, and all bleeding must be controlled before proceeding farther.

The **fascia** (the antibrachial) is a very thick, whitish tough membrane at this point. It lies in close relation to the median nerve, vein and artery. The greatest danger of median neurotomy lies in the improper division of this structure. If incised with a scalpel the vein may be wounded in spite of the greatest caution. To avoid this very serious accident the fascia is divided with the **probe-pointed bistoury, cutting upward and outward** after making a very small point of entrance with the tip of the scalpel.

Fourth Step.—Search for the Nerve.—When the incision has been advantageously located the nerve will promptly bulge through the incision in the fascia, and thus end the search. Usually, however, the division of the fascia reveals first the brown flesh of the flexor muscles or else the median vein. These two structures may be mistaken for each other on account of their similarity in color and their roundness. The retractors are then adjusted under the cut edges of the fascia and tension enough brought upon them to expose a wider range of underlying surface. If it does not yield enough to bring the nerve within range it may be incised transversely with the probe-pointed bistoury. When the wound is thus dilated the nerve is searched out by carefully picking up the masking areolar tissue and dissecting it away here and there as the assistant bails out every vestige of blood. During this dissection the nerve usually appears upon the foreground in the form of a whitish ribbon slightly less than a quarter of an inch in width, closely united to the vein to which it is attached with a loose connective tissue. If the search is still fruitless it is evident that the incision has been made too low, where the median nerve has already curved outward in its descent. In this event the whole incision, skin, muscle and fascia, should be carried upward a half inch or more where the nerve is more superficial. Whenever any confusion arises in the search of the nerve there must be no haste to dig deeply in every direction through the surrounding structures, as this course will always terminate disasterously as well as fruitlessly. The median nerve is superficial; it is closely related to the antibrachial fascia. Searching deeply into the region is, therefore, useless. Failure to find the nerve may be due to a trivial amount of areolar tissue bathed with blood which, when dissected away, brings the nerve into prominence where it had not been expected.

Fifth Step.—Elevating the Nerve.—The elevation of the nerve, when found, is not without danger in view of its clos?

proximity to the vein. A sharp pointed elevator may easily penetrate the vein and produce a very serious complication in the form of a hæmorrhage that is difficult to control. The nerve is elevated by first carefully loosening one of its borders from the vein, and then forcing a blunt elevator under it. It is loosened from the vein along the whole course of the wound by simultaneously lifting it with the elevator and breaking down the connecting areolar tissue by blunt dissection.

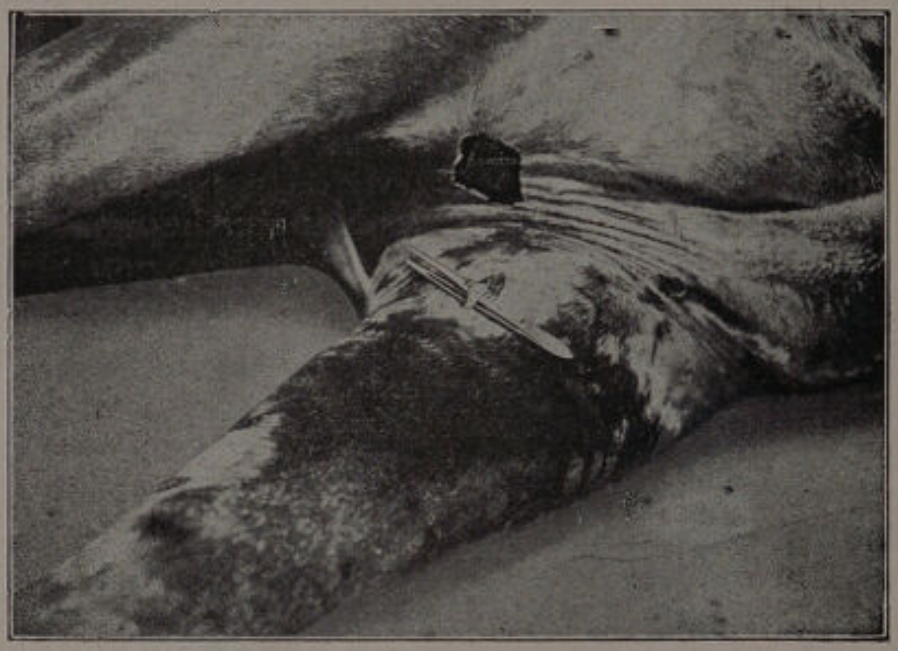


Fig. 111—Fifth Step of Median Neurotomy. The Nerve Elevated.

Sixth Step.—The Neurotomy.—This step is simple, and now without danger. It is performed, as all other neurotomies, by first dividing the nerve proximally and then distally.

Seventh Step.—Closing the Wound.—The wound of median neurotomy never heals by primary union. If the fascia, the muscle and then the skin are consecutively sutured with the greatest caution, the wound will burst open in spite of everything, in spite of every precaution, because the relations of these structures and the several parts of each of them, change considerably from the recumbent to the standing position. A wound sutured neatly in the recumbent position will always be found distorted when the standing posture is attained. The irregular tension of the sutures on the different parts of the wound precludes prompt union. With this fact in view, it is found advisable to close the

wound with only one or two loose stitches, leaving the breach to heal by secondary intention.

AFTER-CARE.—The patient is kept quiet in the standing position for two or three days and then turned into the loose box during the remainder of the convalescence. The wound requires no special attention if the operation has been clean. The only medical treatment required is a washing of the forearm to rid it of the little secretion that flows over it from the wound during the first week, and dusting with antiseptic powder. The wound itself needs no irrigation nor other treatment unless it becomes purulent, then the usual antiseptic irrigation is required. The stitches are usually removed on the fifth to the sixth day. Healing requires twenty to twenty-five days, at which time the horse may be returned to work. A longer period of rest is, however, advisable.

ACCIDENTS AND SEQUELÆ.—During the operation there is always danger of **wounding the vein** or even the satellite artery. It is the former, however, that is most likely to be cut or pricked during the search for the nerve which is so closely related to it. This accident is prevented by avoiding the use of the scalpel after the antibrachial has been exposed. The division of the fascia and the subsequent dissection should be done with blunt-pointed instruments (the probe-pointed bistoury, the tissue forceps and blunt nerve elevator); otherwise this accident will occur with great frequency. Sometimes small branches of the vein are cut near the main trunk if sharp cutting instruments are used, and these may bleed profusely enough to give the impression that the vein itself has been cut. The search for the exact seat of the breach is not always fruitful; on the contrary, it may increase the flow by still farther widening the breach. Whether branch or trunk is wounded, the flow is always copious; the blood gushes out so rapidly, and is so difficult to control while the breach is sought that often the operation must be abandoned. Sometimes by pressing the fingers forcibly into the course of the vein both above and below the wound it can be stopped long enough to render possible the continuation of the operation. More times this is useless. Again, the hemastat may be successfully adjusted to the breach while the flow is momentarily controlled by pressure. When this is successful the operation may proceed and the forceps may be left undisturbed for the first twenty-four hours after its completion. Ligation of the vein is generally very difficult to accomplish. The dissection of the vein to

facilitate the passing of ligatures below and above the breach often makes matters worse by opening up branches which are very numerous in this particular region. When these manipulations fail the wound is packed taut with wadding and sutured firmly.

Wounding of the median vein is always followed by a very painful œdema of the limb, lasting six to eight days, but is otherwise of no serious consequence. It is never fatal. It can always be controlled. The **median artery may also be wounded** in the course of the operation, but this accident is much less liable to occur, because the artery is readily recognized, has thicker coats and is more remote from the nerve. When it does occur ligation is the only remedy, otherwise fatal bleeding will rapidly ensue. Animals survive ligation of this artery. The accident occurred to Dr. ——— of Chicago several years ago. The accident was successfully met and the patient, after a very long period of convalescence, made an incomplete recovery. The accident was survived well enough, but the nerve was not divided and, of course, the lameness continued.

Œdema of the leg due to pressure of the swelling upon the veins, or to infection, sometimes appears threatening several days after median neurotomy has been performed, the wound, being an open one, but serious blood poisoning seldom follows. Gross carelessness in operating may, however, be followed by serious complications because of the nature of the wound. The operation must be a clean one.

Pruritus of the Fetlock.—Itching of the medial surface of the fetlock occurs with great frequency during the second and third week of convalescence. It is manifested by an inclination to first lick and then gnaw that region until the skin bleeds and becomes the seat of a large ulcer that refuses to heal. This remarkable sequel is undoubtedly due to the irritation of the nerve stump at the seat of operation. It might be compared to the cold or painful foot the human often complains of after a leg has been amputated. This sequel is serious on acount of the great difficulty of healing the wound caused by the gnawing. It may require months to heal the wound. The sequel must be prevented by the prompt application of a protecting bandage to the fetlock or by tying the patient short, as soon as the tendency to lick the region appears.

Breaking down of the ligaments and tendons, and shedding of the hoof does not occur after median neurotomy as frequently as after the high plantar operation, because no

whole portion of the leg is entirely unnerved. But these accidents sometimes follow, especially in the region of the inferior sesamoidean ligaments. The hoof may sometimes threaten to loosen and then heal up without falling off. Occasionally it is shed entirely, as after plantar neurotomy. These sequelæ are prevented by avoiding the operation in the treatment of new, acute or serious inflammations whether tendinous, ligamentous, synovial or osseous.

TIBIAL NEUROTOMY

SYNONYMS.—Posterior tibial neurotomy; sciatic neurotomy.

DEFINITION.—Tibial neurotomy is the surgical division of the tibial nerve some four to six inches above the tarsus.

DISTRIBUTION OF THE POSTERIOR TIBIAL NERVE.—The great sciatic nerve is the chief radicle of the lumbo-sacral plexus. It is a mixed nerve in the femoral region, but after traversing the popliteal space the distribution of sensation is its only function. In the tibial region it occupies the space between the belly of the flexor pedis perforans and the tendo-Achilles. At the level of the fibulo-tarsal it bifurcates into the **medial and lateral,** which have an analogous distribution to the digitals of the pectoral limb, with the exception that they distribute many ramuscules to the hock before proceeding to the foot. From a number of careful dissections of this nerve made by Thompson, it is very evident that much has heretofore been omitted in its study by the equine anatomist in this connection. The tibial nerve is prominently concerned in giving sensibility to the tarsal structures. Its first effort in this direction is that of providing a large branch which separates from the main trunk four inches above the point of the hock, passes down with the trunk, and then enters the joint at the level of the tibio-tarsal bone. At the level of the fibulo-tarsal it divides into the plantars, each of which furnish ramuscules to the articulation in their course along its posterior aspect. The medial plantar furnishes the branches for the anterior parts of the hock, and the lateral one to the posterior portion.

In addition to this nerve, the hock receives sensory innervation from other sources, which, according to Thompson's dissection, have never been correctly interpreted. The **deep peroneal or anterior tibial,** an indirect branch of the sciatic, passes down the tibial regian somewhat deeply im-

bedded between the long extensor and the lateral extensor muscles. Upon approaching the hock it is related to the tibial artery and tendon of the long extensor. In front of the hock it gives a branch which divides into numerous ramuscules, and directly ramifies amid the tarsal bones at the medial aspect. That is to say, it penetrates the usual seat of spavin. But besides this branch it also supplies another, which accompanies the perforating pedal artery directly into the depths of the tarsal articulations. The continuing branch traces its course over the dorsal aspect of the metatarsus, where it is lost in the skin. This nerve is, therefore, important in the surgical treatment of spavin. The **superficial peroneal,** or musculo-cutaneous nerve, runs parallel to the deep peroneal in the tibial region, but is much more superficial. It lies directly beneath the tibial fascia in the groove between the lateral and long extensor muscles. Approaching the hock it lies along the lateral side of the long extensor, traces its course over the lateral aspect of the tarsus about midway between the latter tendon and that of the lateral extensor, and then is lost in the skin of the metatarsal region. This nerve probably has little influence over the bones, but furnishes sensibility to the peri-articular structures along the region it traverses.

The **lateral saphenic** nerve is related to the tendo-Achilles laterally in the tibial region. At the level of the os calcis it reflects forward and is distributed over the lateral aspect of the hock posteriorly, and then over the region of the splint bone, to become lost cutaneously. The **medial saphenic** nerve, unlike the others concerned in the innervation of the tarsus, is not a radicle of the sciatic. Its remote origin is the anterior portion of the lumbo-sacral plexus, while that of the sciatic is the posterior portion. This nerve occupies the medial aspect of the femoral and tibial regions, terminating on the dorsal face of the hock and metatarsus. It gives off a number of branches to the femoral muscles, and in the upper third of the tibial region divides into three or four branches. Two of these branches accompany the saphenic vein, one on either side; another large branch winds over the belly of the tibialis anterior in the middle of the third of the tibial region and loses itself around the anterior part of the hock, while another one continues down the medial aspect of the tibia over the front of the hock, and thence downward into the skin of the metatarsal region. The ramuscules of this nerve are easily traced into the tarsal syno-

vials anteriorly and are therefore prominently concerned in supplying sensibility to important tarsal structures.

Conclusions.—The hock receives sensibility from the following sources, named in the order of their importance: (1) The deep peroneal. (2) The medial plantar. (3) The unnamed branch leaving the posterior tibial four inches above the point of the hock. (4) The lateral plantar. (5) The lateral saphenic. (6) The medial saphenic. All of these nerve trunks are purely sensory nerves below the upper third of the tibial. Above that point they may contain motor fibers enough to produce permanent paralysis of certain muscles when surgically divided.

INDICATIONS.—The large size of the tibial nerve renders its division for surgical purposes somewhat hazardous at all times. The area it supplies with sensibility is extensive and includes the most important structures of the pelvic limb;—the hock, the tendons, the fetlock, the foot. Neurotomy removes the sensibility of too great a region to warrant its use for circumscribed lesion here or there. If the hock is the seat of a lameness the sensibility of the foot and fetlock is also uselessly sacrificed. If the foot is the seat of disease the others are needlessly deprived of their innervation. Herein lies the greatest fault with tibial neurotomy. Tibial neurotomy has been too highly recommended. It is effectual in promptly curing lameness of the fetlock and hoof, but too often the relief is purchased at the expense of the patient's life. For diseases of an acute character it is positively disastrous. The hoof sheds, the sesamoidean ligaments loosen from their attachments, or the flexor tendons give way. Sometimes the dissolution is an aggregation of all of these unfortunate events combined.

In **spavin** lameness the operation has been recommended highly in conjunction with peroneal neurotomy. This double operation, true enough, often promptly terminates the limp of spavin, but, unfortunately, the whole fetlock and foot being deprived of sensibility, nail pricks, treads, hoof cracks, wounds from interfering, and flexion crevices (scratches), too often enter into the situation sooner or later, and develop into incurable, fatal complications. In view of this fact it is doubtful whether the veterinary practitioner should recommend the operation. Certainly it must not be too hurriedly resorted to. Other treatments, firing and cunean tendinotomy, at least should precede it. It is only when these have failed that this double operation becomes a justified treatment. To recommend it as the first

treatment of spavin will sooner or later discredit the operation and operator.

In **chronic sesamoiditis** tibial neurotomy is often of great service. This condition in the hind legs is very often chronic. The lameness persists in spite of everything. It yields to palliative treatments only to return again. In this event, when the inflammation is chronic and the lameness not too pronounced, tibial neurotomy will make a useless subject useful as long as it escapes serious accidental wounds of the unnerved region. There is never any doubt as to the effect of tibial neurotomy on lesions in the sesamoidean apparatus. The pain of this region is always promptly and totally dispatched. It is the sequelæ that limit its value.

In **chronic lesions resulting from serious nail pricks,** where the navicular synovial has been implicated, tibial neurotomy is also strikingly effectual. But like sesamoiditis, this lesion must not be in the siege of an active inflammation nor produce much lameness, if a lasting result is expected. These lesions sometimes consist of rather trivial adhesions of the plantar aponeurosis to the navicular bone and navicular ligaments. The integrity,—the strength,—of these affected structures is not greatly impaired and the inflammatory process is latent, probably cured. Under such circumstances it is admissible to perform the operation, after four, six or eight months have elapsed and lameness continues.

Knuckling, that is, constant plantar flexion often exists in the absence of any apparent lesion. There is no swelling, no pain or manipulation, still the flexion accentuates more and more with hard work. Rest and blisters correct the defect only temporarily. The condition returns when hard work is resumed, and very soon becomes chronic and incurable. Once satisfied that this state is not due to spavin or any definite lesion along the course of the tendons, the sesamoids may reasonably be suspected of being the seat of pain that induces the horse to hold the fetlock in plantar flexion, and thus gradually cause the tendons to compensate by contracting. Tibial neurotomy, by removing the pain responsible for this state, will always gradually correct the deformity. The fetlock will straighten and then soon resume its normal backward inclination.

Here again the operation does well enough for the purpose intended, but unfortunately leaves the subject susceptible to the usual accidents.

In **ringbone** tibial neurotomy is not always successful. Sometimes the relief is only partial on account of the distrib-

ution of other sensory nerves, which reach the anterior part of the pastern. In most instances, however, it may be depended upon so far as terminating the lameness is concerned.

In **obstinate curb lameness** tibial neurotomy cannot be depended upon and should not be resorted to. The subject is better off with a slight impediment than with the benumbed leg.

RESTRAINT.—The operation is performed in the recumbent position with the affected leg undermost. The operating table is the best apparatus to secure the leg and position it advantageously. The casting harness or hopples in lieu of a table will answer, however.

On the table the leg is secured some distance behind the uppermost one, and in a slightly flexed position. When the hock is slightly flexed the space between the tendo-Achilles and the perforans muscle is widened and this brings the nerve into a more available field. When the leg is stretched in extension the nerve is pressed against the muscle anteriorly and is more difficult to find.

When the casting harness is used the same flexed position of the hock is desirable, but it is much more difficult to maintain against the patients struggles. About the best method of overcoming this difficulty is to fix the leg in the desired position to a plank, by means of several straps at different points encircling both the plank and the leg. Subcutaneous cocainization of the seat completes the restraint.

EQUIPMENT.—The instruments required are identical to those for median neurotomy: Scalpel, tissue forcep, haemostats, nerve elevator, probe-pointed bistoury, wound retractors, needle and thread, needle holder, hypodermic syringe, cocaine 4% mercuric chloride solution, razor and scissors.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The seat of operation is a hands breadth above the point of the hock, in the groove between the tendo-Achilles and the perforans muscle, on the medial aspect of the leg.

It is made against the muscle rather than too near the tendon, as the tibial nerve, when the hock is flexed, lies rather close to the former. An incision made in the depths of groove will answer, but the one made slightly anterior to this point will more nearly parallel the nerve. If made too near the tendo-Achilles some difficulty will be encountered in locating the nerve.

Second Step.—Disinfecting the Seat of Operation.—The hair is clipped from the groove with scissors; the field is

then moistened and shaved. The shape of the region renders this step somewhat difficult. The razor cannot be easily carried into all parts of groove on account of its sharp and deep depressions at the very point where the incision is to be made. It will be found necessary to press the fingers into the groove beneath and lift the parts upward before thorough shaving is possible. The disinfection is completed by rinsing the parts with mercuric chloride solution.

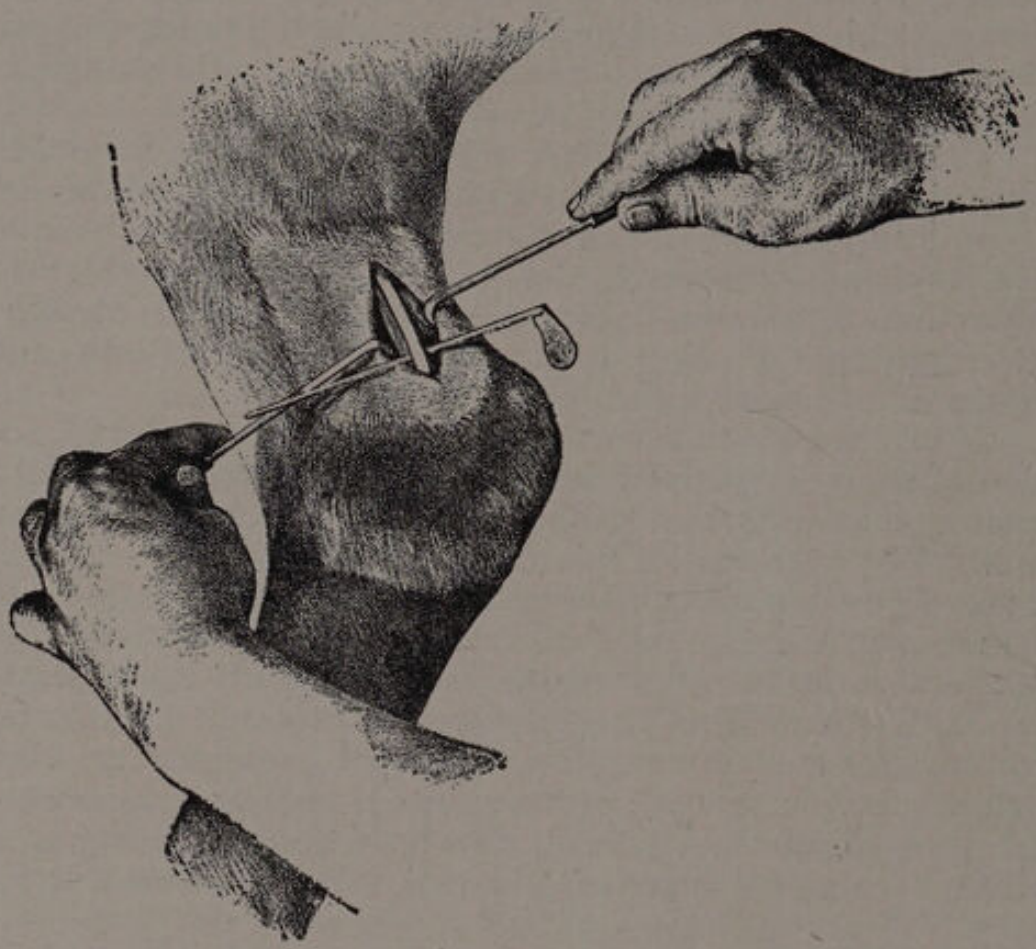
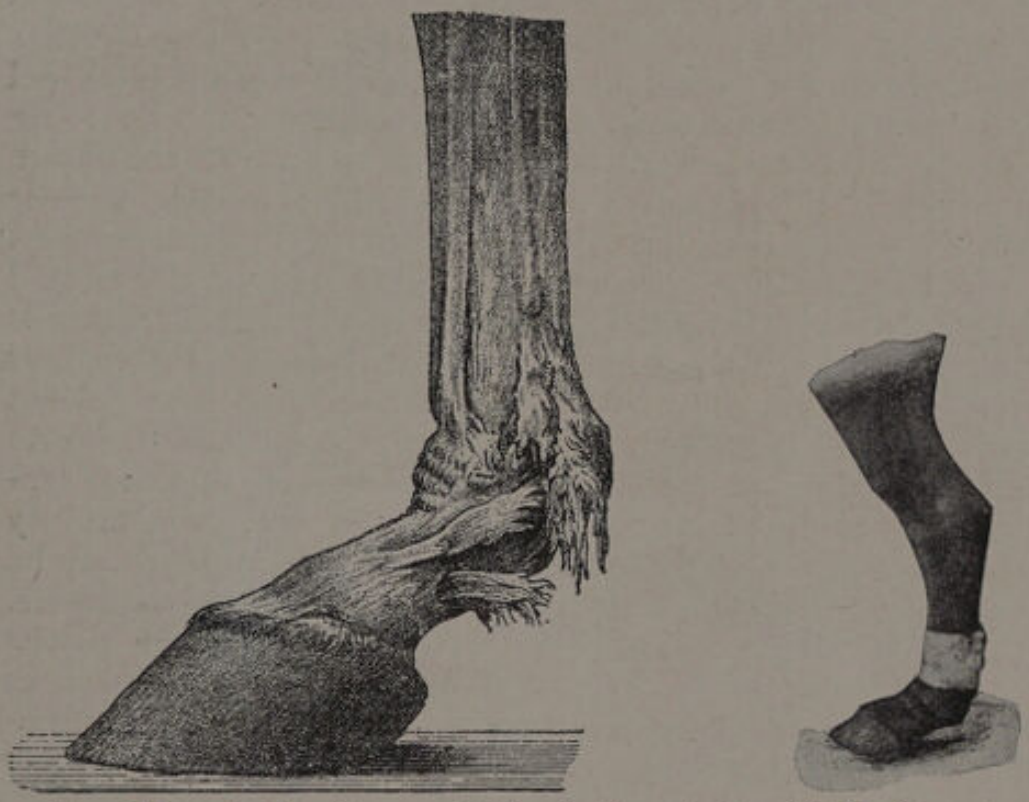


Fig. 112—Position of the Leg and the Incision in Tibial Neurotomy. (Bayer.)

Third Step.—Making the Incision.—The incision is made one and a half inches long at the point indicated, first through the skin with the scalpel and then through the fascia with the probe-pointed bistoury, cutting upward and outward in order to avoid wounding the large vein which lies directly under the fascia, slightly anterior to the line of the incision, but sometimes immediately under it. As in median neurotomy, the probe-pointed bistoury is indispensable. Otherwise, the vein, sometimes full and bulging, will frequently be wounded and cause troublesome hæmorrhage.

which will have to be arrested before the operator can proceed.

Fourth Step.—Dissecting the Nerve.—The tibial nerve is always masked. It never promptly appears upon the foreground when the fascia is divided, even when the division is made directly over it. This nerve is encircled with a covering of adipose tissue which forms a perfect mask, and this immediately perplexes the unsuspecting operator. Although this nerve is large and superficial and the parts are



Figs. 113 and 114—Forms of "Break-Down" after Tibial Neurotomy.

easy to dissect, the new operator is certain to become confused if this special feature of the region is not known.

The method of procedure after the fascia has been divided along the entire length of the incision is to first dispose of all of the blood and bleeding, and then pick up and divide the areolar and adipose tissues here and there along the course of the incision until a part of the glistening surface of the nerve is encountered. Deep digging is to be avoided, as the nerve is not deep. It is hidden right in the foreground, surrounded by fatty tissue. When the vein appears in the incision it will serve as a certain landmark. The nerve lies immediately beneath and slightly posterior to it. These two structures, vein and nerve, are never widely separated. They are related to each other always.

When once located by this dissection it is loosened from its embedded position at a certain point, and then lifted from the wound with the nerve elevator. Ofttimes the vein sends one or more branches backward, which may easily be wounded while dissecting the nerve from its fatty encasement.

Fifth Step.—Resetting the Nerve.—The elevated nerve is stretched by means of an elevator and then quickly snipped off proximally with the probe-pointed bistoury, after which the stump is picked us with the artery or tissue forceps and divided distally. About two inches of the trunk should be resected.

Sixth Step.—Closing the Wound.—The wound is closed with interrupted sutures, special care being taken to bring the edges of the skin into perfect apposition throughout. The edges of this wound fold inward unless special care is taken to arrange them properly. Drainage is not necessary.

AFTER-CARE.—The wound of tibial neurotomy should be protected with a plastic dressing of collodion, which is not disturbed until the edges have united, six or seven days later, at which time the stitches are removed. The patient is kept in the standing position at all hazards, in order to protect the edges of the wound against the friction and tension produced by curving the leg beneath the body, and by getting up and down. After twenty days the patient may be returned to work, but a longer rest at pasture is advisable. The hoof must henceforth be protected against nail pricks and treads, and the pasterns and fetlock against scratches and interfering wounds. But above all the patients occupation must not be arduous. Hard or fast work will sooner or later cause dissolution of the hoof or fetlock.

PERONEAL NEUROTOMY

SYNONYMS.—Anterior tibial neurotomy; deep peroneal neurotomy.

DEFINITION.—Peroneal neurotomy is the resection of a part of the anterior tibial nerve in the middle third of the tibial region.

DISTRIBUTION OF THE ANTERIOR TIBIAL NERVE.—The anterior tibial or deep peroneal nerve is a radicle of the femoro-popliteal branch of the sciatic. It leaves the parent trunk at the upper third of the tibia after the latter has passed diagonally across the lateral surface of the tibia. On its course down the leg it occupies the space between the bellies of the long and lateral extensors, about

three-quarters of an inch from the surface of the skin, and but a short distance from the anterior tibial artery. Approaching the hock it directs its course medially until it gains the antero-medial part of the tarsus, where it sends branches into the midst of the tarsal bones. One of its branches accompanies the perforating pedal artery into the depth of the articulations, the other, the terminal branch, continues down the anterior aspect of the leg to be lost cutaneously along the metatarsus. This nerve has a pronounced influence on the

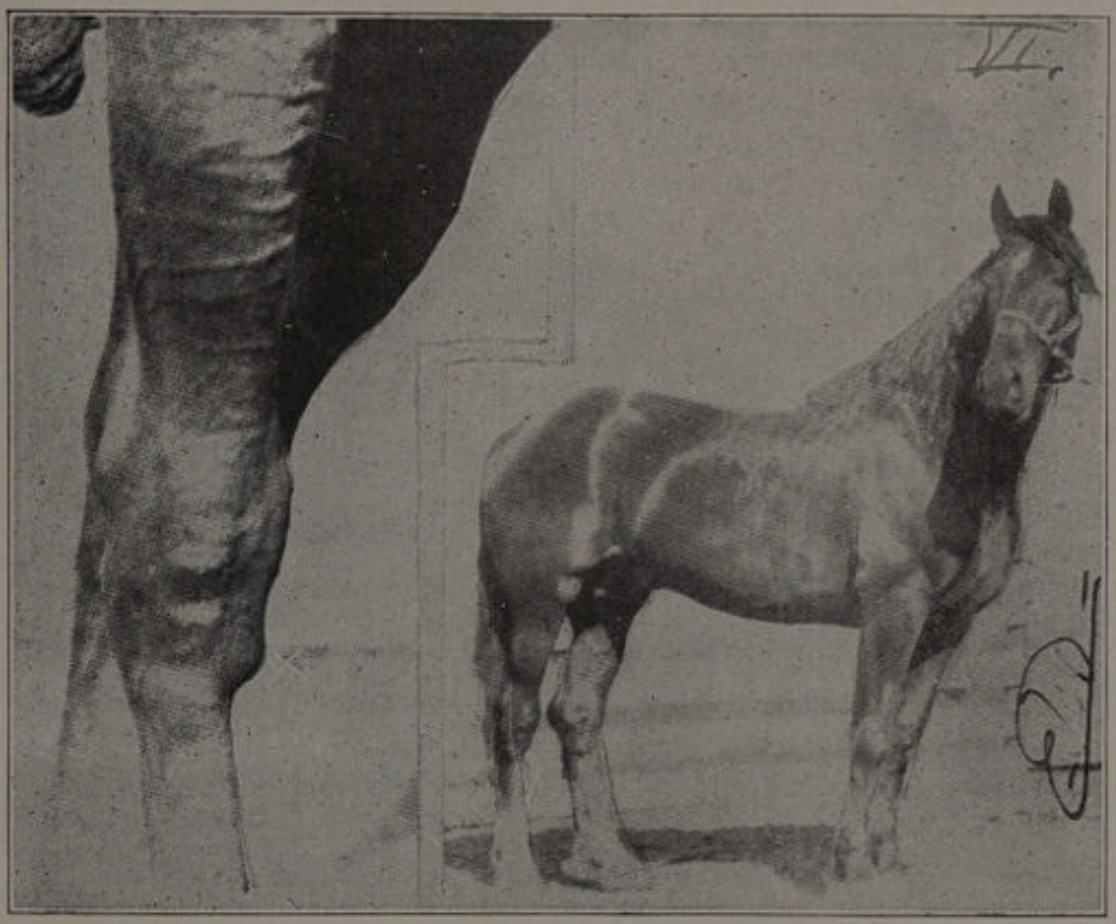


Fig. 114-A—Character of Spavin that Yields to Peroneal Neurotomy.

sensory innervation of the seat of spavin, but is not alone in supplying sensation to the hock. It is largely concerned in distributing sensation to the lower row of bones.

INDICATIONS.—Peroneal neurotomy has heretofore been used in conjunction with tibial neurotomy for the relief of spavin lameness. It has never been recommended alone for this or another purpose. Recently, however, in numerous trials, we have used it with phenomenal success in circumscribed spavin located in the usual position, after repeated blisters, firing,—feather and puncture,—and cunean

tendinotomy had failed to afford relief. It may be used alone, for circumscribed spavin.

A spavin has been fired, probably twice, it has been blistered, cunean tendinotomy has been performed and the lameness persists. At this time, the disease being local peroneal neurotomy alone may be safely recommended as a positive cure for the lameness. It seldom fails. When the inflammation is new, spreading, encroaching, active, the same benefits are not obtained, and when the spavin is diffused, implicating nearly all of the tarsal bones, even if the condition is old and the lameness trivial, very little benefit is derived. In these diffused cases tibial neurotomy must be performed in addition to the peroneal operation, and even then relief is not certain, particularly if the tibio-astragular articulation is implicated. A spavin involving the major part of the tarsus is not affected by peroneal neurotomy, and is not always cured when both operations are performed. When the true hock joint is involved no relief seems possible, from any neurotomy.

The **double or tibio-peroneal operation** has, therefore, only a limited sphere of usefulness. It is only a last-resort operation. A spavined horse may lame for one or two years and then finally become useful during the remainder of a long life. If this double operation is performed the complications which are certain to follow sooner or later will shorten this period of usefulness. This double operation is one the veterinary practitioner should not recommend unwisely.

RESTRAINT.—Peroneal neurotomy is performed in the lateral recumbent position with the affected leg uppermost. The leg should be extended from the body rather than flexed at the hock for the important purpose of bringing the anatomical structures separated in the operation into the same relations they occupy when the patient is in the standing position. If the operation is performed with the leg in a cramped, unnatural position, it will be found that the sutured wound will be crimped and distorted when the patient assumes the standing posture. The difficulty of healing the wound of peroneal neurotomy, which is referred to below, is guarded against at this, the first step of the operation, by so arranging the leg that the structures will be separated in their normal respective positions.

The **operating table** is by far the best apparatus for the operation, because of a normal extension of the leg is maintained by simply fixing the foot to the table, and then fastening both legs together with a "figure eight" below the hocks.

Subcutaneous cocainization, in addition to these fastenings, is sufficient restraint on the operating table. When the **casting harnesses** are used, general anæsthesia is advisable to assure the perfect immobilization of the region that is essential to the execution of the rather difficult technique. Local anæsthesia is hardly sufficient because at the crucial part of the operation,—the elevation of the nerve,—a struggle will often so change the relations of the muscles as to hide the nerve that was previously visible in the depths of the wound. The **English hopples** are fairly satisfactory. With the aid of general anæsthesia the operation can be performed without even releasing the leg from the hopples.

Whichever apparatus is used the one point to respect is the fixation of the leg in the extended position.

EQUIPMENT.—Scalpel, probe-pointed bistoury, tissue forceps, three or four hæmostats, two tenacula for wound retractors, a special nerve elevator. (Fig. 115), needles and thread, cocaine solution, antiseptic solutions, razor and clippers, constitute the necessary equipment. As suppuration of the wound of peroneal neurotomy is a serious matter, sterilization of the instruments is important.

TECHNIQUE.—Locating the Seat of Incision.—The incision is located in the middle third of the tibial region laterally, at the summit of the anterior tibial muscles; that is at the apex of the muscular protuberance formed by this group of muscles. By passing the finger tips along these muscles, a groove is felt between the bellies of the long and lateral extensors. It is over this groove that the incision is made. The plexus of superficial veins which occupy the seat, should not be regarded as sufficient reason to change the line of incision.

Second Step.—Disinfecting the Field.—Special effort is made to thoroughly cleanse the field. The hair is clipped and shaved, and the skin submitted to a cleansing, first with soap and water, then with mercuric chloride solution 1-500, and then finally tincture of iodine.

Third Step.—Incising the Skin and Fascia.—An incision is made two inches long along the line decided upon, regardless of the veins which may cross the field. These veins are subcutaneous. They should be exposed without cutting them in making the incision through the skin, and then picked up and twisted with the forcep to prevent blood from saturating the wound. When these vessels are disposed of, the underlying tibial fascia is incised with the probe-pointed bistoury. Then the perimysium of the muscles is likewise incised.

These incisions expose brownish-red muscles beneath. Before proceeding further, the blood flow must be controlled.

Fourth Step.—Separating the Long from the Lateral Extensor and Searching for the Nerve.—The two tenacula are now hooked into the muscles on either side of the wound, as the handle of the scalpel gently breaks down the areolar

Fig. 115—Special Nerve Elevator for Peroneal Neurotomy.

tissue connecting them. This breaking down process with the handle of the scalpel is carried about three-quarters of an inch deep. Then as the tenacula widen the space, the muscles are pressed first to one side and then to the other, with the handle of the scalpel, while the eye searches the depth of the wound for a slender, whitish cord lying flush against the

Fig. 116—Position of Incision in Peroneal Neurotomy.

anterior wall of the wound. This cord,—the peroneal nerve,—is no larger than the size of a small straw, but it is easily seen against the brownish-red back-ground, if there is no blood to mask the surface. When it is not promptly seen, the incision is not immediately deepened. Instead, the muscles are pressed to and fro with the handle of the scalpel, un-

TABLE I.

Spavin.

Ringbone.

Another Form of Spavin.

Ringbone.

til the part related to the nerve is rolled into view. Sometimes the dissection of the muscles is accidentally carried between the long extensor and tibealis anterior, in the anterior direction where, of course, no nerve will be found. This diversion in the wrong direction is recognized by the absence of the nerve when the incision is three-quarters of an inch deep. In this step special effort is made not to cut directly into the muscles; these are only separated by blunt dissection.

Fifth Step.—Elevating the Nerve.—A special instrument facilitates this step. The elevator best adapted for the purpose (Fig. 115) is a long, slender tenaculum with a short, pointed hook. The usual nerve elevator, adapted for shallow wounds, is difficult to pass beneath the nerve, because of the depth and narrowness of the wound.

The nerve is hooked up with this long tenaculum and then brought to the surface.

Sixth Step.—Resecting the Nerve.—Little dissecting is required to free the nerve from its attachments. The tension caused by elevating it from the depths of the wound loosens it from its delicate areolar surroundings. When brought to the surface it is at once found to be perfectly free and ready for resection.

The resection is carried out as in all neurotomies, with the exception that an haemostat should first be fixed upon it below the tenaculum, which holds it out of the wound, in order to prevent the distal stump from falling back into the deep wound after it has been divided superiorly. The nerve is slender; it may be even more slender than usual from stretching; if the distal stump is lost in the depths of the narrow wound, some difficulty may be found in locating it.

Seventh Step.—Closing the Wound.—The wound of peroneal neurotomy is a difficult one to manage. By dividing the tibial fascia, the subjacent muscles lose their chief support, their chief incarceration, and that at the most prominent part of their bellies. With this support lost, they tend to bulge through the breach and produces a **real muscle hernia,** whose formation is still further favored by their contractures with every movement of the limb. Bursting of the sutures are certain to terminate in the formation of this unfortunate sequel.

The closure of the wound is therefore a matter of much importance. It must be effected with special effort to accomplish a primary union of both the fascia and the skin. Delayed cicatrization will always result in protruding gran-

ulations which leave an indelible blemish at this conspicious place. Sometimes several months will elapse before cicatrization is complete.

The first step in closing the wound is to carefully adjust a row of small interrupted cat-gut sutures in the fascia. It is needless to state that these should be sterilized and inserted with precautions to prevent contamination of the buried structures.

The second step consists of the insertion of two crucial sutures in the skin. They are not drawn taut. When tied, the wound should gap a little, about a quarter of an inch.

The third step is the insertion of a row of small interrupted sutures along the edges of the skin wound to complete the closure. The loops should be small and a quarter of an inch apart. We then cross the wound with two lines of Mayo's running loop.

The fourth step consists of varnishing the whole region with collodion to still further immobilize the skin, as well as to prevent infection from without. This step is postponed until the subject has regained the standing posture, and all of the bleeding sometimes caused by suturing has ceased. Drainage is not necessary.

AFTER-CARE.—The subject is kept in the standing position for no less than eight days and at all hazards. Lying down for a single moment will demoralize the whole affair. The sutures will burst and the desired primary union will be defeated. At the end of seven to eight days, the dressing is carefully removed. The skin should have healed. If, however, there is any doubt as to the integrity of the union, the sutures may be left in place for two or three days more.

When a union has not been effected, the stitches are removed, the patient kept in the standing position for another week and astringent lotions applied frequently and freely.

The large muscle hernia, which sometimes follows peroneal neurotomy, should be treated from the beginning by keeping the patient quiet, and by the application of strong astringents. Caustic and actual cautery are even necessary to control the protruding granulation, but these should not be resorted to until the acute inflammation has subsided, after the third or fourth week.

ACCIDENTS AND SEQUELÆ.—Peroneal neurotomy is not a dangerous operation. There is some slight danger of cutting the anterior tibial artery, which lies about one-half an inch beneath the nerve (operating position.) There is little danger, however, if the distance of the peroneal nerve

from the surface is known to the operator. The anterior tibial artery has been mistaken for the nerve, but only by operators who have no previous knowledge of their relative dimensions. The nerve is a mere shred, while the artery is a large, cylindrical structure, the size of a small lead pencil.

The only serious sequel is the muscle hernia, described above, that occurs in different degrees of severity, according to the cleanliness of the operation, and the skill displayed in preventing bursting of the sutures. Breaking down of the unnerved parts never follows. From this standpoint, peroneal neurotomy is harmless.

ULNAR NEUROTOMY

DEFINITION.—Ulnar neurotomy is the surgical division of the ulnar nerve in the middle third of the fore-arm.

HISTORY.—Ulnar neurotomy really has no history, at least little is ever heard of the operation. It is sometimes mentioned in connection with median neurotomy. When the latter has failed to entirely cure the lameness, the ulnar operation is sometimes referred to as a method of turning failure into success. But the number of such operations performed have been few, and the success met by them is still unknown to the veterinary profession. It is by no means a standard operation today; the veterinary practitioners are little acquainted with its worth or the method of performance.

INDICATIONS.—The ulnar or cubital cutaneous nerve, a radicle of the brachial plexus, is closely related to the median or cubito-plantar, in the region of the arm. In the fore-arm it occupies a rather superficial position between the middle and lateral flexors of the carpus. Near the accessory carpal (trapezium) it joins a branch of the median to form the lateral digital, and also sends a branch over the anterior surface of the knee. Its influence over the sensibility of the knee is, however, limited to the superficial structures. To the tendons, fetlock and foot, it furnishes only a part of the sensibility, being fused with the median, whose influence predominates. Ulnar neurotomy alone is, therefore, of no service whatever. It can only be utilized to remove the sensibility that remains in certain structures after the median has been divided, in which instance the two operations combined become about equivalent to high plantar neurotomy, with the exception that the fetlock and part of the tendons are completely unnerved, while in plantar this articulation

and the tendons are not affected. We have tried the operation for the cure of lameness, due to an osteophyte, located on the supero-external part of the os suffraginus with negative results; but finally cured the lameness by adding median neurotomy.

For tendinitis, navicular arthritis, sesamoiditis, or a combination of these, the combined operations have a decidedly marked influence. The patient is at once better. The results are pronounced, immediate, flattering, but the danger of disaster to the diseased parts is sensibly greater than in

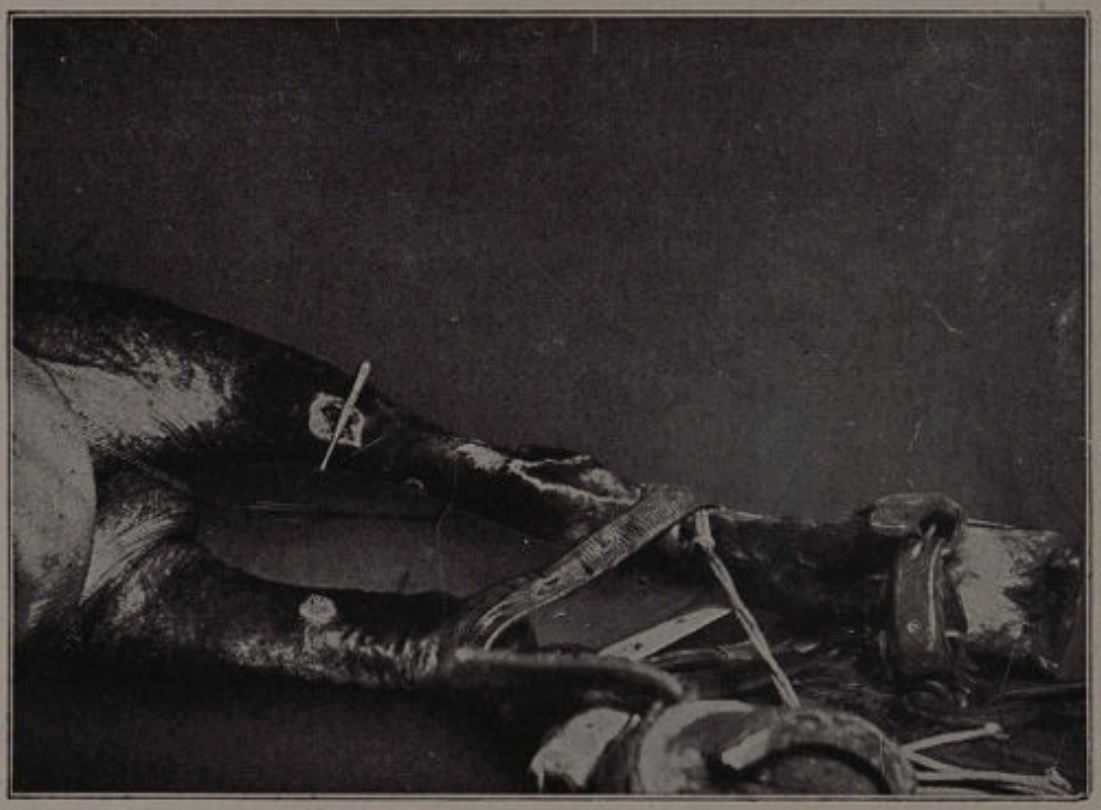


Fig. 117—Position of Incision in Ulnar Neurotomy.

any other of the nerve operations. In fact, the patients seldom survive long. The hoof sheds, the ligaments loosen or the leg swells, and becomes the seat of an extensive dissolution. In the face of these unfavorable comments, we are forced to record several very flattering cures from these combined operations, wherein the subjects were permanently benefited; and although several years have elapsed, no serious accident has yet occurred to any of them. The great majority, however, do not survive the ordeal for more than two or three months, sometimes much less.

RESTRAINT.—Ulnar neurotomy is performed in the recumbent position, with the affected leg uppermost, and brought out at a right angle with the long axis of the body.

Either the operating table or harness will answer. The leg is fixed in the usual manner, and the seat of operation is anæsthetized subcutaneously with a five per cent solution of cocaine. General anæsthesia is unnecessary.

TECHNIQUE.—The technique is as follows:

First Step.—Locating the Seat of the Operation.—The ulnar nerve, although quite superficial, cannot be felt on palpation, on account of its hidden position beneath the antibrachial fascia. It occupies the well-marked groove between the lateral and middle flexors, which can be felt by pressing the finger tips along the postero-lateral aspect of the forearm. The nerve is best reached in the middle third of the forearm, although it can be easily found as far down as the accessory carpal. The location to select in the above-

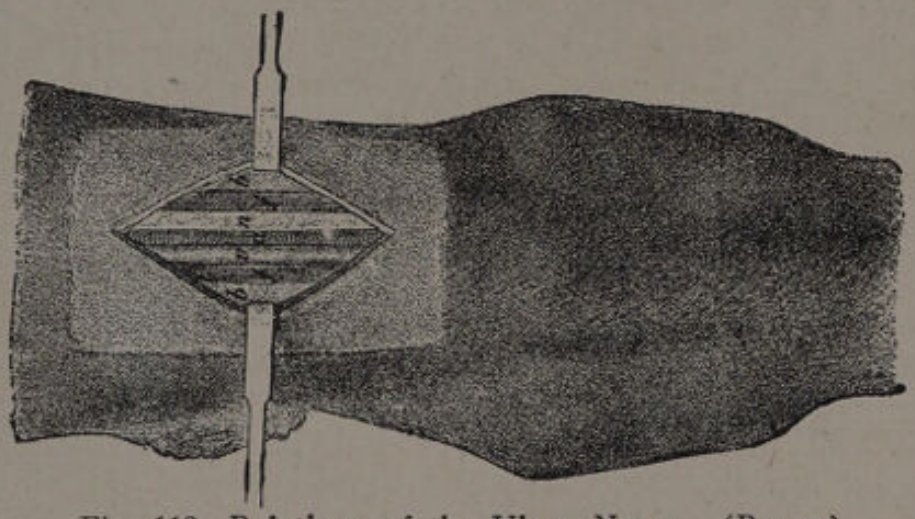


Fig. 118—Relations of the Ulnar Nerve. (Bayer.)
a—Artery. *b*, *b*—Skin. *n*—Nerve. *v*—Vein. *f*, *f*—Fascia.

mentioned groove, is a point midway between the olecranon and the accessory carpal, determined by measurement.

Second Step.—Disinfection of the Seat and Anæsthesia.—The region is shaved, washed, immersed in mercuric chloride solution 1-500, and then anæsthetized subcutaneously with cocaine hydrochlorate five per cent.

Third Step.—Dissection.—An incision is made through the skin, one and a half inches long, which will expose the thick underlying antibrachial fascia. Retractors are applied to the wound, and the fascia incised along its whole course with a probe-pointed bistoury, cutting upward and outward. At this point, search is made for the external radial vein, which should now lie along the course of the incision. If this vein is not visible, the antibrachial fascia just divided is dissected away along both edges, until it is brought into the

foreground. Once found, it is utilized as the land-mark in the search for the nerve, which is always closely related to it. The ulnar nerve lies beneath and slightly anterior to the vein. It is never deeply imbedded. Just beneath it is the small tendon of the ulnaris accessoris, which might at first be mistaken for it, but which is soon seen to be too large. The ulnar nerve at this point is the size of a wheat straw, and it is generally found by pushing aside the vein with the dissecting ferceps, or by carefully separating the vein from its surrounding structure with the forceps and scalpel.

Fourth Step.—Elevation of the Nerve.—The nerve is elevated with the elevator, loosened along the course of the wound, and then resected in the usual manner.

Fifth Step.—Closing the Wound.—The wound of ulnar neurotomy is closed with two sets of sutures. Two mattress sutures are first adjusted some distance from the edges of the wound, and then several interrupted stitches are placed along the edges to keep them in perfect apposition. In this manner there is no friction of the edges, as the horse moves about, and the union is primary. It is essential to heal this wound promptly, to prevent a muscle hernia. If the skin edges gap, the underlying muscles (no longer supported by the antibrachial fascia) protrude, delay cicatrization, and finally leave an indelible blemish.

AFTER-CARE.—The patient is kept in the standing position for ten days, or until the wound is safely united. The lying posture would disturb the sutures and prevent their union.

CHAPTER III

TENOTOMY AND MYOTOMY

DEFINITION.—Tenotomy is the surgical division of a tendon to correct a deformity or inequality, or to relieve tension produced by encroaching pathological conditions.

INDICATIONS.—Although tenotomies are very frequently desorted to in domestic animal surgery for one condition or other it is worth noting that they are never curative. **Tenotomies in veterinary surgery correct the effects, but do not modify the cause.** Shortened tendons are secondary conditions, due to pathological conditions of articulations or synovial apparatuses, in which they themselves do not share. The tendons themselves are free from disease; they simply contract to accommodate themselves to changes in the skeletal angles. Osteites, synovites and tendo-synovites are the primary lesions. Thus an inflammation in the region of the carpus, by causing the knee to be held in constant flexion, brings about a shortening of the metacarpal flexors; and inflammation about the fetlock, pastern or coffin joint in the same way shortens the flexors of the phalanges, and so forth, throughout all of the articulation having tendinous relations.

The object of the tenotomy is therefore that of correcting deformities, due to certain diseases which must in addition, be submitted to appropriate treatment. The condition known as "knee sprung" is an example of this compensatory contraction of tendons. The carpal bones or the neighboring synovials, when attacked with painful inflammations, cause the knee to be kept in constant flexion, and thus bring a relaxation of the normal tension of the three flexors of the articulation, which then gradually shorten in length to accommodate themselves to the new angle. At the same time, structural changes occur in the diseased organs (bones, ligaments, and synovials) which will sooner or later prevent the readjustment of the angle, even though the tendons have been surgically divided. In order that tenotomies be successful it is, therefore, essential that the operation precede the development of permanent deformities at the seat of disease. Otherwise the relief is partial or nil. Again it is

essential that the causative condition be submitted to abortive treatment as soon as the tenotomy is performed, in order to prevent recurrence.

It is very evident, therefore, that tenotomies have a limited sphere of usefulness. Generally the primary lesion is a serious, deforming, incurable defect, often in an old animal of little value, which circumstance again circumscribes the usefulness of the operation.

Here and there, however, conditions are met in which the operation gives fairly satisfactory results. If the primary disease aborts without leaving any serious obstruction to the reposition of the articulation to its normal angle, a tenotomy may permanently correct a deformity, but these favorable indications are, unfortunately, rare. Generally there are exostoses, contracted binding ligaments, or chronic inflammations to prevent a satisfactory and lasting effect.

The different tenotomies in veterinary surgery are not, however, all performed for the purpose of correcting deformities. Cunean tenotomy and peroneal tenotomy are performed with entirely different objects in view. Furthermore, tendons are now often divided in the treatment of acute traumatic inflammations of bursae and sheaths, examples of which are the division of the plantar aponeurosis for tendo-synovitis of the navicular bursa, and division of the perforans for thecal abscess at the sesamoids.

TECHNIQUE.—Each tenotomy has its special technique which is described below under a separate head. In a general way it may, however, be mentioned that the tenotomies for correcting deformities are all rather simple operations, consisting of a subcutaneous division of the contracted organ with a curved bistoury, followed by a forcible reposition of the deformed articulation to its normal angle. If the adhesions are not too firm, only a little force may be required, but in almost every case some difficulty is met in breaking them down. In every case, as soon as the divided tendon no longer lends to the deformity, traction is applied from a point of advantage until the adhesions give way. The manipulation necessary to effect this breaking down process varies according to the location of the deformity and strength of the adhesions. Special apparatuses have been improvised for this particular purpose, but these are not absolutely necessary. Traction upon ropes advantageously adjusted to the deformed leg is generally effectual. When the deformity has been thus corrected, a retention bandage is necessary to retain the articulation in the normal posi-

tion. It may return to the old position, or else break down entirely in the opposite direction. A bandage is necessary to support the parts for some days after large supporting tendons have been divided. Another feature of these operations is the necessary attention to the hoof, which has grown too long at the heels to allow the joints to fall into their normal positions. This excess hoof-growth should be trimmed before the operation is performed; that is, the hoof should be pared to its normal shape.

CARPAL TENOTOMY

DEFINITION.—Carpal tenotomy is the name we apply to the subcutaneous division of the tendons of the middle and lateral flexors of the carpus, a short distance above the accessory carpal bone (trapezium), for the purpose of correcting the deformity known as "knee-sprung."

INDICATIONS.—In a normal leg the line formed by the radius, carpus and metacarpus, is a straight one. When this straight line is interrupted at the carpus by chronic flexion, the horse is said to be "knee-sprung," or, in still more vulgar parlance, "cut out at the knees." This common condition is sometimes congenital, sometimes acquired. The new-born frequently presents the deformity in an aggravated form, but it gradually improves as the skeletal and muscular systems develop. It sometimes happens that the improvement is not perfected, and the subject is left with a permanent deformity. The carpus or both carpi, are thrown forward; they are "shaky." The horse is said to be "cut out" or "shaky" at the knees. There is no definite lesion. The structures comprising the articulation and the muscles attached to it are free from disease, but they are anatomically deformed. The flexor tendons are too short, and the bones have developed in shape to accommodate themselves to the position they are thus forced to occupy. If the tendons are divided, it may be found that the binding ligaments and the osseous apophyses prevent the perfect reposition of the articulation. The deformity may be only partially corrected and the shape of the bones will favor an early recurrence of the trouble. The operation of tenotomy is, therefore, not highly recommended for **"congenital knee-sprung."**

The principal indication is **"acquired knee-sprung,"** a deformity due to inflammation of some part of the carpal articulation. It may be an osteitis, synovitis or tendo-synovitis. The former, by producing obstructing, encroaching

exostoses, is the most common causative disease. The latter, that is inflammation of the extensive synovial apparatus behind the carpus (the carpal sheath), is, however, very frequently the seat of the responsible lesion. These painful inflammations cause the knee to be held flexed, and thus relax the flexor muscles, which in turn shorten to compensate for the changed relations. The change in the muscle is a shortening without a morbid entity. The whole structure is too short, not the tendon alone. It is, indeed, quite probable that it is the fleshy parts of the muscles that shorten.

This condition affects chiefly the aged and the hard-worked horse. It accentuates with hard, arduous work, and improves somewhat with rest and palliative treatments, but the deformity is never entirely cured, except by tenotomy. The young horse that has had only nominal work may sometimes become badly knee-sprung, when predisposed to the deformity by the congenital form. That is to say, a horse thus deformed from birth, when worked hard may become worse without carpal disease.

The ideal indication for the operation is the "knee-sprung" case that is accompanied with no appreciable structural obstruction, such as exostoses, contracted binding ligaments, etc., but is deformed because of a sub-acute inflammation that causes the point to be held forward. Under such favorable circumstances the divisions of the flexor tendons, blisters, firing and rest will very often bring a highly flattering result. The permanency of the cure will depend upon the success in curing the causative inflammation. When this is not cured, the deformity will recur, but if aborted, the cure is permanent.

An inimical circumstance in many cases is the low value of the horse, due to its age and general state of decrepitude. Very frequently the knee-sprung horse is an old subject, probably suffering from other locomotory defects. This low value, together with the long period of post-operative convalescence, markedly limits the number of suitable surgical subjects.

EQUIPMENT.—Division of the tendons is best effected with a **special bistoury**, curved slightly, probepointed, with a cutting edge extending to the very end. This knife is identical to the ordinary probe-pointed, curved bistoury, with the exception that the rounded protuberances at each side of the end of the blade are absent. The essentials are those required for any surgical operation; i. e., antiseptics,

scalpel, razor, clippers, soap and bandages. Special pains is taken to sterilize the scalpel and bistoury.

RESTRAINT.—The operation is performed in the lateral recumbent position, with the deformed leg uppermost, and brought out at a right angle with the long axis of the body. The **operating table and casting harness** are both suitable methods. The leg is fixed with a strap or rope extending from the lower part of the middle third of the radius to a stationary point posteriorly,—the hopple of a hind leg or the frame of the table, and a second rope looped around the pastern and brought forward around the heel of the foot. This second rope is given into the hands of one or two strong assistants, who are instructed to pull with their might while the tendons are being divided. This tension facilitates the cutting. The only appropriate anæsthesia is general anæsthesia. Local anæsthesia is ineffectual, on account of the impossibility of bringing the solution in contact with all of the tissues to be incised. Mere subcutaneous cocainization is of no service whatever during the crucial part of the operation. A sudden jerk as the knife is cutting the tendon always spoils a nice operation and may enlarge the cutaneous incision as the blade is withdrawn.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The point of entrance for the bistoury is located about one inch above the trapezium in the grooved depression that can be felt with the finger tips between the tendons of the external and middle flexors. The groove is not a distinct one, except on firm pressure, when the skin is found to push inward slightly between the tendons. Distinct palpation of each tendon is prevented by the firmness of the antibrachial fascia.

Second Step.—Disinfecting the Field.—The hair is clipped, shaved, and the skin well washed with mercuric chloride solution 1-500, over a liberal surface around the point selected. It is important to execute this step well, with the view of preventing abscess. The space between the cut ends of the tendons leaves a favorable field for infection, which might be accidentally carried in from a dirty skin. Furthermore, purulent products freely burrow between adjacent structures in this region and cause serious complications. Absolute cleanliness is therefore specially essential.

Third Step.—Making a Point of Entrance for the Bistoury.—The point of the scalpel is plunged firmly through the skin and subjacent fascia. The knife is held firmly between the fingers, and the hand is pressed flush against the

leg, so that a sudden jerk will not slash a large opening in the skin. The point of entrance is made just large enough to admitt the bistoury, and no larger. With a gaping wound at this location, subsequent infection of the deeper recesses could hardly be prevented.

Fourth Step.—Dividing the Tendons.—The probe-pointed bistoury is now passed through this small incision, between the two tendons, until its point is on a level with their deepest part. Its cutting edge is turned against the lateral tendon and the handle is then grasped firmly, the other hand acting as a guard externally. The assistants who are holding the leg pull with their might to stretch the tendon, as a deliberate sweep of the bistoury snaps it off. Then, without removing the bistoury, its cutting edge is turned against the medius, which is divided in exactly the same manner. The only special precaution to take in this step is that of not passing the bistoury too deep. The posterior radial artery, and the superior cul-de-sac of the carpal sheath, may thus be unnecessarily wounded.

Fifth Step.—Bandaging.—A thin layer of cotton soaked in an antiseptic is placed over the wound and a firm muslin bandage wound over the region, including the upper third of the metacarpus and the lower third of the radius.

AFTER-CARE.—The patient is kept in the standing position for several days. The bandage is changed daily to prevent discomfort from pressure. At the end of the week the patient is turned into a loose box, paddock or pasture, and allowed at least six weeks of rest.

SEQUELÆ AND ACCIDENTS.—Infection of the surgical wound, which may spread into the adjacent synovials, is the most serious sequel of the operation. If guarded against by cleanly methods of operating, it will seldom occur. The radial artery may be accidentally cut by passing the bistoury too deep between the tendons, but the accident is easily avoided by exercising a little care in passing the bistoury around the medius. There is no danger while dividing the external tendon. The hæmorrhage resulting from this accident is controlled promptly by applying a taut compressing bandage over the whole lower half of the forearm.

One of the unfortunate results is the failure to relieve the deformity. Although the tendons are well divided and the carpus can be straightened, it sometimes happens that the patient will persist in keeping it flexed, except when it is retained on a straight line by force. In this event it will be

necessary to apply a hard retention bandage (plaster of Paris) to prevent flexion for several weeks, at which time the condition will be found to be at least partially ameliorated.

METACARPAL TENOTOMY

SYNONYM.—Tenotomy of the perforans and perforatus tendons.

DEFINITION.—Metacarpal tenotomy is the name we apply to the subcutaneous division of the flexors of the phalanges, at the middle third of the metacarpus, for the purpose of correcting the deformity known as volar or palmar flexion.

INDICATIONS.—Chronic volar flexion is a deformity of solipeds, consisting of a contraction of the flexors of the phalanges, due to a definite lesion in the digital region. On account of a painful disease, located at some point along the "palmar surface," the phalangeal articulations are thrown into a constant state of excessive flexion, which relaxes muscles controlling that action, and thus induces them to shorten in obedience to the distance they cover. Once contracted, the flexed state, commonly known by the phrase "volar flexion," persists until the tendons are again lengthened by tenotomy or other treatments. The definite lesion is generally a tendo-synovitis of the navicular bursa, but may also be located in the bones, tendons or synovials, at any point between the fetlock and the semilunar ridge. Exostoses, severe strains of the tendons or ligaments, severe inflammations of the synovials, and sometimes chronic laminitis, are the usual primary lesions that cause the muscles (and their tendons) to become shorter and shorter as the articulations become more and more flexed by the animal's efforts to place them in the most comfortable angle.

It thus occurs that acquired volar flexion of solipeds is a complex entity, consisting of a serious lesion as a **cause**, and contracted tendons as an ultimate **effect**.

Aggravated volar flexions of congenital origin are common in the new-born in the absence of any perceptible lesion, but these usually improve with the development of the skeletal and muscular systems, like all other similar deformities of the young. These require surgical treatment, however, when the deformity is serious. In the most pronounced form they cause the patient to walk upon the dorsal surface of the phalanges.

Contractions of tendons from lesions in the tendons themselves seldom ever occur. The flexor tendons of the horse may be sprained, ruptured or "bowed," and in the siege of a painful, obstinate inflammation, without ever contracting to any appreciable extent. A slight volar flexion may result from such lesions, but it is never of the accentuated type seen from lesions along the digital region. The sprained

Fig. 119—Volar Flexion of Pedal Origin.

Fig. 120—Bilateral Volar Flexion due to Sesamoiditis.

tendon is, therefore, in the metacarpal region, not an indication for tenotomy. It does not cause a pronounced volar flexion.

Similar deformities also occur in the pelvic limb, but not with the same frequency as in the pectoral. The knuckling deformity of the hind leg is generally due to the sesamoiditis, but as in the fore limb, it may sometimes be due to lesions along the plantar aspect of the digital region. Goneitis, spavin and exostoses about the head of the great suspensory ligament are also occasionally causative.

In the selection of a suitable case for tenotomy, the character of the primary lesion deserves first consideration. It may be impossible to correct the deformity, even after the tendons are cut, or the great force required may inflict serious injury to the diseased structures. Before operating, there must always be some certainty that reposition of the

deformed articulation will not be prevented by confirmed ankylosis or adhesions.

When the initial lesion is in the navicular bursa, division of both the deep and superficial flexors may always be depended upon to correct the deformed fetlock. Sometimes division of the deep one alone is sufficient. But there is no assurance that the cure will be permanent, because the initial lesion may cause a recurrence. The operation to correct the deformity must, therefore, be followed by treatment that will tend to benefit the original disease to which it was

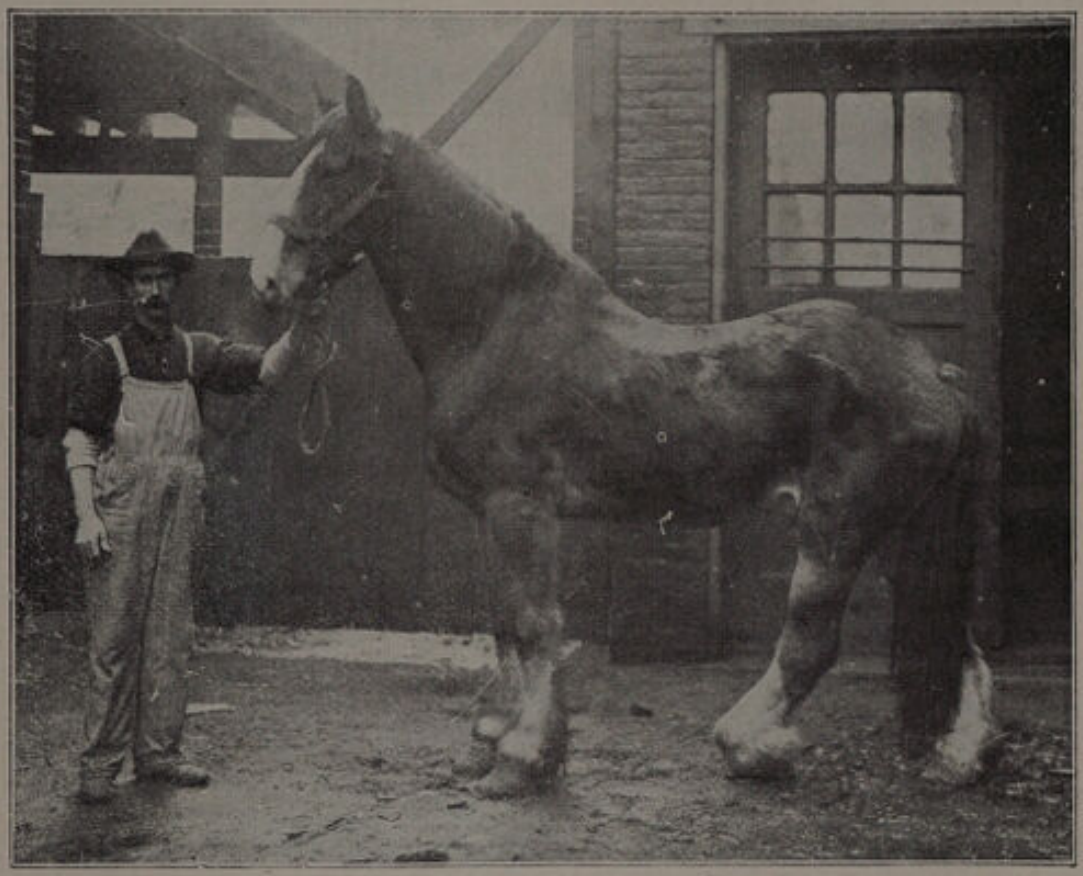


Fig 121—An Extreme Case of Chronic Plantar Flexion from Goneitis.

due. Firing, blistering, appropriate shoeing, and long rest or easy work are often helpful in bringing about a satisfactory termination of the operative treatment.

In the ox and dog similar deformities are rare; the deformity is seen chiefly in solipeds, because these animals alone are constantly submitted to the arduous work, and are exposed to the kind of injuries that are capable of causing the particular lesions which produce contracted tendons.

EQUIPMENT.—The division of the tendons is made with the same special bistoury described under the head of

carpal tenotomy (Fig. 8). A common tenetome, pricking knife, sharp-pointed curved bistoury may, however, be substituted in the absence of this special bistoury. The other needs are: Scalpel, clippers, razor, hoof-knife, hoof-nippers, hoof-chisel, bandages in abundance, antiseptic solutions.

RESTRAINT.—The operation is performed in the recumbent position with the affected leg undermost and stretched out at a right angle from the body. General anæsthesia is helpful, and is especially required, when there are firm adhesions to break down after the tendons are divided. The division of the tendons alone is not very painful, but the breaking-down process inflicts a torturing pain that deserves consideration. Local anæsthesia is of no service whatever.

The leg itself is secured with two ropes, one passing from the knee backward to some fixed point, and a second one looped around the pastern and brought forward around the heel of the foot. The first is a stay rope to prevent the leg from pulling forward, while traction is applied to the other one to break down the deformity.

The operating table and casting harness are both suitable apparatuses to restrain the subject, but the former is somewhat more convenient.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The division of the tendons is made **exactly at the middle of the metacarpus**, a point devoid of synovials. At the lower third is the superior cul-de-sac of the sesamoidean synovial, while at the upper third is the inferior extension of the carpal sheath. These two important sheaths must be avoided. The medial aspect of the leg is selected for the purpose of avoiding the great metacarpal artery. If a tenetome is passed between the perforans tendon and the great suspensory ligament, from the lateral side of the leg, it can hardly be made to sweep around the tendons without cutting this large blood vessel, while on the other hand if the point of entrance is medial, the blade can easily be slipped beneath this vessel, which occupies a rather superficial location along the medial surface of the region.

Second Step.—Disinfecting the Field.—The whole middle third of the metacarpal region is clipped, shaved and disinfected with mercuric chloride solution 1-500, and then painted with tr. of iodine. It is important that no infectious matter be carried in with the bistoury.

Third Step.—Incising the Skin as a Point of Entrance.—A small point of entrance for the bistoury is first made with

the point of the scalpel in the groove between the perforans tendon and great suspensory ligament. The exact location of this point of entrance is important. Is is made at the posterior edge of the groove, not in its depths, so that the

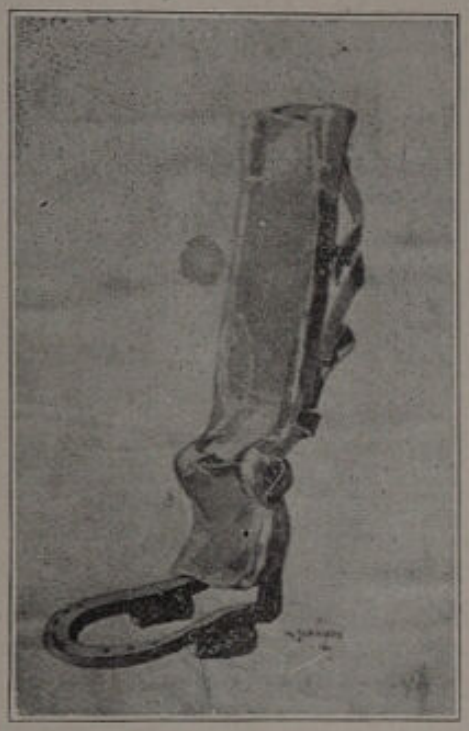


Fig. 121-a—Dr. G. H. Roberts Leg Brace for Supporting Legs After Tenotomy.

Fig. 121-b—Dr. Roberts Leg Brace Applied.

Fig. 122—Position of Incision and Correct Direction of Tenetome in Metacarpal Tenotomy.

Fig. 122.

Fig. 123—Fourth Step of Metacarpal Tenotomy (Moller.)

Fig. 123.

bistoury can be passed downward and forward under the metacarpal artery, and medial metacarpal vein. If the entrance point is made in the depths of the groove these two vessels can hardly be avoided.

Fourth Step.—Dividing the Tendons.—This step is effected with the special bistoury previously described. The bistoury is passed through the entrance incision, dorsolaterally; that is to say, forward and downward, so as to glide under the artery, vein and nerve. The blade is placed flatwise against the tendon on its downward course. When it is buried beyond its cutting portion it is first passed through to the opposite side, until its point is felt beneath the skin, and then turned, cutting edge against the tendon. At the same moment the assistant holding the rope is instructed to pull with his might to bring tension upon the tendons as the bistoury divides them. It is advisable to first divide only the perforans and then endeavor to break down the deformity by force. If the adhesions do not yield to the traction, the perforatus is then severed.

Fifth Step.—Breaking down the Adhesions.—Old deformities are hard to break down. If they do not yield to ordinary traction the rope looped around the pastern is taken in both hands as one foot is placed against the front of the fetlock. A steady and forcible forward traction with one's hands and a firm backward pressure with one's foot will usually bring the fetlock to its normal angle without much trouble. The reposition is attended with a crunching sound caused by the tearing of the adhesions. It sometimes happens that the adhesions will stubbornly resist any ordinary force that can be applied. Under such circumstances additional help is enlisted. The full strength of two, or even three, strong men may be required, each one pulling upon the rope with one foot against the dorsal surface of the leg. No matter how much force is required the volar flexion must be straightened. To simply sever the tendons without breaking down the adhesions is useless.

Sixth Step.—Applying the Supporting Bandage.—The amount of support required to prevent the fetlock from breaking down altogether into an exaggerated dorsal flexion and the turning up of the toe, will vary greatly in each case. It sometimes happens that no bandage supporting is necessary. The remaining adhesions may be sufficient to retain the fetlock at the proper angle. Frequently the deformity is only partially corrected by the traction and the weight of the body gradually forces the phalanges to the proper inclination. This is particularly the case when only the perforans is severed.

Usually, however, it is necessary to support the articulations with a substantial bandage. A thick wrap of firm

muslin bandages extending from the carpus to the foot partially covering the latter is an appropriate support for the first week.

Seventh Step.—Shaping the Hoof.—This part of the operation, which may be executed before or immediately after the preceding steps, is required, because of the excessive growth of the heels. The heels of the hoof, not being in wear, elongate in proportion to the degree and the duration of the deformity. They are sometimes four or even six inches long.

It is probably advisable to shape the hoof with the hoof-chisel, hoof-nippers and hoof-knife as a preliminary step before the patient is placed in the recumbent position. Once cast, these instruments cannot be as conveniently used. Another method, however, is to reduce the hoof to its proper dimensions with a saw while in the recumbent position, after the other steps have been completed.

AFTER-CARE.—The patient is given the preference of standing or lying at will in an ordinary loose box. The muslin bandage is not disturbed for six or seven days unless swelling or pain supervenes, which circumstance would necessitate readjustment. At the end of the first week the muslin bandage is replaced by a hard retention bandage of insulation tape, which is removed at end of third week. At this time the tendons will have reinforced themselves sufficiently to perform their weight-carrying function unaided. A blister or firing with the feather-edge iron, and finally a rest at pasture or in a paddock for one or two months, completes the procedure.

ACCIDENTS AND SEQUELÆ.—In dividing the flexors of the phalanges special care is taken to prevent **infection.** An accumulation of pus between the divided ends of the tendons may spread into the neighboring synovials and terminate in a serious complication. The prevention is found in performing the operation with sterilized instruments after having thoroughly cleansed the field.

A bad dorsal flexion may result from failure to apply an effectual supporting bandage. The fetlock descends almost to the floor and the toe turns upward at every step.

Induration of the tendons at the seat of operation is an inevitable and unavoidable sequel. The operation always leaves an indelible hard tumefaction. This sequel is not important in view of the much greater deformity which preceded it.

During the operations there is always some danger of **severing the great metacarpal artery and vein.** This accident is followed by a very troublesome œdema of the leg. This is prevented by operating on the medial side of the leg and by passing the bistoury safely beneath the vessels.

Recurrence of the Deformity.—Volar flexions straightened by tenotomy do not always remain permanently cured. In view of the fact that they are caused by primary lesions that are not benefited by the operation, recurrence may be expected. The cure is permanent only when the causative lesion is no longer active. The supposition that tendons shorten again on account of the contraction of the cicatricial tissue that fills up the space between the divided ends is not true. **It is the initial lesion that governs their future behavior.** If this lesion is cured the tenotomy will be a pronounced success, otherwise recurrence will occur to a greater or lesser degree.

METATARSAL TENOTOMY

Metatarsal tenotomy is performed for analogous deformities in the pelvic limb, according to the same special recommendations governing metacarpal tenotomy. Plantar flexions (knuckling) grave enough to require operation are, however, much more liable to recur than the volar flexions of the pectoral limb. This is particularly the case when the causative lesion is connected with the tarsus.

PERONEAL TENOTOMY

DEFINITION.—Peroneal tenotomy is the name we apply to the surgical division of the tendon of the lateral extension of this phalanges at or near to its insertion to the long extensor, for the cure of stringhalt.

HISTORY.—Peroneal tenotomy is a modern operation, first recommended by Bassi only a few years ago. It has been performed in America only during the past twenty or twenty-five years, but was done in Europe some years before. At the present time it is very frequently performed by American veterinary practitioners. In fact, few stringhalt horses escape the operation where there chances to be a veterinarian to perform it. It seems to be performed by nearly all of the country practitioners. Horses coming into the markets very often show evidence of having been thus treated. It is a very common occurrence to find that

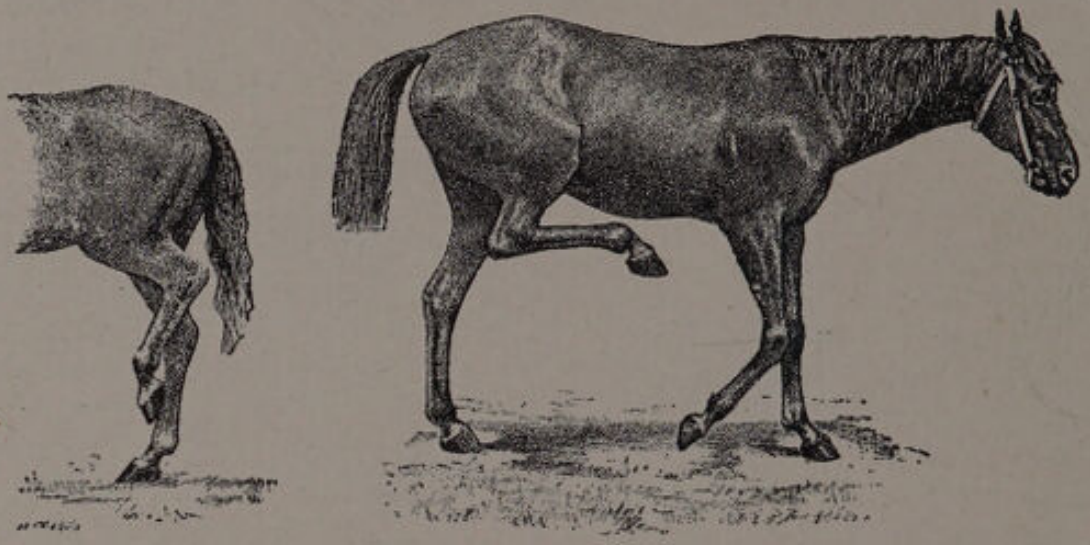
the stringhalt horses submitted at the large clinics have been operated upon before having been brought from the country districts. Although a common procedure of the veterinary surgeon it is now generally known to be rather unreliable. Some are cured, some are benefited, but many are not even improved, and it seems absolutely impossible to predict the results. Its unreliability is, however, regarded as being counter-balanced by its simplicity and harmlessness, which fact will doubtless serve to retain its same nominal popularity until a better treatment for this mysterious abnormality of locomotion is found.

INDICATIONS AND CONTRA-INDICATIONS.—The operation of peroneal tenotomy is performed only for **stringhalt.** It is intended to cure or modify the excessive flexion of the hock, by which the disease is manifested. Stringhalt is the symptom of an obscure lesion, whose pathology is still a mystery. The various explanations and speculations by pathologists give the reader no positive information, and the closest observation on innumerable affected subjects gives no clew to the nature or location of the causative lesion. It is true that stringhalt often co-exists with definite abnormalities about the hock, foot, stifle or hip, but the existence of similar abnormalities without this involuntary excessive flexion, must, for the present at least, leave some doubt as to whether they are the causative factors or not. The improvement of the symptom so often following the division of the peroneus tendon would indicate that the seat of the lesion is not far from the hock or tibial region, but the fact that peroneal tenotomy often fails and that desmotomy of the internal patellar ligament is sometimes successful, shows beyond reasonable doubt that the trouble is at times located above these regions.

The disease is interpreted differently by each investigator. Bassi recognizes two forms, **true** and **false** stringhalt. The former he attributes to some abnormality about the patella, and the latter to some definite lesion in the tarsal bones, fascia of the leg or extensor muscles. Contraction of fascia at any point from the hip to the metatarsus, he supposes, is the most likely lesion responsible for the faulty gait. Moller differentiates between two forms also, but calls them **idiopathic** and **symptomatic** stringhalt; the latter when due to a perceptible cause, and the former when the cause is obscure. The theories of different veterinarians might be repeated ad infinitum without finding two of them similar,

which fact clearly exemplifies the mysteriousness of the condition.

It is, however, probable that stringhalt very often is a symptom of some lesion of, or is closely related to, the great fascia that envelope the pelvic limb. Speculations on the nature of disease, varying from neuroses of the spinal cord to definite lesions in the foot, do not harmonize very well with the striking uniformity of the manifestation. The symptom, stringhalt, is characteristic and manifestly uniform in every case. The variation in different cases is one of degree only. It is not very likely that this same sign,—excessive flexion of the hock,—is caused by so many dissimilar lesions. The sensible decision is that stringhalt is due to a causative lesion as uniform as the symptom itself,



Figs. 124 and 125—Two Distinct Forms of Operable Stringhalt.

were it only known. To claim that one case is due to chorea,—a brain lesion,—another to some defect in the spinal cord, another to some abnormality of a peripheral nerve, another to injury to the stifle, another to spavin, another to sidebone, another to injury to the extensor tendons, and another to contraction of the tibial fascia, seems very illogical when the uniformity of the symptom is taken into consideration. At the present time stringhalt is not understood. It is a mysterious manifestation of some unknown lesion. Its treatment is empirical. It is sometimes cured by dividing the peroneus tendon, but the mechanism by which the cure is accomplished is quite as mysterious as the primary lesion itself. The peroneous is an accessory extensor; it has no marked action upon the hock, and its action is to assist the long extensor. If divided accidentally or surgically its

loss produces no perceptible change in locomotion, which fact shows conclusively that the cure from tenotomy is not due to any direct modification of muscular activity. The same fact proves also that stringhalt is not of nervous origin. The cure of some cases by peroneal tenotomy points to a lesion somewhere near the peroneus muscle, at its origin, its belly or its tendon. That the lesion is sometimes located near its origin is suggested by the cures which follow division of the internal patellar ligament. These two operations may sooner or later solve the perplexing problem; and in view of all facts connected therewith it will not be surprising if the cause is found somewhere in the neighborhood of the stifle, especially around the proximal extremities of the tibia and fibula.

Another theory which we now entertain very favorably is that it is due to injury of the sheath of the tendon. Exposed to pressure from lying down in hard places this long superficial theca is sometimes riddled with adhesions, which may have some influence. The fact that more cases of stringhalt are cured by removing the entire tendon from malleolus to insertion is the chief argument in favor of this theory. Besides old stringhalt cases often, if not always, exhibit some lesion about the lateral face of the hock and metatarsus.

The "spermatic cord theory" which laid the blame upon adhesions of the cord following castration is not sound as we have found stringhalt quite as common in mares as in geldings.

That stringhalt is due to a definite lesion as uniform as the symptom itself is the only reasonable hypothesis upon which to base future investigation.

EQUIPMENT.—Scalpel, tissue forcep, nerve elevator, scissors, probe pointed bistoury, hæmostats and the local anæsthetic outfit with the usual antiseptic, completes the outfit.

RESTRAINT.—The operation can be performed in the standing position with the aid of twitch, single side line to lift the opposite leg and local anæsthesia. Recumbent restraint becomes necessary only in horses whose natural tendency to oppose restraint may interfere with the successful execution of the technique. As most stringhalt horses are well broken, and as the disease is not so frequent in unbroken, unworked animals, the operation is usually very easily performed in the standing posture.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The antero-external aspect of the leg at the superior

part of the upper third of the metatarsus is the surgical field. In this area the tendon of the lateral extensor can be plainly felt extending from the point of its insertion to the long extensor. It rolls under the fingers tips, when pressed against the bone beneath. Its caliber is that of a small lead pencil, but it is slightly flattened from side to side. When traced upward by palpation it is gradually lost as it surmounts the tarsal bones. The division of the tendon, or its partial resection, is made at any point between its insertion to the tendon of the long extensor and the point above where it is lost in the tarsal fascia. It is advisable to divide it as near the insertion as possible, or as far from it as possible, in order to leave either a very short distal stump or else one long enough to preserve the sheat in which it plays. A distal stump of an inch, by moving up and down with each contraction of the longus, will sometimes develop a pronounced tumefaction below the seat of operation. This is particularly important when a part of the tendon is resected, and much less important when the tendon is simply divided subcutaneously.

Second Step.—Disinfecting and Anæsthetizing the Field.—The field is clipped, shaved, washed with mercuric chloride solution, 1-500, and then anæsthetized by sucutaneous injections of cocaine solution 4%. The anæsthetic solution is distributed under the tendon as well as subcutaneously, in order to anæsthetize every part touched with the knife.

Third Step.—Dividing or Resecting the Tendon.—Some veterinarians prefer simple subcutaneous division of the tendon, while others claim better results when a portion is resected (tenectomy). The former procedure is very simple. As soon as the cocaine solution has effectually anæsthetized the parts a small point of entrance is made in the skin with the point of the scalpel, along the anterior border of the tendon, that is in the space between it and the tendon of the extensor pedis. The point of entrance is made deep. The point of the scalpel should touch the bone, so as to complete the channel for the probe-pointed bistoury, as far as possible. If only a cutaneous incision is made, the probe-pointed bistoury will be blocked by the underlying connective tissue, in its downward passage. The bistoury is passed flatwise beneath the tendon and then turned against it. The division is then done by pressing the tendon against the sharp edge with the thumb.

To resect a part of the tendon a cutaneous incision is made, one-half inch long, along the course of the tendon at

its most conspicuous part. The tendon is then brought out with a nerve elevator or tenaculum, stretched as tight as possible and then divided, first proximally and then distally. An inch is easily resected in this manner.

A third method, somewhat more complicated than the preceding, consists of first elevating the tendon through a half-inch incision made as low as possible and then dividing it subcutaneously a inch higher, so that a long piece of the tendon can be pulled out of the incision. After the tendon has been elevated through the lower incision, the

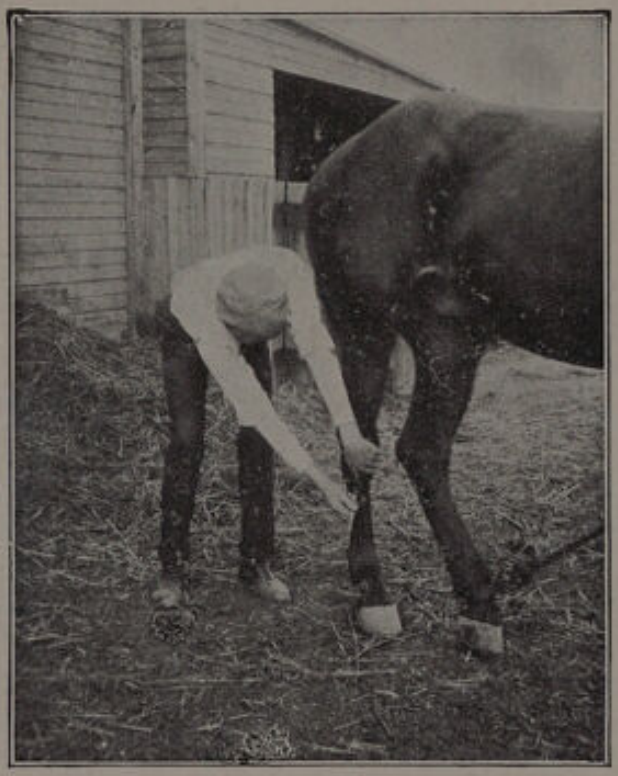


Fig. 126—Side-Line Restraint and Position of Operator in Peroneal Tenotomy.

bistoury is passed under it an inch or so higher up and as its blade is turned against it, traction is applied to the elevator to facilitate its division by increasing the tension. When the division is made a firm pull will bring the whole distal stump out of the incision. Division distally then completes the resection.

Still another method (Lyford's Operation) which to the best of our knowledge was first performed by Dr. C. C. Lyford includes the resection of the entire tendon from the level of the lateral malleolus to a point near its insertion to the longus. This operation requires two incisions, one at the malleolus and one at the insertion six to eight inches below.

This operation requires recumbent restraint. The tendon is first exposed at the level of the malleolus by carefully incising the skin and two layers of thick fascia and then elevated with from the wound with a tenaculum. Then it is raised through an incision just above its insertion the same as in the ordinary operation for resection of a small piece. Here a strong elevator is passed under and after dividing it at the upper incision strong traction is applied to draw it downward out of its sheath. In this way eight to ten inches, in fact the whole tendon is removed.

There is no intention here to claim any special merit for any one of these methods over the others. Each one has its failures as well as its victories. The latter, however, has given us the highest percentages of cures, but the number of cases specially observed for differentiation has not been sufficient to warrant a final decision in its favor.

Fourth Step.—If but a subcutaneous division of the tendon has been made the operation is completed by simply covering the small incision with collodion. A dab of iodoform is also sufficient if renewed daily for a few days. When either of the other methods is used a stitch to the incision will be required to prevent scarring.

AFTER-CARE.—The stitches are removed at the usual time. In the meantime the horse is turned into a loose box for a week and then given slight exercise for another week. At the end of the second week he may be returned to his usual work without harm or without danger of distracting from the final results. Some time always elapses before any benefit is observed. There is often a marked amelioration as late as six weeks after the operation has been performed, and it is seldom that any perceptible modification of the flexion occurs sooner than two weeks. Sometimes the cure is not permanent. The symptom may subside markedly during the first and second months and then return in a more exaggerated form than ever. We have seen recurrences after two years.

ACCIDENTS AND SEQUELÆ.—If the operation is carefully performed with regard to surgical cleanliness it is harmless. Sometimes a pronounced tumefaction at or immediately below the seat of operation develops after some weeks. This sequel is due both to a septic wound and to the irritation caused by friction of the distal stump. As stated above, the stump should be very short, (one-half an inch) or long (one and one-half inches or longer).

The only accident we have ever known to occur is the accidental division of the longus, resulting from a sudden jerk of the leg as the knife,—a scalpel,—was being passed under the tendon from behind forward. The prevention is found in passing the bistoury in the opposite direction as previously recommended. A certain veterinarian performing the operation for the first time deliberately divided the long extensor tendon of each leg, mistaking them for the tendons of the lateral extensor; but this accident is little likely to occur to a more intelligent practitioner.

CUNEAN TENOTOMY

DEFINITION.—Cunean tenotomy is the resection of a portion of the cunean branch of the tibiales anterior where it winds diagonally over the internal aspect of the tarsus, for the purpose of curing or modifying the lameness of spavin.

HISTORY.—Cunean tenotomy is the artifice of Peters and Dieckerhoff, although others before them suggested and attempted similar operations to cure spavin lameness by different procedures directed towards this tendinous structure. The peculiar relations of the cunean tendon to the exostosis of spavin, led many veterinarians during the past decade toward this interesting anatomical structure in their vain endeavors to ameliorate this refractory lameness. When the operation was first introduced into America about twenty-five years ago, too much was claimed for it. Today, after sufficient time has elapsed to gather on its real effects, the operation has lost some of its prestige. Some experienced practitioners have abandoned it entirely, while others, more correctly, still defend it as a satisfactory operation under certain circumstances. It is not now regarded as the cure for spavin lameness; firing, blistering and rest, having by far the most adherents among the best practitioners. The tendency today is to perform cunean tenotomy after these usual measures have failed.

INDICATIONS AND CONTRA INDICATIONS.—Cunean tenotomy has but a single indication—the lameness of spavin. Its proper place in veterinary surgery today is that of a second resort in the treatment of circumscribed spavin. A prominent exostosis, limited in extent, implicating only the lower part of the tarsus, is the preferable indication.

Dr. John Adams claims that one of the benefits derived from cunean tenotomy is the detachment of the tendon from the affected bones. The claim is based on the logical reasoning that the tendon, as the hock flexes, pulls against the diseased bone and thus causes at least a part of the lameness. Severed, this much of the lameness is removed. If this reasoning is correct, a backward extension of the exostosis, a common occurrence, should be a favorable rather than an unfavorable condition of the operation. Cunean tenotomy is also defended on the grounds that it causes a deep seated inflammation, deeper than puncture firing, and thus hastens ankylosis. One of the first contentions held, was that tension against the tendon caused lameness, and that its division by removing the tension palliated the limp. This theory is probably ill-founded, as the tendon is never found in a state of tension. On the contrary, it is always imbedded in a deep, well carpeted groove. The exostosis builds up around the tendon but never presses it into a state of tension.

Cunean tenotomy performed at the very beginning of spavin lameness seldom ever affords the desired relief. It is probably as effectual as any of the other treatments, but as some times must always elapse between the beginning and the termination of every real spavin lameness, the operation, like all other treatments, is generally found to have given little or no benefit after the usual period of post-operative convalescence is over. Firing and blistering might then be recommended as a second resort, but the tenotomy being regarded as the radical treatment it is preferable that the former precede it.

Besides those serious, diffused, incurable spavins which encroach farther and farther over the articulation until the entire tarsus is implicated, almost all spavins will eventually recover in from three to six months of treatment. Treatment tending to hasten this cure must consist of keeping the seat of disease in a constant state of irritation. Cunean tenotomy maintains such a state for some weeks, and is therefore a defensible procedure.

EQUIPMENT.—No special equipment is required to perform the operation. The usual operating outfit containing the essential instruments,—scalpel, curved, probe-pointed bistoury, small curved scissors, tissue forcep, razor, clipper, hypodermic syringe, 4% solution of cocaine, antiseptics, needles and thread are the necessary instruments.

RESTRAINT.—Cunean tenotomy can be performed in both the standing and the recumbent positions. The former is ample restraint if the patient is not restive and if the seat of operation is well cocainized subcutaneously. The twitch for the nose, the side line to lift the opposite leg from the floor, and the liberal use of the cocaine solution along the line of incision, will effectually restrain the ordinary horse

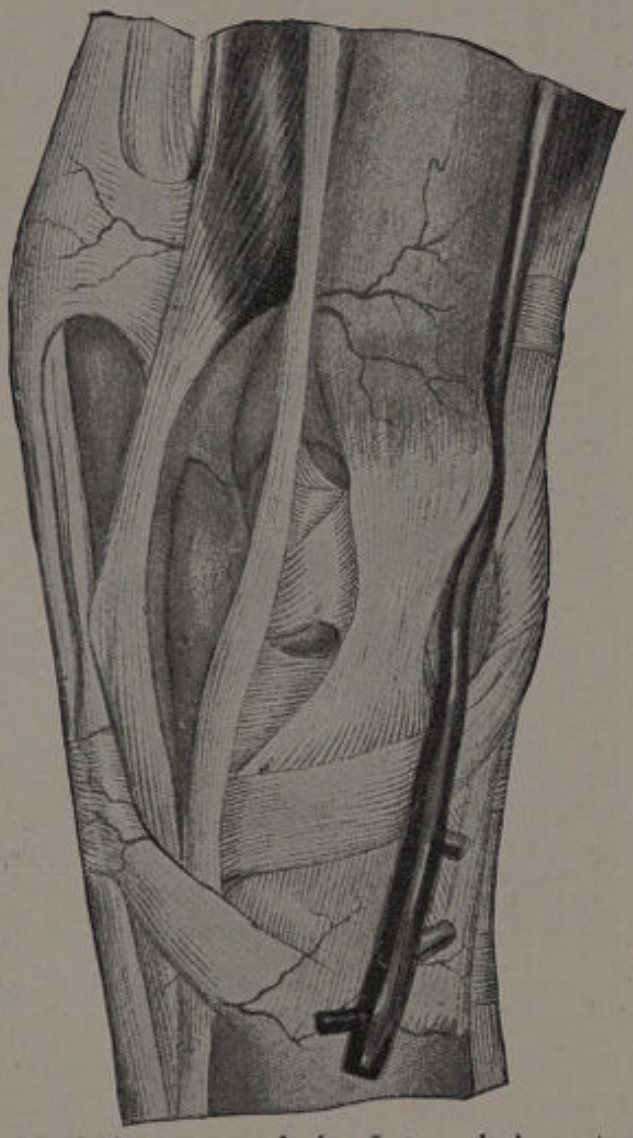
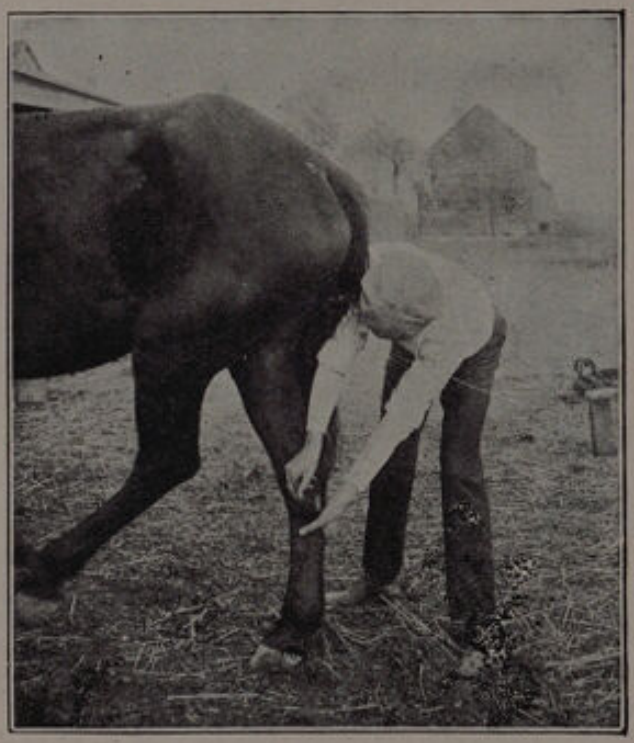


Fig. 127—Surgical Anatomy of the Internal Aspect of the Tarsus.

for cunean tenotomy. If for any reason the recumbent position is found necessary, the operating table will be found most suitable. It is much more difficult to secure and retain the legs in a convenient position when the patient is cast with the harness, and harness restraint is always more or less dangerous in spavined horses; if aged, fracture of the lumbar vertebræ is not an unlikely accident.

TECHNIQUE.—First Step.—Locating the Line of In-

cision.—The incision is along a vertical line at the very middle of the hock internally, and is about two inches long. The cunean tendon can not be felt on palpation. It is flat and hidden in a groove which is quite deep if the exostosis is a large one. It traverses the inner side of the hock in an oblique direction from above downward and backward from the astragalus to the cuneiform parvum. A line drawn from the anterior face of the astragalus to the head of the medial splint bone about follows its course. These two points are selected because of their prominence. A vertical incision in the middle of the medial surface of the hock crosses the tendon at the safest and most conspicuous place. Some



128—Restraint and Position of Operator in Cunean Tenotomy.

practitioners make a diagonal incision following the oblique course of the tendon, but besides giving no advantage it is much more difficult to heal than the vertical one.

The line of incision is determined by mental calculation; there are no land-marks to follow. The incision is two inches long, the lower end coming downward to the level of the large metatarsus. If the incision is kept in the middle of the hock no important structures will be encountered. Anteriorly the field is traversed by the saphenic vein, but this vessel is visible and easily avoided. If carried too high there is danger of entering the capsular ligament of the tibio-astragular articulation. (Fig. 129.) By keeping in the middle

of the hock and cutting two inches upward from the head of the large metatarsus, a free, bold, deep incision can be made with impunity.

Second Step.—Disinfecting and Anæsthetizing the Field.—Having previously applied the twitch and side-line, the whole inner surface of the hock is clipped, shaved and rinsed with mercuric chloride solution, after which a liberal amount of cocaine solution 4% is injected subcutaneously along the line of incision.

Third Step.—Making the Cutaneous Incision.—The operator stands parallel to the affected leg, facing its inward surface, leans over the hock and makes an upward incision through the skin at one deliberate stroke, beginning at the head of the large metatarsus and ending two inches higher.

Fig. 129—Location of Incision in Cunean Tenotomy. Dotted Lines Show Course of the Tendon.

The edges of the wound are separated to either side with the dissecting forceps and as the assistant bails out the blood the tarsus fascia is seen in the depths of the wound. Sometimes one or even two cutaneous vessels will bleed quite profusely. These are managed with the hæmostat. If they are allowed to bleed search for the tendon will be more difficult. (Fig. 128).

Fourth Step.—Searching for the Tendon.—When the skin is divided the tendon still remains covered by the tarsal fascia, a rather thick but somewhat indistinct structure which is now divided by a second upward stroke of the scalpel. This fascia is adherent to its subjacent structures and cannot be separated as easily as the skin. It is, however, advisable to push it apart in both directions so as to

expose the tendon better. The tendon is then searched for by palpation with a blunt instrument,—the closed tissue forcep or the handle of the scalpel. **The tendon will be found to move under the pressure of a blunt instrument,** and is thus accurately located and outlined. Its very edges can be thus found. All of the surrounding structures are immovable and are easily differentiated from the tendon itself.

Fifth Step.—Elevating and Resecting the Tendon.—The distal edge of the tendon is sought and slightly dissected free from its attachments, so as to give a point of entrance for the elevator. The best elevator is the curved scissors, which are now passed under the tendon from below upwards until they are safely lodged and held by the pressure. The probe-pointed bistoury is then passed under the tendon in front of the scissors. The scissors are lifted up so as to bring out as much tendon as possible as the bistoury divides it. This leaves the distal stump protruding from the incision, while the proximal stump sinks out of view by the contraction of the muscle. The distal stump is now grasped with the tissue forcep and as much of it as possible is resected with the scalpel.

Sixth Step.—Suturing the Incision.—The wound is closed with interrupted sutures, with the exception of a small orifice inferiorly for drainage. The edges are carefully approximated and all hæmorrhage has been arrested.

Seventh Step.—Applying a Protective Dressing.—It is important to guard the wound against infection by applying collodion over the sutured portion. A thick layer or two should be varnished over the entire field with the exception of the drainage orifice.

AFTER-CARE.—The subject is kept in the standing position for five or six days, largely for the purpose of keeping the wound intact and to prevent its contamination with the dirty floor or litter. On the sixth or seventh day the protective dressing and the stitches are removed. If the union of the edges is firm little additional treatment will be required, besides that of keeping the parts clean with weak antiseptic or astringent lotions. If the union is not perfect, as is often the case, the wound must be cleansed, matted with idoform and then recoated with collodion. If the wound becomes infected soon after the operation, a circumstance that should not be permitted to occur, the drainage orifice is widened by the application of a pledget of wadding, and the wound frequently irrigated with hydrogen peroxide. The stitches are not disturbed unless the infection is virulent

and threatening, in which case the whole wound is laid bare and treated as an open one.

At least six weeks of rest should be allowed after cunean tenotomy, if any benefit is to be derived. An immediate return to work after the cutaneous incision has healed will deprive the operation of whatever benefit might have been otherwise derived.

ACCIDENTS AND SEQUELÆ.—The only accidents liable to occur during the operation are **wounding of the vena saphena** by making the incision too far forward, or **wounding the capsular ligament** if made too high. These, however, could result only from gross carelessness.

The most serious sequel is **infective inflammation of the surroundings or abscess,** manifested by the appearance of swelling and acute lameness before the wound has healed. Ordinarily this complication is not dangerous, but may cause considerable anxiety for one or two weeks by threatening to implicate the articulation.

A second sequel is the **enlargement of the exostosis.** Cunean tenotomy enlarges the spavin but never decreases its size. It seems to transform the circumscribed exostosis into a wider one. The exostosis seems to grow upward into the space previously occupied by the excised tendon. For a long time after the operation, two, three or four months, the whole internal face of the hock is tumefied, seemingly with permanent new tissue, but this finally reduces until only the exostosis remains.

PATELLAR DESMOTOMY

SYNONYMS.—Patellar syndesmotomy; Operation for the cure of habitual luxation of the patella and other conditions.

DEFINITION.—Patellar desmotomy is the surgical division of the internal straight ligament.

HISTORY.—The operation is the artifice of Bassi, and is one that has only recently been introduced into this country. Although performed and somewhat freely discussed by continental veterinarians for some years, it has only been performed by few veterinarians in America. The difficulty of its technique and the apparent danger of injuring the synovials of the stifle seem thus far to have induced dissuasive arguments against it. The few cases reported in this country, although all were favorable, do not seem to have prompted American veterinarians to adopt it against the

warning of its dangerousness by such well known writers as Moller, and others, who emphasize the great liability of transgressing upon dangerous ground while attempting to locate and isolate the ligament whose outlines are none too well marked. In our experience no such complications have ever followed in the many operations performed during the past ten years, when the technique was carried out according to certain specified directions, and division was a very simple matter.

Bassi and others have recommended the operation for the cure of stringhalt, but up to the present time little is known of its real worth in this connection.

INDICATIONS.—Patellar desmotomy has, three indications, namely; **Habitual luxation of the patella of young animals, colt goneitis** and **stringhalt** of the mature horses. For the former it is a radical cure as well as a scientific operation.

Habitual luxation of the patella is a congenital weakness, a relaxation, of the mechanism holding the patella to the femoral trochlea. The ligaments, and the muscles are too lax to prevent the bone from slipping from its groove, and as the lateral wall of the groove (the lateral lip of the trochlea) is relatively small, the luxation is outward. In exaggerated cases the relaxation will let the bone slip freely across the whole trochlea. When the condition prevails until the patient grows to maturity the trochlea may be worn into a perfectly flat surface; as a trochlea it becomes obliterated. The disease is seen in **foals, calves,** and **pups,** especially in weak subjects. Its tendency is toward improvement as an improved diet, and medical treatment of the young and its mother, promotes the general strength. If the relaxation is pronounced the patella slips in and out at every step without preventing locomotion, but if a less degree of relaxation exists the patella slips over the lip of the trochlea and locks the motion of the stifle so effectually as to prevent extension of the leg. If bilateral, locomotion is impossible except when the patella is accidentally or manually restored to its proper position. Generally the luxation will promptly recur and thus perpetuate a pitiful state of decrepitude. The **operation is indicated only when the patella locks itself over the trochlea.** If the relaxation is so pronounced as to permit the bone to slip freely to any position without locking, the operation can do no good, because **its only service is that of preventing the patella from remaining in the state of luxation.** The cure of the relaxation will depend upon gain in

general strength as well as local strength of the relaxed structures.

Certain treatments, local and general, should precede the operation in hope of curing the defect by easier means. It is only when the condition persists that the operation should be performed, but it should never be delayed until the slipping of the patella over the edges of the trochlea has deformed it.

Chronic goneitis or hydroarthrosis of the stifle of colts we have found after many trials to be very materially improved by this operation if performed before too much permanent damage has been done to the articulation. Colts as old as two years old, badly crippled and apparently worthless have been turned into useful subjects and the younger ones with no other manifestation than bulging of the joint capsule have been made perfectly sound. So splendid have been the results that every veterinarian who has tried it has adopted it as a routine treatment of this otherwise incurable affliction.

EQUIPMENT.—The operation will demand the following equipment: Scalpel, tissue forceps, artery forceps, two wound retractors, curved probe pointed bistoury, needles and silk thread for three to five stitches, needle holder, razor, soap and water, mercuric chloride solution 1-500, mercuric chloride 1-2000 in sterilized water, cocaine solution 4%.

RESTRAINT.—The operation is performed in the lateral recumbent position with the affected leg undermost, and under local anæsthesia.

The operating table, or any ordinary casting harness or ropes will answer. On the operating table the uppermost leg is hoisted ceilingward, at the same time rolling the patient slightly toward the dorsal posture, and the affected leg is fixed to the table after being drawn slightly backward and well flexed at the stifle. A certain definite position markedly facilitates the operation. It is obtained by bringing the femur as far backward as possible and then folding (flexing) the tibia upon it. This brings the field some distance from the body. If the stifle is left to hug the abdomen the work is hindered. In the casting ropes or harness the uppermost leg is well flexed upon the pelvis and spread outward as if to expose the inguinal region. The patient is rolled toward the dorsal posture and the affected leg is drawn to the proper position with a rope fastened to the lower third of the tibia and pulled backward by an assistant. General anæsthesia is preferable with rope restraint.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The ligament is located in the field representing the medial aspect of the flexed stifle. It is easily felt by firm pressure with the finger, extending from the patella, in an oblique direction, toward the supero-internal part of the tibia. The middle straight ligament is found extending vertically from the middle of the patella to the tibial crest. It stands out prominently, much more so than the medial. By palpating inwardly from the middle straight a V-shaped depression dividing it from the medial straight easily determines the anterior edge of the latter, which exists in the form of a firm flat body about one inch in width in the mature normal horse, proportionately smaller in the colt, and

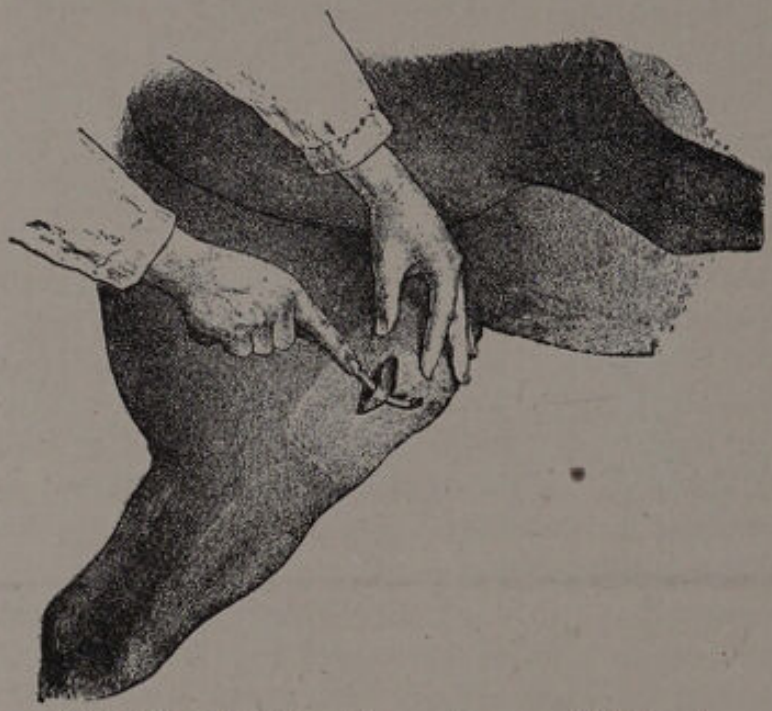


Fig. 130—Patellar Desmotomy. (Moller.)

more or less rounded in a patient affected with habitual luxation. The direction of the ligament varies somewhat with the position of the stifle. Flexion increases its obliquity; extension straightens it. It is essential in this step to determine its outlines by cautious palpation, so that the line of incision can be made directly along its long axis and as near as possible to the middle of its breadth.

Second Step.—Making the Cutaneous Incision.—Having determined the exact location of the ligament, an incision is made through the skin from the superior part of its middle third downward to and slightly beyond its insertion to the tibia, in all about two and a half inches long. Although the

region is not very vascular, the cutaneous incision gives a little hæmorrhage that must first be controlled perfectly before proceeding, in order that the subsequent dissection is not hindered by making blood.

Third Step.—Searching for the Lateral Edges of the Ligament.—The wound is widened with the retractors, and as soon as the bleeding no longer hinders, the edges of the ligament near its tibial insertion are searched out by cautiously dissecting the areolar tissue and fascia. The fascia is thick and closely blended with the ligament itself; in fact they are inseparable. It is impossible to lift the fascia from the ligament so as to expose it. They must be managed as a single structure. The edges are sought directly through the fascia, where by palpation it is found to be thin and devoid of the thick underlying fibrous tissue—(the ligament itself). The search for these two lateral edges is limited to the distal part of the wound, where a thick pad of adipose tissue interposed between the ligament and the capsular ligament acts as a perfect protection against wounding the latter. Higher up the capsular ligament is so closely related to the ligament as to render their separation quite hazardous.

Fourth Step.—Dividing the Ligament.—When the edges have been thus exposed the blunt elevator is passed flatwise under the ligament from before backward, keeping its point against the ligament rather than plunging it inward. If the cut ends do not at once separate at least a quarter of an inch when cut off it is evident that some of the fibers have not been divided and will require subsequent attention. These few fibers are divided after carefully passing the elevator under them.

When the capsule is bulged out the ligament is imbedded, creasing the sac from one end to the other, until every fiber is cut, then it becomes evenly rounded.

Fifth Step.—Closing the Wound.—The wound is closed with three to five interrupted sutures so adjusted as to assure perfect apposition of the wound from end to end. Drainage is not indicated except when found necessary to deal with a septic state a few days later. The sutures are closed with an impervious dressing of collodion. If there is any blood flowing or oozing from the incision the dressing is postponed until the standing position is regained and all of the flow has ceased.

AFTER-CARE.—The wound is given the usual treatment for wounds requiring no drainage, i. e., renewal or repair of the dressing as required and the removal of the

sutures at the end of six or seven days. Except in the case of a suckling it is advisable to keep the patient standing until the sutures have been removed in order to preserve the apposition of the edges of the wound.

When there is evidence of infection on the second, third or fourth day the lower stitch is removed to facilitate the escape of the wound secretions. In addition to the removal of the stitch the wound at that point may be carefully widened with a blunt instrument and submitted to a daily injection of a limited amount of hydrogen peroxide, more for the purpose of preserving the orifice than to disinfect the whole area. Forcible irrigations are contraindicated.

The cure is instantaneous in the case of luxation. Patients which have never been able to walk before are now able to move freely about unincumbered. It is, however, advisable to first heal the wound before any exercise is allowed, except in the case of a suckling, in which such control is impossible. In the case of hydroarthrosis of the stifle the improvement is gradual.

ACCIDENTS AND SEQUELÆ.—During the operation there is always danger of wounding the capsular ligament, but this danger has been greatly exaggerated. If the division is made at the distal end of the ligament as above recommended, the danger of this accident is practically nil. When the accident does occur its gravity cannot be overestimated. It may prove fatal. Although the wound may, at the time of the operation, be perfectly aseptic, the subsequent flow of synovia into it will surely cause trouble.

Septic arthritis may ensue even in the absence of the above accident by the spread of an infective inflammation from the surgical wound into the articulation. This accident does not occur after clean operations.

CAUDAL MYOTOMY

SYNONYMS.—Pricking; nicking.

DEFINITION.—Caudal myotomy is a subcutaneous division of one or more of the coccygeal group of muscles for the purpose of correcting defects in the carriage of the tail.

INDICATIONS.—The principal indication for caudal myotomy is habitual deflection of the tail of the horse. While driving, or when trotted to the halter, the tail is deflected to one side of the vertebral axis. The defect is regarded as a serious deformity by fanciers of good horses, either saddle

horses or harness horses, and its amelioration is always anxiously sought.

Where docking is extensively practiced among coach horses, caudal myotomy finds its principal indication in "setting up" the tails before amputation, and for this purpose the operation was chiefly known as "nicking" or "pricking." Its object is that of producing a higher carriage of the amputated stump. By dividing the depressor muscles and then preventing them from reuniting, the elevators, with their antagonist out of commission, are free to raise the tail to a higher level. Today, however, this use of caudal myotomy is as unlawful as docking itself, although it can be employed lawfully if intended solely to improve the carriage of the entire tail. Every horse of quality must carry a "good" tail to be favorably pledged and as an otherwise splendid individual may hug the tail into the perineum ar let it flop listlessly about, the operation is justifiable, corrective surgery.

RESTRAINT.—The operation is best performed in the standing position with the aid of the twitch to the nose, and the side-line to elevate one hind leg. Stocks are also very useful. Cocainization of the seat of operation is sometimes practiced, but it does not help matters much on account of the impracticability of depositing the solution into every part of the substance of the muscle where the section is to be made. While a more or less effectual anæsthesia can be produced by injecting the solution subcutaneously at different points around the depressor muscle of each side, into the space between the muscle and bone, and then directly into the substance of the muscle, the process of administration is difficult, and the numerous needle pricks necessary to complete it cause as much pain as the operation itself.

The extremely restive horse may be secured on the table or with harness, but this emergency is seldom required.

ANTISEPSIS.—Caudal myotomy is an extremely dangerous procedure if performed without adequate antiseptic precautions, especially in regards to the tenetome, which should be made absolutely aseptic. Caudal myotomies performed with an aseptic tenetome (pricking knife) heal up without visible reaction, but if done with an unclean knife, inflammation, abscess, septicæmia malignant œdema and sometimes sloughing off of the tail, may supervene. In short, the disinfection preparatory to the operation must be thorough, absolute, perfect.

To this end, the first step is to submit the tenetome to a boiling of no less than ten minutes, or in lieu of this, to an

immersion in pure phenol for no less than twenty minutes. The seat of operation is washed with mercuric chloride 1-500, after the inferior surface of the tail, the surrounding portion of the buttocks and the pudendum have been cleansed with soap and water. Braiding the tail hairs, while not absolutely necessary, is helpful.

Special attention to the hands is not necessary because they do not contact the wound.

If the sterilized tenetome, after having been used upon one side of the tail, becomes soiled, the procedure should be delayed for a few minutes, pending its re-disinfection. As regards the bandage, it will be sufficient to immerse it in the mercuric chloride solution from the time the preparatory step begins until needed at the end of the operation.

INSTRUMENTS, ETC.—The **pricking knife,** which is nothing more than an ordinary narrow bladed tenetome, is the only instrument required. This and a muslin bandage three yards long completes the equipment, unless it is intended to "pulley the tail;" then a sash cord about twenty feet long, two small pulleys and two six-pound weights must

Fig. 131—Myotomy (Pricking) Knife.

be provided and arranged on the stall beforehand, ready to receive the patient as soon as the operation is over.

If the operation is performed for lateral incurvation, then a short piece of cord and a girth will be needed to tie the tail to the opposite side.

TECHNIQUE FOR BILATERAL CAUDAL MYOTOMY.—First Step.—Surgical Position.—The horse having been properly restrained as above recommended, the tail disinfected and the sterilized tenetome placed within reach upon a tray held by an assistant, the first step is to take a good hold of the tail about twelve inches from the root and push it firmly over the back with the left hand, in which position is should be held until the whole operation is complete. An assistant standing opposite the stifle can lend useful help in maintaining this position by pulling forward upon the tail hairs.

Second Step.—Myotomy.—The division of the depressor muscles is made subcutaneously; the only external wound is the small entrance point for the knife. The same wound will answer to divide both sides. The location to select in order to obtain the best results should be no more than one inch

from the root of the tail and in the median line. The tenetome is passed through the skin, immediately deflected to one side to avoid puncturing the middle coccygeal artery, then passed obliquely upward between the bone and the muscle until its point reaches the level of its uppermost part. The section is effected by turning the edge of the tenetome outward and then pressing the muscle against it with the thumb as the knife blade is made to execute a circular sweep corresponding to the contour of the tail. As the most painful part of the procedure is that produced by cutting off the muscle, opposition must be prevented as soon as the cutting begins, by pushing the head upward and giving the twitch

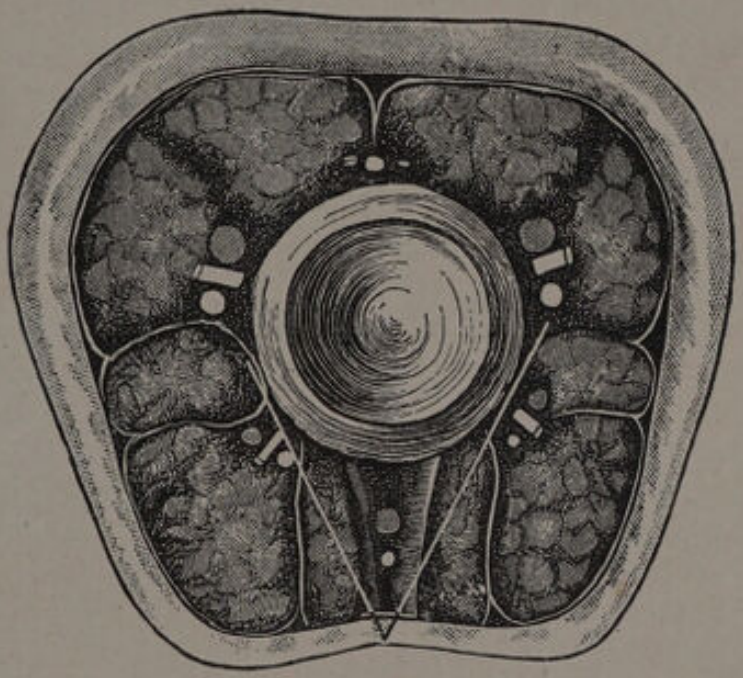


Fig. 132—Section of the Tail Showing Muscles. Straight White Lines Show Direction of Knife.

an extra turn. If the patient takes a step or two forward it is important to follow the movement without releasing the hold on the tail and to continue the cutting as if no molestation had occurred. Otherwise, if the tail is suddenly released and the tenetome not as suddenly withdrawn there is always danger of breaking its slender blade within the substance of the muscle. If the edge is keen-cutting and the tail pushed taut over the back the muscle snaps off almost instantly with little opposition, while on the other hand if the cutting is delayed by a dull knife or a relaxed state of the muscle, the duration of the pain will cause annoying opposition that may necessitate withdrawal of the tenetome several times before all of the muscle is finally divided.

The opposite side is managed in the same manner through the same perforation and releasing the tail from its position over the back.

Third Step.—Hæmostasis.—The bleeding, unless its arrest is immediately provided for, is always copious. The operation can, however, be made perfectly bloodless by keeping the tail stretched over the back (in which position the wound will not bleed) until the bandage is applied, and in the interest of neat surgery this should always be the aim, in distinction to allowing blood to gush out over the buttocks and hind extremities while preparation is being made to apply the hæmostatic bandage. The safebandaging of the tail at this point, where its diminishing diameter favors slipping, is effected by twisting the end of the bandage into a loose cord and passing it around the tail once or twice at the seat of section, where it will imbed itself between the divided ends of the muscles and thus effectually lock itself against slipping downwards. The bandage is wrapped tight but is removed two hours afterward on account of the danger of inflicting injury.

When it has been decided to "pulley" the tail the bandage is superfluous, as the stretching of the tail upwards will control the bleeding sufficiently, if not absolutely. If after the tail has been thus elevated the bleeding seems rather copious or persistent, the addition of more weight to the pulley-cords for an hour or two will generally control the situation satisfactorily. When the cutaneous incision has been accidentally made rather large and thus operates to favor bleeding, the edges may be closed with a short pin held in place with a thread, figure eight fashion.

AFTER-CARE.—The after-care of the patient is of capital importance, in that the success of the operation depends entirely upon preventing reunion of the divided muscles. The continuity must be permanently destroyed to assure permanent results. If no provision is made to prevent reunion a cicatrix is promptly interposed between the cut ends and the function of the muscle is soon fully restored. To prevent reunion the following methods are recommended:

1. Daily, beginning the day following the operation, the tail is carefully but firmly pushed over the back and the thumb is pressed forcibly into the space between the cut ends, forcing the contents of the cavity out through the small cutaneous wound. Thus on the first day the cavity is rid of its coagulum which would have aided in the construction of the connective union, and during the subsequent

twelve days the repeated pressing out of the secretions and forcing apart the cut ends with the thumbs soon leaves them hopelessly separated—active regenerative efforts having ceased. Among the various measures to prevent reunion of caudal myotomies none is as humane nor as universally effectual as this simple manipulation. At first, on account of recollections of the operation on the previous day, the patient may rebel slightly, but if done as gently as the necessary thoroughness warrants, there will be little opposition after the first two or three days.

2. **"Pulleying,"** as it has been done in past, is barbarous, and its discontinuance is a credit to the modern practitioner. But as there are situations in which good results cannot be otherwise obtained, the method may sometimes be excused. This method of preventing reunion of the divided muscles requires pulleys, rope and weights. The pulleys are fastened to the ceiling on each side of the stall opposite the stall pillars and on a plane with the hocks when standing in a comfortable position to feed from the manger. The rope is passed through each pulley so that each end hangs down to receive the weights and the center is pulled downward and looped to the tail hairs. About six pounds is attached to each side. Immediately after the operation, to arrest the bleeding; ten to twelve pounds may be hung at each end for several hours.

The practice of keeping horses' tails thus weighted for two to three weeks, day and night, is no longer practiced in America, on account of the cruelty, and because it has been found sufficient to weight them ten to twelve hours during each twenty-four for a period of about ten days.

Care must be taken to place the pulleys so that the tail will not be pulled too perpendicularly or forward over the back, as in these positions the circulation may be so hindered as to cause gangrene; and again, excessive weight must be avoided in certain patients having weak tails, or in patients that abandon themselves to the weights without offering any resistance to them.

3. **Cruppers.**—For horses already docked, a crupper of special design is used to hold the tail stump upward. The crupper has a trough-like extension to receive the tail and a back strap that passes forward to a girth. Such appliances are worn continuously, day and night, for a period of ten days; they are removed only when deemed necessary to inspect the condition of the wound.

4. **Tying the tail over the back to the girth,** is a cruel relic of bygone days.

UNILATERAL CAUDAL MYOTOMY FOR LATERAL INCURVATION. — Technique. — The depressor muscle on the side toward which the tail is deflected is divided as in the bilateral operation. It is important here to pass the tenetome far enough upward to include every shred of the muscle, otherwise permanent results will not be obtained. The elevator muscle on the same side is then divided by passing the tenetome beneath it from the **median line of the superior surface,** or from the middle of the lateral surface. To assure against immediate reunion the tail is then tied around to the opposite side for a period of ten to fourteen days.

The secrets of successful intervention are to divide every particle of the muscles, and to operate as near to the root of the tail as possible.

Note.—The incurvation is sometimes located some distance from the root of the tail, and not infrequently it transcribes a double curve the shape of an S. Such curves are more difficulty to correct, and may require two or three operations before a straight carriage is obtained. The first operation should always be performed at the root of the tail, and after the healing process is complete, the location of subsequent sections of the muscles is decided upon by the location of the remaining incurvation. Sometimes the section is made eight, twelve, fifteen or even eighteen inches from the root, and in the case of double incurvation it may be found necessary to operate also upon the opposite side, after the first one has healed.

SEQUELÆ AND ACCIDENTS.—(1) **Hæmorrhage.**—Caudal myotomy sacrifices the lateral coccygeal arteries, which yield a copious bleeding if not controlled. When the cutaneous puncture has been accidentally made too large to hold the coagulum, stretching the tail in the pulleys may not immediately arrest the flow, and if the addition of more weight to the ropes proves unsuccessful, a temporary bandage may be required, but in no case must the bandage be left on more than two or three hours.

(2) **Secondary hæmorrhage** is the most common sequel of the operation. It occurs after the bandage has been removed, and as it must be reapplied, strangulation of the circulation terminating in gangrene, multiple abscesses, diffuse alopecia, or even death, may ensue. The proper man-

agement of secondary hæmorrhage consists of suturing the puncture with a pin held in place with a figure eight suture. The reapplication of a bandage should be avoided; it is a dangerous practice. Suturing is by far the safest practice, although sometimes the blood may find its way into the peri-rectal space, and if infection ensues as a subsequent complication serious results may follow. It is when the middle coccygeal artery has been accidentally severed that this sequel is most likely to occur.

. (3 **Gangrene of the tail** ensues when there has been a too radical interference with the caudal circulation, either from having cut too many of its nutrient arteries, from prolonged bandage compression, or from the improper use of the pulleys and weights, and especially when these faults are added to unclean methods of operating or unclean after-care. Microbes find a mighty favorable field in the partially strangulated tail, or before collateral circulation has been sufficiently established. The prevention consists of (1) avoiding the severing of the middle coccygeal artery, (2) avoiding the use of too heavy weights, (3) placing the weights so as to pull backward rather than forward, (4) removing the bandage in two to three hours and then never re-applying it to control secondary hæmorrhage, and (5) operating under strict aseptic conditions.

The treatment of threatened gangrene consists of free evacuation of accumulated secretions and the application of hot antiseptic baths. When well established, amputation of the dead portion should not be delayed.

(3) **Wound Infection.**—The infection of the wound of caudal myotomy varies in seriousness from a trivial infective inflammation ending in harmless suppuration, to grave and even fatal **septicæmia.** The blood clot within the wound may also extend into the peri-rectal space, and if it becomes the seat of an active microbian growth, especially when the integrity of the caudal circulation has been seriously impaired, threatening local and general symptoms may follow. Fatal septicæmia, **tetanus,** and **malignant œdema** have been occasionally noticed as sequelæ of caudal myotomies. The **prevention** is found in the use of a perfectly sterilized tenetome and thorough cleansing of the seat of puncture. With these precautions fully respected the wound will heal without perceptible reaction, even when other errors in management are made. When infection is noticed the **treatment** must begin at once. The wound is opened, and pus squeezed out and

hydrogen peroxide in small quantities is injected several times daily until all danger of serious consequences has passed, and as long as the morbid process is threatening all violent attempts to prevent reunion must be abandoned.

(4) **Paralysis of the tail,** although a rare result, has been observed once by the author, following prolonged pulleying with heavy weights. The paralysis, at first complete, gradually improved to complete recovery in four months.

CHAPTER IV

CASTRATION AND SPAYING

CASTRATION

SYNONYMS.—Emasculation gelding; caponizing (in cocks).

DEFINITION.—Castration is the ablation of the testicles.

INDICATIONS.—The operation is practiced extensively, in fact almost universally, on domestic animals; only the highest types of individuals intended for breeding purposes, escape the operation.

Castration of young animals, before they have arrived at puberty, by intercepting the development of the sexual nisus, creates an individuality that combines the effeminate excellency of the female temperament to the strength, vigor and endurance of the male physique. By nullifying the baser passions it invites the evolution of the finer instincts, and although the highest mental development is somewhat forestalled, the docility, tractability and general good behavior gained thereby more than compensate for the trivial loss in a function (the mental) that is of so little importance compared with the improvement. The slight stunting of the mental faculties is in fact more desirable than objectionable.

In the mature and the aged animal, castration produces almost immediate impotence, but the impelling impulses for sexual intercourse are retained for a long while, waning gradually during the succeeding months. In individuals that have never been used for breeding purposes and which have never developed strong impulses by cohabitation with the opposite sex, the sexual desires fade more rapidly than in studs.

While one of the chief objects of animal castration is the improvement of breeds by preventing procreation from undesirable individuals, there are special reasons found for the operation in the different species, each differing from the other. In the equine species, the tractability is decidedly improved; cohabitation of the sexes is rendered safe; and the body escapes the exaggerated development of certain re-

gions which distinguishes the fineness of the gelding from the characteristic coarseness of the stallion. In the **ruminating, meat-producing species** the operation is performed not only to forestall the sexual impulse that renders unprofitable the cohabitation of males and females, but especially to improve the excellency of their meat products; and by facilitating fattening it yields a handsome salvage in the cost of feeding for the market. In the **porcine species** the additional object is chiefly to prevent the harmful molestation and wholesale impregnation of the young sows. In the **canine and feline species,** the principal reason for castration is to forestall the inclination to roam about in search of consenting females, which habit, besides exposing them to serious contagions, renders them undesirable for household companions. The castrated pet grows large and fat, caressant, docile and obedient, and although somewhat more indolent, it is never involved in obscene manœuvers.

In cocks caponizing is practiced solely to increase the profits of the chicken industry. The caponized rooster grows fat and large, and yields meat of exceptional excellence that is salable at a much higher price than that of the entire cock. But on account of the small economic importance of each individual operation, the caponizing of cocks is destined to be practiced more extensively by the fancier than by the veterinary practitioner.

The testicles must sometimes be sacrificed on account of disease. **Tumors and hernias** are the commonest diseases of this category. A tumor of the scrotum whose ablation would expose the testicle is best managed by removing the latter instead of attempting the futile step of reconstructing the scrotum over it, and when tumors or any other serious pathologic process (tuberculosis, glanders, etc.) attacks the testicles themselves their sacrifice is always advisable, as it is never profitable to conserve diseased testicles in animals. In the surgical treatment of **bubonoceles** and **oscheoceles,** castration is generally one of the steps of technique, as the radical kelotomies with conservation of the testicles can not be successfully done in large animals.

In **orchitis** of aged animals with prevailing impotence castration may often be performed to the benefit of the general health, and in **habitual onanism,** so rampant amongst race horses, where the vitality is threatened or has waned under the influence of frequent ejaculations, the operation is often required to retain or to restore a vigorous constitution.

INSTRUMENTS, ETC.—The complete outfit required to perform the operation and to meet every untoward exigency should include.

1. A special castrating scalpel.
2. An emasculator.
3. An ecraseur.
4. A pair of wooden clamps.
5. Strong braided silk.
6. Needle.
7. Antiseptics.

The castrating scalpel (Fig. 133) has a markedly convex blade to facilitate cutting through the scrotal integuments

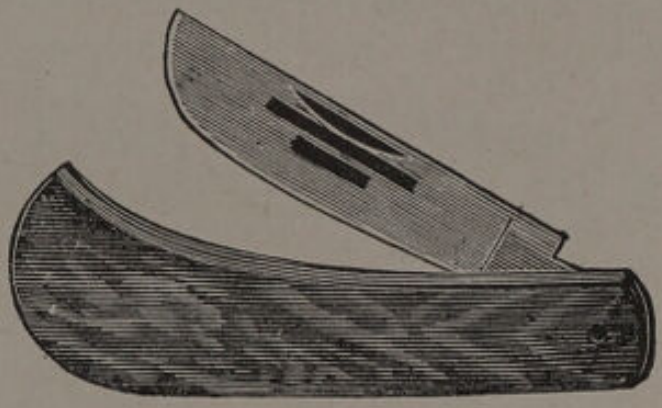


Fig. 133

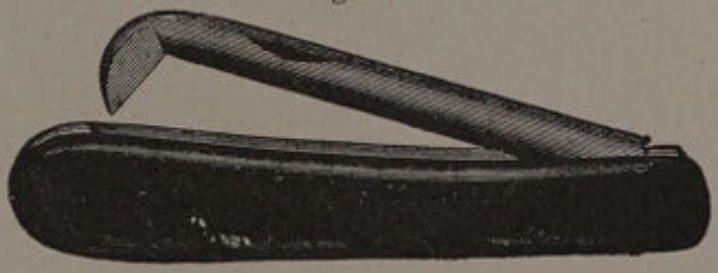


Fig. 134

Figs. 133 and 134—Castrating Knives.

at one deliberate stroke. The **emasculator** (Fig. 27) is the best instrument to divide the cord. It not only crushes and cuts off the spermatic cord at one pang but also satisfactorily manages the bleeding. It, however, has the fault of severing the tunica vaginalis of full growns with difficulty. When ablated below the attachment of the tunica vaginalis the emasculator cuts the cord off well enough but, when a higher level is selected it sometimes cuts off with considerable difficulty. An emasculator that easily cuts off the cord above the tunic is too sharp to effectually prevent hæmorrhage, and one that will always prevent hæmorrhage is too blunt to

cut through this tough fibrous membrane except by the employment of more than the ordinary strength of one or even both hands.

The **ecraseur** is much the best instrument for the castration of horses, bulls, bucks and goats, especially where it is desired to effect the division of the cord high up in the inguinal canal. It is much less convenient and inflicts a more lasting pain than the emasculator, because more time is required to crush through the spermatic cord. For standing castration it is much too slow however; the subject often becomes uncontrollable before the ordeal is over.

The **wooden clamps**, once a standard and very popular method of managing the hæmorrhage, are now used only in

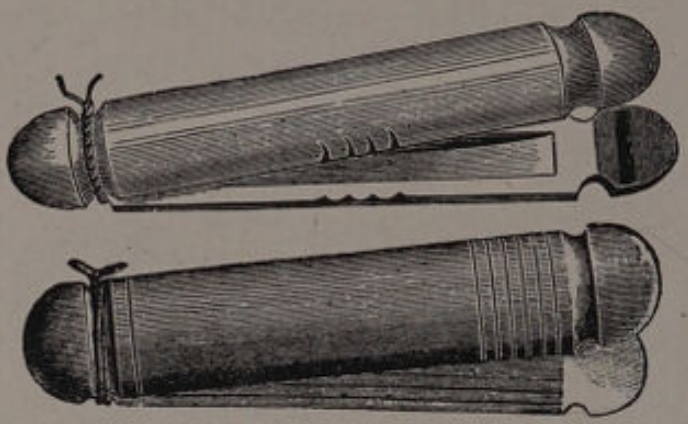


Fig. 135—Wooden Clamp for Castration and for the Clamping of Hernias.

emergencies. The ecraseur chain may break unexpectedly, the emasculator may be inadequate on account of an unexpected anomaly, or a hernia not previously noticed may present itself at a critical moment. The clamps are included in the equipment to meet such emergencies, if not also sometimes to satisfy a caprice against the more modern instruments. The **braided silk** is sometimes required to control hæmorrhage from the spermatic artery and occasionally to perform an operation against hernia. (See Van Law's operation.)

RESTRAINT.—Any of the domestic animals can be castrated in the **standing position.** In the **horse,** however, the **recumbent position** is generally desirable on account of the danger of personal injury, or because the testicles may be too high up in the scrotum to be drawn down. The standing position may be selected in **well-broken adults** and in tractable **two or three-year-olds** which do not object to manipulations of the scrotum. A colt or adult that will tolerate scrotal manipulations is generally a safe subject for

standing castration, but the ticklish animal, whether colt or adult, is seldom ever a good subject for this method of restraint. Mules, bronchos, vicious horses, unbroken colts and horses, yearlings and ponies should be cast; the standing restraint is reserved more for the full-grown, well-broken and fairly tractable horse.

Standing Position.—Standing castrations are performed with no other restraint than the twitch, but a single side-line to lift a hind leg should be available in case the horse unexpectedly becomes unmanageable before the operation is over, or in case some unusual abnormality (hernia, adhesions, etc.) is encountered. The twitch is always previously inspected as to the strength and security of its cord; a good grip is taken on the nose; and the holding is entrusted only

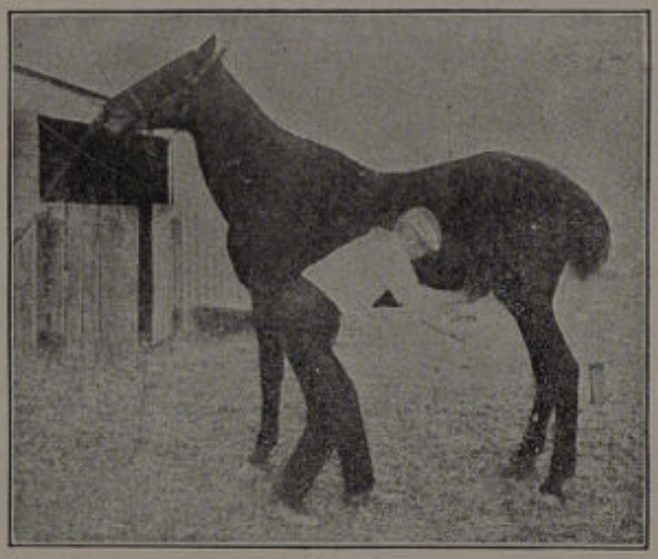


Fig. 136—Restraint and Position of Operator in Standing Castration.

to a fearless, unflinching attendant who is instructed to push the head upward as the operation begins. The operating place should be an open space, preferably a grass plot where a sudden fall would be harmless to the patient, and to the operator. In a box stall, a small room, or corner of a paddock or corral the castrator is in danger of being trapped by a plunging or falling patient, and while such manœuvers are exceptional they are too consequential when they do occur to be ignored.

Recumbent Position.—The best apparatus for securing horses in the recumbent position for castration is the common side-lines, in anyone of its variations. Although castration is a relatively brief operation, performable by almost any kind of restraint, every interest is best served by insist-

ing upon a perfect, methodical and standard restraint in which the hind legs are well flexed upon the pelvis by ropes which protect the spine against injury and at the same time spread the legs apart so as to give free access to the inguinal region.

Operating tables, unless the subject is anæsthetized have nothing to recommend them above the ropes, because parting of the hind legs by lifting the uppermost one toward the ceiling is unsafe to both the patient and the operator. When-

Fig. 137—Correct Mode of Securing Horse for Castration in Recumbent Position.

ever horses are castrated upon the operating table chloroform anæsthesia should be included in the restraint.

TECHNIQUE OF STANDING CASTRATION—First Step.—Disinfection of the Field.—Good cleansing of the scrotum must not be omitted. In order to facilitate matters in this connection a stronger antiseptic solution is used and the washing is restricted to the outlines of the dependent parts of the scrotum. Mercuric chloride, 1-200, briskly rubbed into the stretched skin with pledgets of cotton which are cast off as they are soiled is the most effectual rapid disinfection. Washing of the whole region with soap and water previous to the application of the antiseptic solution is advisable only in exceptionally tractable horses accus-

tomed to such baths, in which there is no danger of causing a suspicion that something unusual is about to occur. In short, disinfection, important as it is, must not materially delay the proceedings nor excite rebellion at the very beginning.

Second Step.—Position of the Operator.—The surgeon stands on the near side, a safe distance in front of the stifle, at extreme arm's length from the scrotum, and far enough outward to avoid touching the horse's body with the shoulder, arm, elbow or forearm. No part of the surgeon's body should touch the horse except the hand, and that should touch only the scrotum. If any part of the operator's body presses against the horse's abdomen or flank as the operation proceeds, it will tend animal to lean over and even fall suddenly when the pain is inflicted. This particular position must be adopted as an absolute law, not only to prevent the tendency to lean over and to fall, but also to escape personal injury from a kick. The kick of a horse at a castrator attempting to operate in the standing position is a forward one, deflected outward about six inches from a straight line connecting the patella to the olecranon. A position six inches from this line may therefore be considered a reasonably safe one.

Third Step.—Pulling Down the Testicle.—The testicles are not always hanging pendulant; on the contrary they are generally drawn upward by the full force of the cremaster muscles. In young animals with short cords they may even be hidden in the inguinal canal. To bring them down at arms length is often difficult and tedious. In an exceptionally tractable subject the rule to not touch the body may be disregarded and one hand passed between the legs from behind and the other from in front, both of them meeting at the scrotum. With the two hands engaging on the scrotum the testicle is easily surrounded above and brought into position. When the two hands can not thus be utilized on account of intractability of the subject it is preferable to wait a few seconds until the incessant pain of the twitch causes the cremasters to relax and drop the testicles into the scrotum, at which moment by gently passing the hand around the cord of the nearest and gathering up the scrotum tightly in the grip, it can be firmly held for the incision. It is, however, essential to inspect the skin covering the testicle to locate the median raphe so that the incision may be made parallel to it, and sometimes to accomplish this object the position of the hand must be changed.

Fourth Step.—The Oscheotomy.—The incision of the scrotum is made at one bold backward slash, a veritable blow that may even bisect the testicle as well as neatly divide all of its enveloping integuments. The incision must never be slowly made nor be so incomplete as to fail to drop the testicle. At the moment the knife strikes the scrotum the assistant, previously instructed gives the twitch an extra turn to divert the horse's attention from the pain of the incision.

Fifth Step.—The Ablation.—The knife is now set aside and the emasculator taken up leisurely to allow the testicle to drop some little distance out of the incision. Generally the testicle is drawn upward for some moments after the incision is made, but as the cremaster relaxes it comes down into position for ablation in a few moments. A few extra turns of the twitch will usually hurry matters somewhat. The forefinger of the left hand is then passed very gently around the exposed cord as high up as possible and the jaws of the emasculator adjusted between it and the testicle. After taking especial pains to note that the point of the emasculator is not engaging any of the integuments, the handles are taken in one or both hands and given a quick, deliberate squeeze that will safely effect a perfect division without delay. If the emasculator fails to divide the cord in this one squeeze, or if the pinching is prolonged, any kind of rebellious act from the subject may be expected. Leaning over into a position that prevents further handling of the instrument, falling down, kicking with one or both legs, or lunging desperately forward are among the unfortunate manœuvers to be expected when there is any delay. On this account it is of capital importance to avoid hooking the skin or any part of the tunica vaginalis with the emasculator.

The ecraseur, on account of its slowness, is, therefore, seldom as satisfactory, and the clamps, although successfully employed by some, are objectionable for the same reason in standing castrations.

The near testicle is selected first, contrary to the custom of many experienced veterinarians, because in our hands this plan has yielded fewer narrow escapes from personal injury. Horses are more likely to kick while the second testicle is being removed than the first, because they are now on their guard expecting a repetition of what has just occurred, and as they usually kick with the leg on the side injured, the danger is very materially lessened.

Sixth Step.—Repetition of the Same Steps on the Opposite Side.—In removing the opposite testicle the operator

continues to occupy the near side of the horse; to take advantage of a much safer position and because a right-handed man would be at a disadvantage on the off side. The removal of the farthest testicle is much the safest as well as the easiest. There is no danger from kicks and the hand is in a much better position to grasp the testicle. Further, there is no difference to relate.

SPECIAL HINTS.—1. Select the subjects with due regard to age and tractability. 2. Make a special examination of the region for abnormalities, hernia, adhesions, etc. 3. Disinfect the scrotum, hands and instruments in exceptionally strong antiseptics. 4. Make a bold, deliberate incision and instruct holder of the twitch to give it a good turn as the knife strikes. 5. Adjust the emasculator carefully and use enough pressure to cut off the cord promptly. 6. Operate upon the near-side testicle first, because the second incision may cause a kick; it is preferable that the kick should occur on the opposite side.

TECHNIQUE OF RECUMBENT CASTRATION.—First Step.—Disinfection of the Field.—The cleansing of the field of operation should be limited to the scrotum itself, but here it should be done well. The rugæ of the scrotal skin should be stretched out and submitted to a good, brisk friction with a strong solution of mercuric chloride no weaker than 1-500 and then painted with tincture of iodine. In view of the small field thus disinfected, even a stronger solution may be employed to advantage. It is not advisable to attempt to cleanse the whole inguinal region, because of the impossibility of cleaning and disinfecting it well in a short time, and if only washed, the supposed cleansing process is more apt to "dig up" and distribute infection than to destroy it. The internal surface of the sheath, which is always filthy, should likewise not be disturbed by a washing process that would distribute rather than adequately destroy filth. It is much better to limit the cleansing to the scrotum itself and then simply sponge or sprinkle the legs, thighs and buttocks with a little water to prevent loosened hairs and other flying particles from falling into the wound.

Second Step.—Oscheotomy.—The undermost testicle is gathered up with the left hand so that the skin is stretched tightly over it, and then the incision made four inches long through all of the scrotal integuments. The cutting should be done quickly, and yet deliberately enough to assure a uniform depth along the whole length of the incision. It is not sufficient that the skin should be incised four inches

and the tunica vaginalis only two inches. The incision must be a through-and-through one, four inches long and parallel to the raphe. When the testicle is too high up on the inguinal canal to be pulled down into the scrotum, the incision of the skin is made by simply stretching it between the thumb and finger, the inguinal canal is opened by forcing two fingers upward beneath the skin until the testicle can be grasped and pulled down by them, and then the tunica vaginalis is incised to expose it for final ablation. Such testicles are usually called **"high flankers."** (See castration of cryptorchids, page 259).

The length of the incision is important in castration. If the operation were strictly aseptic and exposed structures (cord, inguinal canal and scrotum), were not subsequently infected, the smallest possible incision would be preferable; but when there is some doubt as to the asepsis of the procedure, and a still greater certainty that the exposed parts will suppurate before the healing process is complete, the long incision, by facilitating drainage, is advisable.

Third Step.—Ablation.—In ablating the testicle especial pains is taken not to touch the hands to any part of the testicle and cord that will not be removed. It is unnecessary to touch the cord above the point of ablation, and to do so with the hands that only a few moments previously were engaged in handling dirty ropes and the still dirtier patient, invites avoidable trouble from infection. The testicle is pulled up with the hand without touching anything else, while the chain of the ecraseur or jaws of the emasculator is passed around the cord. The cutting off process should be done as promptly as possible; there is nothing gained by crushing the cord slowly, and promptness shortens the duration of the pain. The division of the cord as high up in the inguinal canal as possible is advisable because a long, hanging cord not only invites ordinary pyogenesis, but also creates a favorable condition for chronic funiculitis and scirrhous cord.

One of the most common sources of infection during a castration is the falling of dirt particles and hairs into the cord above the emasculator. Just as the emasculator begins to hurt there is always a struggle that loosens dirt particles from the uppermost leg and foot and other parts of the surroundings. These particles fall upon a part of the cord that will soon be drawn high up into the inguinal canal—a splendid incubator for microbian growth. To avert this the cord is allowed to relax into the inguinal canal as it is being sev-

ered, or when there has been dirt deposited upon this spot pure tincture of iodine is painted over the part of the cord that was exposed before it is released from the jaws of the instrument.

Fifth Step.—Repetition of the Same Steps on the Uppermost Testicle.—The uppermost testicle is removed last because if the reverse order were followed blood would flow over the scrotum to the annoyance of the operator.

Sixth Step.—Ridding the Scrotum of Blood.—While the uppermost testicle is being removed the scrotum of the undermost one may fill with blood, generally from vessels of the tunica vaginalis, and as this accumulation is a favorable soil for microbes, its removal is of capital importance. The blood thus gathered in the scrotum is squeezed out by pressing the hands along the inguinal canals just before the patient is rolled to the lateral position preparatory to releasing the ropes. Once in the standing position the blood will flow outward.

AFTER-CARE.—The care of a castrated horse consists of nothing more than daily exercise, either at the halter, in harness or at pasture. The latter in nice weather, and especially if there are other horses to encourage the patient to move about, is preferable to the other. In cities and in all instances where the patient shows a stubborn inclination to stand around instead of moving about, halter exercise or hitching must be insisted upon. Exercise prevents oedema of the sheath, causes the serous secretions to drain from the scrotum, prevents stiffness, and encourages good health. Washing of the scrotum, opening the incisions with the fingers, and irrigation of the canal by attendants in charge of the patient are always more harmful than beneficial. It is only when there are unmistakable signs of sepsis that such treatments are advisable, and then they should, if possible, be done by the surgeon himself. As long as there is no elevation of the temperature, there is no occasion to molest the scrotum with any local treatment or manipulation. Œdema in the absence of fever is not a sufficient reason to open up the incision with the fingers, and such a procedure is always certain to transform a harmless serous exudation into a much more serious purulent discharge by making a portal of entrance for microbes. The appearance of fever, however, must be met by prompt evacuation of the contents of the scrotum, followed by irrigations of the inguinal canals with antiseptic solutions, and the maintenance of proper drainage thereafter.

SEQUELÆ AND ACCIDENTS.—Peritonitis.—Septic peritonitis is the most formidable sequel of castration; it is the usual cause of death when the operation results fatally. It is caused by filthy surgical methods or by improper after-care. The **unclean emasculator or ecraseur,** handling of the spermatic cord with the **hands** and **digital explorations** of the incisions during convalescence are the most common causes of the disease. When no infectious matter is deposited in the scrotum, in the canal or upon the cord during the operation, and no unnecessary fingering of the incision is done afterwards, there will be indeed few cases of serious infection from castration. Contamination of the scrotum from the litter or ground of the pasture, especially if blood clots were allowed to remain in the scrotum, may sometimes cause the disease, but by far the most common sources of infection are the **hands and the instruments,** which sow the seeds of mischief at the time of the operation. There are, however, also **certain predisposing causes** in the form of ill health from **bad nourishment, privation, exposure, febrile disease, approaching febrile diseases, convalescence from diseases** and all forms of **general systemic debility,** which, in addition to dirty methods of operating, are very prolific in causing fatal consequences.

The symptoms begin about the fourth day with a slight indisposition. The patient stands continually, seems fixed to the floor and will only move about when urged; the appetite gradually fails, the temperature rises to 103° to 105° Fahr.; the flanks are tucked; the coat is staring; the urine scanty; the bowels are constipated and defecation is avoided on account of the pain produced in straining to perform the act; the scrotum and sheath may be either slightly or enormously swollen; the inguinal region on palpation of the cords is found exceptionally painful; and the wounds when evacuated of their contents are found to contain a sero-purulent secretion which becomes more purulent as the disease advances. Later, as the peritoneum becomes more extensively implicated, colics and diarrhea complicate matters and death soon follows. In some cases the disease takes a more subacute form from the beginning or from the acute stage, and only ends fatally after three to four weeks of illness. Rare cases terminate in the formation of abscesses which may point favorably, and after discharging their contents leave behind an enfeebled patient which slowly recovers its health, during the succeeding months.

To be successful the **treatment** must be prompt; the dis-

ease must be recognized early, before the inflammation has made any headway into the peritoneum. Otherwise, the most energetic therapy is futile. As the disease at the beginning is only an extra-abdominal inflammation that is limited to the scrotum, cord and tunica vaginalis, it is really a trivial one until it advances upward beyond the inguinal canal; then it becomes a very formidable affliction because it is no longer accessible for local treatment. The treatment should, in fact, begin before any peritonitis exists, while it is still a funiculitis.

The important remedial measure consists of the establishment of free drainage by breaking open the incisions and forcing the fingers upward along the cord so as to assure evacuation of all of the secretions that have accumulated at different parts of the inflamed canal. The cord must be entirely loosened from the wall of the canal where it is found adhered, so that no part of the canal is capable of harboring pus, and in order to allow the local treatment to reach every point of the infected surfaces. When the canal has been thus drained it is submitted to thorough irrigations with solutions of hydrogen peroxide and mercuric chloride consecutively, and these are repeated every three or four hours until the temperature indicates that the hot-bed of the disease has been destroyed. Internally, large doses of quinine are helpful.

Funiculitis, or inflammation of the inguinal canal and spermatic cord, of course, supervenes all castrations, but when there is no infection, resolution is complete in a few days. If, however, the funiculitis is infective the seriousness varies. It may end in a tumefaction which, after becoming fibrous, may be the precursor of a scirrhous cord; it may act as the initial seat of a grave septic peritonitis; or it may terminate in the formation of a hot abscess that produces all of the symptoms of septic peritonitis from which it is differentiated only by the prompt abortion of the fever when the abscess is drained by opening the incisions. Funiculitis is but a local inflammation of the cord and canal that is only serious when the virulence of the infection or the meager autogenic resistance of the patient cause it to spread into the peritoneum.

Simple cases of funiculitis require no special treatment until general symptoms (fever, etc.) indicate the existence of sepsis. As long as there is no fever, no matter how badly the cords are swollen, it is prudent to trust solely to exercise for the cure; but on the first appearance of a rise of

the temperature the canals must be drained and irrigated to prevent graver consequences, and when the tumefaction becomes chronic, lasting for several months (scirrhous cord), operative intervention will be necessary. (See scirrhous cord.)

Œdema of the Sheath.—Œdema or swelling of the sheath is a very common result of castration. This loose, pendulant structure is a favorable harbor for serous infiltrations. It requires little provocation to produce swelling of the sheath in any event, and the wound of castration, even in the absence of infection, is sufficient to cause it in a very threatening if not serious form. The swelling of the sheath following castration is a trivial matter unless it infections or becomes voluminous enough to cause paraphimosis. It follows aseptic as well as septic operations, long as well as short incisions of the scrotum, and any of the various methods of ablation or any of the systems of after-care. Its prevention seems impossible. The swelling usually begins on the third or fourth day after the operation and it increases gradually until the tenth or twelfth day when it begins to diminish by gradual stages.

The treatment of œdema of the sheath must vary according to the cause. If there is fever to indicate that the cause is infection, the scrotum must be drained by promptly opening the incision with the well cleaned fingers; then irrigate the canals to assure thorough cleansing of the infected area. On the other hand, if the œdema is not accompanied by any systemic derangement, exercise alone may safely be depended upon unless the swelling becomes very large or threatens to so affect the capacity of the sheath as to produce paraphimosis, in which event moderate scarification may be practiced to good advantage. The operation of scarification is preceded by a good washing of the parts to be punctured with a strong antiseptic solution; then, with a lancet or scalpel guarded with the thumb and finger to only penetrate a short distance, a number of stabs are made here and there, chiefly about the anterior part of the sheath. The effect is the dripping of considerable serosity for some hours. The wounds thus made are then submitted to frequent baths of antiseptics to prevent them from becoming infected. When the œdema accentuates instead of diminishing, the operation may be repeated every second or third day, but the reiteration need not be practiced after there is any evidence of a decrease in the volume of the swellings.

Paraphimosis.—Prolapse of the penis results from two distinct initial causes. The first and most common one is œdema of the sheath and prepuce, in which instance the swelling encroaches upon the sheath cavity and thus actually forces the penis out, where it remains until the œdema diminishes. The second is paraphimosis from funiculitis. The cords become swollen and painful, and the penis is protruded to accommodate them. Generally the protrusion does not persist for more than two or three days, but in

Fig. 138—Paraphimosis Following Castration.

some instances the prepuce becomes so œdematous in this pendulous position that reduction becomes impossible until the swelling disappears.

The treatment of prolapse of the penis must begin promptly, and must continue incessantly until a cure is effected, in order to intercept serious consequences. The œdematous swelling of the sheath and of the prepuce may become so large as to obstruct the nutrient vessels and cause gangrene, or to press upon the urethra and prevent micturition. The first evidence of paraphimosis is met by first bathing the swollen parts with hot water and then wrapping the

protruding organ with muslin bandages soaked with astringents (ten per cent tannic acid). The bandaged penis, especially if the prolapse is long and the swelling large, may then be supported against the abdomen by body bandages passing over the loins. A sling made of heavy leather, rubber belting, thick canvas, or linoleum, supported by appropriately adjusted body bands, may be improvised and used to good advantage. The object is to support the now heavy organ whose weight aggravates the condition, and whose position subjects it to exposure and injury.

Scirrhous Cord is a progressive fibrosis of the part of the spermatic cord that remains in the inguinal canal. Path-

Fig. 139—A Large Scirrhous Cord.

ologically, it may be correctly classed as a cold abscess due to microbes that gain access to the exposed field at the time of castration or during convalescence from the operation, and there implant themselves as the seeds of the future growth which then evolves rapidly or slowly. Although it generally presents itself to the practitioner a short time after the operation in the form of a castration wound that is refusing to behave in the usual manner by healing up promptly. there are numerous instances where the evolution is so slow that nothing abnormal is noticed for years, when rather sud-

denly an œdema of the sheath accompanied with manifestations of pain in the inguinal region announces the existence of a previously unsuspected tumefaction of the scrotum. This is a scirrhous cord; the real entity. The acute swelling of the cord following immediately in the wake of castration is not always a true specimen of this morbid condition, for it may disappear spontaneously, even after sojourning for six weeks to more than two months. True scirrhous cord never diminishes in volume, but grows gradually larger and larger, presenting clinical signs analogous to those of true tumors with which, however, it must not be classified. The acute varieties occurring immediately after castration, although they present themselves in the form of very hard and sometimes quite voluminous tumefactions of the cord, should be called "funiculitis," and the phrase "scirrhous cord" should be reserved for the chronic, encroaching variety.

The pyogenesis of scirrhous cord may be streptococcic, botryomycotic, or actimomycotic, the latter being rare. The formation of abscesses which are all destined to point at the surface of the scrotum sooner or later is accompanied with the formation of abundance of fibrous tissue around them. The abscesses may be small, large, single or multiple; the pointing and cicatrization of one is followed by the evolution of others, leaving the mass more or less riddled with excavations and tracts. Sometimes a single excavation (abscess cavity), a single tract and the surrounding fibrous tissue constitutes the entire tumefaction; and sometimes the size of the cavity is so large as compared with the amount of fibrous tissue surrounding it that the condition is more like a cyst than a growth.

The cause of scirrhous cord may always be safely attributed to badly done castrations. The cords were left too long, protruding into the scrotal incision where they were exposed to infection, the instruments were dirty, or the hands needlessly deposited infectious matter upon the cords. The prevention is found in clean methods of performance and sensible after-care. The use of clamps to arrest the hæmorrhage yielded many scirrhous cords that are now prevented by the ecraseur and the emasculator, but the use of these instruments is universally preventive only when aseptic technique is respected as well.

In size scirrhous cords vary greatly. They may be no larger than the thumb or they may reach the enormous weight of fifteen pounds. They may be confined to the end

of the cord or may extend upward along it to the internal abdominal ring and even into the abdominal cavity. A tumefaction about the size of a cocoanut attached to a peduncle about the size of the wrist, gradually diminishing in diameter towards the internal abdominal ring, is, however, the average volume. The diseased tissue is always firmly fused with the surrounding tissues, from which it can be separated only with the greatest difficulty.

The subject affected with scirrhous cord is always unthrifty from the constant drain and discomfort and sometimes suffers from attacks of pyrexia while the abscesses are forming. Colics, peritonitis, chronic septicæmia, emaciation, eventually terminate life when operative intervention is postponed too long.

The treatment of scirrhous cord once well established is total ablation (see page 306), but in the recent case this radical intervention should be postponed in expectation of spontaneous disappearance of the tumefaction. Six weeks to three months should always elapse between the castration and the passing of final judgment as to the permanency of enlarged cords. In the interval potassium iodide may be given to advantage. The author's experience with this drug in old as well as in recent cases leaves no doubt that it exerts some "arresting influence" upon the progress of the growth, similar to that observed in actinomycosis.

Sloughing with caustics, especially by packing copper sulphate into the tracts, can not be entirely discarded, but as this treatment affects only the smaller ones and as the patient must first be placed in the recumbent position to properly apply it, ablation suggests itself as the most sensible remedy.

Post-Operative Hæmorrhage.—There are two kinds of bleeding after castration by the modern methods above recommended: 1. **primary hæmorrhage** from the vessels of the scrotum and, 2. **secondary hæmorrhage** from the spermatic artery.

The first, although never serious, is sometimes the cause of considerable anxiety until its source is definitely determined. This variety of bleeding originates from the vessels of the scrotal integuments, especially from the tunica vaginalis, which in full grown adults and aged horses are by no means small ones. As division of the vessels is made with a sharp knife and as no provision is made to arrest the bleeding from them, an occasional hæmorrhage from this source may be expected. It is generally noticed soon after

the horse has been returned to the stall, running in a stream the size of a straw or even larger, and when the patient moves about the blood accumulating in the scrotum may gush out en masse in the most threatening manner imaginable as if coming from the spermatic artery instead of from insignificant vessels. The differentiation is soon made, however, by the gradual diminution of the flow. At first the stream reaches the ground unbroken, then it begins to break into drops some distance from the floor and finally drips drop by drop until it ceases entirely. There is no occasion to make any effort to arrest this hæmorrhage as natural hæmostasia may always be depended upon.

The second, that is, secondary hæmorrhage from the spermatic artery, on the contrary, is a serious hæmorrhage that may terminate fatally if not controlled. It may occur at any time from twenty minutes to three hours after castration. Hæmorrhages occurring later than three hours are rare. The cause of spermatic hæmorrhage is inadequate crushing of the artery with an instrument that was too sharp, hæmophilia, or disease of the coats of the artery. For a time the crushing holds the blood current, but the fortification being insufficient the barrier breaks down and the bleeding begins, and since the spermatic artery is a large one, proceeding directly from aorta where the blood pressure is high, a very copious flow generally results. This hæmorrhage is easily recognized from the former by the size of the stream and when there is any doubt, by passing the finger into the incision the synchronism of the spurts with heart beats is easily recognized.

When hæmorrhage is recognized as coming from the spermatic artery, it should be arrested without delay as a harmful amount of blood may be lost. The loss of blood from castration leaves the patient at the mercy of the septic sequelæ even when it does not itself cause death. In fact, few patients that have bled profusely do well for some time after the operation. They swell badly, fever generally ensues and the clotted blood in the scrotum usually furnishes a field for infection. The mortality amongst patients that have bled profusely is higher than among those operated upon bloodlessly.

There are various methods employed **to control spermatic hæmorrhage.** In tractable subjects it is sometimes possible to pinch the artery between the thumb and finger for a few minutes with successful results, or to snap an artery forcep upon it. By applying a twitch and lifting a hind leg

with the sideline these simple efforts are indeed very frequently successfully carried out. When the cord has been cut very short and the patient is restive packing the scrotum with an antiseptic wadding held in place with a few stitches across the incision, may be tried, but by far the safest and the most effectual method is to place the patient in the recumbent position and ligate the artery with a catgut or a silk ligature, and then submit the interior of the canal and scrotum to a good irrigation to rid it of blood clots and to cope with the infection that may have occurred during the execution of these steps.

Prolapsus of the Intestines is a rare accident of castration when the operation has been preceded by a careful examination for hernia, but when through carelessness no effort was made to determine the existence of hernia or when the patient was too fractious to approach near enough to do so, there is always danger of prolapsus some minutes after the operation is completed. In the recumbent position hernia may escape notice by the contents falling back into the abdominal cavity as the patient is rolled upon its back, and occasionally hernia, especially epiploceles, are not conspicuous enough to attract attention even when a careful examination is made.

Prolapsus of the intestines is always fatal unless promptly treated. As soon as the hernial sac has been destroyed by the incision of the scrotum and the ablation of the testicle, the intestines rapidly gravitate downward until an enormous amount protrude, and if not supported immediately they will soon trail to the ground to be trampled upon by the feet. The situation is, therefore, always an urgent one. There must be no delay, or treatment will be futile. The first appearance of intestines at or through the incision in the scrotum must be met by immediately preventing their further prolapse. A twitch is placed on the nose, a sideline applied to a hind leg and then a few stitches are sewed across the incision close enough to safely assure against further protrusion. These emergencies having been completed no time is then lost in casting, anæsthetizing, and placing the patient in the dorsal position. The region is then rinsed with abundance of antiseptic solution and as soon as the anæsthesia is profound the emergency stitches are removed and attempt begun to replace the intestines. If filled with gas they are punctured with a small trocar and canula and if still irreducible kelotomy must be performed. Once reduced safely in the abdominal cavity the tunica vaginalis is

drawn up and ligated according to Van Law's method (see page 361). Thorough rinsing of the cavity completes the operation.

Prolapsus of the Omentum is less serious but not entirely without danger. It is generally safe to simply cut off the protruding portion, at the level of the incision, with the emasculator or ecraseur, but never with a sharp knife on account of the large size of the vessels it contains. If left alone its weight will drag down more and more and finally bring out loops of intestines. A patient treated by simple ablation of the protruding portion must be carefully watched for several hours in order that a possible prolapsus of the intestines may be discovered early enough for successful intervention.

A much safer method of dealing with prolapsus of the omentum is to place the patient in the recumbent position, cut off the protruding end, replace the remainder and then apply a clamp upon the cord including the tunica vaginalis.

Adhesion of the Testicles to the Tunica Vaginalis is a condition that often complicates castration. It is one of the banes of the standing operation, because the adhesions are sometimes too firm to be broken down with the fingers until the patient is cast. This condition should if possible be determined in the pre-operative examination and when discovered the patient should be cast and the testicles, tunica vaginalis and all should be removed with the ecraseur.

CRYPTORCHIDECTOMY

SYNONYM.—Ridgling castration.

DEFINITION.—Cryptorchidectomy is the operation of ablating hidden testicles—testicles that have not descended into the scrotal sac.

INDICATIONS.—It may be said that the operation is always indicated, in every domestic animal, where cryptorchidism exists, as the individual so affected is always a degenerate, and never a good specimen from which to breed. The operation is, however, not very frequently done in city work-horses because the hard-working ridgling, although sometimes somewhat troublesome, is by no means as intolerable a creature as the young, growing farm ridgling, whose impelling impulses render him absolutely unsafe in the pasture. It is in the springtime when it is desired to turn the two- or the three-year-old into the pasture with other horses that the importance of castration becomes apparent to the

owner of a ridgling. If the young ridgling could be economically reared to maturity it is very doubtful whether many of these subjects would ever be castrated.

Cryptorchidism results from some obscure perversion of fœtal evolution. It is frequently hereditary. Mares bred to cryptorchid horses give birth to a remarkably large per cent of colts similarly affected. It is much more common in grade animals than in well bred ones. In the latter it is usually traceable to inbreeding or defective nutrition in utero. The condition is physiological during the first few months after birth in some mammals, but in most species the testicles should descend into the scrotum during the fœtal life. The hidden testicle of youth is known as a **pseudo-cryptorchid.** It is this tendency of growth and development that is evidently responsible for the hidden testicle of mature subjects. The exact cause of the retarded or arrested descent cannot be satisfactorily explained. It is, however, only reasonable to expect that the effort of nature to guide the testicle from the lumbar region to the scrotum during the fœtal life should occasionally miscarry. A rational supposition in this connection is that the small weight of an undeveloped testicle delays its descent until the internal inguinal ring has closed, and in the case of the "high flanker" variety, until the tunica vaginalis is too firmly developed to respond to the weight of the testicle. Debilitating diseases, exposure, overwork and poor quality of food during the period of gestation may be responsible.

The testicles of cryptorchids are found floating within the abdominal cavity (intra-abdominal cryptorchid), within the inguinal canal (extra- abdominal cryptorchid), or caught trap-like by the epididymis in the internal inguinal ring (intra-inguinal cryptorchid).

1. Intra-abdominal cryptorchidism may be unilateral or bilateral, usually the former. The testicle is small, undeveloped, and its secretion is sterile. It will develop to the normal size, or even larger, after the opposing testicle is removed by castration, but its secretion remains sterile through life. It is only on the rarest occasions that the bilateral ridgling or the half-castrated proves able to procreate.

In the process of growth and an effort to perform the function of both organs after one is removed, the single organ within the abdominal cavity frequently undergoes cystic degeneration and develops into a large fluctuating body. (Farmer Miles designated this condition "internal hydrocele.") In other cases they undergo fibrous degeneration

and become hard, indurated masses; and furthermore the abdominal testicle, owing to its abnormal life, is very susceptible to strongylus, tuberculosis, glanders, and suppurative processes. The latter condition frequently coexists with the cystic degeneration. The testicle is not covered with peritoneum. The tunica vaginalis is wanting; except in rare cases it is found collapsed and protruding down the inguinal canal several inches.

2. Extra-abdominal cryptorchidism, like the foregoing, may be unilateral or bilateral. It is a normal anatomical

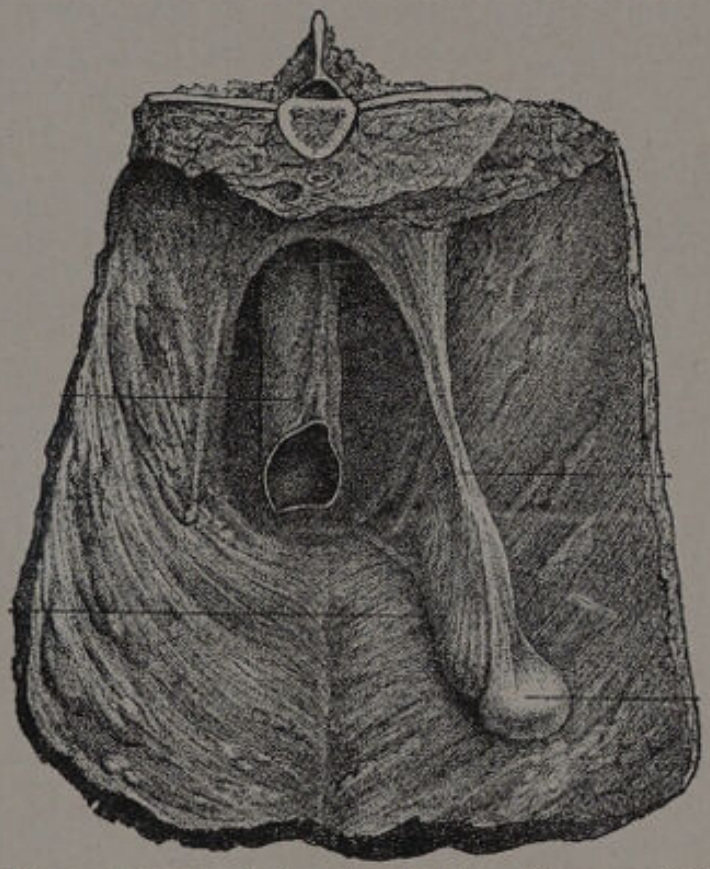


Fig. 140—Intra-Abdominal Cryptorchidism (Farmer Miles' No. 3). (Bayer.)

condition with some mammals during the brief period after birth. In most animals, however, it is pathological. In both instances there is a strong tendency toward descent of the testicle into the scrotum as the subject grows older. When the opposing testicle is removed by castration their descent is more certain.

This variety is again subdivided into **supra-scrotal** and **inter-inguinal** cryptorchidism. The supra-scrotal testicle is common in young animals, and may descend into the scrotum as the animal develops. If the opposing testicle is removed its descent is certain. The testicle is covered with the tunica

vaginalis and is better developed than any of the other varieties. In the inter-inguinal (high-flanker) variety the testicle is found just below the internal inguinal ring within the inguinal canal, appropriately clothed with the tunica vaginalis. The testicle is smaller than the supra-scrotal, and is less inclined to descend when the opposing testicle is removed. It is frequently very small and easily "overlooked" in palpating the region before operating.

The intra-inguinal cryptorchid is one of the interesting freaks of cryptorchidism in horses. The testicle is found strangled by the epididymis in the inguinal ring, the major portion of the testicle remaining within the abdominal cavity.

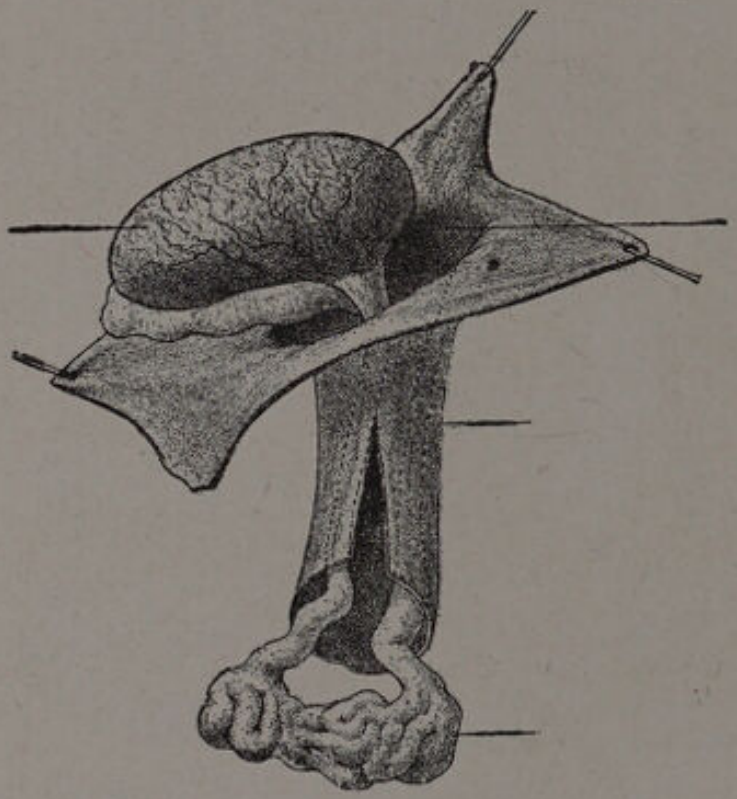


Fig. 141—Intra-Inguinal Cryptorchidism. The Epididymis Extends Downward Into the Inguinal Canal, Covered with the Tunica Vaginalis. (Bayer.)

The epididymis is covered with a tunica vaginalis and is distended with fluid. (See modifications page 271.)

Farmer Miles classified ridglings into Nos. 1, 2, 3, 4, and 5. The first three refer to the location, and the remaining two to pathological conditions of the testicles:

No. 1.—The testicle is located above the scrotum in the inguinal canal. covered with a tunica vaginalis and can be felt on palpation with the patient in the standing or recumbent position.

No. 2.—The testicle is small and about five or six inches from the external inguinal ring, just below the internal ring. It is covered with the tunica vaginalis and can not easily be felt on palpation in either standing or recumbent position.

No. 3.—The testicle is in the abdominal cavity, without a peritoneal covering. The testicle is small in the young animal or entire horse, but large in the mature horse that was castrated on the opposite side in youth. This variety is the most common of all ridglings.

No. 4.—The testicle is partly through the internal ring and is covered over its protruding portion with peritoneum (tunica vaginalis) filled with serous fluid. The testicle itself remains within the cavity.

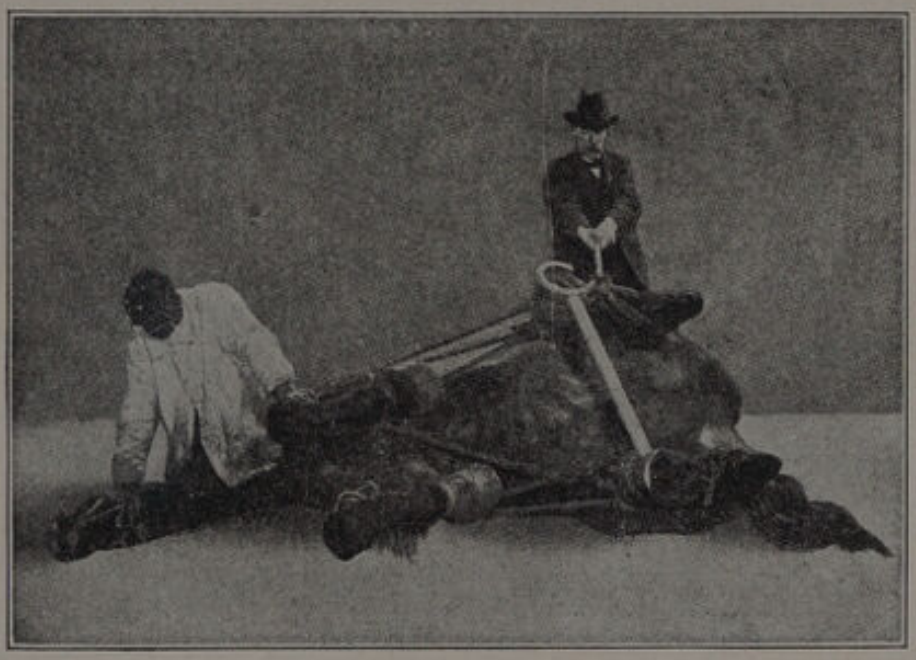


Fig. 142.—Correct Position for Cryptorchid Castration.

No. 5.—The testicle is enlarged from disease, within the abdominal cavity.

It will be observed that this classification includes supra-scrotal, inter-scrotal, intra-abdominal, intra-inguinal, and the intra-abdominal pathological testicle, respectively, and is made with the purpose of distinguishing five separate operative requirements.

SURGICAL ANATOMY OF THE INGUINAL REGION.—The inguinal region includes the space on each side of a raphe extending from the perineum to the umbilicus. Superficially it presents the sheath and scrotum; the prepubian tendon extends forward from the brim of the pubes forming the internal boundary of the external inguinal ring;

an aponeurotic portion of the tendon extending from the femoral fascia forms the antero-external boundary of the external inguinal rings, and inguinal ligament forms the posterior boundary. The external ring is a large opening, and can be located by external manipulation. The inguinal canal is funnel shaped, and extends from the external ring, upward and outward to the internal inguinal ring, which is but a small slit in the abdominal wall. The length of the canal is from six to nine inches, according to the size of the horse.

The large arteries of the region are the external pubic and the subcutaneous abdominal, a branch of the former located along the line of the sheath.

Fig. 143—Technique of Cryptorchidectomy with Miles' Harness.

DIAGNOSIS.—In the entire animal the condition is readily recognized by the absence of one or both testicles from the scrotum. When there is no history to confirm the diagnosis, suspicion is aroused by the amorous nature of the animal and the willful and impelling disposition characteristic of stallions. The neck is large, but not as well developed as in the normal stallion, but the muscular system, especially the buttocks, fall far below the average in contour.

The chief source of confusion in the diagnosis of cryptorchidism is the location of the affected side. In the supra-

scrotal ridgling the testicle is felt on palpation of the inguinal canal, but in all the other varieties the diagnosis can only be made in the recumbent position, by the examination for the scar remaining from the castration of the normal side, and by the palpation of the inguinal canal for the remains of the spermatic cord of the previous operation. The fact that two-thirds of all cryptorchid testicles are located on the left side will materially assist in this connection. If the region is not marked with fat the cord is easily felt, and in most instances the scar is visible. The greatest confusion

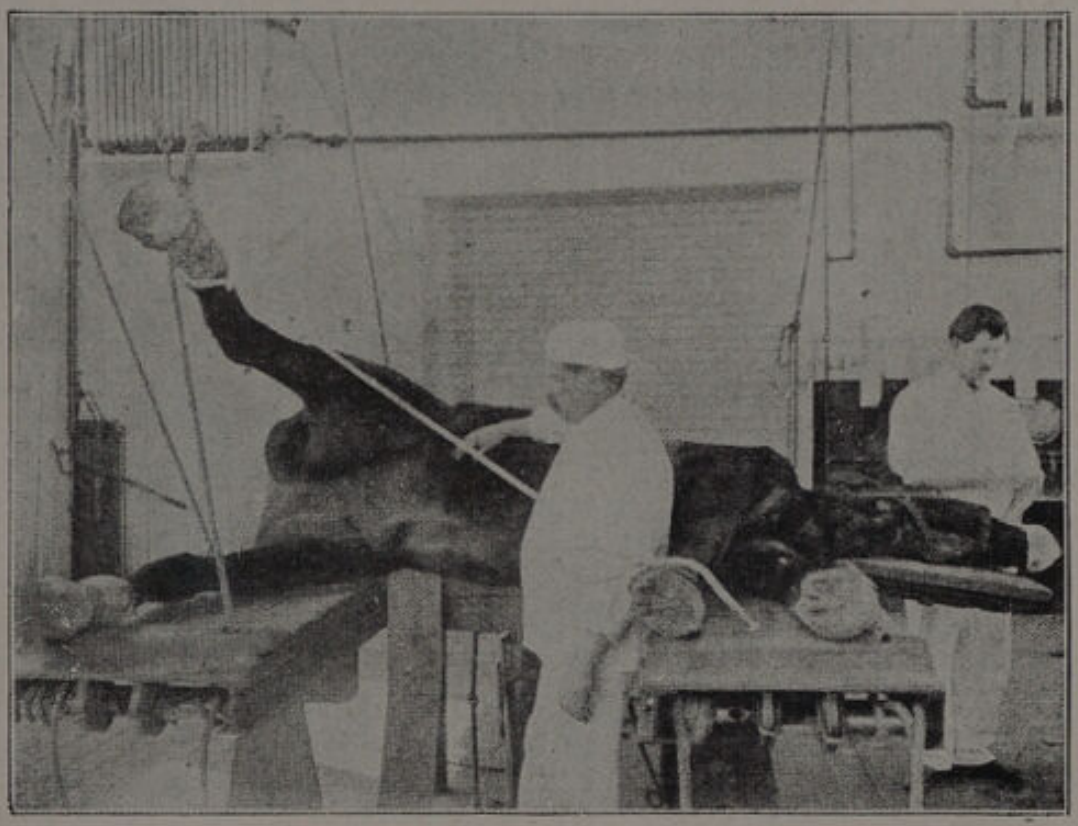


Fig. 144—Restraint with Operating Table. (Courtesy of Prof. W. L. Williams.)

arises when scars exist upon both sides, one from the original castration and one from previous attempts to find the hidden testicle. In this circumstance an attempt must be made to locate the old spermatic cord on the castrated side, and if results are negative the only recourse is to operate first on the left side. Rectal explorations are deceptive and very seldom fruitful. There is sometimes a difference in the cicatrix that helps to locate the abnormal side. The one is longer and less wrinkled than the other.

PREPARATION.—It is advisable when, possible, to administer an oleaginous cathartic three days in advance of

the operation and follow the purge with a limited diet. During the last twelve hours no food or water should be allowed.

EQUIPMENT.—Castrating knife, ecraseur and antiseptics, needle, thread and gauze.

RESTRAINT.—A special form of restraint is indispensable, the object being to flex the hind legs upon the pelvis and part them as wide as possible to expose the inguinal region and to prevent any interference with the free passage of the hand down the inguinal canal.

The best throwing harness is the double sideline, consisting of about sixty feet of ¾-inch rope, with a loop in the center for a collar, two hopples for the hind legs, and small sash cords or straps for the fore legs. The loop is placed around the neck and the two ropes passed between the fore legs to each hopple and then upward to the rings in the neck loop. One rope is held by an assistant behind the horse and the other by a second person in front. The fore-leg on the side on which the horse is intended to fall is tied up with a sash cord or strap. The third man then takes the horse by the head and directs the assistants at the ropes to pull in opposite directions until the horse falls. The rope of the uppermost leg is now "double-half-hitched" over the foot, passed around the loins, and "double-half-hitched" to the opposite foot. The horse is then rolled over to the opposite side and the other foot fastened in the same manner. The legs may be parted still further by the use of a spreader passing between the feet, but if the ropes passing around the loin are drawn taut the spreader will not be necessary. The forelegs are secured in the flexed position with small cords or straps.

The best position for operation is the dorso-lateral one with the affected side uppermost. The operator takes either a sitting or a kneeling attitude posteriorly.

General anæsthesia is advisable, although not essential nor customary amongst American veterinarians. The administration of one ounce of chloral hydrate one hour before operating is beneficial.

On the operating table ridgling castration can not be safely performed without profound anæsthesia, and the table must be cut out so that the operator can approach the abdomen, then with the patient under the influence of chloroform and the uppermost leg pulled upward the inguinal region can be exposed for the operation.

ANTISEPSIS.—There is no other veterinary operation in which careful, painstaking antiseptic precautions are more

essential than in the castration of a ridgling. The first step in this direction is the sterilization of the knife and **emasculator,** especially the latter, as this instrument must under no circumstances deposit infection when it crushes the cord. It is here that the mischief, ending fatally, often occurs, and to forestall **every** chance of infection from this source, only **perfect** sterilization of the instrument will answer. For this purpose, when operating without a steam sterilizer, the author uses mercuric chloride solution no weaker than 1 to 300. The harmful effect of this solution upon the metal is easily compensated by the greater certainty of the disinfection as compared with that obtained from the other antiseptics. An emasculator or ecraseur, previously cleaned or boiled and carried about wrapped in a clean cloth, that is immersed for ten to twenty minutes in such a solution while the horse is being cast, and only removed therefrom when needed to ablate the testicle is always safe. The **knife** being used only to perform a very small part of the operation is a less frequent carrier of infection. If kept reasonably clean, and if the blade is placed in phenol for a few minutes, there will be little danger from this source. The **hands,** on the contrary, are of capital importance. Contaminated with dirt while tying the patient, they must in a few minutes be passed into the peritoneal cavity. The best system of dealing with the whole matter of antisepsis for ridgling castration is as follows:

1st. Submit the hands to a good washing with soap and water, after cleaning and trimming the nails, then rinse them for a few minutes in a solution of mercuric chloride 1-500.

2nd. Place the emasculator in a basin containing a solution of mercuric chloride 1-300, and the knife blade in phenol.

3rd. Wear gloves while casting, tying and placing the patient in proper position.

4th. Remove the gloves and rinse the hands in the mercuric chloride solution, just before the operation proper begins, and thereafter do not touch any septic objects.

5th. Wash the region well with soap and water and then with mercuric chloride, and moisten the thighs, buttocks, and abdomen to prevent hairs from flying.

6th. Do not allow the fingers to touch the dirty rugæ of the sheath while making the incision.

7th. Rinse the hand after the incision is made, just before passing it upward through the inguinal canal.

8th. When the testicle has been found, take the emasculator directly from the basin to cut off the testicle.

While this routine does not constitute absolute asepsis, it takes advantage of all reasonable precautions without delaying any part of the work.

It has been observed that certain of the old ridgling castrators entirely ignored cleanliness in their operations and yet were very successful, in fact more so than the practitioners who make strong pretenses toward the observance of antiseptic technique. These results are found by observation to be due to the greater skill of the former and the misconception of the latter as to what actually constitutes effectual antisepsis.

First Step.—Oscheotomy.—The incision of the scrotum is made about four to five inches long, according to the size of the operator's hand. As there is no objection to a long incision, it is well not to handicap the hand in a tight place.

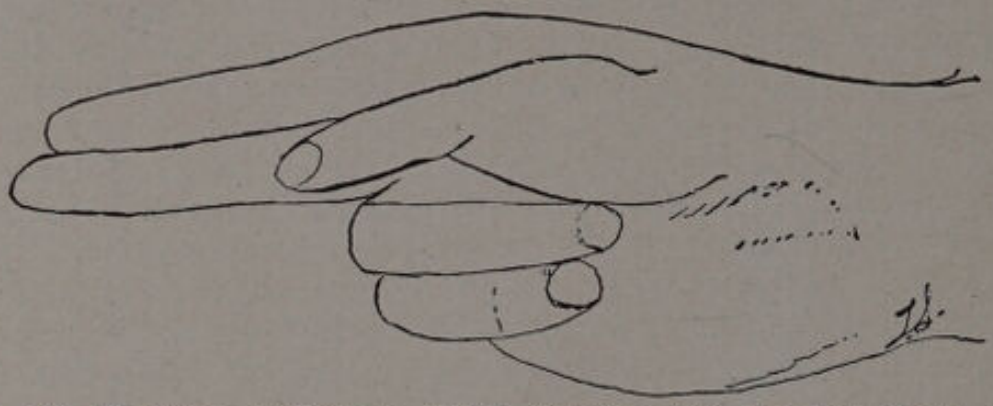


Fig. 145—Position of Fingers While Opening the Inguinal Canal and Perforating the Peritoneal Cavity.

The incision is made parallel to and one to one and a half inches from the median raphe over the external inguinal ring; in other words, across the undeveloped scrotal sac. The exact position is easily determined by comparison with the opposite side, where there is either a testicle or scar from which to locate the middle of the incision. The skin of the scrotum is stretched between the thumb and finger of the left hand and the knife is drawn backward carefully so as not to cut too deep as there is some danger of cutting underlying vessels, the bleeding of which would be annoying and harmful. Some operators stretch the scrotum forward with the left hand, but as the sheath is always dirty this can only be recommended if done by an assistant. The incision includes the skin and the dartos.

Second Step.—Opening the Inguinal Canal.—The four fingers of each hand, placed back to back, are pushed into the incision about one inch in depth and then with consider-

able force the edge of the canal is torn open for passage of one hand into it. The course of the hand is now downward and backward toward the flank just beneath the skin, to the depth of six to nine inches, according to the size of the horse. The fingers are closed cone-shaped and the penetration is effected by rotation and gentle forward pressure until the desired depth is reached. The hand is in the proper position for the next step of the operation when it is buried six to nine inches and the fingers can be felt under the skin about one-half inch from the surface of the body. Most of the failures are due to pushing the hand downward directly into the abdominal cavity instead of directing it beneath the skin toward the internal abdominal ring. While this step of the operation is being done the canal is palpated for the testicle which might already be found in the canal covered with the tunica vaginalis.

The opening of the inguinal canal is facilitated somewhat by oiling the hand. But when oiling is practiced care should be taken to use only a perfectly sterilized lubricant. Boiled linseed oil with three to five per cent phenol, kept in a well stoppered sterilized bottle answers the purpose.

Third Step.—Perforating the Peritoneum.—This is the step of the operation in which the operator either succeeds or fails. That is to say, it is the most important part of the whole procedure. If the abdomen is perforated in the right place the testicle is promptly located, while on the other hand if not properly placed it may not be found at all.

The perforation is made in the upper posterior quadrant of the internal inguinal ring area. The ring can usually (but not always) be felt as the teat-like protrusion that sucks up into the grouped fingers as their tips are palpating about the region.

Direct entrance through this thin place (the ring) may be decided upon when it seems large, but three-quarters of an inch beyond when the protruding teat is small.

First the index finger alone is pushed through; then, if the cord cannot be found at once by "wiping" around in different directions, the second finger is also passed through the perforation. Failure to find the cord or the testicle with the two fingers may necessitate passing the entire hand into the abdominal cavity, but as this is an exceptionally hazardous procedure, and is only required in anomalies of great rarity, the failure to find the testicle with the two fingers must be complete before it is attempted.

Fourth Step.—Searching for the Testicle.—The search begins as soon as the hand enters the external abdominal ring and continues while the canal is being opened, in the hope of finding the testicle in the canal (extra-abdominal), and when the hand has penetrated the required distance (six to nine inches) the index finger palpates for a possible fluctuant teat. If these extra-abdominal manipulations show that the canal is free from any evidence of a testicle the diagnosis of intra-abdominal cryptorchidism is then certain, and the perforation of the abdomen as described in step three becomes necessary. The perforation being made first with the index finger, attempt is made to hook

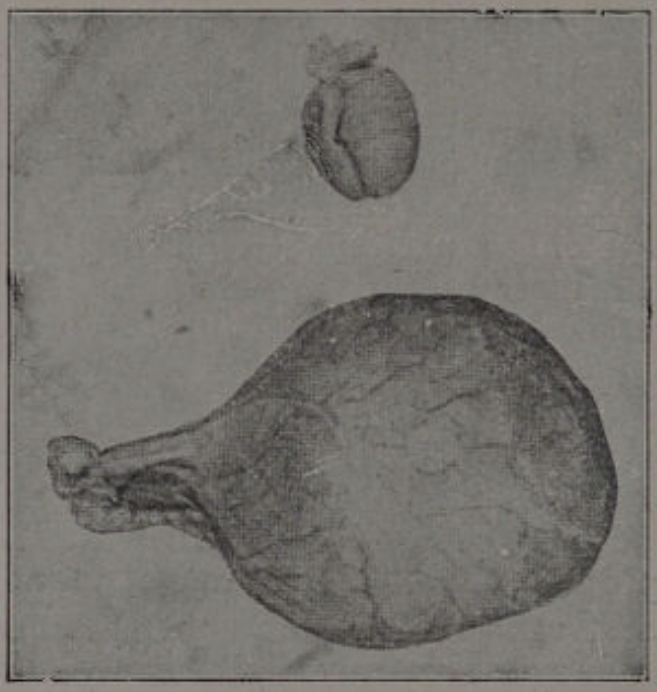


Fig. 146—Cryptorchidic Testicle.

up the cord or some part of the testicle without any further enlargement of the opening, and indeed very frequently the intra-abdominal pressure will press the testicle toward the opening when the least bit of traction is applied to any of its appendages. But when these efforts fail after a few minutes' trial, the second finger is passed through the perforation and the search extended over wider limits. The fingers execute wiping movements, first against the parietal peritoneum and then in different directions amongst the viscera, in search of a hard cord (the vas deferens) which, when felt, is hooked up or pinched between the fingers and drawn toward the orifice. By the gentlest kind of traction the visceral pressure will bring the testicle through the opening

without difficulty. When there is any difficulty in grasping the vas deferens effectually, Farmer Miles recommended that it be trapped firmly between the two fingers by crossing the third over the index finger. Although these manipulations are executed in a few moments by the experienced operator, the novice should work slowly and with great caution, even if ten, fifteen or twenty minutes is consumed in the search. The manipulations must be exceptionally gentle, because force will soon widen the perforation beyond the limits of safety.

If after diligent search it is found positively certain that the vas deferens is not within the reach of the fingers, the whole hand is passed through the perforation and a systematic search is made with all the fingers, but this step must only be taken as a last resort, because a perforation large enough to admit the hand invites prolapsus of the intestines, often with disastrous results. Another method of meeting this exigency is to make a new incision along Poupart's ligament and then penetrate the abdominal cavity behind it with the whole hand. This method prevents prolapse because the pressure of the thigh effectually closes the perforation, no matter how large.

Fifth Step.—Ablating the Testicle.—The ablation is effected in the usual manner, with the emasculator or ecraseur.

Sixth Step.—Preventing Prolapsus of the Intestines.—This part of the operation must never be entirely ignored; sometimes it is a very essential feature of the successful procedure. When the perforation is a small one the only precaution to take is that of keeping a firm pressure with the hand over the perforation as long as the legs are widely parted by the ropes, as sudden tenesmus may send a loop of intestines through it unnoticed. The operator should keep the hand upon the region while the assistant releases the patient from the harness. When the legs close together after untying there is little danger of the accident occurring.

When the perforation is a large one the only safe practice is that of packing the inguinal canal with sterilized gauze and retaining it with a few stitches across the incision. The packing, in order to be effectual, must be voluminous enough at the level of the orifice to actually support the intestines if any should rest upon it. (See Sequelæ, page 273.)

MODIFICATIONS.—These technics do not meet every contingency, as they do not answer for several more or less rare cryptorchidic conditions. The most common one requir-

ing a modification of these descriptions is the one we arbitrarily designate as "intra-inguinal." This testicle is trapped in the internal abdominal ring. The epididymis has passed through the internal abdominal ring, carrying with it the tunica vaginalis, but the body of the testicle is within the abdomen, resting upon the ring. Sometimes the epididymis stretches down at great length, almost descending as far as the scrotum, and when found during the operation it may be mistaken for the testicle until exposed by cutting the tunica vaginalis. This form of cryptorchidism is met by tracing the epididymis upward as far as the ring and then making a perforation one-half inch or so anterior to it, large enough to admit the index finger, with which the testicle is easily hooked out.

In this same variety of cryptorchidism the testicle may be found to have undergone cystic degeneration or hypertrophy. Sometimes the cyst is so large that its contents must first be evacuated before it can be brought through the perforation, and at other times the testicle may be enormously enlarged by degenerating processes. Fluid may be evacuated with a trocar and canula, or else by simply rupturing the wall with the finger and allow the fluid contents to flood into the peritoneal cavity. The latter course is quite as successful and much less complicated than the former. These cysts occasionally are dermoid, containing in addition to the serous fluid such unnatural objects as hairs, teeth, horn, or cartilage.

The second variation in the technique is necessitated by the enormous volume of the testicle, which in some instances may be found as large as a child's head, or even larger. Removal under this circumstance is effected by enlarging the perforation, or may even require a laparotomy.

AFTER-CARE.—The castrated ridgling should be kept tied up for twenty-four hours in a clean stall, and then given a limited amount of walking exercise daily. Turning out in the paddock or pasture is seldom sufficient on account of the invariable inclination to stand about instead of voluntarily taking the required exercise. The practice of trotting the patient is extremely harmful, and while the exercise should be forced, it must never be violent. Standing about in a stall, paddock or pasture on account of the soreness in the groin, or enforced standing in a single stall, in theory, should be desirable after an abdominal operation, but experience indicates that it is quite as harmful as violent exercise. It is possible that the state of absolute repose favors

chills as well as the localization of septic foci along the surgical channel, which are dispatched by the drainage produced by movements of the parts. Whatever may be the scientific explanation of the benefits of exercise, experience soon teaches that it operates to the well-being of the patient, and hence should be insisted upon.

There should be no molestation of the wound as long as the patient is not attacked with fever, no matter how pronounced the stiffness of the hind extremities becomes, but when fever supervenes drainage and irrigation of the canal are essential.

SEQUELÆ and ACCIDENTS.—(1) **Septic peritonitis,** induced always by soiled hands or instruments, is the most serious result of the operation, and although it may sometimes be unavoidable on account of the impossibility of thoroughly disinfecting the hands, if the above instructions in that connection are respected absolutely, it is indeed remarkable how badly the operation can be done without infecting the abdominal organs, or surgical tract. On the other hand, if no adequate and intelligent precautions are taken the very neatest operation may turn out badly from this cause. (See Castration, page 244.) (2) **Prolapse of the intestines,** is a very common complication of ridgling castration, especially when the perforation has been accidentally or intentially made very large. In every case some pains must be taken to prevent this accident, and when the perforation has been a large one special treatment becomes essential. The recommendations are described in step 6. (3) **Abscesses** in the inguinal canal sometimes supervene, and may cause considerable annoyance, and even death, after a protracted indisposition lasting several weeks or more. They are treated by early evacuation and antiseptic irrigations with hydrogen peroxide. (4) **Œdema of the sheath and ventral surface of the abdomen,** frequently follow the operation, but unless they reflect from a septic surgical wound, they are harmless. (See Castration, page 244.) (5) **Scirrhous cord,** while rare does occur occasionally after cryptorchidectomy. The treatment does not differ from that of the same condition following ordinary castration, but on account of its close proximity to the abdominal cavity operative treatment is much more dangerous. (6) **Hæmorrhage from the inguinal veins** is an untoward event of the operation that sometimes occurs when the tearing open of the inguinal canal with the fingers is done too harshly, and especially when the incision of the scrotum was made too deep, that is beyond the pre-

scribed limits,—the skin and the dartos. If the incision is carried at once beyond the depth of these two integuments the hand either passes beneath the inguinal plexus of veins or else exposes them to injury during the operation. This hæmorrhage is both annoying and serious; serious when a large one is ruptured high up in the canal where it can not easily be ligated. The accident furthermore delays the procedure, complicates matters, and always causes considerable anxiety.

CRYPTORCHIDECTOMY IN OTHER DOMESTIC ANIMALS

In the dog the operation is best performed through a median line laparotomy, but it must always be preceded by a careful examination of the inguinal canal to determine with certainty that the case is one of intra-abdominal cryptorchidism and not a simple "high flanker," which of course could not be removed by way of the abdominal cavity. The incision is made in the median line between the umbilicus and brim of the pubis, just long enough to admit the index finger, which, after being admitted, hooks up the testicle or its appendages with facility.

In bulls and boars the flank laparotomy is preferable. An incision is made in the flank of the affected side large enough to admit the hand, which is then passed through to the region of the internal abdominal ring from whence the testicle is easily brought forward. But as in operating upon the smaller species, especial precaution is taken to exclude extra-abdominal cryptorchidism, by first casting the patient and making a painstaking palpation of the inguinal tract. The bull may be operated upon in stocks or recumbent, while the boar may be either held down on the ground or hung by the hind legs.

CAPONIZING

DEFINITION.—Caponizing is the name applied to the castration of aves. The bird so treated is called a capon.

INDICATIONS.—The operation is performed chiefly upon roosters, although recently it has been practiced in South Africa upon ostriches. In the former its object is that of improving the commercial value of the animal operated upon. The caponized rooster fattens easier, grows larger and, owing to a well recognized improvement in the taste

and tenderness of the meat, brings a much larger price per pound on the market. In fact the demand for capons has always exceeded the supply, even at the fancy price of two to three dollars per head.

As the demands of the epicure are gradually increasing it is likely that the popularity of the operation will likewise increase, although until the present time the economic importance of each operation has been regarded as too trivial to attract any attention from practitioners. In fact the operation is willingly consigned to the fancier and poultryman in this country; the practitioner is not as yet interested enough to have mastered the technique which to him is a mysterious chapter in his surgical education. The operation is, however, not a difficult one. In France and in Italy it is often performed by cooks, and in this country there are poultrymen who find it no trouble to castrate more than a hundred in a single day with good success.

In ostriches the operation is performed to increase the plume production; an effect that is said to be attracting considerable attention amongst breeders of these animals.

SURGICAL ANATOMY.—The testicles of birds are intra-peritoneal. They are very soft, friable, bean-shaped bodies of about the consistency and not unlike the color of a "chicken-fat" blood clot. They are located in front of the kidneys at the level of the last rib. They are held in position very loosely by their vessels and a loose areolar tissue. In size they vary with breed, size and age of animal. In roosters, the most favorable time for operation is at the age of four months.

TECHNIQUE.—In America it has been customary to perform the operation by making an incision between the last two ribs, which is held open with a special spring retractor, while the testicles are drawn out with a blunt, spoon-like forcep. But this technique has been outclassed by the Germans, who perform it in a more simple manner and with much better general results, as follows:

The expert operator holds the rooster, back downwards under his left arm, the feet in his left hand, thus exposing the abdomen and flanks. The less experienced may enlist the help of an assistant who sits upon a table or chair and holds the animal on his knees with the back downward and the hind quarters toward the operator.

Either flank may be selected for the incision, which is made midway between the posterior extremity of the ster-

num and the anus. The feathers are plucked, the skin disinfected and an incision just long enough to admit the index finger made through the skin and underlying muscles down to the peritoneum which is lifted and torn with the tissue forcep. If the side air sack settles in front of the opening it can be excised without hesitation.

The index finger is then introduced and passed toward the vertebral column, just in front of the kidney, where a

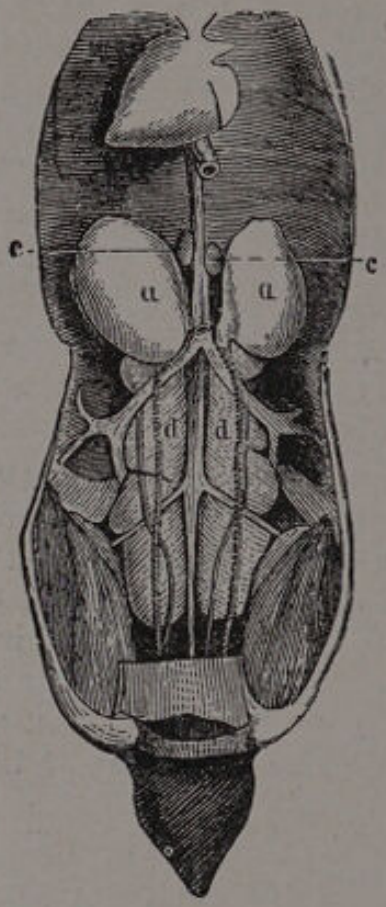


Fig. 147—Internal Organs of a Fowl. *a*, *a*—Testicles, *c*, *c*—Supra-Renal Capsules.

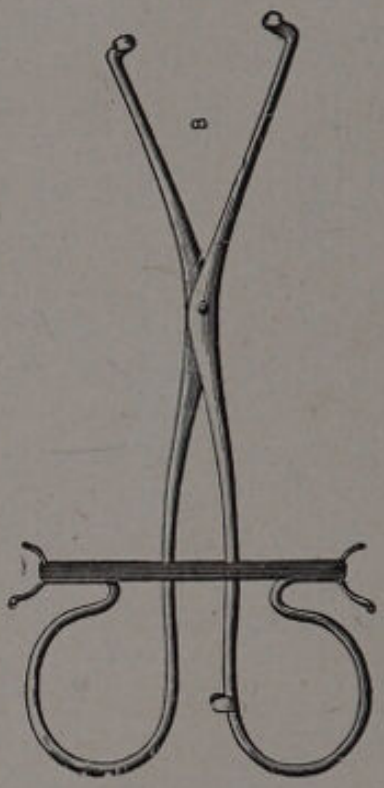


Fig. 148—Retractive Instrument for Caponizing by American Method.

firm but soft body one-half inch wide and three quarters of an inch long is soon recognized. When found the testicle is worked loose all around its circumference with the end of the finger (not the nail) and then "wiped" loose from all of its attachments by a down and outward motion and then is left to float at liberty amongst the viscera. The opposite testicle is then treated in the same manner without withdrawing the finger from the abdominal cavity. No attempt is made to remove the extirpated testicles from the abdomi-

nal cavity as they will absorb in a short time, without causing any further trouble.

The incision is closed with a stitch and the wound brushed over with collodion. As a mark of identification the comb may be snipped as the animal is released.

Operated animals are fed lightly on soft feed for several days, and protected against inclement weather. Shelter against rain and drafts and artificial heat in extremely cold weather is essential to the best results. In order that the wound be not unnecessarily molested by movements of the

Fig. 149—Securing Cord.

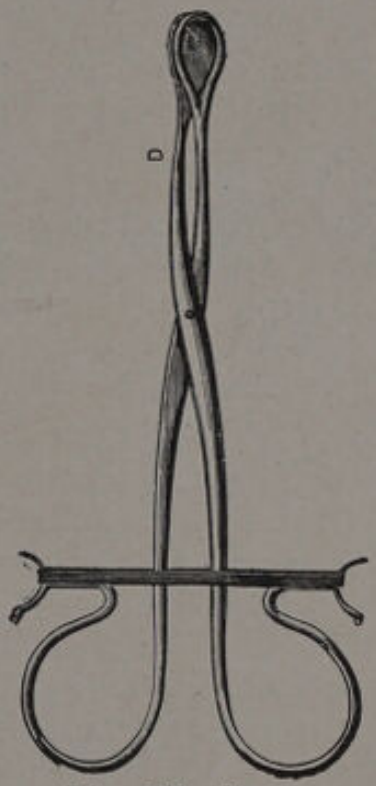


Fig. 150—Spoon.

wings the perches are removed to prevent flying, and the animals compelled to roost upon the floor.

SEQUELÆ.—The losses are not great where asepsis is respected and the above after-care carried out. According to Gunther the losses are caused by rough handling of the kidneys when these are at first mistaken for the testicles and almost torn from their attachments before the error is discovered.

The first evidence of a forthcoming death is refusal to eat, which circumstance might always be advantageously met by slaughtering the animal for food before any diseased process has advanced far enough to make its meat unwholesome.

CASTRATION OF BULLS

INDICATIONS.—Bulls are usually castrated when, having reached the limit of their usefulness, it is decided to fatten them for the market, and although castrated bulls never develop into choice meat cattle, they fatten more rapidly and their general behavior is improved.

RESTRAINT.—Adequate restraint is essential. The standing position is the preferable one. The head is secured in the stanchion and held high with the nose ring in the hands of a strong attendant. The hind legs are hoppled to protect the operator against kicks, and decumbency prevented by one or two ropes passed under the body and fastened to the ceiling beams. The tail is held aside by an assistant or else tied upward and to one side with a strong cord.

INSTRUMENTS, ETC.—Ecraseur and castrating knife are the only instruments needed.

ANTISEPSIS.—A thorough antisepsis is needed more in the castration of bulls than similar operations upon other animals, on account of an admitted susceptibility to complications. Although fatalities are not so very frequent, serious illness is almost universal where antisepsis is disregarded or performed in a perfunctory fashion.

The scrotum must first be washed well with soap and water, then with a solution of mercuric chloride 1-500 and finally with tincture of iodine. In executing this step the scrotum is stretched so that the depths of its corduroy rugæ will be cleansed. The scalpel and especially the ecraseur is boiled or otherwise made safely aseptic.

TECHNIQUE.—The apex of the scrotum is taken in the fist of the left hand and resected by one sweep of the scalpel, instead of making individual vertical incisions for each testicle. This form of oscheotomy exposes the ends of both testicles with the tunica vaginalis still covering them. The tunica vaginalis is then manually loosened from the scrotum, to which it is feebly attached by areolar tissue, and the ecraseur chain adjusted over it at the highest possible level without exposing the testicle itself. The ecrasement assures a safe hæmostasia.

AFTER-CARE.—As long as there is no evidence of local complications the parts are not molested, but if the scrotum fills up with secretions or becomes swollen the wound should be drained and irrigated daily. Formalin ½% gives the best results as an irrigating liquid. Exercise, pasturing, sunlight,

succulent feeds and abundance of water, are essential to the best results.

CASTRATION OF CALVES

Calves are usually castrated very young, sometimes at birth, but the best breeders prefer to postpone the operation until they have arrived at the age of three to four months, and especially until such time as they can be allowed the advantage of a good, clean pasture. Stable confinement is more dirty, even in the cleanest establishments, while romping about in the pasture, in addition to affording the greatest possible cleanliness, encourages good health and vigor, and thus forestalls complications.

The calf should be secured by "hog tying" the legs or by the sheer force of one or two men. The scrotum is washed with soap and water and submitted to a good friction of mercuric chloride 1-500. The apex is picked up with all of the fingers of the left hand and excised with the scalpel, then when the testicle is released from the tunica vaginalis are pulled bodily out one after the other (castration by avulsion). Shreds of the cord that protrude from the scrotum are snipped off. A dusting with iodoform completes the operation.

CASTRATION OF LAMBS

The mortality amongst castrated lambs is higher than in the other species, unless special provisions are made to prevent complications. The scrotum of lambs is a folded, woolly receptacle for dirt, the manure of the sheepfold is the lambs' litter, and even in sheep kept out of doors, they lie about in denuded places where the flock congregates. If lambs are castrated without precautions to prevent wound infections from these harmful conditions many of them often fall victims to septic complications, which, in addition, are frequently aggravated by inclemencies of the weather. A cold rain, a sudden drop of the temperature or a storm is often a serious matter to a flock of castrated lambs. The age at which lambs should be castrated is less important than the prospects of good, warm, spring weather and a new, clean pasture for them to inhabit during the first ten days following the operation. In addition the manure of the sheepfold, which is usually allowed to accumulate during a whole winter, should be cleaned out and a fresh litter of straw supplied, should weather conditions necessitate a re-confinement of the flock.

A table, a bucketful of mercuric chloride solution 1-200 containing a large number of pledgets of cotton, and a sharp, strong pair of scissors is the equipment required. The scissors are immmersed constantly in the antiseptic solution.

The lambs are held by an attendant who sits upon the table adjacent to the bucket of antiseptic solution. The four legs are gathered together and held with the right hand, and the head with the left. The body rests upon the attendant's knees with the buttocks pointing toward the operator.

The scrotum is at once soaked with the antiseptic rinsed from the pledgets of cotton, which are cast aside when soiled. The apex of the scrotum is picked up with the fingers of the left hand and excised with the scissors, which are immediately returned to the bucket of antiseptic. Both exposed testicles are then grasped firmly between the second and third fingers of the right hand as the finger tips of the left squeeze them out of the scrotum. The extirpation is then affected by traction. As the cords are being drawn out the fingers of the left hand, still in the same place, press upon the scrotum as if to close the wound as the cord is leaving it. This squeezing of the scrotum with the left hand prevents wool or any dirt particles from entering the wound.

Protecting pastes such as tar, shellac, wound varnishes or collodion are harmful. If any antiseptic is applied to the wound it should be iodoform.

AFTER-CARE.—As soon as the lamb is castrated he is turned into the pasture or a specially cleaned place previously provided to receive the operated animals. In no case should they be even momentarily allowed to re-inhabit the uncleaned fold with the rest of the flock. Pasture diet and shelter against bad weather is the only other after-care required. Complications are treated as in other animals.

CASTRATION OF DOGS

Dogs are muzzled and secured manually or upon the canine operating table. The scrotum is washed with mercuric chloride solution and shaved if ordinary precautions are to be respected, and these are as important in canines as in any of the other species.

Each testicle is ablated separately. The incision is made parallel to the raphe, after pinching up the testicle with the fingers of the left hand. The extirpation is done by traction in small animals, and with the emasculator in the larger ones.

CASTRATION OF CATS

On account of the difficulty of coping with the feline gymnastics provoked by the restraint and the operation itself, the castration of cats is not a popular operation. The danger of personal injury from scratches and bites is great, especially in cats that are not accustomed to fondling. In handling a caressant cat the crafty surgeon can "apply the barnacles" before the instinct of self-preservation is aroused, but in the individual that has never been handled the maneuver, from beginning to end, is a screeching, scratching, fighting affair like surgery in a menagerie.

There are various methods of securing cats safely, but these afford no protection to the surgeon while the appliance is being adjusted. The body may be wrapped in a blanket or large towel, or forced head downward into a bootleg, but the best method is to take the cat in the arms, hold the nape of the neck in the left hand and then gather up the four legs with the fingers of the gloved right hand; or, according to Hobday, take the right legs in the right hand, the left legs in the left hand, and then force the head forward by bringing the hands together behind the neck.

Anæsthesia is not indicated on account of the short duration of the operation. The discomfort of the anæsthesia exceeds that of the operation.

Disinfection, although almost universally omitted in castration of ordinary cats, should not be neglected in the finer, long-haired breeds, as complications ending fatally are not rare. The disinfection consists of trimming the hairs from the scrotum and washing with mercuric chloride of the usual strength.

The castration is effected by separate incision for each testicle, and extirpation by traction, care being taken to ship off protruding shreds of the cord.

ABLATION OF THE OVARIES

SYNONYMS.—Ovariectomy; oophorectomy; spaying.

DEFINITION.—Surgical removal of the ovaries.

INDICATIONS.—The purpose of the operation of ablation of the ovaries varies with each species of domestic animals. Pathological conditions of the ovaries therefore furnish few surgical subjects. Ovarian tumors, ovarian cysts and ovarian abscesses occur frequently in the bitch, cow and mare, but they are seldom submitted to operative treatment. Spaying of animals does not belong to the

treatment of diseases. Its purpose is to prove the usefulness or value of an already healthy subject. In the bitch its chief purpose is to improve the value of a pet, as such, by preventing conception, obscene manœuvers, and the habit of roaming during the period of œstrum, and to admit of free co-habitation with other dogs. In the **ox** the value of the operation reaches a higher point than in any other animal. In the **western ranges,** where thousands of cattle herd together, the heifers were annually subjected to the operation with the object of preventing the too rapid increase of the herd. It is the policy of the rangemen to spay 10%, 20%, 50%, or even 75% of the heifers, according to the number of breeding animals wanted for the next year's quota. A secondary object of the operation is found in the increased value of the spayed heifer as compared with the virgin or primipara, as a meat producing animal. On the **stock and agricultural farms** the heifers are spayed so they can co-habit with bulls without interfering with their preparation for market, and also to improve their meat. In **milch cows** the value of the operation can hardly be overestimated, and is as yet but little understood by the American dairyman. It has been demonstrated, that the operation of spaying a milch cow within a reasonable time after parturition will prolong the milking period one to two years or even longer, without diminution of the supply. When the secretion of milk finally diminishes to an unprofitable point the subject is a desirable one for fattening purposes. In the **mare** the indication is limited to the nymphomanic condition manifested by vicious switching of the tail and kicking in harness. For this condition the operation is not a universal success, but improves and entirely cures a sufficient number to warrant its recommendation on the otherwise useless animal.

VAGINAL OVARIECTOMY IN THE MARE

INDICATIONS.—The spaying of mares is practiced today solely to conquer the vicious mare whose inclination to kick is due to an irritable condition of the genitalia. The disease is generally referred to as **nymphomania,** as the patient appears to be in œstrum constantly or at least very frequently. In harness, while being groomed, or when in contact with other horses in the stable, the tail is switched,

spurts of urine are frequently ejected, the clitoris moves actively, and there is an irresistible desire to kick at the stall or in harness to demolish everything behind. In some subjects these manifestations of bad temper are constant, while in others they are periodical, corresponding to certain frequent periods of œstrum. The disease seems to exist in variable degrees of intensity. One will only occasionally exhibit inconspicuous symptoms by leaning against the groom or by feebly switching the tail occasionally while driving, while another will almost constantly switch, kick, piss and even squeal at the slightest provocation. The former is still useful; the latter is a useless, miserable wretch; and between these two extremes are all the intermediate forms. Some are only useful when reduced to fatigue by hard work; some can only be worked single, and others work well for a time and then finally are seized with a desire to act viciously.

The disease has not been satisfactorily explained as to its pathogeny, although pathological ovaries are often found associated with it. That it is a disease running a definite, chronic course, accentuating with age, is admitted. Observations clearly prove its existence, but its nature, its location and its cause are unknown quantities. The ovaries are not always abnormal; sometimes they seem perfectly sound, and the uterus is not affected with a chronic inflammation. The clitoris, however, is usually red, tumefied, and sensitive, but this is easily an effect rather than a cause. Much remains to be explained about all features of the disease.

The results of the operation are not immediate in the confirmed case. From three to twelve months sometimes elapse before there is any perceptible change in the disposition. Generally the urination ceases first, to announce that improvement has begun; then the desires to kick become less frequent and finally the switchings of the tail become more feeble. The latter, however, usually remains to a certain extent for all times; there will always be some inclination to switch at intervals. In younger mares, where the habit of kicking is less confirmed, the cure is more certain and much more prompt. Usually one to two months after the operation the patient has developed into a fairly good individual. Failures have been reported, but it is evident that these are due to the anticipation of immediate relief rather than to the absolute failure of the operation. Furthermore, success in the confirmed subject, depends considerably upon judicious handling. The unfortunate creature should be kept at work, and prevented from kicking by kind

treatment, until the habit is forgotten. Rough handling will perpetuate the habit in spite of the operation.

PREPARATION.—The operation is much more easily performed when the bowels are empty. An oleaginous purge three days before the operation, and a restricted regimen for two days, should not be omitted.

RESTRAINT.—Restraint by means of the stocks is much the best. But in lieu of stocks the patient may be placed in a narrow, single stall, the standing position maintained with slings, and the hind legs hoppled to provide against kicking. In addition the nose is twitched, the head held in an elevated position, and a rope stretched across the dorsum to prevent arching the back and to hinder straining. The tail is braided and held upward with a rope passed over a beam or ring in the ceiling. Mares may also be spayed in the **recumbent position,** tied, preferably with the English hopples or other method of fixing the feet together with the legs fully extended. The operating table answers the purpose well. In the standing posture a good dose of chloral or morphine is helpful, and in the recumbent posture general anæsthesia is almost indispensable.

INSTRUMENTS, ETC., REQUIRED.—1. **Colin's scalpel** (Fig. 151) which has a well convexed blade safely

Fig. 151—Colin's Sheathed Scalpel.

sheathed to prevent cutting until properly adjusted to the seat of incision, is the best knife with which to make the incision, although the common castrating knife, in lieu of the former, may be made to answer. 2. Ecraseur, 22 inches long, (Fig. 152) constructed so that the chain loop can be conveniently wound up with one hand, is indispensable; the common ecraseur used for castration is inadequate. 3. A **syringe or pump** to wash out the vagina. 4. Antiseptics,—mercuric chloride, 1-1000; alcohol, 50%; and sodium bicarbonate, 1%.

ANTISEPSIS.—The instrument should be boiled to a point of absolute safety and then kept clean until used. **The hands** are washed thoroughly with soap and water, rinsed in mercuric chloride solution, dried with a friction of alcohol, and then enclosed in a clean pair of gloves during the pre-

paratory steps of the operation. The tail is braided and then tied up out of the way and the pudendum is submitted to a good washing with soap and water and then with mercuric chloride. To facilitate the passage of the hand into the vagina a little vaseline is smeared upon the lips of the vulva.

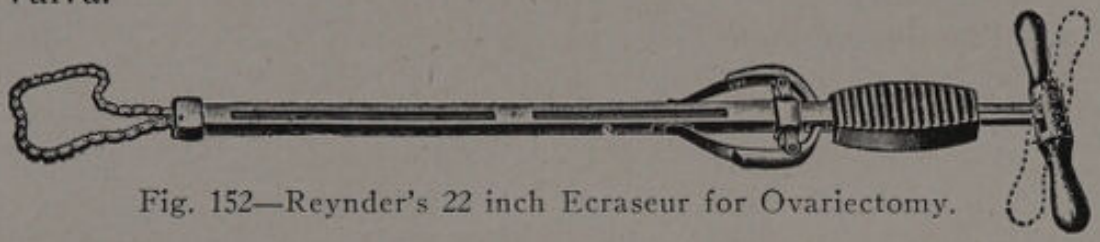


Fig. 152—Reynder's 22 inch Ecraseur for Ovariectomy.

First Step.—Disinfection and Dilation of the Vagina.—The vagina of the subject is generally filthy and sometimes irritated, necessitating liberal cleansing, yet in doing so it is important not to cause straining by injecting objectionable liquids into it. Water with a little lysol, phenol or very weak mercuric chloride at a temperature slightly in excess of the body heat, is pumped or syringed gently into every recess of the vaginal tube while one hand holding a pledget of cotton washes it into every wrinkle. After this irrigation the vagina is filled with a warm solution of sodium bicarbonate, one per cent until it is full, and until all of the wrinkles have stretched out. Williams calls this step "ballooning the vagina." The vaginal wall anteriorly is a loose membranous affair that is difficult to incise unless thus stretched out.

Third Step.—Vaginotomy.—The incision is made by taking the scalpel in the right hand, passing it into the vagina until the convex edge lies directly and firmly against the vaginal wall just above the os uteri. The blade is then unsheathed and thrust through the wall by a sudden forward movement. Sheathed again, the knife is withdrawn and the index finger passed into the incision to determine whether the peritoneum has been incised with the rest of the wall. If not, that is if the incision is not through into the peritoneal cavity, the knife must again be unsheathed and the incision completed. It is not prudent to rupture the peritoneum with the finger because of the danger of pushing it forward. When the incision has been made the knife is either dropped into the vagina or else handed to an assistant, after which the perforation is enlarged by gradually forcing the fingers consecutively into it until the whole hand can be passed into the peritoneal cavity.

Fourth Step.—Search for the Ovaries.—The hand is passed backward along the body of the uterus until the bi-

furcation is reached, then it is deflected to one side, where the ovary is soon found. The organ is easily recognized by its firm texture and undulated surface. The size may vary somewhat. Generally it is the size of a walnut but in certain pathological conditions it may assume the size of a base ball or even a cocoanut. The operator must assure himself that lesser mesentery is not held between the hand and ovary.

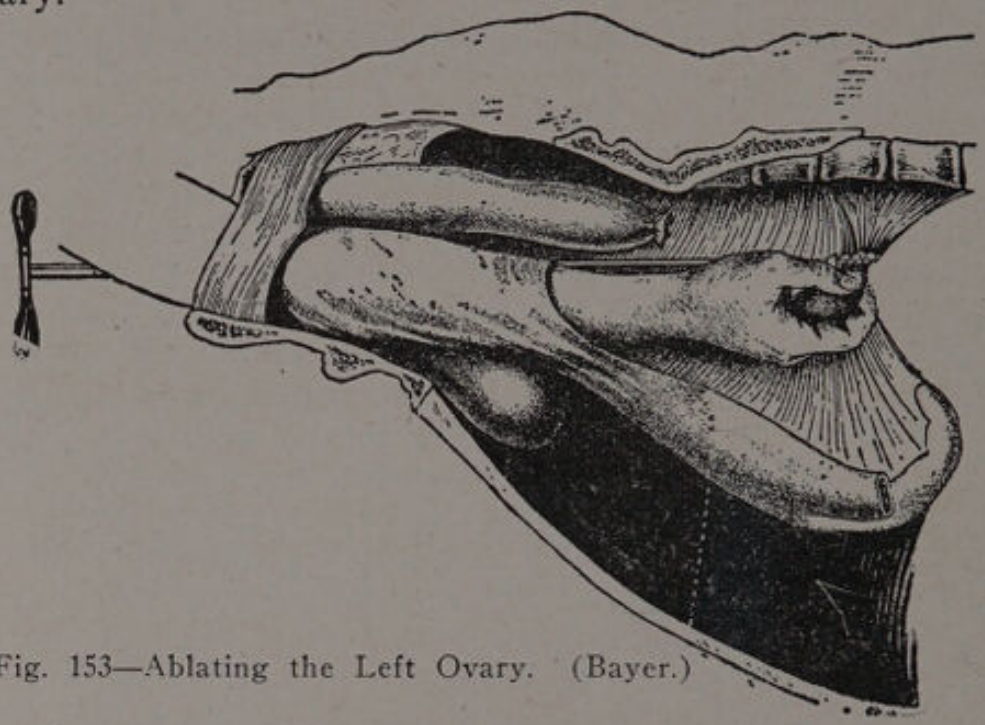


Fig. 153—Ablating the Left Ovary. (Bayer.)

Fifth Step.—Ablation.—When found the ecraseur is passed into the peritoneal cavity through the incision, paralleling the arm until the chain loop reaches the level of the hand. The fingers are now passed through the chain loop and the ovary drawn into it, and then as soon as the chain rests safely over the organ the handle of the ecraseur is taken in the left hand and worked as rapidly as possible in order to effect a hurried ablation. The crushing of the attachments always causes severe straining which rapid ablation reduces to the minimum. The ablated ovary is then deposited on the floor of the vagina and the same steps performed on the opposite side.

The operation is completed by simply bringing out the two ovaries as the ecraseur is withdrawn. The perforation of the vagina is not sutured nor submitted to any form of after-treatment.

AFTER-CARE.—The patient is kept in the standing position on a limited diet for twenty-four hours and then turned into the loose box for ten days, at which time, in the absence

of complications, she is ready for work. Protracted rest is unnecessary. In fact, rest and good care that would tend to improve the general health and spirits, especially in adults where the kicking is due as much to habit as to disease, is apt to impel viciousness rather than diminish it. It is advisable to return the patient to good hard work and to keep it everlastingly busy until the habit is gradually abandoned.

SEQUELÆ and ACCIDENTS.—Septic peritonitis is the most likely complication, but it is indeed rare when hands and instrument have been properly cleaned preparatory to the operation. Amongst the accidents are incision of the bowels, especially the rectum, caused by making the incision too high, or the cæcum by failing to diet the subject before operating. Prolapse of the bowels has never occurred to our knowledge.

VAGINAL OVARIECTOMY IN THE COW

INDICATIONS.—The vaginal operation in ruminants although possible only in full growns, is the preferable one for milch cows, because there is no external wound to complicate matters. In the yearling and smaller two-year olds the vagina is too small to admit the hand and instruments, but in the full grown cow the size of the vaginal tube is ample.

The object of the operation already referred to is chiefly that of increasing the duration of the period of lactation. Ordinarily the milch cows of our dairies fail in their milk secretion after a few months, and at the end of ten to twelve, they gradually dry up until the next parturition. During the interval between the periods of profuse lactation the cost of maintenance often exceeds the receipts from the meager supply. The loss accumulating during œstrum, during the last months of gestation and during convalescence from parturition is entirely prevented by spaying. The spayed cow becomes tractable and amiable in disposition, gains flesh on limited rations, gives an abundance of milk for twenty-four to thirty-six months, and at the end, when the secretion finally becomes unprofitable, is readily fattened for beef purposes and as such brings a much higher price than the ordinary cow. While the spaying of cows with this end in view has not been extensively practiced, the observations already made, show clearly its wisdom where the production of milk is the chief desideratum.

The proper time to operate is two to three weeks after the second parturition, or even after the third calf has been born. The object of the postponement is to allow the udder to develop to its full physiological capacity. The mammæ after the first birth are small and incapable of producing a profitable amount of milk, and as they undergo no further development after spaying, the best results are obtained in cows having full developed udders.

RESTRAINT.—The operation is performed in the standing position. The head is secured in the stanchion and the body between two blanks constructed in the form of a narrow stall. A railing on either side higher up than the lateral blanks serves to fasten ropes or slings which pass under the body to prevent lying down. The nose may be managed with the leading ring and the hind legs to prevent kicking are tied with ropes or hopples. The tail is either tied or held upward and to one side. The construction of such a stocks is a matter of but a few moments, either in the cow stable or out of doors.

EQUIPMENT REQUIRED.—The instruments best adapted for the operation are **Colin's** scalpel or common castrating knife, **22 inch ecraseur,** and a **vaginal speculum** or **vaginal stretcher.**

ANTISEPSIS.—In operating upon a number of animals the antisepsis is somewhat difficult to maintain because of the general contamination of everything connected with the work. A reasonably safe state of cleanliness can easily be established for a single operation, or for only a few, but when a large number are hurriedly performed consecutively, the washing basins, the sponges, the instruments and the hands soon become more and more unsafe for intra-abdominal manipulations. Where water is scarce, difficult to procure or is itself contaminated, there is much to be feared in the possibility of seriously infecting a large per cent of the animals operated upon. The most practical precautions in this connection may be done as follows: (1) Rinse the pudendum, tail and buttock with plain water. In order to economize the water a large twenty-four ounce syringe or pump is used instead of sponges, for these, if carried back and forth from patient to pail will necessitate the use of a clean pailful for each animal, and even then the pail soon becomes too filthy to be in any way associated with an abdominal operation. To the water used for this rinsing process creolin or lysol may be added. (2) The anus and vulva, following the rinsing process, are then washed with mercuric

chloride solution 1-500, using pledgets of cotton which are cast off when soiled. To facilitate passage of the speculum into the vagina the next step is to lubricate the vulval surface with vaseline. (3) No washing of the vagina is attempted, except in the individual operation where sufficient time to do it properly can be allotted to this step of the antisepsis. To wash the vagina perfunctorily is useless, and in fact is more apt to cause infection than to destroy it. Unless the vagina can be submitted to a thorough cleansing, consuming considerable precious time, much better results will be derived from leaving it strictly alone. The only antisepsis necessary here is to give the seat of incision a few good wipes with a pledget of cotton soaked in the strong mercuric chloride solution, after the speculum has been adjusted and just before the incision is made; and even this may safely be omitted. (4) The instruments are boiled to assure absolute sterilization at the beginning; and to maintain them in a safe condition the knife blade between intervals of use is kept immersed in pure phenol and the ecraseur head in the strong mercuric chloride solution. It may be repeated here that although this solution will unpolish the metal it does no permanent harm to the instrument and the safe sterilization maintained thereby easily compensates for this trivial objection. When the mercuric chloride solution becomes bloody or accidentally dirty it is replaced with a new supply. The hands are frequently rinsed in the same solution used for the ecraseur.

A review of these steps shows the reader that the antisepsis is not complicated, only one pail of real antiseptic liquid being required, as it is utilized for the triple purpose of washing the vulva, rinsing the hands and immersing the ecraseur. The phenol for the knife is kept in a salt-mouthed bottle.

When the operator is compelled to assist in securing the animals a clean pair of gloves should be worn between operating intervals to prevent the hands from becoming repeatedly soiled with dirty ropes, stocks, hairs, excrement, etc.

TECHNIQUE.—The technique varies from that of the mare operation only in the use of the vaginal speculum. In the mare some pains is always taken to cause a dilatation of the vagina by filling it full of liquids, while in the cow the dilatation is effected at once, without ceremony, with the vaginal speculum or with a special stretcher. Although it is, of course, possible to perform the operation without the speculum, it is nevertheless too helpful to be omitted.

After the patient has been secured and the antiseptic washing completed the speculum is inserted and screwed open. This dilates the vaginal tube anteriorly, stretching it at the seat of incision. The knife is taken from the phenol bottle, rinsed in the pail of clean water to wash off the caustic coating, and then passed with the right hand to the anterior vaginal wall. The blade is pressed firmly against the wall just above and near to the os uteri and the vagina incised by one quick thrust. With a little experience the force of the thrust can be gauged so as to make a complete through-and-through incision without endangering the abdominal organs. The incision is enlarged by forcing the fingers one after the other through the opening until the whole hand is admitted. The speculum may be removed after the incision has been made. The search for the ovaries and their ablation does not differ from that of the mare operation.

AFTER-CARE.—The cows require no special after-care except restriction of the diet for several days. If accustomed to the pasture they may be turned out, but on account of the tendency to overeating when first pastured in the spring, they should not be allowed to run at grass for the first time after the operation.

SEQUELÆ AND ACCIDENTS.—Septic Peritonitis, the one serious post-operative complication, does not often supervene when the above antiseptic precautions were respected throughout, but when careless methods have prevailed, especially in aged and more or less debilitated cows, the fatalities are common enough. Vaginal ovariectomy of cows must not be undertaken under unfavorable conditions, especially conditions which contravene the antiseptic precautions. **Prolapse of the bowels** through the vaginal incision, which would seem possible, is prevented by the wrinkling up of the vagina. Amongst the accidents is the accidental **incising of the intestines** while making the incision through the vagina. This accident is indeed quite possible when the rectum is full, when the incision is made at too high a point in the vagina, when attempt is made to incise the vagina without stretching its walls with the speculum, or when the intra-abdominal tension, from failure to diet the animals, presses the cæcum into juxtaposition with the vaginal wall. **Hæmorrhage** from the ovarian arteries is a much more frequent accident than is generally supposed, and although it is not always serious, death may sometimes occur therefrom. The seriousness harmonizes with the vol-

ume lost, and when infection adds to the mischief the chances of recovery are small.

Bloating.—Cows sometimes bloat considerably one-half hour to two hours after the operation, in which instance they may lie down and manifest a somewhat threatening distress. These manifestations are, however, usually transient, gradually disappearing without treatment. Paracentesis of the rumen and the internal administration of antacids is seldom necessary.

OVARIECTOMY IN HEIFERS

INDICATIONS.—In young she-stuff the objects of the spaying differs entirely from those described in the operation upon full grown cows. Here the chief aim is to develop a more valuable as well as a more economically fed beef animal. The spayed heifer grows faster, fattens easier, cohabits with others without molestation and brings the same price as steers in the market. On the smaller farms where a few bovines are reared annually to be marketed for beef it is no small convenience and no trivial asset to be able to safely allow all the bovines to herd together in the same pasture or in winter in the same yard, in contradistinction to the annoyance of constantly keeping the sexes segregated in different enclosures. These presents, in addition to the advanced value of the spayed heifer on account of the excellency of its beef, gives a high value to the operation. The operation should be practiced more extensively on the small farms than it has been during the past, on account of its great value in animal husbandry. The large majority of American veterinarians have not only failed to encourage the practice amongst stockmen, but they have actually avoided the operation.

On the American ranges the operation of ovariectomy in heifers needs no introduction. It has been performed for years with gratifying results. In fact, the profitable management of large herds would be quite impossible on account of the difficulty of regulating reproduction, and the loss incurred in the wholesale marketing of pregnant females.

RESTRAINT.—The operation may be performed both in the **standing position** and in the **recumbent position.** The **standing position** is the preferable one and should always be adopted where a substantial and suitable yard, chute and stocks can be constructed. The novice will find that the ovaries are more easily found when the viscera hang in their normal relations. A yard leading into a narrow chute ad-

mitting the animals single file, and ending at an improvised stocks fitted with a trap for the head, ropes to prevent lying down, and an open space on the left side to expose the seat of operation, constitutes the ideal arrangement when a number of heifers are to be operated upon consecutively. The animals are driven into the chute, prodded along to the stocks, fastened, operated upon and then released at the front end, leaving the stock ready to receive the one waiting behind. With such an arrangement large numbers can be operated upon with minimum delay. The stocks construction is a simple one. It is but the end of the chute, equipped in front with two hinged railings between which the head is trapped, and two ropes fastened on the top railing of the

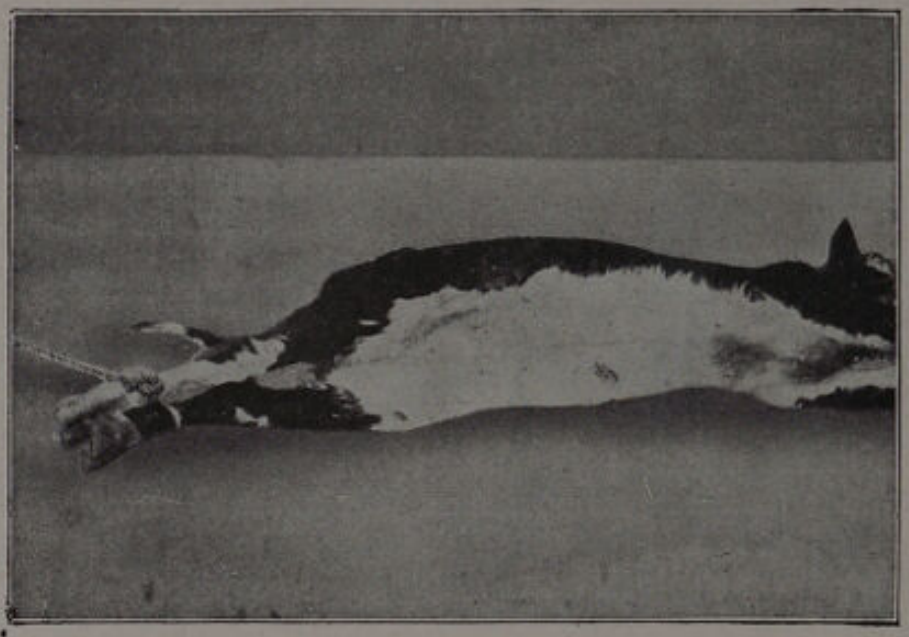


Fig. 154—Posture for Spaying. The Recumbent Position.

right side. The ropes drop to the ground and when the animal is driven into the stocks and the head has been fixed between the hinged railings they are brought around the body one at the chest and one at the flank. The front rope passes around the body just below the elbow and the hindermost one passes upward in front of the stifle and then backwards behind the external angle of the ilium. Both are tied with loop knots at the point of origin, thus fixing the patient against the right wall of the stocks. The left side has a wide gap between the railings so as not to obstruct free access to the seat of operation. A hinged door that will prevent the animal from jumping through the gap before being tied, and which can be quickly dropped as soon as the

head is safely trapped, is an excellent improvement, although a removable railing will answer. The author has found it entirely practical to build the left side of the stock only two and a half feet high and then keep the animals from jumping over by lassoing and then dragging them to the front. This leaves the entire side of the animal exposed and gives the surgeon much more freedom.

The **recumbent position** with ropes is the one adapted to operations in the open prairie, and where there are only a

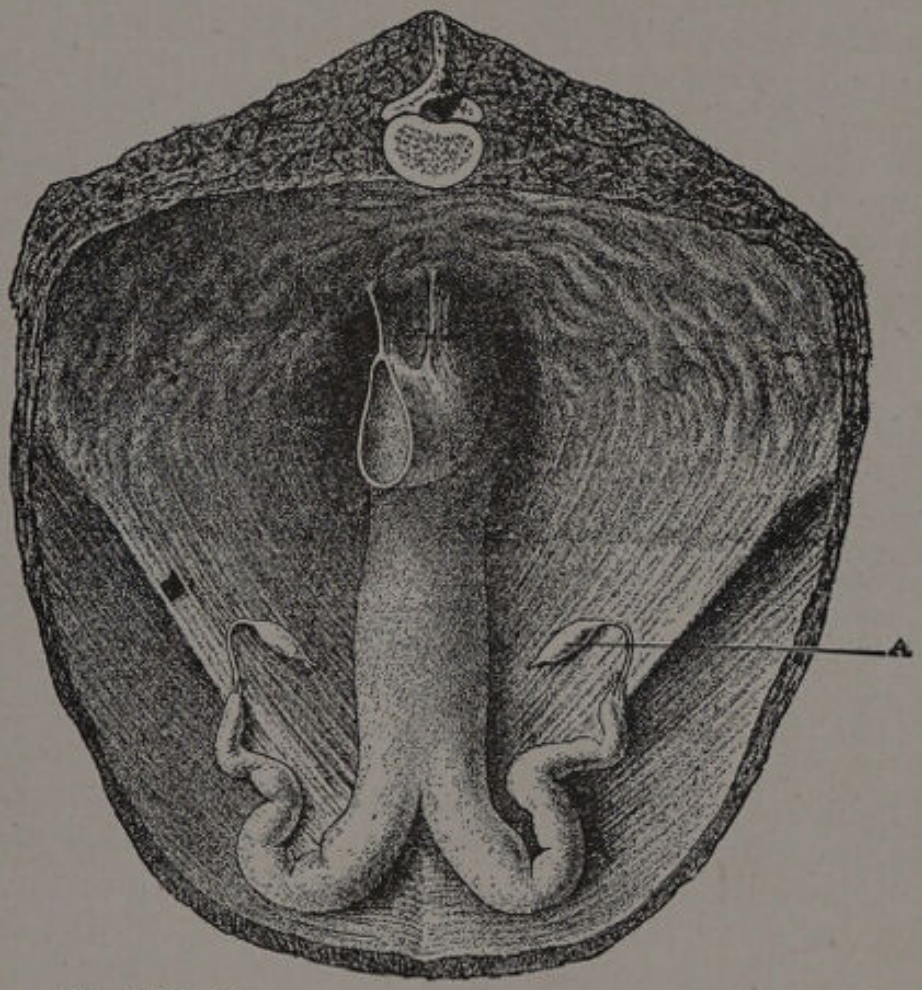


Fig. 155—The Anatomy of the Internal Genitalia.
A, Right Ovary. (Bayer.)

few animals to be operated upon. The method most suitable is to simply fix the two fore feet and the two hind ones together, each with separate ropes, which are then used to stretch the fore legs forward and the hind ones backward. The operator takes a kneeling position at the lumbar region. On the ranges the legs are lassoed from ponies and the stretching of the animal into the operating position is accomplished without dismounting.

INSTRUMENTS.—1. Scalpel. 2. Ecraseur, emasculator (spaying) or spaying shears. Of these three instruments the spaying shears, which are nothing more than a large pair of curved scissors, are much the easiest to handle, and although they cut keenly the bleeding resulting therefrom seems to be trivial. Some spayers take the opposite view that bleeding is often a matter of serious moment when the shears are used. The spaying emasculator effectually prevents bleeding, but is a somewhat less handy instrument, in that a little difficulty is sometimes met in placing the ovarian attachments into its jaws. The ecraseur is ideal, but too slow. It prolongs the pain, causes struggling and delays matters unnecessarily. 3. Needles, thread, needle holder. The needle should be large and keenly penetrant, because the skin is thick and tough, the thread strong and small, and the needle holder of sufficient size to enable the surgeon to push the needle through the tough skin without delay. 4. Clippers. 5. Razor. The razor is only used when haste is no object,

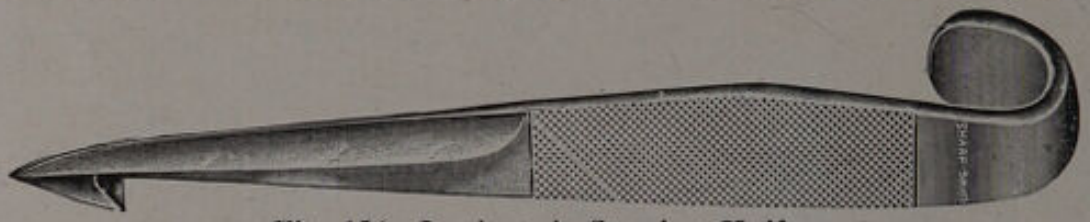


Fig. 156—Jamieson's Spaying Knife.

as for example when only one or two animals are to be operated upon.

ANTISEPSIS.—There is often much to contend with in this connection. Despite everything the environment generally abounds with filth that is difficult to control. The surrounding grounds has often been trampled into dust, which, manure laden, may be blown by gusts of wind into the antiseptics, over the instruments and upon the field of operation, defeating the most painstaking efforts. Dust, if blown about abundantly, should be allayed by sprinkling, and a clean elevated table constructed for the equipment, instruments and antiseptics, in order that these may be kept as clean as possible.

The surgeon himself should take no part in tying the patient, nor preparing the field of operation to avoid the alternate handling of the dirty extraneous objects and the abdominal viscera with the same hands. These preparatory steps are assigned to assistants, and the surgeon occupies his time between operating intervals, in maintaining the cleanliness of the hands, the instruments and the antiseptics.

The **instruments**, knife and emasculator, should be boiled before using and the boiling should be repeated as often as time will permit, and to keep them reasonably safe while in use they should be kept in a pailful of lysol solution, two per cent.

The **hands** are submitted to a thorough washing first with soap and water, second with mercuric chloride solution, 1-500, and then dried with alcohol. The nails are trimmed and well cleaned. The cleanliness of the hands is thereafter maintained by frequent rinsing in the mercuric chloride solution, and if through lack of help it is found necessary to

Fig. 157—Location of Incision in Flank Ovariectomy and Operator's Position.

handle ropes, bars, or the patient, clean gloves must be worn to prevent harmful contamination.

The **field** is prepared as follows:—A space over the flank six inches in diameter is clipped and then the loose hairs are sponged off with water. At the same time the surface of the abdomen, the back, and the buttock is sprinkled with water to prevent the flying of hairs. The clipped surface is then given a brisk rubbing with mercuric chloride solution 1-500. For this purpose pledgets of cotton are used, and when soiled they are cast off, in order to keep the antiseptic solution clean. Shaving the field is not advisable on account

of the precious time consumed. However, if speed is no object, shaving is a step in the right direction.

PREPARATION.—The animals should be sustained on a limited diet for at least three days, as intra-abdominal tension from loaded viscera, especially the rumen, is positively a serious obstacle. The full rumen will bulge through the incision, the ovaries are more difficult to locate and post-operative bloat is more certain to occur when the heifers are allowed full rations until the very moment of being submitted to the operation.

TECHNIQUE.—First Step.—Location of the Incision.—The left side is now most frequently selected for the laparotomy, although either will answer. On the left side there is only the rumen, while on the right one there is a mass of bowels with which to cope. The incision is made perpendicularly in the very middle of the space between the tuber coxæ and the last rib, and extends from a point about two inches from the transverse processes of the lumbar vertebræ downwards three and one-half to four inches, according to the size of the surgeon's hands. The author prefers the vertical incision, but others favor a slightly diagonal one extending downward and forward. (Fig. 157.)

Second Step.—The Laparotomy.—The thick skin is cut through at one firm, deliberate stroke, (three and one half to four inches) exposing at once the underlying external oblique muscle, whose fibers extend downward and backward. The division of this muscle is made in the direction of its fibers with the scalpel, and then the incision is torn wider with the fingers, exposing the internal oblique, which is then treated in the same manner; that is to say, it is incised in the direction of its fibers. The underlying aponeurosis and the peritoneum is punctured with the point of the scalpel and then enlarged by tearing. At once the inward suction of air announces that the abdominal incision is complete. The rumen is now in view. The object of making this apparently complicated abdominal incision is to create an automatically closed opening. The incisions through the muscles cross each other in such manner as to effect an almost perfect closure, and the time required to make them is no greater than a direct through and through division of the entire wall.

Third Step.—The Search for the Ovaries.—The surgeon stands with his back to the patient's head, passes the left hand through the incision, backward and downward over the rumen and then across the abdominal cavity to the point

where the brim of the pubis turns upward toward the shaft of the ilium. It is in this region that the right ovary is found hanging from its appendages. It is recognized by its hanging position, by the facility with which it can be moved about in every direction, by its indulated surface, by its hilus, and by its size. The ovaries of heifers are about the size of the end of a man's thumb, of an acorn, of an almond nut, or of a small hickory nut. The only other structures with which they may be confounded are lymphatic glands, whose surfaces, however, are always smooth, and whose positions are always fixed.

Fig. 158—Ablation of the Ovaries and Operator's Position.

Fourth Step.—The Ablation.—The ovary is held in the palm while the emasculator is passed to it along the dorsal surface of the arm. The attachments of the ovary are then placed between its jaws and the ablation effected at one snap.

Fifth Step.—Ablation of the Left Ovary.—Without withdrawing the hand, or even the emasculator, the other ovary, which occupies the same relative position on the left side, is found and treated in the same manner. Both ovaries are thereby brought out together, the time consumed is but a moment and the wound in the abdominal wall has had little opportunity to become infected. If the hand is withdrawn

after removing the first ovary, the operator in making the excursion for the other one must be sure to pass the hand under the edge of the broad ligament. Otherwise this curtain will be between the hand and the ovary.

Sixth Step.—Suturing the Wound.—The wound of the skin is closed with three interrupted sutures which are carefully placed so as to bring neat apposition of the edges. The underlying muscles, on account of the method of division (Step 2), require no sutures.

Seventh Step.—Protection of the Wound Against Infection.—The best protecting substance is a wound varnish consisting of melted rosin and linseed oil. Tar, collodion, Canada balsam, et. al., may be used.

AFTER-CARE.—The animals are turned to pasture or else given the freedom of a clean yard. The wounds should be inspected at least once during the succeeding eight days, in search of untoward reactions, and at the end of eight days the sutures are removed and the wounds given a final treatment according to their requirements. This after-care is, however, not always possible. In the ranges no attention is paid to the wounds after the animals are once operated upon. The stitches are left to slough out. In every case where heifers can be caught, as it is a matter of but a few moments, the stitches should be removed and the wounds given sensible treatment.

SEQUELÆ AND ACCIDENTS.—Septic peritonitis, hæmorrhage, septicæmia, abscess of the abdominal wall and post-operative bloating are the possible sequelæ. The only accidents likely to occur are accidental incision of an intestine when the curved scissors are used and bleeding from the circumflex illi artery.

Note.—It is possible to ablate the ovaries of heifers through a flank incision only large enough to admit one finger. The patient is recumbent and the incision is made in the right flank about five to six inches below the tuber coxæ. The index finger is inserted and by pressing the belly downward with some force the tip of the finger can be hooked over the left ovary, which is brought out through the incision and held there while the finger returns for the right one. When both are brought out they are ablated together with the ecraseur. It seems, however, that many have completely failed to perform the operation in this manner, and many with whom the author has conversed have doubted its possibility. It is, however, personally known to

me that Vanlaw, a spayer of wide experience, has operated upon as many as 20,000 heifers in this manner in a single season.

OVARIECTOMY IN SOWS

INDICATIONS.—Nowadays sows are not very frequently submitted to the operation of spaying, because hogs are marketed at a very early age. The fattening of pigs begins almost from the time of their birth and continues incessantly under forced feeding until they reach that state of unnatural obesity,—the marketable condition,—as early as ten months. Under such conditions spaying is unnecessary. Previously hogs were fattened during the second year of their lives and as a consequence the danger of pregnancy necessitated preventive measures. Nevertheless, it being a fact that veterinarians are occasionally called upon to perform this operation, its performance should not be permitted to become a lost art.

TECHNIQUE.—The sow is held on the left side by two assistants, and the operator kneels at the back. An incision one and a half inches long is made in the flank in front and a little below the tuber coxæ. The skin is incised and the fingers complete the perforation. The index finger is passed backward over the fundus of the bladder and hooks up the uterus, which is brought out through the incision. The bifurcation is sought and then one of the cornue is pulled out hand over hand until it brings out the ovary which is cut off with a scissors. The cornue is returned through the incision until the bifurcation is reached again, and then the other one is brought out and treated in the same manner. A single stitch completes the operation.

OVARIECTOMY IN THE BITCH

INDICATIONS.—The objects of averting pregnancy and œstrum in bitches is chiefly that of preventing them from running about or engaging in obscene maneuvers during the periods of œstrum, which seems to produce a greater pschycological effect in bitches than other domestic females. The spayed bitch is a much more desirable pet, a more faithful watch dog and is much more reliable in the field than the entire animal whose periodical concupiscence greatly distracts from her usefulness in the several capacities for which the dog is utilized. To obtain the best general results the operation should be performed before the bitch-pup has ar-

rived at puberty, because when the sexual impulses of bitches have once developed strongly, it is by no means certain that spaying will entirely destroy them. Although pregnancy is, of course, impossible, spayed bitches may quite frequently consent to copulate at definite periods, precisely the same as before ovariectomy had been performed, and this unexpected result can not always be traced to defective surgery, since they have been observed by the author when all of the ovaries and a part of each cornua had been removed.

RESTRAINT.—The bitch to be spayed is tied by the four legs in the dorsal recumbent position with the head declining 15 to 20 degrees or more. A board or ladder supported against a wall or fence at the proper incline may be utilized with good advantage. In the operating room, Young's device (Fig. 159), consisting of a simple triangular

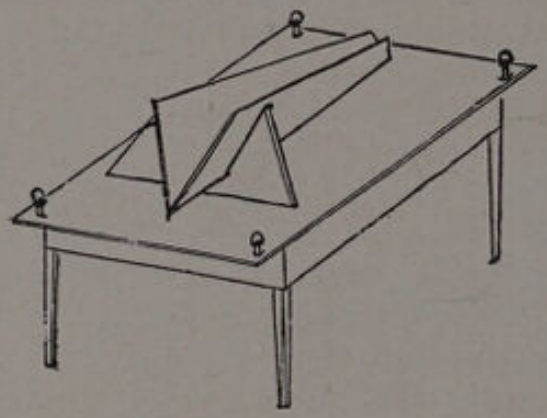


Fig. 159—Young's Table for Spaying Bitches.

trough made by nailing the edges of two boards together and then preventing it from tipping over by nailing a third board across one end, answers the purpose exceptionally well. In the author's operating room this exigence is met by a polished board two feet wide and five feet long, hinged to the wall two and one-half feet from the floor. When not in use it is fastened to the wall with hooks and eyes, where it occupies little space. When turned down for use the free end is rested upon objects of various heights according to the degree of inclination desired. The edges of the board are equipped with screw-eyes at different points upon which to fasten the tie cords from the patient's legs. This is by far the handiest, as well the most economical, dog table for the ordinary veterinary hospital where canine operations are not numerically important.

In addition to the restraint, general anæsthesia is desirable to facilitate the technique, as well as to avert the horri-

fying spectacle of exposing the viscera without any attempt to control the pain. Total general anæsthesia with ether or else partial general anæsthesia with hypodermic injections of morphia may be selected. Of the latter two to six grains may be administered, according to the size of the bitch. These large doses of morphia are both effectual and safe. In fact they are much safer than the administration

Fig. 160—The Author's Ovariectomy Forcep for Bitches.

of ether by inexperienced hands. M. A. C. tablets (Abbott) administered hypodermicaliy act well in the dog, and for this purpose especially.

INSTRUMENTS.—1. Scalpel, probe-pointed bistoury.
2. Tissue forceps.
3. Two hæmostats.
4. Needles and silk thread.
5. Scissors.

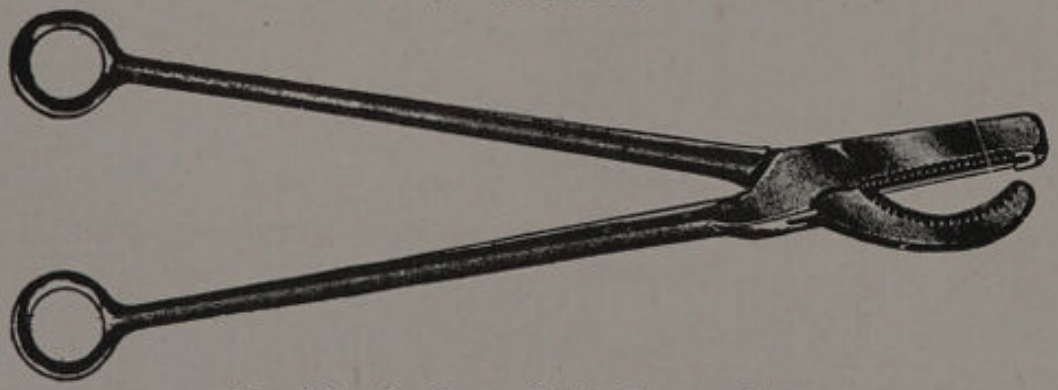


Fig. 161—Ordinary Bitch Emasculator.

ANTISEPSIS.—The belly must be shaved and washed well with lysol solution or mercuric chloride after having been submitted to a good cleansing with soap and water. To prevent shedding hairs from entering the field the surrounding parts are wet down with water and the whole region except the field itself covered with towels. Only boiled instruments are absolutely safe. Manual manipulations of

the viscera and abdominal incision is avoided as much as possible.

PREPARATION.—As an empty alimentary canal greatly facilitates matters a course of dieting should precede the operation. Solid food is withheld during at least the preceding three days; only liquids are allowed and these in limited quantities during the last twelve hours.

TECHNIQUE.—First Step.—Location of the Incision.—The line of incision is about one and a half inches long,

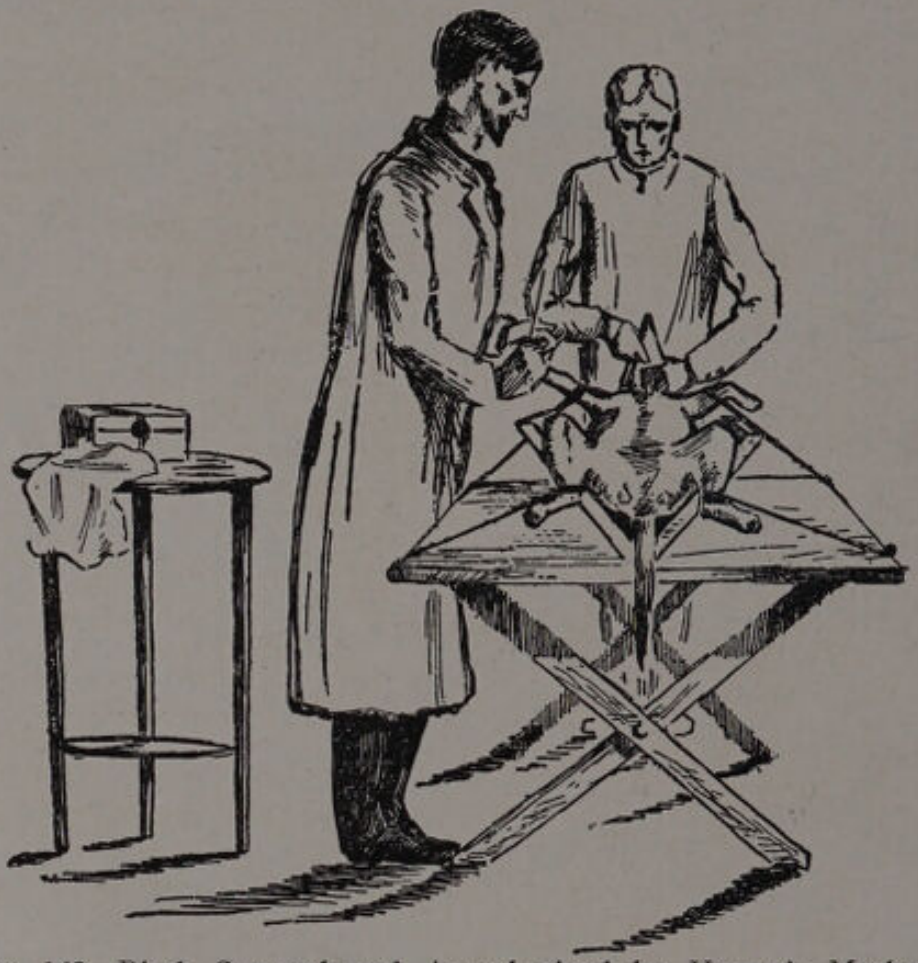


Fig. 162—Bitch Secured and Anesthetized by Young's Method.

crossing the umbilicus so that the anterior half inch overlaps it. It is preferable to select a line at one side of the linea alba, in order to avoid a hernia arising from the failure of this poorly nourished fibrous structure to unite promptly. If the incision is made too far posteriorly there may be some difficulty encountered in bringing the ovary through the incision, even by considerable traction upon the cornua, hence the advisability of overlapping the umbilicus.

Second Step.—The Celiotomy.—Following the line above described the skin and underlying muscles are incised. The latter are divided cautiously to avoid puncturing the periton-

eum prematurely. When the latter is exposed it is punctured at one end of the wound with the scalpel and then divided along the entire course of the incision with the probe-pointed bistoury. A grooved director passed beneath the peritoneum may also be employed to guard against visceral injury.

Third Step.—Search for the Uterus.—There is no immediate attempt to find the ovaries; the uterus or one of the cornu, which lie just beneath the bladder, is sought by palpation. The inexperienced may facilitate matters by passing a probe into the uterus through the vagina. The probe, if moved about gently, promptly discloses the position of the uterus.

Fig. 163—Bitch Properly Bandaged after Ovariectomy.

Fourth Step.—The Ablation.—When the uterus has thus been discovered it is hooked up, either with the index finger or with a blunt tenaculum, and brought out through the wound. The bifurcation is sought and then gentle traction upon one of the cornua soon brings the ovary attached to it into view. The ovary will be recognized from adipose masses by its elongated form and its relatively firm texture. Its ablation may be effected in various ways. The simplest safe method is to grasp the attachments of the ovary firmly with the artery forceps and then cut it off with the scissors, leaving the forceps to hang until the opposite ovary is brought out and ablated in the same manner. The forceps are allowed to remain for a few moments while preparation for the next step is being made. This method of ablation is simple and never fails to prevent bleeding, except in bitches in heat, where ligation with catgut is the only absolutely safe measure.

It is also customary with some to tie off and remove the greater part of each cornua as well as the ovary. The particular advantage of this is not apparent in theory nor in practice, except possibly in subjects found to be pregnant.

The emasculators in miniature, sold under the name of "bitch emasculators," besides being entirely too cumbersome, seldom prevent bleeding as effectually as the above method.

Fifth Step.—Suturing the Wound.—The operator may select between the three following methods: (1) Through-and-through interrupted sutures of silk; (2) a row of buried catgut interrupted sutures for the muscles and peritoneum, taken together, and a row of silk interrupted sutures for the skin; and (3) removable buried sutures of silk. Of these the last is recommended. (See Fig. 67.)

Sixth Step.—Post-operative Protection.—The sutured wound should be protected by a firm body wrap to assure against infection, to support and immobilize the abdominal parietes and to prevent the patient from tearing the sutures with the teeth. Chemical antiseptics are not employed in dogs, except under a safe bandage, on account of the possibility of licking them.

AFTER-CARE.—A clean wound will require no further attention until the eighth day, when removal of the stitches becomes necessary. The patient, by gradual stages, is allowed to return to its normal diet and is given the freedom of a small kennel. Running about, especially during the first few days, is harmful.

ACCIDENTS AND SEQUELÆ.—(1) **Hæmorrhage** from the ovarian artery of one or of both ovaries sometimes occurs. It is not rare for the peritoneal cavity to fill quite full of blood when some error in ablation has been made, e. g., when in pregnant bitches or bitches in heat no ligatures were applied to the arteries. When the bleeding is copious attempt may be made to again bring up the end of the cornu and apply a ligature around the bleeding place. Between the two evils of prolonging the operation while the wound is reopened and the vessels ligated, and that of trusting to spontaneous arrest, by all means choose the latter. The application of cold compresses over the abdomen and loins is helpful.

(2) **Hernia** is much less common in bitches than in cats, but it does sometimes occur when the muscles, on account of improper suturing or sepsis, have not united while at the same time firm union of the skin promptly occurred. The **prevention** consists of making the incision to one side of the

linea alba, of effectually suturing the peritoneum and muscles, and of preventing sepsis by cleanly methods. A cure can only be effected by a radical herniotomy.

(3) **Prolapsus of the bowels** is a common occurrence during the operation, especially on the unanæsthetized animal. By straining a whole mass of small intestines sometimes press out through the incision to the dismay of the surgeon. The accident, however, is more annoying than serious, but is should be promptly met by returning them before the volume is too large and before they have been unnecessarily soiled.

Delayed prolapse may occur during the first three days from the bitch tearing out the stitches with the teeth, and as the accident may not be promptly discovered fatal results may be expected. The accident is prevented by effectual body wraps, and when it has occurred the treatment should consist of prompt return of the bowels after having submitted them to a thorough cleansing, and of closing the wound with through-and-through interrupted sutures.

(4.) **Anorexia** persisting for a few days, is a quite common sequel, but is more common in cats than in bitches. There is no apparent cause in some cases, and despite treatment death sometimes supervenes from actual starvation. Often, however, this symptom is due to peritonitis. Alcoholic stimulants, aromatic bitters and forced feeding is the proper treatment.

(5) **Shock** sometimes supervenes a prolonged operation performed without anæsthesia, and in which considerable blood has been lost, or in advanced pregnancy, where the gravid cornu were removed. This accident is met with strychnia, ammoniacal stimulants, friction, tight abdominal pressure and subcutaneous injections of normal salt solution.

(6) **Septic peritonitis** is by no means as common a sequel in bitches as in the larger domestic animals, but it does occur after filthy operations, or in enfeebled animals where the antiseptic precautions were not free from fault. The prevailing impression that dogs can tolerate filthy abdominal surgery with impunity is not correct.

OVARIECTOMY IN CATS

There is no essential difference in the technique from that described above, except that the smallness of kittens makes the operation somewhat more tedious. It is in the sequelæ that the greatest difference is found. Cats are much

more sensitive to ovariectomy than bitches; all of the sequelæ are more likely to occur and in a much more severe form. Hernia, septic peritonitis, and anorexia are quite common. The cat should be secured dorsally on an inclined plane, with all of the legs well spread out.

ABLATION OF SCIRRHOUS CORDS

INDICATIONS.—The decision to operate upon an enlarged spermatic cord depends upon whether the tumefaction is in reality a permanent sclerosis, an encroaching new growth, or simply a temporary swollen condition dependent upon an active though sometimes stubborn inflammatory process that will eventually subside spontaneously. It sometimes happens after castration that one or both of the spermatic cords become the seat of an inflammation that gives the inguinal region a physiognomy simulating scirrhous cord, but which in reality is but a transient morbid process. One, two and sometimes three months after the operation the region of the scrotum appears to be in bad condition. The incisions, instead of healing, continue to discharge a limited amount of pus and the cords on palpation are found hard, enlarged and somewhat painful. Notwithstanding that such a condition is often the precursor of a real scirrhous cord, it is always advisable to postpone operative intervention until its chronicity is positively established by the lapse of considerable time or by ample evidence that the growth is increasing instead of diminishing in size. A tumefied cord that continues to enlarge after six weeks, or one that continues to sojourn at the end of four months, may safely be pronounced chronic, and hence is a fit subject for ablation; while on the other hand, one that is only of three, four or five weeks' standing and that shows a decided inclination to cicatrize into a smaller and smaller object from time to time may prudently be treated expectantly for several months, in hopes that operative treatment may eventually prove unnecessary. It is true that ablation will more promptly cure these recent cases than the expectant treatment ever does, yet the wisdom of submitting the patient to a second operation that is fraught with considerable danger, can always be questioned in view of the excellent recoveries that often occur without operation.

There is, however, no excuse for indecision when the chronicity is well established, nor in any of the scirrhous cords found many months or years after castration. Here,

ablation should be practiced without delay, to prevent the diseased cord from growing to a size that would render the operation more and more hazardous.

When the growth is enormous, or when large and bilateral, especially if the patient's health is bad from the constant drain from the disease or from overwork, the operation is an exceptionally dangerous one. Fatalities are common. In such cases it is always advisable to postpone the operation until the vigor can be restored by rest, healthful exercise, tonics and good feeding. In view of the high mortality the wisdom of undertaking the ablation of enormous scirrhous cords in more or less emaciated subjects is indeed doubtful. Although the worthlessness of the patient may be admitted, there will be little credit gained in performing a difficult operation whose mortality is as high as that of ablating exceptionally large scirrhous cords from debilitated horses.

RESTRAINT.—The horse is in the dorsal position with the casting ropes, and the hind legs are spread out so that the inguinal region is accessible. General anæsthesia is not only advisable but highly essential to the success of the operation. In small unilateral scirrhous cord the partial general anæsthesia of chloral hydrate (one to one and a half ounces given as a drench one hour before operating) is sufficient, but when the growth is so large and widely adherent as to necessitate a long, painful dissection, chloroform anæsthesia can not be arbitrarily omitted. The operation is much too painful and of much too long duration to be performed without general anæsthesia. The omission is not only brutal but also invites fatal results from shock, syncope, exhaustion from straining against the restraint, hæmorrhage and sepsis.

On the operating table after the anæsthetic has been administered the uppermost leg is drawn toward the ceiling with a rope and the tail is tied backward to prevent switching into the field should the patient partially recover from the anæsthesia during the operation.

INSTRUMENTS.—The equipment is as follows:

1. Scalpels.
2. Tissue forceps.
3. A number of hæmostats.
4. A tumor forceps.
5. Threaded needles for ligating vessels.
6. Needle and thread to suture the incision.

7. Large needle and thread to ligate the cord if found necessary by failure of the ecraseur to crush it off.
8. Ecraseur.
9. Antiseptic solutions.

TECHNIQUE.—First Step.—Disinfecting the Field.—As the field is often covered with putrid discharge, some of which is desiccated over the skin, a preliminary washing, before casting, is advisable. After the patient is in position the growth is squeezed with the hands to evacuate as much of the pus in the sinuses as possible, and then the sinuses are irrigated with a strong solution of mercuric chloride. This precaution prevents the flow of pus into the surgical wound during the dissection. The whole region is given, in addition, the usual surface cleansing with soap, water and mercuric chloride.

Second Step.—Dissecting the Growth from the Surrounding Attachments.—An incision is made from the level of the internal inguinal ring downward toward the growth and then deflected forward and backward so as to circumscribe the fistula-ridden base. The size of the circle thus made must vary according to the amount and the character of the skin involvement. Thick cicatricial skin, inseparable from the body of the growth and skin riddled with tracts must be included in this island.

At or near the internal inguinal ring the cord is first surrounded with the fingers by blunt dissection and the ecraseur chain pass around it. If it can be served with the ecraseur it is immediately cut off; but if too large to be crushed through it is ligated with multiple ligatures which in addition to the crushing will control the bleeding of the stump as well as very materially reduce that resulting from the subsequent dissection of the tumour.

When the stump has thus been managed the distal end is grabbed with the tumour forcep and drawn upon as the growth is dissected out from above downward. Vessels entering it directly from the immediate surroundings must be ligated either before or immediately after cutting them. In loose vascular places the tissues are tied off before cutting. Thus the ablation of a large scirrhous cord can be done with very little blood loss.

Third Step.—Final Arrest of the Hæmorrhage.—When bleeding occurs despite this care the wound is immediately packed with antiseptic oakum and closed with sutures. This step may however be omitted when bleeding is negligible and

the operation completed by rinsing out the cavity with antiseptic solution.

Special precaution in large scirrhous cords is always taken not to unnecessarily expose the penis over a wide range as this leaves a gaping wound of the sheath that sometimes causes a paraphimosis and delayed healing of the wound.

AFTER-CARE.—The packing is removed at the end of twenty-four hours and the cavity irrigated thoroughly with lysol, phenol or sublimate solutions twice each day until the ligatures have sloughed off. Exercise, good food, and clean surroundings must be insisted upon.

SEQUELÆ AND ACCIDENTS.—Shock, hæmorrhage, septicæmia, paraphimosis and recurrence of the growth are the untoward results of the operation.

Shock and Hæmorrhage.—The loss of blood, the pain of a tedious dissection, and the terrible agony of crushing the peduncle of the growth, combine three very likely causes of post-operative collapse,—a sequel of the operation that may always be expected when the growth is large, when the disease is bilateral, and especially when the patient is none too robust at the beginning. The symptoms of this unfortunate accident manifest themselves immediately after the operation by the inability of the patient to rise after having been released from the restraint. The body is bathed in perspiration, the pupils are dilated, the respiration accelerated and jerky, and in spite of frequent urging the patient makes no effort to rise, and then after becoming delirious finally dies several hours later from syncope. In milder forms the patient rises half exhausted, shows colicky symptoms, and then either sinks into the severe state of the disease or else revives and then improves during the succeeding two or three hours.

The prevention consists of (1) the administration of chloroform, (2) the proper control of the bleeding vessels to forestall a serious loss of blood, and (3) the proper preparation of the enfeebled patient.

The treatment consists of ammoniacal stimulants internally, strychnia hypodermically and the intravenous and subcutaneous injections of normal salt solutions.

Septicæmia follows unclean methods of operating, especially when the resulting sepsis is predisposed by systemic weakness or by the ligation of large vessels which, by depriving certain areas of tissues of an adequate supply of blood, leave them prey for the microbes deposited in the course of the operation. The **prevention** consists of exceptionally good antisepsis while operating and of good

drainage and irrigation during the first three to six days of convalescence. When ligatures are applied to the stump of the cord, it is essential that they should have been sterilized, as this focus is generally the hot-bed of this grave sequel. As the stump below the ligature must slough off, it is important to prevent putrefaction therein, first by applying an aseptic ligature and then by good antiseptic treatment until the cavity rids itself of this harmful element.

The treatment after the disease has developed consists of providing a free drainage of the purulent cavity, and of submitting it to frequent irrigations of hydrogen peroxide and mercuric chloride solution. Care is taken to reach every recess of the cavity with the former, after which the froth resulting therefrom is washed out by a good and prolonged irrigation with the latter. To still further combat the infectious process the cavity may then be wiped throughout with pure tincture of iodine, or, better still, with a solution consisting of iodine crystals one part and ether sixteen parts. This leaves a coating antiseptic to the tissues between the intervals of treatment.

Internally quinine is par excellence the best medicament. It should be given in large doses frequently repeated.

Œdema of the Sheath and Paraphimosis.—After ablation of scirrhous cords the sheath always becomes more or less œdematous; sometimes it is enormous and in rare cases the condition is permanent. Paraphimosis may result, depending upon the amount of swelling developed in the prepuce and the sheath. (For treatment and prevention see Castration, page 252.)

Recurrence of the Growth.—In spite of the fact that it is very frequently impossible to remove all of the growth because it ascends into the internal abdominal ring, and the ablation must be made through a large sclerotic peduncle, it is rare that the stump becomes the focus for a recurrent formation. On the contrary, the stump shrinks up and the cavity cicatrizes around it in perfect harmony. Our experience is like Moller's, who refers to 100 cases, all of which were permanently cured. There are, however, rare cases, clearly of botriomycotic origin, which encroach upon the peritoneum and abdominal organs, wherein there is no arrest of the onward trend after mere ablation of the external part of the neoplasm. But such instances are hardly recurrences; they are the result of incomplete ablations due to the inaccessibility of a great portion of the diseased parts.

In short recurrence of scirrhous cords is rare; the operation, in so far as this sequel is concerned, is generally successful.

Embolic Pneumonia.—Operations of this magnitude, performed under a prolonged anæsthesia and attended with the ligation of large veins are always prone to yield emboli that lodge in the lungs. Whether these are infected at the time the vein is ligated or simply create favorable foci for pulmonary microorganism the results are the same. The patient become ill on the fourth day with pronounced pneumonia and usually succumbs. This form of dissolution must be differentiated from septicæmia with which in this operation as well as in others it is often confused.

It being more common in enfeebled patients these must be operated upon with more care, in respect to cleanliness, loss of blood, duration of the anæsthesia and after care.

CHAPTER V

FISTULAE

RADICAL OPERATION FOR FISTULA OF THE WITHERS

DEFINITION.—Resection of necrotic parts of the supra-spinous and ligamentum nuchæ, sometimes including portions of the underlying spinous apophyses together with the construction of dependent drainage of the fistulous tracts and purulent sinuses associated therewith.

INDICATIONS.—Excepting acute superficial abcesses of the withers suppurating processes that are commonly designated as "fistulæ of the withers," consist of a necrosis of the ligamentum nuchæ supra-spinous ligament with or without implication of the subjacent bones, and in every case this causative "necrotic center" must first be disposed of before a diseased process will progress toward recovery; but on account of the position and direction of the tracts and sinuses, resection of the necrotic structures alone is not sufficient. Drainage must also be provided for them. Classical surgical intervention, therefore, has two objects: (1) the total resection of all the necrotic elements and (2) drainage of the purulent tracts and sinuses. These two objects are named in the order of their importance. To operate upon fistulæ of the withers with the object of simply providing drainage at dependent parts is not sufficient intervention; the causative element must, in addition, be removed. Although the evacuation of the confined pus through incisions made here and there at more or less dependent parts may tend to arrest the onward march of the disease, and the incisions may be useful as drainage orifices besides serving as channels through which to apply medical treatment, the highest ideals in modern surgery are never thus attained. The suppurative process goes on and on, week after week, and although it may sometimes finally subside, it also very frequently continues until chronic septicæmia or a disgusted owner ends the loathsome scene, and all this because within the depths of the tracts a necrotic ligament, acting as a foreign body awaits removal.

The classification of fistulæ into typical and atypical is now generally accepted as the best. By typical fistula we designate those originating in a cyst located generally at the level of the second dorsal spine that finally bulges at the surface of the neck just in front of the shoulder and contains a sterile, amber-colored liquid which separates it from the surrounding musculature. The cyst may be small as a base-ball or as large as a foot-ball. It is located medially but bulges laterally on one or both sides. The liquid is fibrinous, precipitating into granules from trituration. Sooner or later, either from within or from lancing the cyst becomes infected and thus is transformed in a phlegmonous state for the first time. It is now an abscess. The central cavity contracts but does not heal entirely leaving a tract extending from the central hot-bed to the surface of the body to carry out the discharge. The tract heals up, the pus accumulates and burrows among the adjacent muscles, fascias and bones, breaking out at other points, riddling the entire region with pus cavities, tracts and fibrous tissue, and at the same time systemically enfeebling the subject more or less.

A typical fistula originates from a traumatism, generally a harness or collar sore, which serves as the avenue of entrance for microbes that form subcutaneous subfascial abscesses, attacking the damaged underlying ligament and bones, becoming a progressive process of destruction.

In both cases sooner or later there are damaged bones and ligamentous tissues which serve as centers to prevent cicitrization. Once these structures are seriously involved both forms of fistula are the same, furnishing the same surgical problem and becoming the potentiality of the same surgical catastrophe.

RESTRAINT AND ANÆSTHESIA.—The operation must be performed under chloroform anæsthesia on the operating table or in rope restraint. For cases requiring free access to both side of the neck the rope restraint is much the best as the patient can be rolled up on its breast into a splendid position for the operation. On the operating table the under side is rather inaccessible.

Where chloroforming is not feasible the subject may be given a dose of chloral hydrate or other narcotic.

In our rural operations we cast with ropes, tying the fore legs safely flexed and then after having clipped and shaved the field we administer chloroform. Under the anæsthetic the patient is rolled on its breast and held there by two or

three men. The operator then stands on one side in a very comfortable position to do the work well.

INSTRUMENTS, ETC.—

1. Scalpel and scissors.
2. Curved probe bistoury.
3. Tissue forceps, probes.
4. Hæmostats.
5. Two tumor forceps, large.
6. Needles and silk suture, seton needle.
7. Wadding of oakum.
8. Antiseptics.
9. Drainage tube inserter and perforated hose.

TECHNIQUE. — First Step. — Disinfection. —As the withers is often found in a bad state of filth, considerable time should be set aside before the operation begins to clean up the region. If possible the surface of the withers and shoulders is washed and cleansed with patience the day preceding, as otherwise much time is always lost in bringing the putrid region into fit state for operation. The enlargement and a liberal surface around it, including the mane hairs some distance forward, is clipped and scrubbed with soap and water and then rinsed with sublimate solution. Shaving, although not absolutely necessary, is always indicated. Fluctuant abscesses are lanced and irrigated and fistulous tracts discharging copiously are syringed out.

Second Step.—The Resection.—Longitudinal incision is made on the median line and about eight inches long from the highest point of the withers forward into the neck. In depth it is carried just beyond the inferior limits of the ligamentum nuchæ. The ligament is cut through transversely, gripped with the tumor forceps, and then carefully dissected back to the other end of the incision, where the resection is completed by another transverse cut. In the middle the resected part is generally found riddled with disease, but gradually terminates into a healthy condition toward the ends, and beneath the diseased part the spinous processes are sometimes found affected. These are not molested. Extensive resection of the spines is contra-indicated, and is always a dangerous procedure, in that fatalities often follow and healing is more retarded than encouraged thereby. Exfoliated parts must, of course, be removed. Sawing off of large parts of the spines still nourished with circulation, is not recommended.

Third Step.—Drainage.—After the causative lesion,—the necrotic ligament and bone,—has been removed, the cure

will then depend upon the ingenuity displayed in draining these depths, and maintaining the drainage until cicatrization is complete. If the first part of the operation has been sanguinary to a dangerous degree, this step may prudently be postponed for two or three days, especially when it is evident that the making of orifices through thick vascular muscles will cause a too great loss of blood. **It does not matter how deep the sinuses are located, or what position they occupy, their drainage by gravity is essential to rapid recovery.**

Drainage is provided by inserting a perforated non-collapsible hose with the special inserted (Fig. 164). The tube

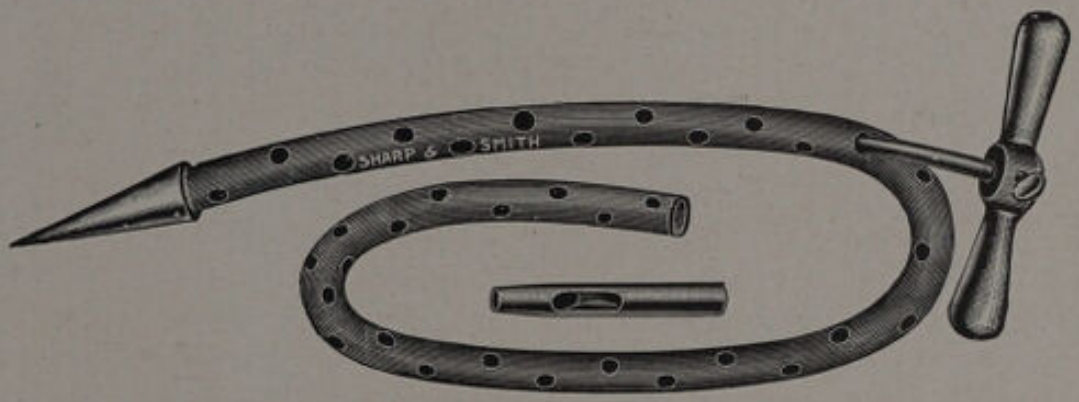


Fig. 164—The Author's Drainage Tube Inserter and Perforated Non-collapsible Hose, with Punch needed to make the Perforations.

is slipped over the inserted and pass from the bottom of the cavity outward in a slightly downward direction to the surface of the neck, first on one side and then on the other so that when in place it crosses the floor of the cavity and then downward through the muscles on each side.

The common half inch garden hose is the best material available for this purpose. Common rubber tubes are collapsed by pressure of the muscles through which it passes.

In more superficial fistulæ incision through the skin and muscles into the bottom of the sinuses may answer well enough, but in deep specimens the incisions close before the

deep-seated lesions of the ligament and bone have safely cicatrized. A more permanent drainage is therefore needed. Besides, incisions through thick muscles do not actually drain a pus cavity to any benefit to cicatrization.

AFTER-CARE.—The tube is washed daily with antiseptics after being drawn to one side where its perforations and its lumen can be cleaned out. Cicatrization is generally complete in sixty days.

SEQUELÆ AND ACCIDENTS.—Such radical intervention upon the withers is not without danger. The untoward happenings are (1) septicæmia, (2) malignant œdema, (3) tetanus, (4) gangrene, (5-6) shock and hæmorrhage and (7) recurrence of the fistulæ, the first four of which are generally due to improper respect for cleanliness. Sometimes, these infections are predisposed by systemic enfeeblement of the patient, which is made still worse by the exhausting effects of the operation, and the creation of ischemic areas by cutting large vessels is also an etiologic factor that must not be overlooked. A weak subject submitted to a long, sanguinary operation, that was none too clean and in which the wound was packed tight and sutured for twenty-four hours to control bleeding, very frequently falls prey to fatal infections of the withers. These sequelæ must be prevented by avoiding operations on enfeebled subjects, by cleanliness of hands and instruments, by controlling blood flow with forceps, ligatures and, lastly, by not packing and suturing the wound tightly, if done at all.

Shock and hæmorrhage are seldom very serious in themselves. The shock is never great and the bleeding can always be controlled when threatening. They are, however, formidable predisposing factors to the sequelæ just enumerated, from which standpoint preventive measures are essential. Partial general anæsthesia with chloral and rapid work prevent shock as well as the unnecessary loss of blood. Chloroformization is however advisable in patients none too vigorous.

Recurrence of the Fistulæ.—Fistulæ recur after radical intervention from failure to remove all of the necrotic portion of the ligament. The extent of the necrotic process may have been under-estimated or the operation itself, by inviting infection, may have caused onward encroachment. However, recurrence may follow failure to drain all of the tracts, failure to establish drainage at dependent parts, but particularly failure to maintain drainage until the central lesion has safely healed.

We find also that patients are very susceptible to grave infections when operations of an extensive and radical character are performed during the cystic stage. That is, before the cavity is infected. In such cases the surrounding tissues are not protected against infection. We recommended with Bemis that the cysts be drained of their contents by lancing a week or ten days before operating.

RADICAL OPERATIONS FOR QUITTOR

SYNONYMS.—Resection of the lateral cartilage.

DEFINITION.—Radical operation for quittor is a total ablation of the lateral cartilage on the affected side, after having exposed it by removing a section of hoof and then making an upward flap of the sensitive laminæ, coronet and skin.

INDICATIONS.—Chronic quittor is a necrotic process affecting the lateral cartilage. It is a slow, creeping morbidity beginning at one part of the cartilage, generally the posterior, and traveling forward until the whole structure has been destroyed and replaced by connective tissue. During the evolution of the destructive process a number of abscesses form consecutively, point at the coronet, and leave in their wake fistulous tracts which cicatrize slowly. While one tract is cicatrizing another abscess is already evolving to form another, generally a little anterior to the preceding; and the process continues until the anterior extremity of the cartilage is reached. The entire cartilage having been totally destroyed, the quittor is cured spontaneously and as evidence of its previous existence, there is left a tumefied condition of the quarter that seldom entirely disappears. During the evolution of this process there are periodical attacks of lameness resulting from the forming of another abscess and which subside when the abscess bursts. The morbid process may also, in some cases, not entirely rare, attack the underlying synovials and pedal articulation and thus cause incurable complications—in the form of articular or thecal abscesses, ("open joint" or "open sheath").

In exceptional instances quittors,—so called,—may consist of nothing more than simple suppurative tracts in the sensitive laminæ without implicating the cartilage (country quittors.) These cicatrize less stubbornly and always yield to simple treatment. And again, a quittor may attack a part of the cartilage and cicatrize without attacking the re-

mainder. But these incidents are the exception and not the rule.

The average quittor of city horses is "cartilaginous" and often stubbornly sojourns as long as a vestige of the lateral cartilage remains undestroyed by the disease process, or until the cartilage is removed or disposed of by surgical intervention. Quittors that seem to have been cured without disposing of the cartilage, sometimes show, on post-mortem examination, that the cartilage has in reality disappeared or has been replaced by fibrous tissue, or else has undergone calcification. That is to say that even though a quittor may have cicatrized promptly after an operation at the posterior part of the cartilage, the entire structure may be found to have

Fig. 164-A—Quittor.

undergone these pronounced structural changes. In short, the whole cartilage, as a rule, must first be disposed of as a cartilage before a cure can be effected; and since spontantous destruction is a slow process that incapacitates the horse for months, that sometimes develops serious complications and that always leaves a permanent blemish and deformity of the foot, the total and immediate resection of the cartilage at once suggests itself as rational treatment. Such was the reasoning of Bayer, who first described a method by which the lateral cartilage can be resected with a degree of safety that would warrant its adoption by the practitioner.

These radical operations described by Bayer, Moller and Frick, and which have been performed extensively by various American practitioners in recent years, must not be thought of where strict asepsis can not be maintained throughout the entire preparation, performance and aftercare. Neither should they be attempted for quittors mutilated by previous operations or caustic treatments, because of the difficulty encountered in separating the anatomical elements without serious danger of encroaching upon the subjacent synovials, after cicatricial tissues have changed the anatomical constitution of the diseased area, often by adhering to the synovial capsules beneath. When the quit-

tor is old, the quarter badly enlarged by new tissue and there is reason to suspect that the changed remains of what once constituted the lateral cartilage is firmly adhered and fused to the articular appendages beneath, total resection is extremely hazardous on account of the certainty of laying open the pedal articulation in the attempt. **On the other hand, it is safe enough in plain, uncomplicated cartilaginous quittors, during the earlier stages of their evolution.**

In **superficial quittors** originating from coronary wounds, total resection is often unnecessary, since the necrotic portion of the cartilage can easily be lifted out with a curette through a simple supra-coronary incision.

RESTRAINT.—Lateral recumbent restraint is essential. The leg must be fixed so as to keep the affected foot under perfect control. General anæsthesia is ideal, although cocainization of the plantar nerve of the affected side will answer when the former is deemed inadvisable. When a **general anæsthetic** is decided upon all of the preparatory non-painful steps (disinfection, paring of the hoof, etc.) are executed before administration in order to shorten the duration of the anæsthesia, and when **regional anæsthesia** is selected the best possible results are obtained by injecting about five grains of cocaine hydrochloride in the form of a four per cent solution at three or four different points over the course of the nerve along the inferior third of the metacarpal region. A perfunctory injection at one point is generally ineffectual, and at best the anæsthesia is sometimes limited to the posterior part of the foot, despite every effort to place the solution directly upon the nerve trunk.

ANTISEPSIS.—The antisepsis must be thorough throughout, beginning twenty-four hours before operating and continuing until the parts are safely healed; otherwise, serious if not fatal implication of the underlying synovials is inevitable. The first step is the removal of the shoe, followed by ridding the sole, frog and wall of every dirt-harboring recess with the file and paring knife. After the hoof has been thus prepared, and the hair clipped closely as high as the metacarpus and the part over the affected quarter shaved, the foot is soaked for some hours in a strong antiseptic bath. On removal from the bath the whole hoof is wrapped in a thick layer of cotton and bandages rinsed out of a strong solution of mercuric chloride, 1-500, or one-half per cent solution of formalin. These are occasionally re-moistened with the same solution during the twelve to twenty-four hours preceding the operation, and are left on

until the horse has been cast and secured in proper position and there is no longer any danger of soiling the field.

Upon removal of the antiseptic pack the field is submitted to a good friction with alcohol and then painted with a fifty per cent solution of tincture of iodine.

The instruments should be boiled well and then managed so as to prevent their subsequent contamination while operating.

The hands must be cleaned in the usual manner and gloves worn while handling the patient and casting apparatus; and after the operation has begun unnecessary handling of the wound must be avoided.

The sutures, above all, must be perfectly sterilized and the needles handled only with forceps. Care must be taken not to drag the threads over dirty parts of the hoof, leg or table.

INSTRUMENTS, ETC.—

1. Horseshoer's knife.
2. Scalpel.
3. Curettes (sharp).
4. Blunt chisel.
5. Tissue forceps.
6. A strong forcep to tear off the section of hoof.
7. Small full-curve needle and suture material, catgut or silk.
8. Sterilized antiseptic solution of mercuric chloride 1-500.
9. Sterilized cotton.
10. Tourniquet of rubber.
11. Tar bandages. A total of about twenty yards.
12. Iodoform, or an etheral solution of iodine crystals ten per cent.

The tar bandages are made by simply rolling common fabric bandages in pine tar. Sage knives, right and left, employed by some operators, are handy but not absolutely essential, as no difficulty will be found in removing the cartilage with the common scalpel and curette.

TECHNIQUE.—The feat of resecting the lateral cartilage is accomplished by different methods, each of which is but a slight modification of the other. The variations will be mentioned in each step.

First Step.—Removal of the Hoof Covering the Whole Base of the Cartilage.—Beginning at a point along the coronet, slightly in advance of the anterior end of the cartilage, a curved groove is cut backward through the wall so as to

dip downward about one and a half inches from the coronet at its middle and to end at the heel opposite the posterior end of the cartilage. The groove, made with the horse-shoer's knife, is cut completely through the hoof until the sensitive laminæ and coronary cushion at each end are visible and bleeding throughout its whole length. Another method is to chizel out this island with the hoof chizel (Fig. 166a). The semi-circular section thus isolated is then carefully torn off with the pincers, after having been pried up with the blunt chisel. The step is completed by trimming off hanging portions of the perioplic ring which may adhere to the skin along the upper margin of the coronary cushion.

Fig. 165—Bayer's Operation for Quittor. First Step.

This step may be executed in part before the animal is cast. The groove may be made in the hoof and the whole section to be removed may be trimmed down to a thin layer, but as a bulky portion of hoof can be torn off with much less injury to the sensitive laminæ than a thin one, the aforementioned method is by far more preferable.

Second Step.—Making the Flap to Expose the Cartilage. —R. C. Moore's Method:—Beginning at a point just below the coronary cushion and three-eighths of an inch from the edge of the hoof incision anteriorly, a similar incision is made through the sensitive laminæ, following the entire semi-circle three-eighths of an inch inwardly, so as to leave space for reuniting the incision with sutures. Posteriorly the in-

cision is carried through the coronary cushion and enough of the surmounting skin to make a supero-anterior flap that will expose the whole cartilage. The laminæ are now carefully dissected from the periosteum of the os pedis and the perichondrium of the lateral cartilage as far upward as the superior border of the latter. In other words, the upward dissection continues until the whole cartilage is exposed except a small part that underlaps the incision posteriorly. This step is sometimes complicated by pathological conditions. The laminæ may be found riddled with tracts, which renders their dissection into a substantial flap quite impossible, and

Fig. 166-A—The Author's Hoof Chisel.

the coronary cushion and the skin surmounting it may be perforated by one or more openings, all of which make the flap a very flimsy affair after all of the attached granulations have been excised.

Bayer carries the incision through the coronary cushion anteriorly as well as posteriorly, making a symmetrical, U-shaped, upward flap; but as the reunion of the coronary cushion is one of the anxious anticipations, and since the resection can be as well effected without it, the author recommends the method of Moore, which conserves to a certainty the continuity of the coronary cushion anteriorly.

Moller and Frick dispense with the flap entirely by resecting and sacrificing the sensitive laminæ covering the base of the cartilage, and then resect the latter by a process of excavation. (Fig. 170.)

Third Step.—Resection of the Cartilage.—The best method of removing the cartilage is to carefully shave it down thinner and thinner with the scalpel or sage knife, to the underlying tissues, to the excellent advantage of the healing process and to the much greater safety to the subjacent synovials. This method is slightly slower than the resection of the cartilage in one or two entire pieces, but it is by far the most satisfactory in the end.

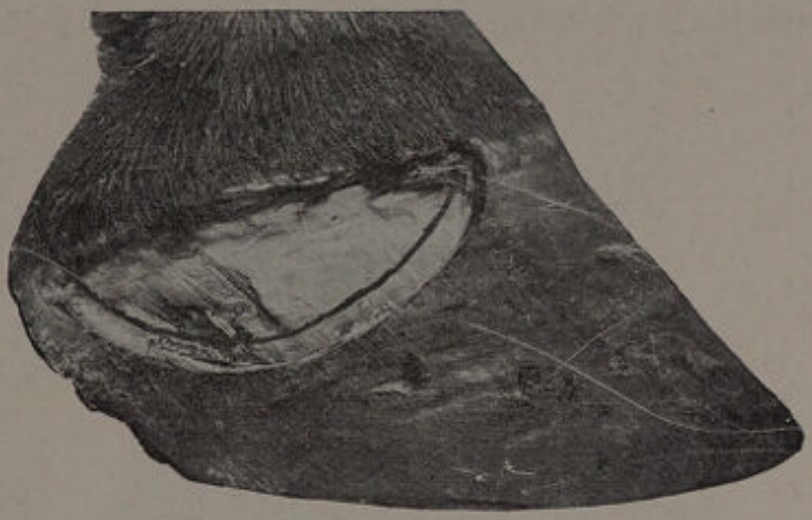


Fig. 166-B—Dark Line Shows Course of R. C. Moore's Incision.

The picture presented by the lateral cartilage affected with quittor is variable. Generally at one point it will present a green colored area surrounded by a marble-white field, indicating the extent of the necrotic process. The green portion may be exceeding small or it may be quite extensive. In some cases, pieces of cartilage surrounded by granulations are found detached from the main body, and in old quittors it may be difficult to identify the cartilages as such.

Other methods require a tedious separation of the inner surface of the cartilage from its underlying attachments, which cannot be done without causing some anxiety for the safety of the capsule of the pedal articulation and the sheath of the perforans tendon, and besides by shaving it off the underlying perichondrium is preserved.

Fourth Step.—Suturing the Flap.—The flap, which now fits somewhat loosely over the excavation, is sutured from end to end, special care being taken to neatly approximate the skin and coronet posteriorly. The laminæ are constituted of very delicate tissue that tears easily with threads, and as a consequence these should be drawn together with great caution. Interrupted sutures are preferable. Catgut

has no advantage over silk, as absorption of the suture is not essential to the success of the procedure.

Fifth Step.—Application of the Protective Dressing.—The operation being completed, the field is rinsed off by flushing with the sterilized antiseptic solution, and then, after drying, it is dusted liberally with iodoform, iodoform-ether mixture, or preferably iodine crystals dissolved in ether. The latter mixture leaves a thick coating of pure iodine over the whole field after the ether evaporates, and besides the iodine is carried into every recess. A piece of dry

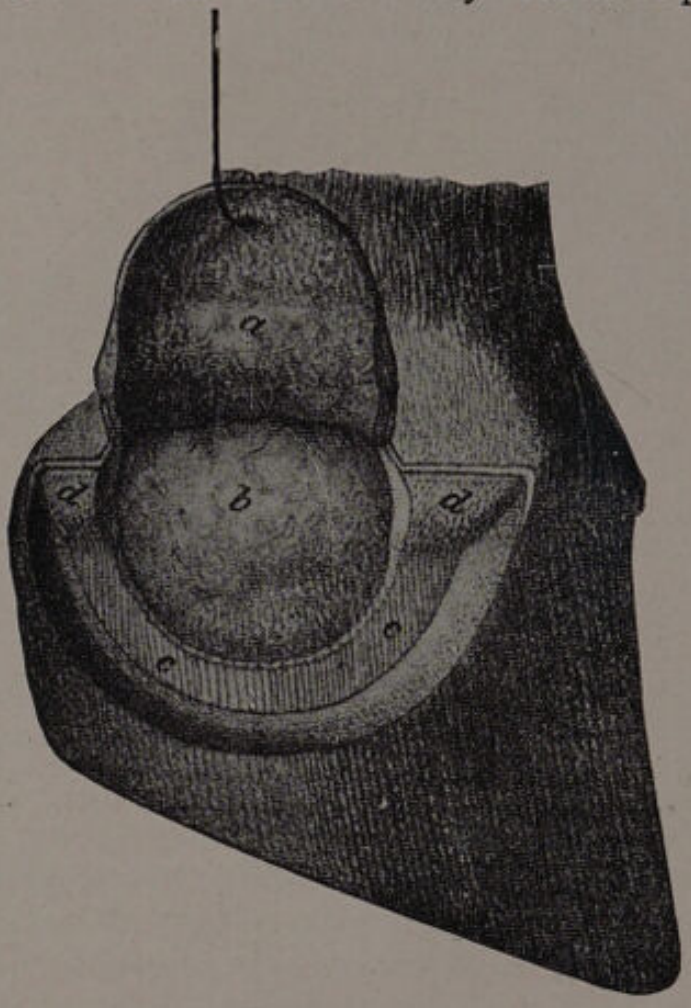


Fig. 167—Second Step of Bayer's Operation for Quittor.
A, Flap. *B*, Lateral Cartilage. *C*, *C*, Laminae. *D*, *D*, Coronary Cushion. (Reeks.)

sterilized cotton is neatly fitted into the semi-circular space and then a larger piece enveloped around the whole foot, after which the tar bandages are applied so as to cover the entire pastern and hoof. In order to at least partly control bleeding the bandages should be drawn fairly taut.

AFTER-CARE.—The horse is given the freedom of a loose box, well bedded and clean, and the bandage is not

removed until the ninth or tenth day, at which time the sutures are removed and the wound given a good sprinkling of iodoform. The subsequent attention must be governed by the condition of the wound. If there are no signs of sepsis the reapplication of an aseptic dressing of cotton and bandages will be sufficient attention for several days more, but the error of applying dressings of doubtful purity must be carefully guarded against at this time, and until the eighteenth to the twentieth day has past, after which there is little danger from infection of extraneous origin.

Fig. 168—Third Step of Bayer's Operation for Quittor. The Cartilage Resected.

The practice of leaving the wound bandaged with the original dressing for twenty days is imprudent, even though there appears no evidence of sepsis, because when the evidence of infection becomes apparent by fever it is often too late to ward off impending disaster. The treatment of this wound should be no exception to the treatment of wounds in general. If aseptic it may safely be left undressed during the first week or so, but thereafter infection is quite certain to enter into the situation unless measures are taken to prevent, and these measures should consist of occasional antiseptic dressing according as the condition of the wound indicates.

During the first week or ten days the temperature of the

patient is taken twice daily, and if pyrexia appears immediate and repeated dressing with irrigations of hydrogen peroxide followed by iodoform ether is an imperative necessity. Otherwise, an active infective inflammation will soon send havoc to the underlying synovials, cause gangrene of the flap, or even end in serious septicæmia.

The horse, under favorable conditions, is ready for moderate work at the end of sixty to ninety days, but sometimes will again become incapacitated by the inability to attach the

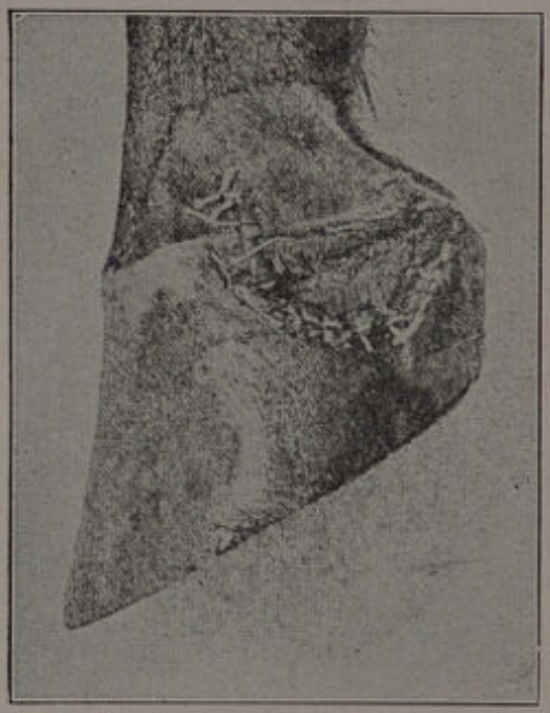


Fig. 169—Fourth Step of Bayer's Operation for Quittor. The Flap Sutured.

shoe to the hoof on the affected side. The removed portion of the wall, by growing down to the nail-line, leaves no place to drive the nails until the new wall from the coronet descends far enough to receive them. The hoofs regenerated from the laminæ of the flap are seldom thick enough nor sufficiently tough to adequately support the shoe.

The entire disappearance of all of the hyperæsthesia that follows this transgression upon so sensitive a region requires considerable time, even after the breach has been reclothed with horn.

SEQUELÆ AND ACCIDENTS.—(1) Infection is the chief enemy of the wound of this operation. Performed for a disease of a septic nature, upon a part that is difficult to cleanse, often under conditions unfavorable to the maintenance of operative cleanliness, and very frequently upon a

patient whose vitality offers little resistance to microbian invasion, it is no wonder that the wound sometimes reacts badly. This sequel ends variably. Sometimes it is trivial and yields promptly to antiseptic treatment, while at other times the inflammation invades the articulation and ends fatally. Between these two extreme results of infection are such sequelæ as loosening of the flap with subsequent tardy healing of the wound, deformity of the hoof, infection of the tendon sheath, and obstinate lameness.

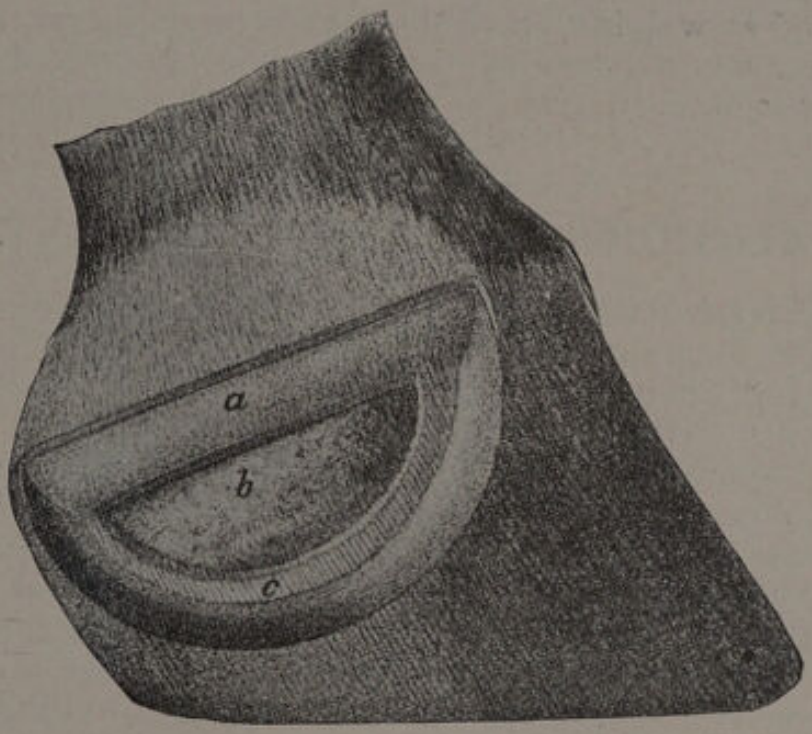


Fig. 170—Method of Exposing Lateral Cartilage without Invading the Coronary Cushion (Frick). *A*, Coronary Cushion. *B*, Lateral Cartilage Uncovered. *C*, Laminae. (Reeks.)

(2) Accidental incision of the capsular ligament of the pedal articulation is one of the accidents that might occur while resecting the cartilage. When the foot is flexed the cul-de-sac protrudes against the cartilage and is easily incised with the knife. The accident is prevented by careful dissection and by keeping the joint well extended while operating, and when it does occur its seriousness depends upon whether or not the wound becomes infected. It is of no consequence whatever if asepsis prevails during the healing of the wound.

(3) Laying bare the pedal articulation occurs when the cartilage, already transformed into cicatricial tissue, is inseparable from its internal relations, which in turn are fused with the capsular ligament. In trying to remove the carti-

lage the whole side of the articulation may suddenly appear in the foreground. The prevention of this accident is found in the chief contra-indication, i. e., old quittors accompanied with pronounced structural changes of the region.

(4) Claudication following the operation varies in severity and duration. Sometimes it is permanent and will yield to no other treatment than unilateral plantar neurotomy, although it will generally subside gradually with time. In most cases there is no lameness except a slight tenderness manifested in walking, until the foot is taxed by work, then the hyperæsthetic state of the region is announced by an annoying claudication that only time or neurotomy will eradicate.

THE AUTHOR'S OPERATION FOR QUITTOR

GENERAL REMARKS.—Extensive observations on all imaginable forms of treatment, medical and surgical, indicate beyond doubt that simple operations ingeniously executed, bring better general results than the radical operations of Bayer, Moller and Frick, even if the most extravagant claims of adherents of the latter methods are granted as a basis for comparison. In the first place, total resection of the lateral cartilage is by no means universally indicated for quittors, since there are quittors and quittors in which such intervention is little less than an invitation of disaster. Furthermore, if it could be claimed without fear of successful contradiction, that these procedures were uniformly curative, and that they never endangered life and never caused permanent disability, there still exists the difficulty of successful performance against them. Moreover, the time required to restore the patient to full and complete usefulness, which is the best argument used in their favor, is always much greater than after the simple operations. True, the foot subjected to Bayer's operation is externally healed, often at the end of forty days, but ninety days, one hundred and twenty days and sometimes six to eight months often elapse while the patient's total or at least partial disability continues; and not infrequently, in the end, it is found necessary to perform neurotomy to banish the tenacious claudication.

The simple operations sometimes, though rarely, require six months to effect a cure, but the hoof comes out of the ordeal sounder and without the annoying lameness that so often supervenes the radical methods, and compared as

regards untoward sequelæ the simple methods are found much safer. The chief argument, however, in favor of the conservative operations, is the fact that some quittors are cured by them in twenty to thirty days, many in forty to sixty days, and indeed few require more than ninety days, and often with little evidence of their previous existence remaining.

RESTRAINT.—Lateral recumbent position and plantar cocainization is the best restraint. The operating table is by far the most satisfactory apparatus, as the foot can be kept cleaner, and besides admitting of better immobilization it is in a more comfortable position for the operator.

INSTRUMENTS, ETC.—

1. Scalpel and tissue forceps.
2. Small curved probe-pointed bistoury and a probe.
3. Curette.
4. Hoof knife.
5. Flexible metallic probe.
6. Tourniquet.
7. Bandages.
8. Antiseptics.

HÆMOSTASIS.—The rubber tourniquet applied to the upper third of the metacarpus is an absolute necessity. It must perfectly prevent bleeding. To prevent post-operative bleeding, packing and bandaging is depended upon.

ANTISEPSIS.—Removing the shoe, trimming the horn smooth throughout, scrubbing and antiseptic washing must not be omitted. The hair about the coronet on the affected side is clipped and shaved or removed with a depilatory, and aseptic instruments only should be used.

TECHNIQUE.—First Step.—Searching the Depths and Direction of the Sinus.—The probe is passed carefully into the orifice and a patient search is made for the lowest point of the tract, by bending its end to different curvatures and attempting to pass it downward in different directions unil the tract is traced to the bottom, which generally corresponds to the level of the attachment of the cartilage to the os pedis. Thus gauged the position of the bottom of the tract is determined externally by measuring with the part of the probe that was buried.

Second Step.—Opening the Bottom of the Tract.—A crescent-shaped piece of hoof about one inch long is then removed with the hoof knife from the point indicated as the bottom of the tract by the probe. When the laminæ and coronary cushion have been thus exposed and the oozing blood

bailed out, the probe is again passed into the tract, and an attempt made to feel its point beneath them, to insure that the hoof has been stripped off at the proper place. If the probe now seems to pass beyond the limits of the removed hoof, additional paring is done until the bottom of the tract is reached. The laminæ are then incised transversely and a small rectangular or elliptical piece removed. Sometimes when the tract is not deep, a part of the coronary cushion is included with the laminæ, the object of the incision being to open the bottom of the tract by sacrificing as little hoof-forming tissue as possible. The probe is again passed into the tract, and now its point can easily be felt beneath the loose connective tissue exposed by removing the laminæ. This connective tissue is the outer wall of the tract, and when incised a few drops of bloody pus escapes and the shiny end of the probe appears.

Third Step.—Search for and Resection of the Necrotic Part of the Cartilage.—With the protruding probe in the tract as a guide at first, the foreground is curetted gently by careful outward strokes to unmask the cartilage beneath. As a certain amount of blood will flow into the wound despite the tourniquet, incessant bailing is essential. The curettage, and sometimes dissection with the scalpel and forceps, continues until the outlines of the diseased portion of the cartilage appear in the foreground. The diseased cartilage is recognized by its marble white color, fringed here and there with pea-green portions which are sometimes free, detached bodies, and by being easily separated from its surroundings. Th curette is now passed under the edge of the diseased portion and a systematic resection piece by piece effected, always cutting outward. As much of the cartilage as can be easily reached is removed in this manner in every direction from the incision, providing the curette can be easily passed beneath the edge. When the curette can no longer hook up the edge by passing easily under it, the resection may be considered complete enough as this indicates that all the diseased part has been removed.

The curette is then directed into the orifice from above, and all of the old granulations of the tract are scraped out except those contiguous to the articulation at the bottom and inner part of the sinus. The close proximity of the capsule of the pedal articulation and the synovial membrane of the navicular sheath must never be forgotten.

Fourth Step.—Inserting the Seton.—The cavity and tract are now syringed out with pure tincture of iodine and a

sterilized seton of muslin large enough to fit moderately tight into the tract is inserted and tied in a loop.

Fifth Step.—Bandaging.—The orifices are then wadded and an aseptic bandage applied to prevent bleeding.

AFTER-CARE.—The after-care consists of daily injections of tincture of iodine along the course of the seton, which is turned in and out at each dressing. Iodoform is sprinkled freely over the seton and over each orifice, and boric acid in abundance is held in place with cotton and the bandage is applied so as to cover the whole affected quarter.

At the end of twenty days the seton is removed and the tract prevented from cicatrizing too rapidly by daily injections of permanganate of potash and zinc sulphate in strong solution.

SEQUELÆ.—(1) Articular complications may follow improper use of the curette in exercising the cartilage or the infection from filthy methods of operating or after-care.

(2) The most common untoward result is the recurrence of the quittor from the onward progress of the inflammation to other parts of the cartilage, which event necessitates a second operation at the end of about forty days.

RADICAL OPERATION FOR POLL-EVIL

DEFINITION.—A resection of the ligamentum nuchæ from its attachment on the occiput backward to the level of the dentata.

INDICATIONS.—Poll-evil may be defined, without fear of successful contradiction, as a necrosis of the anterior portion of the ligamentum nuchæ. Although it may have its origin as a bursitis under the attachment of the ligament or in a subcutaneous abscess, the force of the disease is always sooner or later centered upon this yellow elastic structure, which, by undergoing a slow process of destruction, acts as a foreign object, and causes abscesses and fistulous tracts and the formation of more or less connective tissues around them. The process may be acute, subacute or chronic from the beginning, but in every case it finally terminates into a chronic morbidity, encroaching more and more into the depths of the poll until the periosteum of the atlas, the atlas itself, the occipital bone, the occipito-atloid articulation, the meninges and even the brain and spinal cord become seriously implicated. Spontaneous cicatrization is exceptional; poll-evil, on the contrary, usually runs a slow but certain course toward a fatal termination, unless prevented

by curative measures. The close proximity of the disease to the highly sensitive nervous structures and to the cranio-vertebral diarthrosis adds materially to the seriousness of this fistulous condition as compared with similar conditions at other parts of the body.

The operation described below is indicated in almost all poll-evils. The only exceptions are superficial abscesses and processes implicating only the tendons of the cervical muscles (superficial poll-evil), which conditions yield to simpler interventions.

It is important to resort to the operation early; before the process has, by reason of its duration, encroached upon the subjacent structures,—the bones, synovials, meninges, brain, etc. There is never any reason to postpone the operation after the physiognomy of the region or the chronicity of the process indicates that the ligament is involved.

CONTRA-INDICATIONS.—This radical operation is useless and dangerous against poll-evil implicating the bones, articulation, meninges, etc. Its usefulness is limited to the uncomplicated form. Moreover, it must be avoided in the weak, debilitated subject, whose vitality will totter under the shock of the operation, or whose infirmity clearly indicates nervous involvement.

RESTRAINT.—The operation can only be successfully performed in the recumbent position, under the influence of general anæsthesia. Restraint without general anæsthesia is not sufficient, on account of the great pain, the copious bleeding and the long duration of the procedure. The operating table is almost indispensable to its successful execution, although by propping up the head after the anæsthetic has been administered, rope restraint may answer, but always with much less satisfaction than with the table, which brings the field into an accessible position.

INSTRUMENTS REQUIRED.

1. Scalpel.
2. Probe-pointed curved bistoury.
3. A number of hæmostats.
4. A large tumor forceps.
5. Needles and thread.
6. Gauze or cotton packing.

TECHNIQUE.—First Step.—Preparation of the Field.—As the field is generally in a filthy state this step may be advantageously done before the animal is cast. The forelock, mane, and the hairs covering the poll are trimmed, well washed, shaved, and then submitted to a good cleansing.

The fistulæ are squeezed to evacuate as much pus as possible, and superficial abscesses are lanced and irrigated.

Second Step.—Incision.—The incision overlaps the crest of the occiput anteriorly and extends backwards as far as the spine of the dentata. It is almost twelve inches long in the ordinary sized horse, and parallels the median line on the uppermost side. The incision, if made from one-half to three-quarters of an inch above (the horse lying) the median line, is still within the area of mane hairs and will therefore leave no visible scar, and furthermore it is handier to operate above the median line than below it, or even directly along its course. The incision is at once carried to the depth of about two inches or more along its whole course through the thick tissue that underlies the mane and the new-formed connective tissue that generally accompanies poll-evil. The knife should almost touch the atlas in the middle; it should overlap the level of the inferior surface of the ligament anteriorly at the occipital crest, but posteriorly the exposed position of the spinal cord in the atlo-axoid may be avoided by a gradual, diminishing depth.

Third Step.—Arrest of Hæmorrhage.—At once a copious flow of blood from numerous vessels will ensue, and as the vessels spurt from hard sclerotic walls only the larger ones can be managed with the hæmostats. The small ones are ignored. The field is thus partly cleared of masking blood and the loss, whose total will be considerable before the procedure is completed, is thus materially diminished.

Fourth Step.—Detaching the Ligament from the Occiput.—The index finger of the left hand is then passed under the ligament at its point of attachment to the occipital bone to serve as a guide for the bistoury, which is now slipped under the ligament and drawn slowly upward until a complete detachment is effected.

Fifth Step.—Dissection of the Ligament.—The ligamentum nuchæ is not a very distinct structure. On the contrary, it is very closely fused to the aponeuroses and tendons of the cervical muscles whose attachments it receives; and besides it is generally enlarged and agglomerated with plenty of new-formed connective tissue, all of which leave rather indistinct outlines to follow. Anteriorly, where the bursa is interposed beneath, is the only unattached portion of the ligament, and it is here that the dissection should begin. The first step to this end is to grasp the now detached end with the tumor forceps, which is then used to lift the ligament out as fast as it is dissected loose with the scalpel. The

resection includes not only the ligament but also the new connective tissue and the tendinous structures of the superior cervical muscles. In fact, the central structures of the poll (whose anatomical outlines are always indistinct) are virtually all enucleated, laying bare the occipital protuberance and the whole superior surface of the atlas. Approaching the atlo-axoid space, the dissection is deflected outward so as to leave abundant protection to the spinal cord in that region.

Sixth Step.—Final Control of the Hæmorrhage.—Hæmostatic forceps fastened to any vessel bleeding copiously and the wound packed loosely with sterile oakum or gauze. The packing is retained by sutures. Tight packing and suturing of the wound is dangerous from the pressure upon the spinal cord in the atlo-axoid space, and from the danger of the confined blood finding its way into the neural canal.

AFTER-CARE.—Twenty-four hours after the operation the stitches are cut and the packing and forceps removed. Then, after submitting every part to a good irrigation with mercuric chloride solution, and dislodging and washing out every blood clot from the different recesses, every part is sprinkled liberally with iodoform twenty-five per cent and boric acid seventy-five per cent. Thereafter antiseptic irrigations and the application of the dusting powder above mentioned are continued until cicatrization is complete. The wound is examined daily for sloughing shreds of ligament or adjacent tendons which may delay the healing process. Cicatrization is generally complete in thirty days. At this time the posterior end of the wound is examined for a slough of the stump of the ligament, which often prevents healing at this point, and which often causes a new phlegmon on one or both sides of the neck.

SEQUELÆ AND ACCIDENTS.—(1) **General paralysis,** induced by involvement of the spinal cord in an effective inflammation extending from the wound, or from pressure of the wound-packing or blood, occasionally supervenes this radical operation, but this incident is rare if reasonable antiseptic precautions are taken during and after the operation, and the wound is not packed and sutured too tightly. The symptoms of this unfortunate termination may begin to manifest themselves as early as the third day, from technical errors, or they may not appeal until the second week, or even the third week, from insufficient antiseptic after-care. The patient refuses food, develops a fever of 103° to 105° Fahr., walks with gradually accentuating difficulty and finally

is unable to rise. If raised with sling, life is prolonged for a few days more, but in every case death ensues.

(2) **Excessive loss of blood and shock** go hand in hand, and although they occur frequently enough, they are indeed rare when the operation is performed under adequate anesthesia and when a little care is displayed in controlling the bleeding. If no anæsthetic is administered and no attention paid to the enormous flow of blood that continues from the time the operation begins until it is completed, the patient will have reached a state of extreme exhaustion that is disastrous to its subsequent welfare.

OPERATION FOR PECTORAL FISTULA OF HORSES

INDICATIONS.—Pectoral fistula is a chronic fistulous condition of the inferior part of the chest along the course of the sternum. It has its origin in a wound or contusion that injures the sternum, either directly or by invasion of the inflammatory process. The sternum, its cartilaginous extremities, and sometimes the costal cartilages, are involved in an inflammation that reflects upon the surroundings by causing the formation of an abundance of fibrous tissue, perforated by one or a number of fistulous tracts that discharge a limited amount of pus. Parts of the sternum exfoliate and may be removed through the tracts; other parts may become riddled with honeycombed compartments and the adjacent cartilages may tumefy and finally undergo calcareous degeneration. The course of the process is decidedly chronic; there is no tendency towards spontaneous cicatrization. On the contrary, the enlargement grows and the osseous and cartilaginous invasion extends, until finally the whole pectoral region is the seat of an enormous enlargement that interferes with locomotion.

Delayed cicatrization of punctured wounds entering the anterior surface of the chest due to the sojourn of desiccated pus, sloughs or sequestra from the sternum, is another matter, and does not belong to the same order of morbidities as the lesion we aim to describe under this head. The real pectoral fistula is located inferiorly, has its origin inferiorly and discharges inferiorly, and is no more nor less than an inflammation of the sternum. The external manifestations harmonize with the amount of the bone involved. The lesion may be small when only a circumscribed spot of the bone is affected, or it may be enormous, indicating a general in-

volvement of the whole bone and the cartilages attached to it. It is sometimes, if not always botryomycotic in origin.

TECHNIQUE.—The patient must be cast or secured upon the operating table with the uppermost leg drawn upward. If cast there must be no ropes or straps crossing the breast.

Fig. 171—The Sternum of a Horse Affected with Pectoral Fistula.

An incision is made in the median line along the whole length of the enlargement, which in some cases is more than a foot long. The incision is carried fearlessly downward until the knife meets resistance from the sternum. Then, in

Fig. 172—Sternum and Two Ribs of a Horse Affected with Chronic Pectoral Fistula.

order to give a better exposure of the bone, a few slices of the fibrous walls are extirpated near the bottom of the wound, on both sides, but it is not prudent to transgress too far from the median line on acount of the danger of dividing

TABLE II.

A Pronounced Fistula of the Withers.

Quittor.

Larynx Choked with Granulations After Operation for Roaring Due To Too Serious Cauterization.

Necrobacillosis of Coronet Pastern, a Common Cause of Quittor

Another View of Larynx Described Above.

large vessels. Attempts are made to trace the tracts into the bone, and to submit them to a thorough curettage. If a tract leads into a cavity, it is enlarged by chiseling to give good drainage and to remove any sequestra it might contain. Other tracts into the bone are searched for, and if found submitted to the same treatment. The tracts in the fibrous mass are curetted and made to communicate directly with the surgical wound. All of the tracts in the fibrous mass, and the cavities in the bone, are irrigated with a strong solution of copper sulphate and then seared thoroughly with hot irons until all of the bleeding is controlled. The searing not only destroys much of the growth, but retards cicatrization of the wound until the bone itself is ready to be reclothed with soft tissues.

AFTER-CARE.—In the standing position little can be done to the wound except irrigating it with antiseptic water. In the hospital the patient should be secured upon the table every second day at least, and the bone cavity and tracts submitted to a good cleansing with the copper sulphate solution. When the eschar has sloughed off the walls are re-seared to retard the too rapid healing of the wound. This burning is repeated three or even more times, each of which finds the growth smaller. When the physiognomy of the region seems to indicate that the growth is disappearing, and the discharge from the sternum has ceased, the treatment is discontinued and the wound is allowed to close.

OPERATION FOR ILIAC FISTULA

INDICATIONS.—By "iliac fistula" is meant fistula in the region of the external angle of the ilium. The fistula is always due to fracture of the ilium. Segments of bone broken from the angle, or the whole angle when broken from the main body, are often drawn downward by the muscles attached to them, and as the accident is always attended with considerable bruising of the soft tissues and the influx of more or less blood and serosity, a favorable field for infection is at once created. An abscess forms, points or is lanced, but the orifice does not heal. On the contrary, it continues to discharge or may apparently cicatrize only to point again, until finally its chronicity is well established. The bone contrary to expectations, does not die and separate from the soft tissues, but instead tends to grow larger by the activity of its still well nourished periosteum, and to become more firmly fused with a mass of connective tissue. Behind this

mass a pus cavity has formed, and in a position contiguous to the abdomen where it can not be easily managed. In fact, a chronic fistulous condition of the most obstinate and inaccessible order has been established. The pus sac locates itself either behind the segment adjacent to the abdominal parietes or else along the shaft of the ilium near the coxo-femoral articulation. In either case it is not an inviting location for radical intervention.

Simple iliac fistulæ may be due to the existence of a well separated sequestrum adjacent to the angle, in which case incision and abstraction with forceps is immediately followed by cicatrization, but this is a minor affair as compared with the case in which a large segment of viable bone and the mass of fibrous tissue with which it surrounds itself, form the outer wall of the abscess cavity and whose inner wall is related closely to the abdomen.

TECHNIQUE.—There are two courses that may be pursued. The first and most desirable one is extirpation of the broken segment with all of the fibrous tissue that surrounds it, and the second is drainage of the pus cavity below the segment and the insertion of a seton or drainage tube to maintain the orifice until the sac has safely cicatrized. The first should be chosen when the bone is small, and the second when the size of the bone and its proximity to the abdomen would render its extirpation hazardous.

In either case the operation should, if possible, be performed in the standing position, because decumbency changes the anatomical relations in the most confusing manner imaginable. The stocks are excellent. If the recumbent position is found necessary the English hopples are far the best, because with them the leg is extended and the field handy to approach.

The first step is to make an incision from the tuber coxæ from the point where the orifice is located, downward and backward until its lowest part overlaps the segment. The incision may be from four to ten inches long, according to the size and position of the segment.

In the next step a part of the bone is exposed by dissection and then grasped with large tumor forceps. With these the bone is drawn upon and turned about as the tedious dissection to release it entirely is complete. If found to have branches extending into inaccessible positions, it may be sectioned with a strong bone forcep and extirpated piece by piece.

Having abstracted every vestige of the segment, the attention is directed to the pus cavity. If found to extend into parts where the pus will not drain by gravity, a dependent drainage is provided.

The cavity is packed with antiseptic cotton and closed temporarily with sutures to retain it. This dressing is removed at the end of twenty-four hours and the cavity treated with abundance of antiseptic powder until cicatrization is well advanced.

When extirpation is not thought advisable, attempt is made to locate the bottom of the tract by probing and an opening made at the level indicated by the depth of the probe. To facilitate the probing the original orifice may be enlarged. When the lower opening has reached the tract below the segment, a seton or drainage tube is passed through it from the original orifice. The seton is renewed every few days but is not dispensed with entirely for three to four weeks. The results from this method are uncertain.

OPERATION FOR RECTAL FISTULA

INDICATIONS.—When the rectum becomes injured by rough handling, by harsh or dry feces, by impactions, or by irritant enemata, abscesses often form in the wall at the injured point. These abscesses may point in the rectum and thereby establish a communication between it and the abscess cavity, constituting at once the **simplest form of rectal fistula.** Sometimes in addition to the tract into the rectum another one is formed from the abscess cavity to the surface of the body at the side of the anus, by the accumulation of pus, flatus and fecal matter in the peri-proctal space. At other times the pus of the abscess cavity gravitates over the ischial arch through the obturator foramen, around the brim of the pubis, or over the shaft of the ischium and then, after finding its way between the femoral muscles, points at the surface in the medial femoral region, generally just inside and slightly above the stifle, or at the bottom of the groove between the sheath and the thigh.

Proctal and periproctal abscesses of this character do not always develop into chronic fistulæ; in fact, they usually cicatrize promptly after discharging their contents either in the rectum, perineum or femoral region. **Occasionally, however, the tract becomes chronic and continues to discharge a limited amount of pus from the surface orifice month after**

month, showing no tendency whatever toward spontaneous recovery. This is the rectal fistula of animals.

Successful intervention is not always possible. When the tract extends only to the side of the anus or over the ischial arch, there is always a chance to submit it to treatment that will encourage cicatrization, but when the tract directs its course from the thigh through the obturator foramen or sciatic notch, or around the brim of the pubis, meddlesome interference may end in fatal abdominal complications. Furthermore, as long as they are compatible with health there is little excuse for the performance of a dangerous operation against them. The following simple procedure is preferable for all of them:

TECHNIQUE.—The patient is secured in the standing position with sideline or stock when the orifice is at the anus, and with the casting harness if it extends below the pubis into the femoral region.

The rectum is emptied manually and an attempt is made to widen the tract and estimate its capacity by passing a smooth, flexible sound to its remotest part, or as far as possible. A torturous tract may be difficult to follow, and to facilitate matters it may be necessary to enlarge the orifice and direct the sound by placing the hand in the rectum, whereby a corrected impression of its course and progress can be determined.

The best treatment consists of daily irrigations of chlorazene 1% in sterile water,

OPERATION FOR CERVICAL FISTULA

INDICATIONS.—By "cervical fistula' 'is meant a purulent fistula located in the cervical region at some point between the withers and the poll. They are usually located in the lower third of the neck and generally below the level of the cordiform portion of the ligamentum nuchæ. The center of the disease is between the two lateral groups of the superior cervical muscles related to the lamellar portion of the ligament and bodies of the vertebræ. The perpetuating cause is the necrosis which the ligament has undergone. The tracts may point on one or both sides, but in every case the disease itself is central and originates like most all fistulæ at the level of the 2nd dorsal spine.

TECHNIQUE.—The operation against this fistula is best performed in the standing posture because the normal

relations of the anatomical structure are thus maintained. Stocks are much the best.

After cleansing the region on both sides in the usual manner an oblique incision about four inches long, paralleling the line of the vertebral column, is made on one side of the neck slightly below the supposed location of the necrotic center, which is usually about two inches above the vertebræ. It is carried inward through the perfectly healthy muscles to the lamellar portion of the ligament. Then, after enlarging the original orifice of the tract above, a large seton is passed between the two points. If there is an additional orifice on the opposite side a second seton is passed from it through the whole neck to the surgical incision.

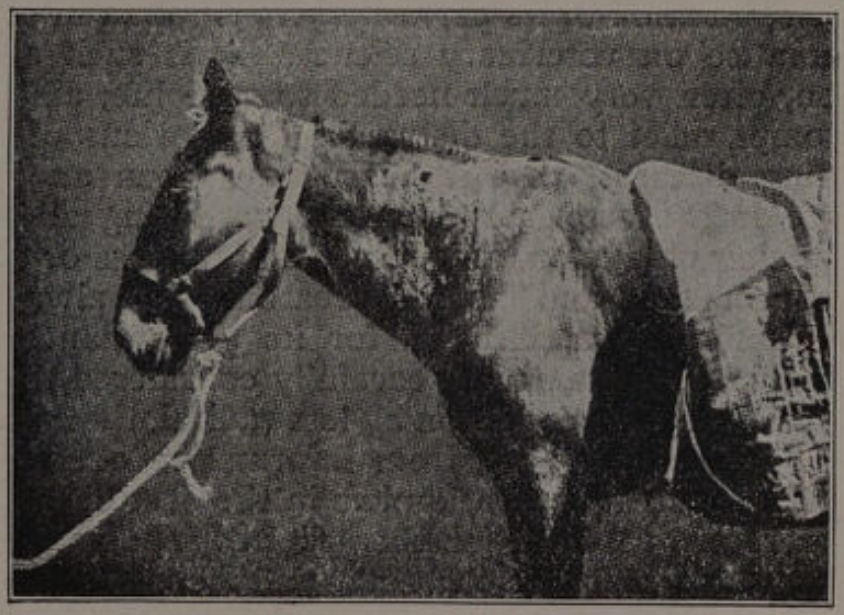


Fig. 173—Cervical Fistula.

These setons are treated with antiseptics and turned about daily for twenty days, or as long as the amount of discharge indicates that the cavity is yet unprepared for cicatrization. When the discharge continues to be abundant, especially from the uppermost orifice, an incision large enough to admit the hand, paralleling the muscle fibers, is made at the level of this orifice. The hand is then passed into the incision and the cavity explored to discover the obstacle against gravity drainage. By boring with the hand or with the aid of a cutting instrument a direct, unobstructed communication is established between the two openings, and then a large seton is again inserted to maintain it. Extensive resection of suspected dead elements is not attempted

on account of their inaccessibility and the utter impossibility of determining the extent of the affected zone.

The setons are dispensed with as soon as the discharge has diminished to the amount of pus usually produced by setons. Thereafter antiseptic irrigation is depended upon as long as the tract remains open.

These fistulæ which in reality are forward extensions of fistula of the withers are often incurable.

CHAPTER VI

THROAT OPERATIONS

TRACHEOTOMY

DEFINITION.—Tracheotomy is surgical incision of the trachea. In veterinary surgery its objects is intubation of the trachea to prevent an impending dyspnœa due to some temporary or permanent obstruction to the upper air passages.

HISTORY.—Tracheotomy is as old as veterinary surgery itself; mention of its performances is found in the very oldest treatise on veterinary science. It is such a simple operation in the long-necked animals, often very much needed to save life, and giving such prompt relief to the distressed respirations of certain obstructing diseases, that it always has been an inviting procedure to the veterinary practitioner. A threatening phlegmon, an encroaching abscess or a tumor that produced loud and labored breathing has always been regarded sufficient justification for its performance, often, however, without first having carefully considered the possibility of palliating the condition by less radical, though slower means. It is very evident, from information obtained in a general way, that the operation has in the past been too frequently resorted to, both for the relief of inflammatory obstructions of a temporary character and for permanent stenoses; in view of the fact that very often a serious, incurable obstruction of the trachea frequently follows its performance. Today tracheotomy is rather reluctantly performed for permanent obstructions, and it is only resorted to in acute diseases when there is sufficient evidence to indicate that a fatal dyspnœa is otherwise inevitable. In short, the present day veterinary practitioner weighs the indication more carefully, knowing the great probability of causing a permanent obstruction by the operation.

INDICATIONS.—The indications for tracheotomy in veterinary surgery may, for the sake of convenience, be divided into two classes, namely: (1) Diseases producing temporary obstructions, and (2) Diseases causing stenoses of a more or less permanent character.

(1) **Diseases producing temporary obstruction of the upper air passages.** Influenza complicated by abscess of the retro-pharyngeal or superior cervical lymph nodes and

strangles gives the practitioner more indications for tracheotomy than all other diseases combined. These diseases, besides the abscesses which bulge across the lumen of the air passages, is also accompanied with more or less inflammatory tumefaction of the aerial mucous membrane. These two conditions combined produce the most formidable temporary obstruction imaginable. Frequently the abscess alone will extend across the entire lumen, or even meet a similar abscess from the opposite side, and totally obstruct the passage of air. At other times the abscesses are wanting and the tumefied mucosa alone obstructs the passage. In this latter event, palliative means of dealing with the disease should first be tried, for very often a very threatening dyspnœa due to nothing more than œdema of the pharyngeal and laryngeal mucosa will subside promptly without tracheotomy; and besides, the labored respirations, by forcing air through the swollen passage, tend to preserve a capacity that would soon be totally and persistently obstructed after the operation had been performed. In these cases the operation should be postponed until a crisis definitely indicates that the life of the patient is in imminent danger from suffocation. When abscesses constitute the obstruction matters are somewhat different, because the passage of air will have little influence in preventing them from bulging inward. They are formidable obstructions and can only be diminished by evacuating their contents when they have matured. During the period of their development nothing but tracheotomy will preserve the respirations. In short, serious dyspnœa due to abscess, should be promptly met by intubation of the trachea, whilst that due to œdema of the mucous membrane should be treated expectantly until suffocation becomes imminent.

Acute uncomplicated **pharyngo-laryngitis** (sore throat) occasionally threatens to occlude the glottis but as in the laryngitis of influenza, tracheotomy should be postponed to the last, in view of the frequency with which the obstruction disappears under medical treatment.

Spasm of the glottis sometimes causes a serious dyspnœa of short duration that only tracheotomy will relieve, but these seizures usually prove fatal or else are relieved spontaneously before arrival of the practitioner. They can also be cured by simply limiting the passage of air into the anterior nares. This disease is, judging from its manifestation, more of an inco-ordinate action of the vagus, than a spasm. The vagus fails, the inspired air drives the arytenoids

into the laryngeal lumen, the organism cries for more oxygen, the second attempt to inspire carries the arytenoid still farther into the larynx, increasing the obstruction, the demand for oxygen downwards, completing the obstruction, and death ensues. A real spasm, owing to the greater strength of the dilators, would dilate instead of constrict the laryngeal opening and glottis.

Foreign Bodies in the Pharynx.—In the ox foreign bodies in the pharynx may obstruct the larynx and produce a threatening dyspnœa demanding tracheotomy, when the removal can not be promptly effected. This condition, choke in its literal sense, is not very common on account of the facility with which such obstruction can be removed. Bradley reports the history of a case in which an ox swallowed a square block of wood that lodged in the pharynx which was removed with some difficulty after the patient's life was saved from suffocation by tracheotomy. Analogous cases may occasionally be encountered.

Primary Abscess of the Retro-pharyngeal Lymph Nodes.—(tuberculosis)) (actinomycosis).—Large abscesses sometimes develop in the lymph about the throat in the absence of any pronounced abnormality of the mucous membranes. In the horse their cause is obscure; probably a simple pyogenic infection carried to them from the nasal mucous membrane explains them. In the ox they are often actinomycotic or tuberculous. In certain rare instances they encroach upon the air passages to the extent of threatening suffocation. If their contents cannot be evacuated owing to their immaturity or other causes, tracheotomy may be necessary to preserve life until their development is complete.

In certain surgical operations on the larynx and pharynx tracheotomy becomes necessary to preserve the respirations while these organs are being obstructed by the surgical work. These include particularly operations about the larynx and pharynx. Intubation of the trachea in these same operations is also sometimes necessary to protect the flow of blood into the lungs. Inflatable tubes which act as tampons are used for this purpose.

To Irrigate the Bronchial Tract.—Williams (W. L.) performs tracheotomy to irrigate the lungs with antiseptics, to combat inflammatory conditions. The operation, logical enough, has never met general approval of this, however effectual it might be.

(2) **Diseases Causing Permanent Stenoses.**—Roaring in horses due to laryngeal hemiplegia or other causes has al-

ways been considered an indication for tracheotomy. Perfectly useless work-horses are made useful, and roaring race horses made to run faster and farther. Sometimes the operation is required simply to prepare a running or trotting roarer for the ordeal of a single race or two. In spite of the fact that the operation is effectual enough for the time being, it never proves satisfactory in the end, and is certain to cause the development of a second still more formidable obstruction at the seat of intubation. Permanent intubation of the trachea is a passing treatment. It is fast becoming obsolete in the face of operations which tend to cure the causative disease, instead of simply temporarily relieving the dyspnœa.

Furthermore, the development of an incurable deformity of the trachea at the seat of intubation is not the only objection to permanent intubation. The tube and wound becomes a filthy pest that receives little attenion from the average stable attendant. The area becomes putrid, fetid, unclean, loathsome to the layman and a disguisting affair to a modern practitioner.

Permanent intubation should be avoided except in certain rare and special instances of strictly incurable conditions of the larynx or trachea when it is desired to prolong a horse's usefulness for a short period. Two, and even three years of work have thus been obtained from otherwise useless horses, true enough; but more often the attempt is abandoned in disgust after a few months. Where horses are scarce, expensive, or impossible to procure, such measures are defensible. Generally, they bring little praise.

Purpura Hæmorrhagica often threatens suffocation by obstructing the anterior nares with a large cutaneous œdema, that can not be met with any other remedy than tracheotomy. Here also, however, the operation is postponed to the last on account of the behavior of the surgical wound, which is certain to become the seat of a new diseased focus. The region often swells enormously after the operation. Sometimes the tissues become so thick that the tube will not reach the trachea.

Tracheotomy is less damaging to the old horse than to the young. It can be performed with impunity in an old, hardened trachea, but is more likely to collapse or distort the young, soft one. This fact should be taken into account in judging its indications.

EQUIPMENT.—The equipment necessary to perform the operation is: Scalpel, tissue forceps, tracheotomy tube, clipper, razor and antiseptic solution.

RESTRAINT.—The operation is always performed in the standing position and generally without the aid of local anæsthesia. The latter is, however, very helpful in the restive horse, especially one attacked with a dyspnœa so serious as to render inadvisable the application of the twitch. The injection of a four per cent solution of cocaine subcutaneously greatly facilitates the work.

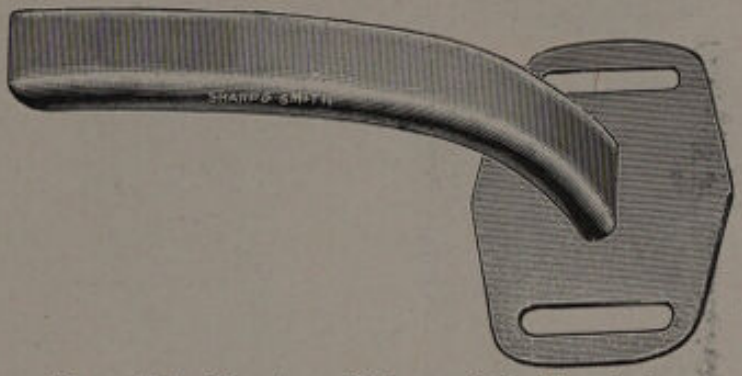
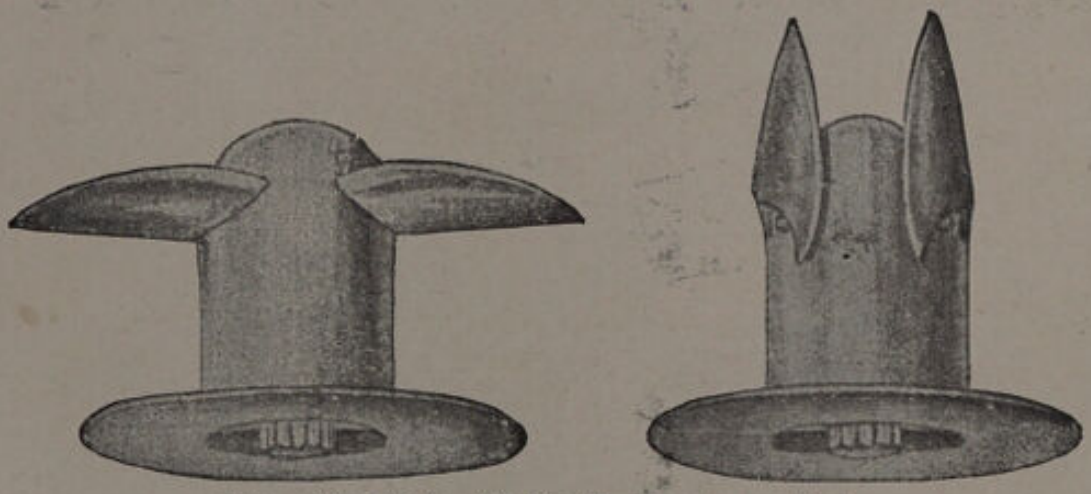


Fig. 174—Trachea Tube, with Beveled End to Insert between the Rings.

Fig. 175—Dyson's Tracheotomy Tube.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—Tracheotomy in the horse is usually performed in the center of the middle third of the trachea at a point where the muscles are spare. The location is selected by mental



Figs. 176-176-A—Well's Tracheotomy Tube.
Fig. 176—Opened as if in Position.
Fig. 176-A—Closed, Ready to Insert.

calculation, as there is no land-mark to direct. If for any reason this special location is not expedient it is preferable to make the incision higher rather than nearer to the lungs.

Second Step.—Exposing the Trachea.—The incision to expose the trachea is made about one and a half inches long, through the skin and subjacent muscles directly along the

median line. Immediately over the trachea is a layer of connective tissue which must be incised and parted or else

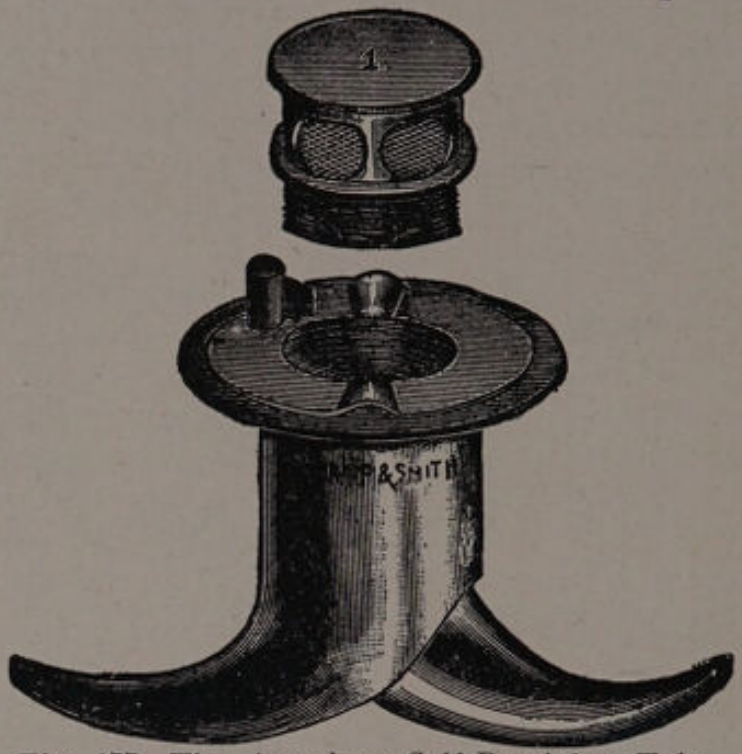


Fig. 177—The American Self-Retaining Tube.

dissected away before the rings are brought plainly into the foreground. In order to perform tracheotomy well it is

Fig. 178—The Incision. (Bayer.)

essential that the ring lying with the scope of the incision be plainly exposed.

Third Step.—Incising the Trachea.—Incisions into the trachea are made according to several different directions. Two rings may be divided requiring a tube flattened from

Fig. 179—Forms of Tracheal Deformity Resulting from Tracheotomy. (Hoffman.)

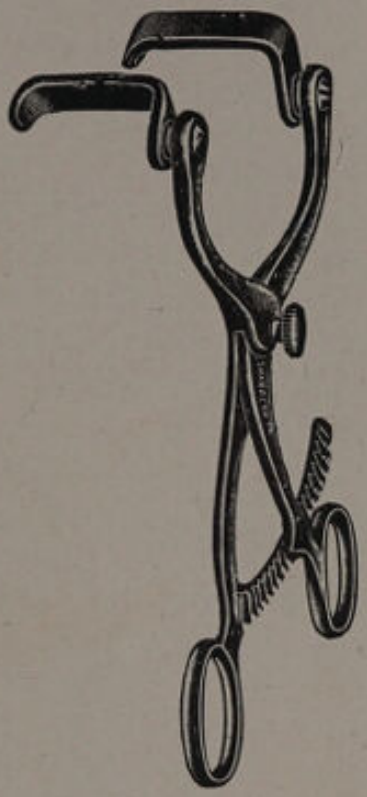


Fig. 179-A—Hobday's Retractor.

side to side; a part of two rings may be excised so as to make a rounded hole, requiring the use of a small, round tube; or a transverse incision may be made through the connect-

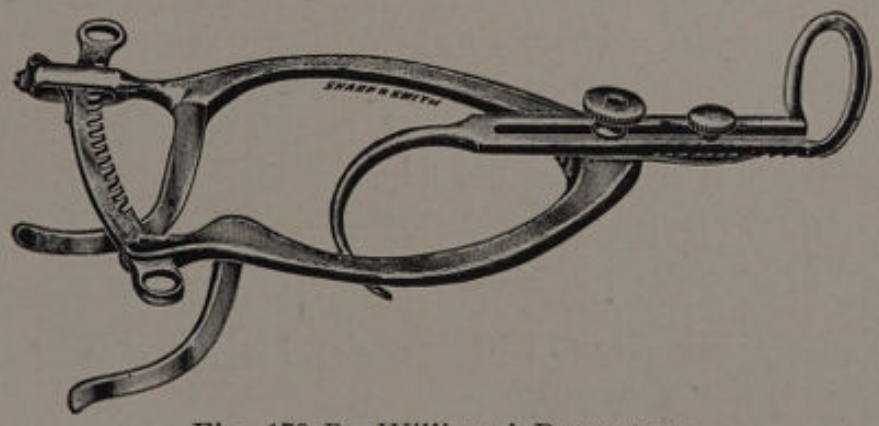


Fig. 179-B—Williams' Retractors.

ing band between two rings, requiring the use of a tube flattened from above downward. The kind of tracheotomy must therefore depend upon the kind of tube at hand, but preference should be given to the transverse incision through

the connecting ligament, as this method lessens the danger of causing a stenosis. In the young horse no other tracheotomy should ever be performed.

Fourth Step.—Inserting the Tube.—The tube improvised for insertion between the rings is wedge-shaped. Its point is simply pressed into and then through the opening in a downward direction, and then kept in place with a tape passed around the neck. Kragness has perfected a self-retaining tube of this same pattern that dispenses with the use of the retaining tape. The other self-retaining tubes of circular shape require division of the rings and are therefore less desirable except for permanent intubation.

AFTER-CARE.—The tube should be removed and cleaned in a hot antiseptic solution every day. Small tubes, when considerable sputum flows through them, may require a semi-daily cleansing to keep their lumen free from incrustations. At each removal the condition of the throat is tested by plugging the opening and as soon as breathing is found possible the tube is dispensed with. It is advisable to compel the patient to force air through the obstructed throat frequently in order to keep the passage open, as well as to determine the amount of obstruction that still remains. Prolonged intubation should be avoided.

SEQUELÆ.—Tracheotomy may sometimes increase the severity of or cause a descending inflammation of the aerial mucous membrane, but complications of this character are, fortunately, rare. Strange to say, pneumonia is seldom ever caused by tracheotomy, in spite of the fact that the wound often becomes very putrid.

The most formidable sequel occurs some weeks, months or even a year after the operation, in the form of a permanent constriction of the tracheal lumen, due to a collapse or distortion of the rings, and a cicatricial contraction of the soft tissues connecting and surrounding them. In the old, mature horse, this sequel is much less liable to occur, because the rings are hardened enough to preserve their contour against inflammation and pressure.

But in the suckling, the yearling, the two-year-old, tracheotomy is positively damaging. The cartilaginous rings are soft and susceptible to inflammatory processes that terminate in a permanent deformity.

ARYTENOPEXY

WILLIAMS' OPERATION FOR ROARING IN SOLIPEDS

DEFINITION.—Williams' operation consists of a resection of the mucous membrane from the laryngeal saccule, with the object of fixing the arytenoid cartilage by means of the ensuing cicatrix.

INDICATIONS.—The operation is indicated only in roaring due to laryngeal hemiphlegia, but is serviceable in every degree of this condition. It is most successful, however, in the lighter breeds and in middle-aged horses.

The role played by the arytenoid cartilage in the causation of roaring is that of being drawn into the laryngeal lumen by the air current. Normally, during inspiration, the arytenoids are drawn apart by the crico-arytenoideus dorsalis muscles; that is to say, the space between them is widened at each inspiratory act. In the forcible inspirations required to supply air during exertion, they are drawn widely apart; in fact they are forcibly imbedded into the soft structures around them, leaving the laryngeal opening free from any obstruction. When the motor nerve governing these movements is paralyzed and the muscles upon which the movements depend are atrophied as a consequence of the paralysis, the arytenoid cartilage on the affected side hangs limp and helpless against the air current, and is drawn inward by the air instead of being drawn outward by the muscles during inspiration. Generally, however, the paralysis is only partial; the muscles are only enfeebled, and the cartilage moves faintly, although not sufficiently to counteract the forcible air currents required to supply the lungs during severe exertion. Roaring may be lucidly depicted as a **constant combat between the air current and the enfeebled crico-arytenoideus dorsalis.** When the air current is gentle, as in ordinary respiration, the strength of the muscle is sufficient to prevent roaring, but as soon as the balance of power is against the muscle, the cartilage flips into the lumen of the larynx and audible noise is at once produced.

With these facts in mind the object of surgical intervention is plain; the flipping of the cartilage before the air current must in some way be prevented. To this end, various operations have been performed, the first of which was the total resection of the affected cartilage **(arytenoidectomy);** but as serious complication always supervened sooner or later it was soon discontinued by each surgeon who elected to adopt it as the treatment of roaring horses. Later, **aryte-**

noidorrhaphy, (recommended by the author in 1898) which consists of suturing the arytenoid cartilage to the inner surface of the thyroid, was attempted, and for a time seemed to give fair results. More recently partial resection of the arytenoid was employed without sufficient success to merit adoption. To these might be added resection of the vocal chord on the affected side, bilateral resection of the vocal chords and cricotomy, all of which were not successful enough to merit general adoption.

In 1906 Prof. W. L. Williams gave publicity to this new procedure which has since become the standard treatment for chronic laryngeal hemiphlegia all over the civilized world, and although not entirely without fault and failure it has after more than ten years retained a place among the useful surgical procedures despite a legion of discriminating critics. Statistics to date gathered from many sources are reassuring.

RESTRAINT.—The operation can be performed either with rope or operating table restraint in the recumbent position or with stocks in the standing position. The operating table is preferable, however, as the field can be brought into a more accessible position and can be more effectually immobilized against sweeping movements. To the ordinary operating table must be added an extension of about eighteen inches over which to stretch the head. We hold the head in place with a rope looped over the lower jaw and passed to a hook or nail droven into the outer border of the extension. A wooden box the height of the operating table will answer as an improvised extension where there is no regular equipment of this kind.

With rope restraint on the ground the head is not so easily held into position. Here a strong assistant must hold it extended and slightly upward while the operator stoops down to do his work.

In the standing position the patient is placed in the stocks or in other narrow confinement where backing is impossible. The head is held upward with a halter shank passed over a beam in the ceiling.

ANÆSTHESIA.—Local anæsthesia is now regarded as sufficient means of controlling the pain. A two per cent solution of cocaine hydrochloride or other effectual local anæsthetic is injected subcutaneously along the proposed line of incision. General anæsthesia, once thought essential, has been discontinued by American surgeons. By making the invading incision under local anæsthesia the pain is neg-

ligible and, besides, the patient more promptly rids its throat of accumulated blood clots than when under the influence of a general anæsthetic.

INSTRUMENTS, ETC.—

1. Scalpel.
2. Hæmostats.
3. A number of artery forceps.
4. A pair of 5-inch Mayo curved scissors.
5. Retractor.

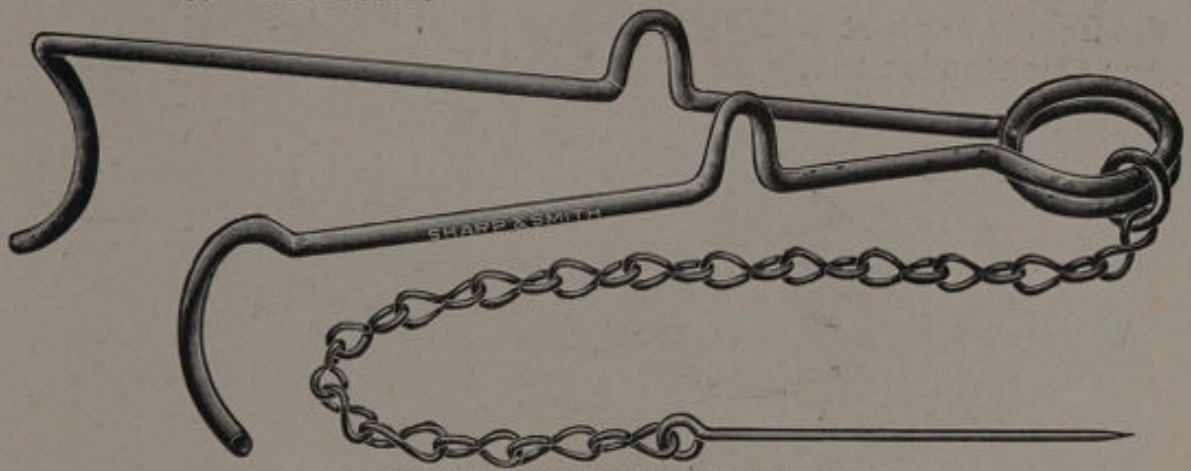


Fig. 179-C—Adam's Retractor.

Fig. 179-D—Blattenberg's Burr.

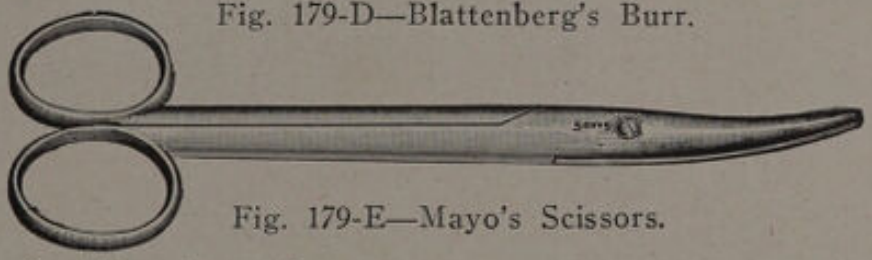


Fig. 179-E—Mayo's Scissors.

6. Two long forceps.
7. Blattenberg's Burr clipper and razor.
8. Antiseptic solutions.
9. Cotton sponges for washing and bailing.

The retractors improvised by Williams are much the best. They are self-retaining and do not slip out when the patient moves as is always the case with the other kinds. Prof. John Adams recommends a spring retractor which he fixes with a suture or skewer passed through the skin within the ring at one end with which it is equipped. (Fig. 179-c.)

Hobday's adjustable ratchet retractor is the most powerful of all and holds the aperture open wider than either of the above, but has the disadvantage of slipping out when the patient moves.

ANTISEPSIS.—Ordinary antisepsis is demanded. It is advisable to avoid immediate infection of the parts operated upon with septic instruments. Although the wound is unavoidably left exposed after the operation, the invasion comes after the tissues are better protected against infection than at the time of completion of the operation. A clean, shaved field, sterilized instruments, clean antiseptic solutions, and clean hands are essential to the best results.

TECHNIQUE.—First Step.—Preparing the Field.—As the field is one not easily cleansed while in the standing position this step is usually postponed until the horse is down and

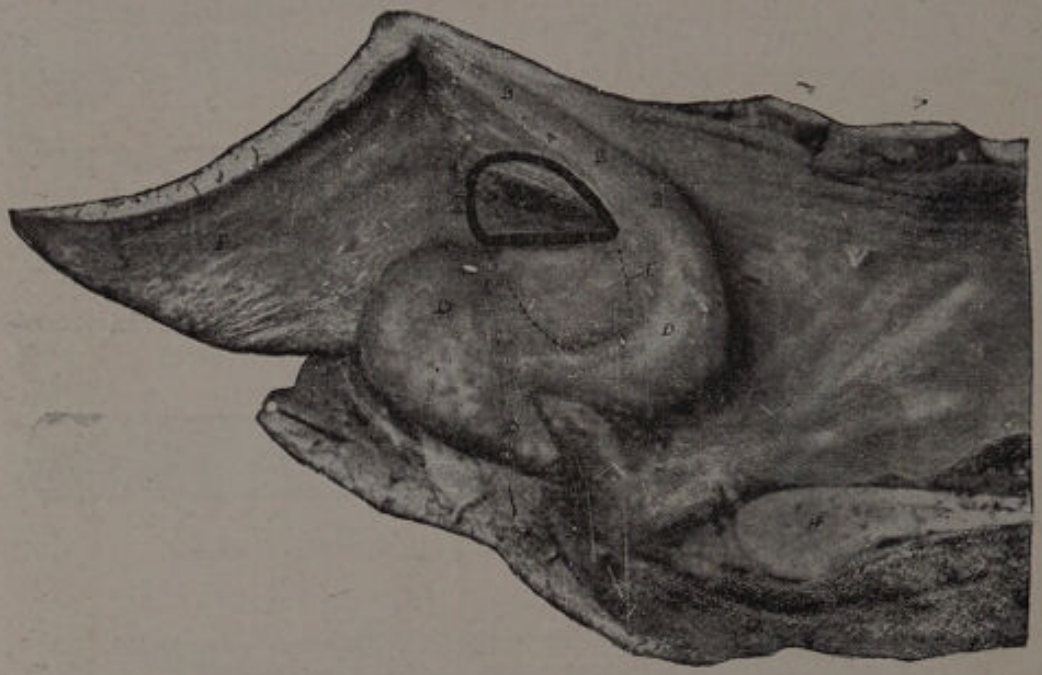


Fig. 180—Longitudinal Section of Larynx.
A, Laryngeal Saccule. *B*, *B*, *B*, Vocal Chord. *C*, Profile of Laryngeal Saccule Beneath the Arytenoid Cartilage. *D*, *D*, Arytenoid Cartilage. *E*, Epilglottis. *H*, Bezel of Cricoid.

positioned. The space between the angles of the jaws as far forward as the base of the hyoid bone and overlapping the first ring of the trachea is clipped, shaved and washed clean with mercuric chloride solution 1-500 and then rubbed with tincture of iodine.

Second Step.—Incising the Skin and Underlying Muscles.—The incision is made in the median line, extending from Adam's apple anteriorly to the first ring of the trachea posteriorly. Adam's apple in the operating position lies between the jaws a little anterior to its angles. It presents itself as a rounded protuberance that is easily felt with the fingers, but it must not be mistaken for the base of the hyoid bone, located about two inches further forward.

The incision is at once carried through the subjacent muscles until the underlying cartilaginous structures appear in the foreground. The retractors are applied and the wound widely opened, while the fascia covering the larynx is divided to give a better view of the anatomical structures exposed. These, naming from before backward, are Adam's apple, crico-thyroidean membrane, cricoid cartilage (a narrow ring), the crico-tracheal membrane, and lastly the first ring of the trachea.

Third Step.—Laryngotomy.—The scalpel is pushed through the crico-thyroidean membrane just behind cricoid cartilage and drawn forward through the structures above

Fig. 181—Fourth Step.

named to Adam's apple anteriorly. Although Adams and others have found it necessary to include the cricoid in the incision its division may be omitted since the intra-laryngeal work can be performed through an incision extending to and not including the cricoid. The bleeding from small vessels is now controlled with the hæmostats and then the retractors are moved into the cavity of the larynx.

Fourth Step.—Resecting the Mucous Membrane from the Ventricle.—The burr is now passed into the laryngeal saccule until its head rests assuredly at the very bottom. With slight downward pressure it is rotated two and one-half turns to

the right and then drawn carefully outward until its head, now covered with mucous membrane, appears at the level of the opening of the ventricle. Without attempting to bring it out further the mucous membrane is clamped under the head of the burr with the forceps and held tight against slipping. The burr is now removed and set aside, and the stripping completed by carefully rolling the forcep first in one direction and then another. As it comes out farther from this traction the other forcep is attached farther down and the same movements repeated until the inversion is complete. The inverted sac is then resected with the curved scissors.

In lieu of a burr the stripping can be effected with scalpel and bistoury. After making an incision through the mucous membrane around the aperture of the ventricle the edge of the sac is picked up with a forcep and drawn upon as a blunt pointed bistoury is passed under the sac, tearing it loose by blunt dissection at all points accessible, and then drawing it forward with forceps attached here and there to the best advantage.

Arytenopexy by Cauterization.—McKillip prefers actual cautery to resection of the mucous membrane by other means. A special firing iron equipped with a flat, circular disc just large enough to fit loosely into the ventricle heated to a cherry red heat is passed quickly into the depths of the cavity and almost immediately removed. The membrane shrivels up and sloughs out later when the seared membrane detaches itself from the living tissues. This may be done in the standing or recumbent position. It has the advantage of expediency on the one hand and the disadvantage of a too severe or an insufficient cauterization on the other.

Fifth Step.—Dressing.—Accumulated blood is bailed from the larynx and trachea and the wound is dusted moderately with iodoform and protected against the aspiration of litter into it while the patient is being released.

AFTER-CARE.—The external wound is washed daily with an antiseptic solution and then painted with tincture of iodine. In twenty days the wound will have healed and the patient may be exercised moderately and be returned to its usual work at the end of thirty days. The cure from this operation is not instantaneous; improvement comes slowly during the weeks succeeding the convalescence. If, however, there is no improvement after two months, the operation may be considered a failure.

SEQUELÆ.—(1) **Chronic inflammation of the laryngeal cartilages,** either local or general, is the only serious sequel

of the operation. This may manifest itself locally upon the cricoid cartilage whose continuity was sacrificed to gain admission into the larynx, or it may attack the whole organ. In either event it ends in stenosis that causes a roaring more formidable than the original. The cartilages become hard and deformed and sometimes the whole organ undergoes a hypertrophy of the soft structures together with a calcification of the cartilages that ends fatally during the succeeding twenty-four months. The prevention of this sequel seems impossible although it is the author's opinion that it can be prevented by more gentle use of the retractors and clean methods. The accident is undoubtedly due to post-operative infection.

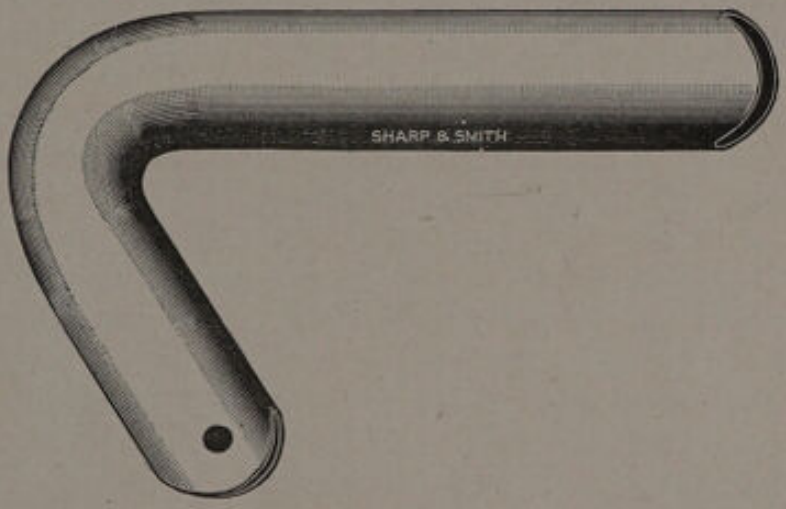


Fig. 181-A—McNeils Tube.

2. **Pneumonia and bronchitis,** which would seem to be very probable sequelæ, seldom occur, and when they do occur they may usually be attributed to a pre-existing enfeeblement.

3. **Dyspnœa.**—A serious dyspnœa sometimes occurs during the second to the fourth days of convalescence due to swelling of the mucous membrane, and possibly, also, to submucous emphysema. This possibility necessitates placing the patient under constant surveillance until danger in this connection has passed. Its occurrence is met by intubation of the trachea through the original incision with a special tube, which the attendants should be provided with to meet the emergency.

When patients can not be placed under constant surveillance it is better to insert a tracheotomy tube immediately after the operation. This we do after the patient has

regained its feet, as the operation can be done better in the standing position. The tube may be inserted at night and removed during the day when the respiration is not threatening in character. At the end of the fourth or fifth days the danger from this source has usually passed.

CHAPTER VII

OPERATIONS FOR HERNIA

DERR'S OPERATION FOR UMBILICAL HERNIA

DEFINITION.—A method of clamping umbilical hernia by means of skewers and ligatures.

INDICATIONS.—Nearly all writers on umbilical hernia have pronounced them universally congenital. That they are often due to persistence of the navel aperture beyond the usual time for cicatrization is not denied, but our observations on many cases during recent years seem to indicate that quite as often they are actually acquired hernias. During the pre-natal life the navel serves as the orifice in the abdominal wall through which the umbilical artery, the umbilical vein and the urachus pass from within the body of the fœtus to its nutrient envelope—the placenta. In the fœtus it is sometimes so very large that some of the viscera protrude through it. This is, however, usually corrected before birth through the development of the abdominal cavity, and the natural narrowing of the aperture. At birth the aperture begins to cicatrize as soon as the navel cord is severed. As the cord shrivels up the elastic sphincter which surrounds it becomes fibrous tissue and gradually contracts upon the disappearing vessels. This process continues until only a firm cicatrix remains—this is the navel. It sometimes happens, however, that this process of contraction and the shriveling of the vessels do not keep pace. When the former process is too slow the viscera sag down into the opening and a hernia results. But the protrusion may not be permanent. The process may continue for several months; it sometimes obliterates the aperture and thus spontaneously cures what was at first a hernia. This influence is also favored by the growth of the abdomen. As it expands in diameter by growth faster than the suspensory apparatus of the viscera elongates the protruding intestines are drawn gradually into the abdominal cavity.

There are, however, umbilical hernias that develop after the navel aperture has been closed. These we classify as acquired hernias. They are observed on the third or the fourth week after birth, or even later. At first small, they

finally enlarge to formidable dimensions. At the age of eight months they are sometimes as large as a cocoanut. (Fig. 183.) The cause here is the feebleness of the connective elements that close the navel aperture anteriorly. At the posterior part of the aperture that was occupied by the urachus and the umbilical artery the cicatrization is usually firm, but anteriorly where the umbilical vein was located the fibers are very often too weak to stand the intra-abdominal pressure incident to filling up of the viscera with ingesta, and thus sag down under the weight, becoming a part of the

Fig. 182—A Typical Umbilical Hernia in a Yearling Colt.

lining of the sac. The study of the etiology of umbilical hernia of this class must also include a reference to the navel as the central focus of such respiratory acts as defecation and micturation. The full strain of these acts centers upon this fulcrum and are often in themselves sufficient to tear the feeble cicatrix that once closed the aperture. In all of these powerful abdominal movements the region of the naval takes the blunt of the force exerted, and the arrangement of the viscera with the fluctuant mass of small intestines resting on the umbilical region and surrounded by the more fixed and strong large bowels tends, during defacation and micturation, to force the fluctuant mass downward in the way to tear apart any weakened place in the abdominal wall in that loca-

tion. Thus we choose to class at least a part of the umbilical hernias as **acquired**—acquired through a feebleness of the navel cicatrix. The time at which this weakness becomes apparent is usually during the first and second months after birth in colts and during the first two weeks after birth in dogs. But without inviting criticism by using exceptional cases to clinch an argument, it seems safe to say that this class of hernias do sometimes develop, solely through these influences, much later in life, or to reverse the expression, hernias of the navel that occur late in the period of growth, do so under these influences. The ruminating animals are much less susceptible to navel hernia than the non-ruminating, because in the latter the posterior abdomen is relatively heavier and full of fluctuant viscera.

Fig. 183—A Large Umbilical Hernia in a Suckling.

DIAGNOSIS.—Umbilical hernia is not difficult to diagnose, and can be mistaken for no other trouble except ventral hernia in or about that region. Ventral hernias about the size of umbilical are frequently seen along the lina alba at any point between the xyphoid cartilage and the umbilicus. In a careless examination these may be mistaken for umbilical hernias. Sometimes, both acquired and congenital ventral hernias are found adjacent to the umbilicus, in front, to one side or even behind it. With this possibility in view the diagnostician examines a hernia in this region carefully to determine whether or not the protrusion is actually through the navel aperture.

The umbilical hernia is a fluctuant, non-painful enlargement at whose base an aperture can be felt. The aperture

will admit one, two or three fingers; and in the larger kind the whole fist. The contents are usually reducible. Sometimes the remains of the navel cord can be rolled between the fingers within the sac. In size they vary a great deal. The small ones are the size of a chicken's egg half embedded, while the large ones may be as large as a goose egg. Rare cases are larger. The largest one that has ever come to our notice had a basilar circumference of eighteen inches and a depth of six inches. The aperture of this case—which was a pure congenital hernia—was five inches long and about four wide.

It is not possible to determine what particular part of the intestines occupy the sac. Sometimes it is a knuckle of

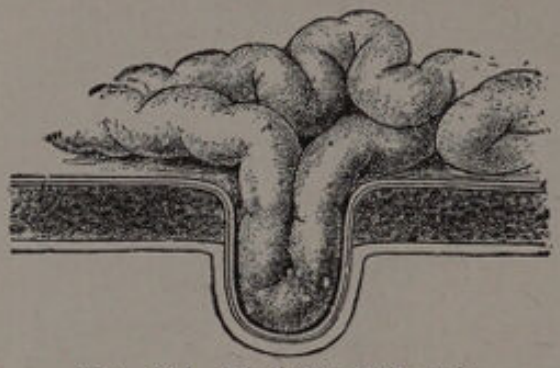


Fig. 184—Umbilical Hernia.

the jejunum, sometimes of the ileum, sometimes of the small colon. In a post-mortem following a misdirected operation the apex of the caecum was found impinged with the spear used to retain the ligature, and in a post-mortem held on the carcass of a middle aged horse dead from colic the caecum had been torn on account of an adhesion at the navel. It was thought that this was an ancient lesion dating back to a navel hernia cured by ligation or clamping.

The sac or navel hernia invariably consists of two distinct layers. The outer one is the common integument, normal in its thickness and elasticity. At some point generally about the apex, however, it is scarred from cicatrization of the aperture through which the navel cord passed and from this scar the remains of the cord can be felt running upward toward the hernial orifice. This layer is loosely attached to the inner layer by the normal subcutaneously areolar tissue. In an operation the two layers can be separated from each other by dissection. The inner layer is composed of the remains of the amniotic coat externally and the peritoneum internally. These two component parts can not, however, be separated into two anatomical membranes. They are

fused into one structure, and should be thus handled in surgical operations. This layer is uniformly about four millimeters thick and is a firm, dense and highly vascular structure. It seldom adheres to the contents as it is paved with the endothelium of the peritoneum. In some cases there are feeble omental adhesions about the orifice, but in no case have we ever found diffused omental adhesion so characteristic in traumatic ventral hernias.

The orifice is circular or oval, and in rare cases irregular. Most of them exhibit a fairly circular aperture whose dimensions vary with the size of the sac. In the small ones the edges of the aperture are thick like the boundary of a normal navel in utero, but in the large ones it is thin, corresponding in thickness to that of the abdominal parietes.

RESTRAINT.—As the patient is usually an unmanageable youngster and the operation one requiring accuracy of technique it is essential that the restraint be effectually done, and in the way to expose unhindered the ventral surface of the abdomen. Ropes that flex the hind legs and part them well are needed to bring about the proper kind of control.

The Treatment and Management.—Umbilical hernia is often, in fact generally, passed off as a triviality by veterinary practitioners. So many of them have been seen to disappear as the subject grows older that it is by no means exceptional for practitioners to recommend that they be left to the influences of nature. This we believe is not the prudent course. In our consultations over subjects in which this favorable termination failed to come about, we have often heard our confreres criticized for having suggested this procrastination. Every umbilical hernia can be benefited by artificial assistance. Even though a spontaneous recovery would have occurred, this process can be hastened by proper treatment, and when it fails, there is no one to criticise. The palliative measure most effectual and practical is that of adjusting a body bandage made of strong muslin or canvas about six inches wide and arranged to buckle tight at the loins. Under this bandage at the level of the protrusion a wad of oakum is arranged in a lump to press up the sac. The contents are thus kept within the abdomen and the inner layer is held like a stopper in the aperture. With patient attention to such an apparatus the recent hernia is often dispatched in a few weeks or even sooner. The bandage may be held in place by two pieces of tape passed backward over each side of the tail and tied to the buckles at the loins. At the level of the flank a little attention must be

given to chafing of the skin from frictions of the edge of the bandage. This we manage by arranging cotton or wool under the bandage at this point. Males will soil the bandage by urination and the irritation therefrom may require changing of the oakum occasionally. This irritation we find is not, however, so objectionable as it probably hastens rather than retards cicatrization.

In older cases yet amenable to palliative treatment a truss constructed of soft wood and strapped up with elastic bands may prove effectual. The knob, at first large enough to fit the aperture loosely, must be trimmed smaller from time to time as the opening becomes smaller.

Fig. 185—Skewer Scheme for Derr's Original Operation.

The elastic bands must be strong enough to give considerable pressure to the knob. The pressure will irritate the skin at the level of the knob and may even cause a sore spot that will demand attention. When the soreness causes too much discomfort the truss may be turned with its flat face upward and it may also be softened with a fabric pad or with a wool covering. This soreness is, however, desirable, inasmuch as it will promote the formation of adhesions of the inner layer of the sac to the edges of the aperture and often thus cure the hernia quite promptly. This apparatus, like the body bandage, will chafe the skin at the flank and will therefore require padding to prevent this useless discomfort. This apparatus may, too, require tapes running backward on each side of the tail to the loins to hold the wooden disc in place.

These palliative measures are given there with the full knowledge of their objectionable features, especially the careless attitude of attendants toward treatments lasting a long while. They will be best appreciated where animals are valuable and where a rigid discipline is maintained among the caretakers of the animals under their charge. Careless, slipshod attention to such efforts are useless, while patient attention and diligence will often be rewarded.

Blisters and caustics are favorite remedies of some practitioners. Aside from the fact that they serve the purpose of excuses, while the natural influences operate to cure the hernia, it is our opinion they do no good. The measures

which lift up the sac cure by causing needful adhesions. Blisters and caustics irritate but have no such influence. They seem to have been the credit that belongs strictly to normal tendency of navel hernia to cure itself.

TECHNIQUE.—Among the operative treatments we have found more generally curative than any other is ligation of the sac. The ligature we hold in place with two steel skewers passed subcutaneously. This skewer operation performed in obedience to certain definite rules will cure more umbilical hernias than the other closed operations like multiple ligation and clamping. Its object is to fold the inner layer of the sac securely into the aperture where it adheres and forms an effectual plug.

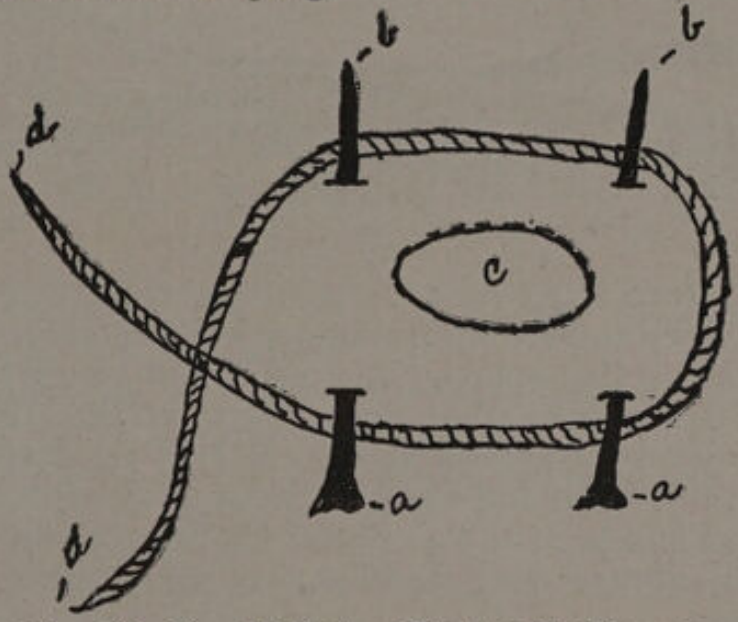


Fig. 186—One Method of Placing the Skewers.

a, a. Heads of the Skewers.
b, b. Sharp Ends of the Skewers.
c. Hernial Aperture.
a. The ligature passed under the protruding ends ready to draw up.

The skewer operations are performed in two ways, the following of which is the one we now prefer: The colt is cast and securely tied as for an inguinal operation. The fact that the patient is a weak youngster is no reason for doing this part of the operation in a slipshod manner. It is important to have the hind legs well flexed and tied against annoying movements. A wiggling colt can hinder surgical work even more than a grown horse.

There must be provided two pointed steel needle-like skewers tempered so as to be only slightly bendable. (Fig. 188.) The loop at one end is the hand-hold needed to facilitate their insertion. They should be slightly bendable because at the end of the operation the ends must be bent

away from the body to prevent them from wounding the surroundings. Their dimensions are that of a common knitting-needle. Before these were provided by manufacturers we utilized knitting-needles for the purpose, but these we have always found of uncertain strength and often non-bendable. Besides, their ends are too blunt to insert without first making small incisions with the scalpel both at the entrance and exit points. The properly appointed skewer made especially for the purpose obviates this additional difficulty, and enables one to do the operation in a few moments.

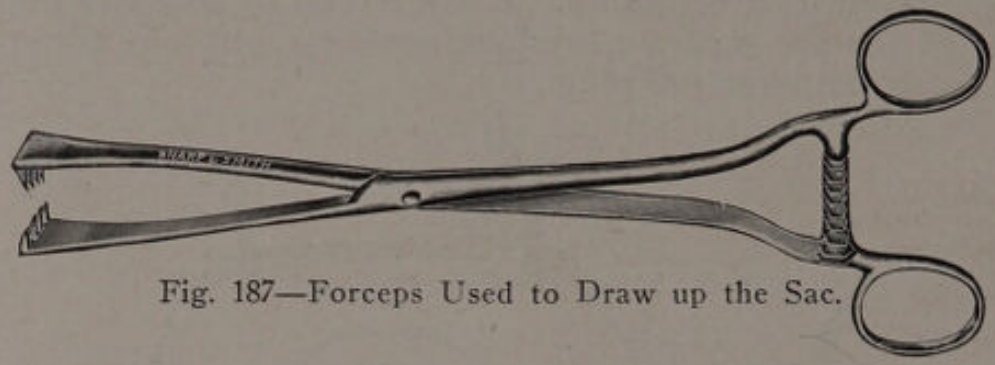


Fig. 187—Forceps Used to Draw up the Sac.

The ligature must be a very strong cord, one that will not break when the strong traction needed to assure strangulation of the sac is applied. We use for this purpose twelve strands of Irish linen, the common suture material now so commonly used by veterinarians. This is sterilized, soaked in tincture of iodine and then made slippery with soft soap. Slipperiness is one of the essential qualities of the ligature; strength is another; and cleanliness is still another.

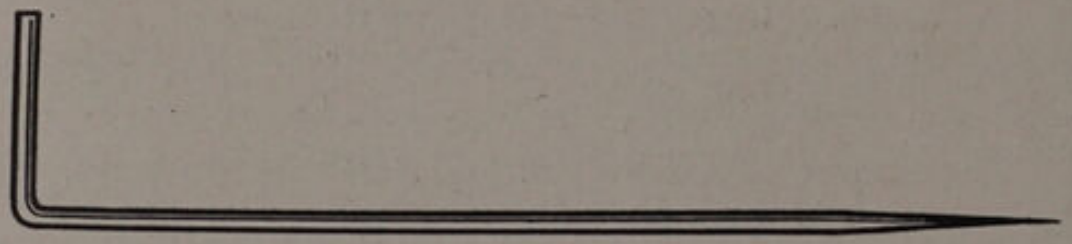


Fig. 188—S. & S. Skewer.

The first step of the operation is that of preparing the field. It is important to clean the sac and its immediate environs very thoroughly. Even though the sac itself will be strangulated and its disinfection will prevent putrefaction in the dying skin, a complication that while not particularly serious does, nevertheless, in rare instances favor the spread of anaerobic infections into the surroundings. We shave the sac and the skin surrounding at least two inches from the basilar circumference, wash the field well with brisk fric-

tions of mercuric chloride solution, no less than 1-500 in water and then when dried paint the surface well with tincture of iodine.

The steel skewers, Fig. 188, which have been sterilized by boiling are now ready to insert. These we have ready lying upon a sterilized receptacle or cloth, together with the sterilized and well soaped ligature.

The second step is the insertion of the skewers. The apex of the sac is grapped up with a tumor forcep (Fig. 187) and drawn up moderately. The traction should be straight from the body, that is, at a right angle from its level, the object being to bring all of the skin of the sac into the zone to be ligated but no more.

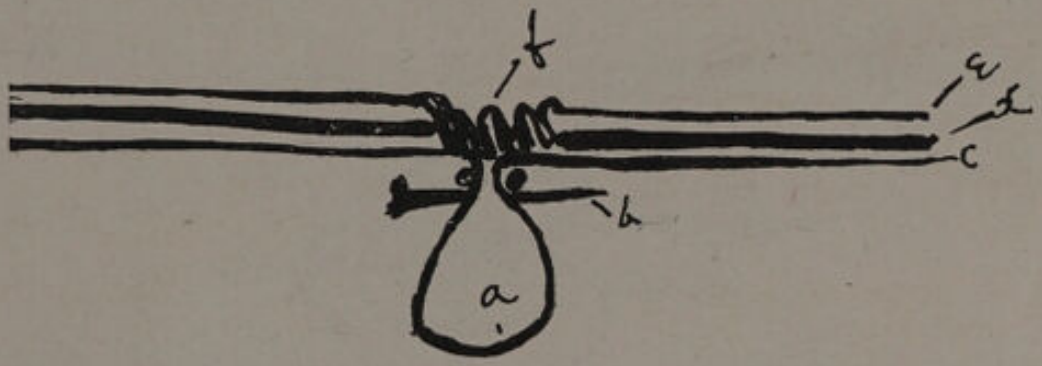


Fig. 189—The Sac Incarcerated with the Ligature and the Inner Layer Folded Up Into the Aperture.
(*a*) The Sac; (*b*) Skewer; (*c*) Skin; (*d*) Abdominal Muscles; (*e*) Peritoneum; (*f*) the Peritoneal Layer Folded.

The skewers (see Fig. 186) are now passed subcutaneously across the linea alba, one just behind the aperture and one just in front of it . The distance between the points of entrance and exit of the skewers should be slightly greater than the lateral edges of the orifice. That is, if the orifice is one inch in width the skewers are inserted a distance of about two inches. As the skewers are four to five inches long the ends protrude about one to one and a half inches at each end. It is these protruding ends that are used to retain the ligature securely fixed at the very level of the body and thus press the inner layer of the sac into the aperture when it is drawn taut. They are passed subcutaneously, that is, between the two layers of the sac, one from before backward following the median line of the body and the other from side to side crossing the first one in the middle of the aperture as above stated. The ligature is then passed beneath the protruding end and then drawn up. (Fig. 189.)

In drawing up the ligature, each end is wrapped around a stick, scissors or forcep to give a good hand-hold, and one

man then draws upon each of these, pulling hard and steady until complete strangulation is assured. It requires a great deal of force to strangulate a large sac and some time must be given up to this part of the operation so as to give the tissues time to give way to the pressure. A hasty tightening of the ligature will produce only incomplete strangulation and leave the sac viable—a sequel that would require a second operation.

The protruding ends of the skewers are now bent upward to prevent them from becoming impigned into the surrounding œdema. In the treatment of small hernias where the protruding ends are long they should be snipped off with a pair of wire cutters, before bending them up.

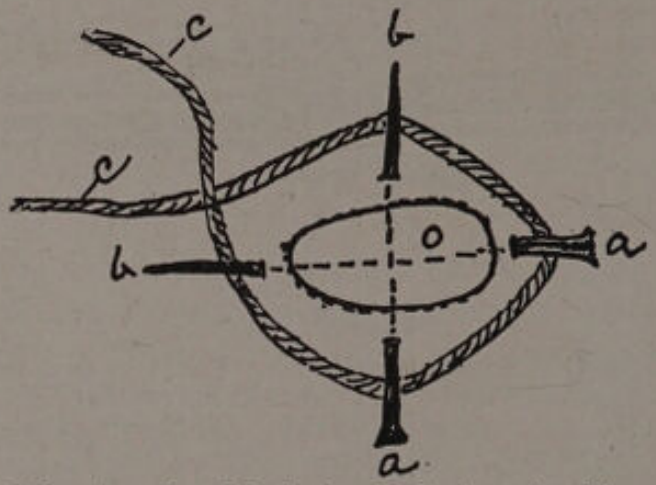


Fig. 190—Another Method of Placing the Skewers.
a, a. Heads of Skewers. *b, b.* Sharp Ends of Skewers. *c, c.* Ends of Ligature, ready to draw up. *o.* Hernial Aperture.

AFTER-CARE.—The subject is given an immunizing dose of antitetanic serum and in ten days or so, when the sac has sloughed off, an astringent wash of white lotion is applied daily until the sore has healed. It is not a bad practice in old cases to apply a supporting bandage for two or three weeks longer to prevent sagging down of a new sac while the adhesions may yet be insecure. This latter precaution we have found has turned into recoveries of cases we had previously thought incurable.

The other method, our old procedure, is performed in much the same manner except that the skewers are made to cross each other in the middle of the aperture, as shown in Fig. 190).

When this operation fails to cure an umbilical hernia a more radical step may be taken. The skin of the sac is incised and dissected free from the inner layer exposing the

latter right down to the level of the abdomen. Then the inner layer is folded into the aperture and the two folds sutured firmly from before backward with a continuous suture of strong cat-gut. The skin is then sutured with linen and a body bandage applied as a support and protection against infection. This operation has more hazards than the skewer method, but may be made safe enough where strict aseptic measures are followed. Attempts to close navel apertures by drawing the edges together with sutures are seldom successful and very often yield serious complications, such as peritonitis and exentration. As such an operation creates a tetanogenic condition a dose of antitonin should never be omitted.

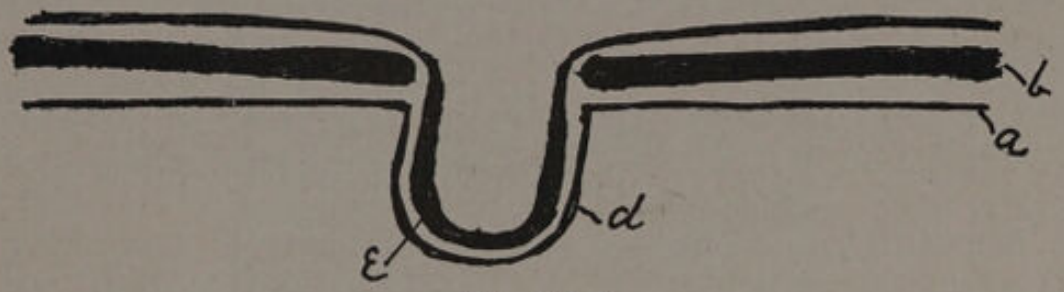


Fig. 190-A.

Scheme of an umbilical hernia: (*a*) skin; (*b*) abdominal muscles; (*d*) skin layer of the sac; (*e*) the peritoneal layer of the sac.

SEQUELÆ.—(I) Recurrence of the Hernia.—The operation, though in the author's opinion the most effectual against umbilical hernia, is not always successful, for there are old cases that prove too refractory to recover under any line of surgical treatment. The failures are, however, fortunately few amongst young animals; it is only the old standing cases of yearlings, two-year-olds and three-year-olds that rebel against this, and in fact any of these palliative operations. In the case of old standing the ligature should not be tied as tight as in young ones, in order to delay the sloughing off of the sac until the orifice has filled up with ciciatricial tissue. Derr, in order to increase the local inflammation about the orifice, has found it beneficial to inject sterilized salt solution subcutaneously around the base of the ligature in old cases, which, in conjunction with the application of the ligature rather loosely turned apparent failures into success.

2. **Peritonitis** is a rare complication, resulting only when the omentum of which the contents of the hernia is sometimes composed, was punctured with the skewers.

3. **Tetanus.**—One case of tetanus has been reported, but as that one occurred before the etiology of the disease was

known, little need be feared in this connection if proper antisepsis is respected, especially in regard to the sterilization of the skewers.

VANLAW'S OPERATION FOR SCROTAL HERNIA

DEFINITION.—A method of ligating the tunica vaginalis near the internal abdominal ring so as to entirely obliterate scrotal hernia without suturing the orifice itself.

INDICATIONS.—Vanlaw's operation is indicated for any oscheocele in any of the domestic animals. Scrotal hernias should be operated against early in life, as the chances of successful intervention decrease with age. The operation necessitates sacrifice of the testicle, hence it is performed at the time of castration. In animals, the cure of scrotal hernia with conservation of the testicle is rarely ever attempted. Although the attempt has been successful a number of times, the danger of fatal complications is great and the chances of permanently curing the hernia are small.

Notwithstanding the fact that scrotal hernias sometimes disappear spontaneously in the young, and that they are often compatible with health, the more important facts that they constitute a serious unsoundness, that they become more and more incurable with age, and that they are often the cause of fatal colics, clearly indicate the course to pursue.

In the suckling and in the yearling success is universal, whereas in older subjects there is always more danger of fatal results or failures, hence the inadvisability of procrastinating is evident. On the other hand, in adult stallions still useful as studs the only excuse for recommending operative intervention is a strangulation of the contents that can not be otherwise managed. When scrotal hernias of studs are compatible with health, the practitioner should leave them severely alone. Moreover, the loss of one testicle would decrease the value more than the hernia of ordinary size.

In the small animals operative treatment is successful at any age. Dogs, cats and pigs submit to the operation without apparent post-operative discomfort in almost every case.

CLASSIFICATION.—We have recognized in domestic animals two distinct kinds of scrotal and inguinal hernias. (1) The **true congenital form** (Fig. 191) in which the displacement of the viscera is directly through the internal abdominal ring which has not closed up after the testicle has passed through it on its course from the intra-abdominal position of early fœtal life to its extra-abdominal location of

full fœtal development. **This is the common scrotal hernia of quadrupeds;** most of them belong to this class. Here the hernial sac is constituted of the normal tunica vaginalis; the contents inhabit the scrotal sac in harmony with its other contents—the testicle and its appendages. (Fig. 191.)

2) The other is **interstitial scrotal hernia** in which the viscera have saculated a process of peritoneum adjacent to and independent of the internal inguinal ring. (Fig. 192.) This is the common scrotal hernia of human beings, and although more rare than the other is met now and then in quadrupeds. **Failure to recognize to which one of these two classes a given hernia belongs accounts for the numerous**

Fig. 191—Congenital Scrotal Hernia Showing Wide Open Internal Inguinal Ring.

failures and fatalities following herniotomies in domestic animal surgery.

Scrotal and inguinal hernias are also classified, as to contents, into **epiploceles** or omental hernias and **enteroceles** or intestinal hernias. Sometimes they contain both in which they might be designated as epiplo-enteroceles or entero-epiploceles. When there is an accumulation of a considerable quantity of peritoneal fluid the term **hydrocele** is permissible. The word hydrocele is, however, not to be used in this connection unless the fluid and not the solid contents determine the size of the sac. That is to say, if the hernia contains a quart of fluid and only a small knuckle of intestines it is in reality a hydrocele complicated with protrusion of the bowel. On the other hand, if the intestinal or omental contents were simply bathed in the fluid distributed about the convolutions without this feature making the sac any larger the term would not apply. It would be misleading.

Again, we must classify hernias of this class into **strangulated and non-strangulated.** Most all scrotal hernias are compatible with health and comfort, but some of them, in fact, sooner or later most of them, undergo changes, physical or pathological, which threaten life. A strangulated hernia is one whose contents have become incarcerated through an inflammatory process, which may be primary, or secondary to a constriction about the aperture.

The aperture of congenital scrotal and inguinal hernias, the kind most common in animals, is constituted of an open —or rather an unclosed—internal inguinal ring. In early foetal development this aperture is wide open, designed as a

Fig. 192—Interstitial Scrotal Hernia Showing the Hernial Aperture Adjacent to the Internal Inguinal Ring and a Hernial sac (10) Independent of the Processus Vaginalis.

thoroughfare for the testicle. It should close up as soon as it has served this purpose. When this closure does not occur at the proper time some part of the viscera accompany the testicle in its downward course and a hernia results. But like in other congential hernias the constricting process continues for some weeks or even months after birth and thus spontaneously cures what was once actually a congenital hernia. Sometimes the process of constriction is arrested before the aperture is closed and thus a permanent hernia results. The size of the aperture varies as does also its shape. Generally it is an elongated slit, twice as long as it is wide, and at other times it is almost circular. It may be just large enough to admit one finger, as in the case of common epiploceles of the yearling and two year old and at other times a man's fist can be passed through it. The large scrotal hernias of stallions have enormously large apertures, rounded anteriorly and limited by the inguinal ligament

(Poupart's). Between the almost closed aperture of the epiplocele and the large open one of the big hernias are all the intermediate varieties. As the aperture of hernias is never directly closed up with sutures in herniotomies of animals this feature interests us, so far as it affects the size of the sac and quantity of contents to hold up in the abdominal cavity. We do not study the aperture with a view of closing it by bringing its edges together but with a view of determining whether we can construct a floor for it out of the integuments composing the sac. We therefore want to know only whether it is large or small. A large aperture existing with a strong but small sac that prevents further saculation is a favorable hernia. It does not strangulate easily and the integuments are strong enough to support the contents at a higher level. On the other hand a small aperture associated with a large sac of weak, thin integuments is less favorable, because it will strangulate readily, and in an operation the sac will be found too weak to bear the weight of the contents. When the aperture is large and the sac weak the condition is quite hopeless, as here we have no strong structures to help support the contents.

The aperture of interstitial scrotal and inguinal hernia is a congenital or acquired perforation of the abdominal wall located medially to the internal abdominal ring, either laterally or medially to the prepudic artery. It is an oblong opening extending obliquely from before backward and medially. Its edges are thin and somewhat irregular. The complex arrangement of the aponeurotic parts of the abdominal muscles afford weak places in the walls that favor saculation at this point. These weak places are more pronounced in certain individuals and then muscular contraction sometimes does the rest. Here the sac drops down into the inguinal canal with (but not in) the vaginal process.

The sac of congenital and inguinal hernias is always constituted of the vaginal process (tunica vaginalis). This process of the peritoneum, in hernias, is, however, very often drawn out into a very thin membrane particularly as it approaches the internal ring. At this point it is often too thin to separate from the surrounding tissues without tearing through it. It actually "runs out" entirely in many cases, so that when the feeble sac is clamped or ligated there is nothing to support the contents and a re-saculation immediately occurs often with fatal results, although sometimes with nothing more serious than a recurrence. This is particularly the case with scrotal hernia of swine, in which animal the sac

is always very thin and not infrequently non-existent at the level of the ring. **This thinness of the sac at the level of the internal abdominal ring is a feature to be kept prominently in mind in all operations for the relief of scrotal hernias.**

The sac (Fig. 192) of interstitial scrotal and inguinal hernia is composed of peritoneum that was pressed down by the weight of the contents. It is always of a uniform thickness and like ventral hernias it thickens with age. The puzzle about this sac is its adhesions to the surrounding tissues from which it is by no means easily separated. It occupies the inguinal canal lying adjacent to the vaginal process but in no way communicating with it. The two sacs (the vaginal process and the hernia sac) are juxtaposed but not intercommunicating; the testicle is in one sac, the contents in another.

The contents of scrotal hernias. Omentum, intestines and peritoneal fluid are the three agents found in these hernias. To these might, however, be added products of pathological process-fibrinous exudates and pus, found in strangulations.

An interesting content is the omentum. This structure finds its way into the orifice in performing its function of policing the abdomen. It plugs hernial apertures, adheres to the internal wall of the sac to strengthen it against further saculation. It prevents further protrusion by bridling the intestines. In the case of small apertures extensions of the omentum pass into the inguinal canal and so occupy the aperture as to effectually prevent intestinal protrusion. As such a case becomes older the part at the aperture adheres firmly to the parietal peritoneum as to cork it securely. When an animal so affected is castrated (an old or mature horse, for example) the loose part of the omentum lying in the inguinal canal protrudes through the scrotal incision while the part in the ring remains fixed and securely averts a prolapse of the intestines. In young animals where no such adhesions have formed the protruding omentum can be drawn out into a dangerously long string and if pulling it persistently in, intestines will follow.*

In old hernias, whether interstitial or congenital, where the omentum co-habits the sac with intestines, it is always badly adhered both to the walls and to the intestines them-

*When hernias reoccur from the above cause the contents unprotected by any peritoneal covering always adhere to the wall of the sac.

selves, producing a hard surgical problem, by complicating the reduction.

The intestinal contents of scrotal hernias is usually composed of knuckles of the floating colon in small ones and portions of the small intestines in the larger varieties. There is usually an entrance gut and an exit gut, with convolutions according to length between them. In small inconspicuous hernias there is but one knuckle—a single loop. (Fig. 193.)

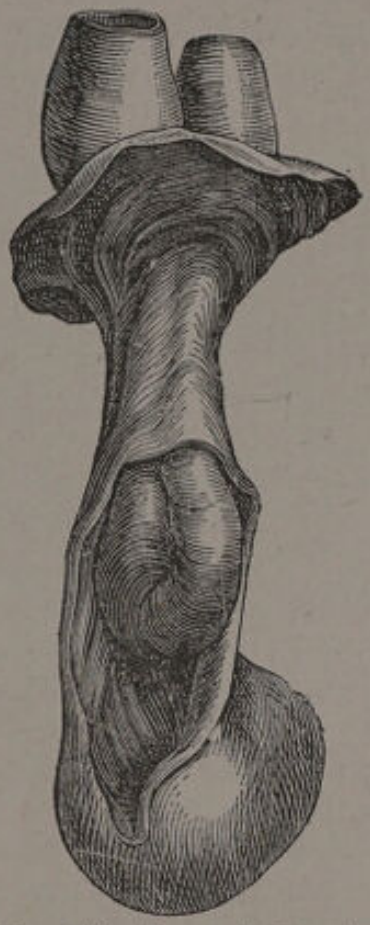


Fig. 193—Scrotal Hernia.

The amount of peritoneal fluid in a hernia differs very much. There are large hernias in which the fluid accumulation constitutes the greatest part of the bulk, but most of them contain only a small amount, scarcely enough to increase the size of the enlargement.

Pus and other inflammatory products are found only in strangulated hernias, particularly those in which the incarceration is incomplete.

Adhesions are by no means rare. In the congenital class as well as in interstitial hernias where omentum has descended with the intestines the former is often matted into the walls of the sac and sometimes into the intestines them-

selves. This is especially true of those which have been the cause of occasional colics. We have found the contents thus securely fixed to the spermatic cord, the epidydimus or the testicle itself.

Diagnosis. On side of the scrotum is larger than the other, and the enlargement is fluctuant, non-painful and usually reducible. High up in the groin the aperture can be felt with the finger tips. When there is any doubt as to the character of the enlargement a rectal exploration will reveal an open ring through which the fingers from without and those within the abdomen touch each other. In confirming a diagnosis by rectal exploration the right hand is used to

Fig. 194—Dissection of a Normal Internal Inguinal Ring. (The Key to the Figures in this Cut is Found in Figs. 196-197-198-199, Page 381).

explore the left side and vice versa while an assistant pushed his fingers into the ring region from without. But even without this plan a skilled diagnostician locates the opening with facility. The practitioner should familiarize himself with the character of a normal ring as felt with the fingers to enable him to recognize the abnormal one. It is thus that the congenital scrotal hernia protruding into the vaginal process is differentiated from the interstitial kind. In the latter there is the normal ring lying to one side of the hernial aperture.

When there is strangulation the sac is sensitive and rectal exploration causes great pain manifested by severe straining, and often there is some oedema of the scrotum.

Treatment. Scrotal and inguinal hernias call for surgical intervention in every case except those of the new-born and sucklings, where procrastination awaiting spontaneous recovery is admissible. But even in these the size must determine the course of action. Very large hernias never re-

cover spontaneously and might better be operated upon promptly than to wait until an operation would be more dangerous.

Although we have heard of and have seen many apparently ingenious procedures for scrotal hernia during recent years, none of them have impressed us as superior to the old plan of ligating the sac at a high level after ablating the testicle and then supporting the part with a packing for forty-eight hours.

The subject is prepared for the ordeal by a few days of low diet and a general grooming and cleaning up of the body. It is foolhardy to do herniotomies on a dirty patient, full of mud, manure and shedding hairs. These must always be dispatched first of all to assure a low death rate.

Colts and calves may be anaesthetized with chloral hydrate and pigs operated upon without any anaesthetic, but mature horses should be chloroformed.

Either the operating table or the ropes may be used to secure the subject. Pigs are hung up by the hind legs with ropes looped above the hocks and tied wide enough apart to spread the thighs away from the inguinal region.

Whatever method of restraint is used the one essential in this regard is to part the legs well and maintain them securely parted throughout the operation. Like ridgling castration, hernia operations require this perfect form of restraint, whether the subject is bovine or equine, or whether young or full grown. It is as much a mistake to attempt such operations on small animals without good restraint as upon mature subjects.

RESTRAINT.—Dorsal recumbent position with ropes or harness, the hind legs well parted, the hind quarters elevated and general anæsthesia is the essential restraint for the operation.

INSTRUMENTS, ETC.—

1. Castrating instruments.
2. Large curved needle and braided silk.
3. Long probe-pointed bistoury.
4. Small trocar and canula.
5. Several hæmostatic forceps.

ANTISEPSIS.—The antisepsis begins with a thorough washing of the inguinal region after the patient is rolled into position. The scrotum is washed with soap and water and rinsed with mercuric chloride solution 1-500. The legs and adjacent parts of the body should be moistened to prevent hairs and dirt from flying upon the wound. The needle,

emasculator and thread are sterilized by boiling or by strong chemical disinfectants. Under no circumstances should the sterilization of these be neglected, as asepsis of the tissues they touch is essential to the success of the operation.

TECHNIQUE.—First Step.—An incision is made through the scrotal integuments, except the vaginal process, the shape of an inverted T, each line of which is about four inches long. In large hernias the line running transversely, that is the stem of the T, may be extended upward far enough to give a good access to the inguinal canal.

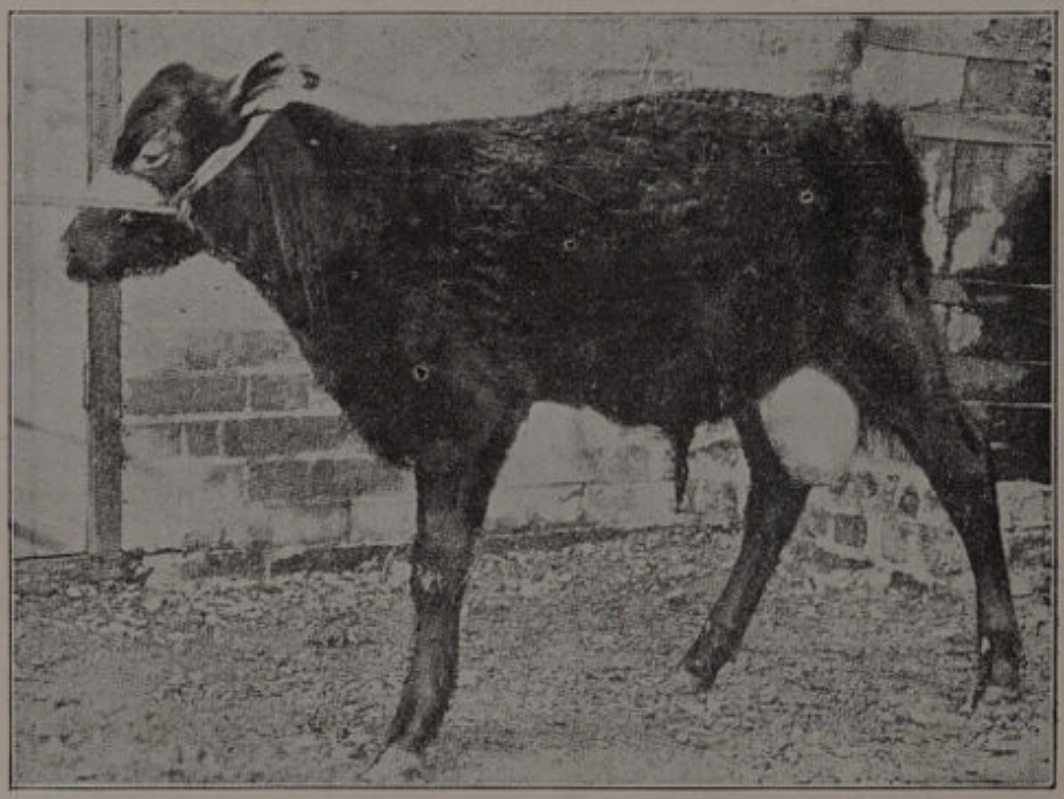


Fig. 195—Scrotal Enterocele in a Calf.

The second Step is to free the sac of its exterior attachments by blunt dissection as far upward as possible without tearing through it. In cases where the sac is thin toward the level of the ring no attempt is made to expose this thin zone. It is better to leave its attachments to the skin unmolested than to take the chance of tearing a hole into it, which accident would not only defeat the purposes of the operation but might actually prove fatal by allowing the intestines to protrude into the subcutaneous space.

The Third Step. We now incise the sac at the fundus, hold the edges apart with the tumor forceps and inspect the interior. If any intestines are visible they are pressed into the abdomen. When adhesions prevent this they must be

carefully disconnected by either sharp or blunt dissection. In strangulated hernias it may be necessary to evacuate the gas they contain with a trocar and canula. It will always be necessary here to prevent a sudden protrusion of a large volume of bowels from straining. This will not occur under profound anæsthesia, but when such operations are attempted without first anæsthetizing well it is very likely to feature the procedure.

In most all scrotal and inguinal hernias the operator never sees the bowels at all, they having gravitated into the abdomen unassisted.

The fourth step is the management of the testicle. We have thus far no successful technique against these hernias that does not include castration. We cannot suture the aperture; and we cannot reduce the dimension of the sac at the level of the ring so as to block subsequent protrusion. We must therefore **ablate the testicle and tie off the sac at its neck.** A recent innovation directs that the testicle be detached from the vaginal process and then passed through the aperture into the abdomen, there to remain among the viscera. To what extent this would conserve the potency of a stallion is still unknown; and what harm might accrue from the adhesions of the raw part of the spermatic cord to the peritoneum, which is sure to occur, is likewise a quandary. The suggestion is, however, worth a trial.

Our plan is to tie off the sac and spermatic cord at as high level as possible with a good strong ligature impinged at one or two places in the sac to prevent slipping. This ligature must be drawn very tight to assure sloughing of the stump. If the stump remains viable the ligature will not slough itself loose and will cause abscess and probably chronic peritonitis. On this account we emphasize the tightening of the ligature above all features of the technique. The ends are cut off long enough to dangle from the incision in order that it can be more easily drawn out when the stump has sloughed. Some operators prefer clamping with a wooden clamp. It is our experience that this is a dangerous practice in mature horses and that the mortality is entirely too high.

Bemis handles the sac by clamping it with an iron clamp while he ablates the testicle and sutures it with a tug-stitch one-half inch from it.

Natress uses a wooden clamp and then an elastic ligature just above it. For the ligature he uses a strip of rubber band made from an inner tube of an automobile tire.

With all due respect to all of these plans we have always had such splendid success from the simple tying off process that we hesitate to recommend them.

The fifth step is that of wadding the cavity with iodoform gauze, quite tightly packed, and then suturing the scrotal incision with a continuous suture to retain it. It is advisable to wad the inguinal well, because this pushes the stump into the aperture where it often immediately fixes itself by adhesions.

After Care. If the operator is sure of his methods, there is no danger in leaving this wadding rest for three days, but where there is some uncertainty about the matter of cleanliness forty-eight hours is as long as such a pack should be allowed to remain sutured up in this closed traumatic cavity. This is a favorable field for anærobes and must not be kept closed too long where slipshod methods of operating prevail or where by accident any infection **ab extra** has occurred.

If the patient is tractable we remove the packing on the second or third day and replace it with another held in place with a clamp forcep. This one not being so closely incarcerated may now be left alone for two or three days more. All of the while the patient's temperature is made to serve as the barometric guide of the impending complications. Irrigations are only practiced when the cavity suppurates and the waddings are continued until the ligated stump sloughs away.

Operations on Pigs. The two kinds of scrotal hernias —congenital and interstitial—must first be differentiated. The latter hernia is more common in pigs than in the larger quadrupeds.

The operation just described for horses will answer for most hernias of these animals, but here and there the vaginal process is so very thin near the ring level that recurrences occur. They saculate into the canal again, sometimes bigger than ever and the contents adhere to the skin in the way to prevent any successful intervention thereafter.

The modus operandi recommended by S. L. Stewart seems to meet every requirement, especially in young pigs. It is less effectual for full growns.

The pig is hung up by the hind legs, the contents are pressed into the abdominal cavity by manipulation and held there securely by an assistant pressing the finger tips into the ring area, the testicle is ablated, and then a wick of gauze is passed into the inguinal canal from the scrotal incision to

a point beyond the ring and secured there by impinging it with a stitch passed into it through the skin at the level of the ring. This is removed in forty-eight hours. No further treatment is necessary.

Fig. 196

Fig. 197

Fig. 198

Fig. 199

Figs. 196, 197, 198, 199—Dissections post mortem of four different interstitial scrotal hernias.

1. Vas Deferens.
2. Spermatic Cord.
3. Internal Inguinal Ring.
4. Bladder.
5. Prepudic Artery.
6. Spermatic Artery.
7. Broad Ligament of Bladder.
8. White Line.
9. Herneal Aperture.
10. Herneal Sac.
11. Cremuster Muscles.
12. Peritoneum.
13. Transverse Abdominal Muscle.
14. Internal Oblique Muscle.

a1. Location of Hernial Aperture.
a. Hernial Aperture.
V. Vaginal Canal.
P. Probe.

AFTER-CARE.—The packing is removed at the end of forty-eight hours, after which the cavity is syringed out daily with iodoform-ether, five per cent, until the ligature has sloughed off and cicatrization is well advanced. In addition, the patient is kept in the standing position for four to five days immediately following the operation.

SEQUELÆ.—(1) **Peritonitis,** manifested by the appearance of fever three to five days after the operation, is the most likely complication. Its prevention is found in cleanly methods and its treatment consists of local irrigations of the wound and appropriate internal remedies.

2. **Recurrence of the hernia** is possible after the ligature has sloughed off and the orifice has failed to close up with cicatricial tissue. This occurrence is met in hernias having exceptionally large orifices, and especially when the sac near the internal ring is constituted of a delicate, stretched-out membrane that sloughs off hurriedly and then gradually allows the intestines to gravitate into the scrotum. This accident sometimes leads to a delayed complication in the form of a subacute peritonitis, local enteritis or peritoneal abscesses.

3. **Shock** sometimes supervenes, although this sequel is most likely to follow operations for strangulated hernias where the subject is already in a delicate condition before the operation began.

OTHER METHODS—(1)—The covered operation, so-called, has the advantage of not exposing the tissues to external influences. The modus operandi consists of reducing the hernia by gravity and manipulations and then pinching up the sac,—skin and all, including the testicle,—with a strong clamp, which is allowed to remain until it sloughs off. In this method, if the hernia is irreducible, the sac is incised and the orifice enlarged anteriorly with the bistoury, after which the scrotum is pinched up as above mentioned.

2. **The uncovered operation** consists of pinching the tunica vaginalis with a clamp after having dissected it out, as in Vanlaw's operation. The testicle and redundant parts of the sac are cut off one inch below the clamp, which is not removed until the third or fourth day.

OPERATION FOR STRANGULATED HERNIA

INDICATIONS.—Operation for strangulated hernia is an emergency intervention. When indicated, that is to say, when strangulation of a hernia exists, it must not be delayed. In the treatment of colic co-existing with scrotal hernia it is important to determine without delay whether or not the hernia is playing any part in the cause of the intestinal pain, and when it is once incriminated it is essential to constantly scrutinize the developments in view of deciding to operate before incurable damage has been done.

The greatest obstacle confronting the practitioner in deciding upon operative intervention for strangulated hernia is the fact that the operation can not very well be successfully performed without sacrificing the testicle involved, and since the loss of a testicle in a stud is a serious matter, the inclination to postpone is always quite as tenable as the decision to operate immediately. Moreover, it is impossible under all circumstances to lay down an absolute law as to when a colic due to hernia actually requires an operation. What might seem to be a threatening condition at the beginning may, after a few hours of waiting, prove to be an entirely harmless colic in no way associated with the hernia; and on the other hand, an at first apparently trivial colic may soon develop into a plain case of intestinal strangulation. With these possibilities in view, the plain duty is to give the suspect constant surveillance and then operate just as soon as the diagnosis of strangulation is established beyond doubt, and before the damage to the incarcerated loop is too great. A too long delay invites certain death, while a too early intervention needlessly sacrifices the testicle. The surgeon's judgment protects against these two evils by operating at the proper time.

Above all things, the unwisdom of operating upon a hopelessly affected case, a dying subject, must be emphasized.

TECHNIQUE.—The operation for the relief of strangulated hernia does not differ materially from that performed against non-complicated scrotal hernia (Vanlaw's operation). The patient is cast, anæsthetized, and rolled to the dorsal posture. The tunica vaginalis is dissected out, the testicle removed and then the intestines are replaced into the abdominal cavity. If any difficulty is encountered they are punctured to reduce the volume and if still refractory kelotomy is performed. The extreme dark color of the incarcerated intestines is not always an indication of gangrene;

on the contrary, when the operation was timely, they are soon restored to a normal condition after being released and returned to their position within the abdomen. The coloration of intestines under the least provocation is a property belonging to them, and must not be misjudged in intestinal surgery.

In any event, especially in the large species of domestic animal, the surgeon has done his full duty when he has restored the strangulated intestines into the abdomen, because the only other recourse (enterectomy and approximation) is always futile.

The intestines having been returned, the tunica vaginalis is ligated near the ring in the manner described in Vanlaw's operation. The cavity is packed with antiseptic gauze, which is retained with sutures across the scrotum.

The patient is given a large dose of an oleaginous purgative, sustained on a strict liquid regimen, and is given such other internal remedies as the general systemic condition indicates.

OTHER METHODS.—Strangulated hernias are sometimes successfully relieved by simple manipulation of the sac after placing the patient in the dorsal posture, and one case reported by Stringer was permanently cured of its hernia by plugging the orifice with the testicle after reducing the contents by gravity and taxis. The testicle never again descended into the scrotum, the hernia never returned and the stud regained its health and lived a useful existence for years.

SEQUELÆ.— 1. **Entero-peritonitis** extending from the initial strangulated focus is the chief untoward result. The pains continue after the operation has been performed and death soon ensues. There is no successful treatment.

2. **Gangrene of the Loop.**—When the incarcerated loop of intestines has become gangrenous or unviable on account of the duration of the period of incarceration, the patient dies within a few hours, with all of the symptoms of shock. Treatment is of no avail.

3. **Peritonitis** is more liable to supervene than in the operation for uncomplicated scrotal hernia, on account of the enfeebled condition of the patient. It is manifested by fever, slight colics, inappetence lasting during the week following the operation, and usually terminates fatally.

RADICAL OPERATION FOR VENTRAL HERNIA

INDICATIONS.—Ventral hernias are usually of traumatic origin, although congenital openings in the abdominal walls at unexpected places do sometimes occur. The latter are however rare and their cause must be sought in a perverted foetal development of the abdominal enclosure, the mechanism of which does not directly interest the surgeon. It is sufficient to know that congenital perforations of the walls of the abdomen account for at least a few of these conditions in domestic animals.

Decidedly the most of them can be traced to some definite injury delivered directly to the abdomen. A violent contact with a more or less **blunt object,** such as a kick from an unshod hoof, the thrust of a horn, collision against the end of a wagon tongue, a leap upon a fence post, a fall upon the stump of a sapling, or protruding stone and even a kick from a man's boot, are generally found to be the causative factors. A solution of the continuity of the abdominal wall is most likely to occur from such injuries when the viscera are full and the intra-abdominal pressure is at its height. Thus a pregnant animal or one highly fed is most susceptible to grave injuries from these sources. Muscular contraction while straining against a heavy load and the severe straining of parturition, obstipation or dysuria, although sometimes very powerful, and sometimes given as probable causes may be thought of in this connection, but in our observation no case has ever been traced to such a cause.

Rupture of the prepubian tendon (Fig. 200) does sometimes occur from the weight of pregnancy, but this accident is really not a ventral hernia. It is a sagging down of the whole abdomen and is actually a total enteroptosis due to detachment of the prepubian tendon from the symphysis. The cause of such a detachment is pressure necrosis. The weight of the growing foetus pressing constantly against the attachment of the tendon causes the degenerative process. With this one exception and the rare cases of congenital apertures of the abdominal walls direct violence will be found to be the one agent responsible for this class of hernias.

Size, Shape and Location. These hernias vary greatly in size. Sometimes they are small, inconspicuous elevations which attract no serious attention, and at other times they are voluminous protusions containing the major portion of the viscera (Fig. 201). Between these two extremes are all the intermediate types, varying with the dimensions of the aperture.

In shape they are usually ventrose but may sometimes be circumscribed and deep like a half embedded sphere. The average ventral hernia is however unsymmetrical, bagging more prominently here or there at a point of least resistence. The most symmetrical ones are those located along the linea alba; elsewhere they are uneven, belly-like, shapeless enlargements.

The location may be anywhere on the dependent parts of the abdomen, but those parts most exposed to injury are more commonly affected. Thus the region of the flank, be-

Fig. 200—Horse Showing Bad Case of Rupture of the Prepubian Tendon.

ing the summit of the abdomen in quadrupeds, seems to be the location of a large portion of them. In cattle they are seldom seen elsewhere than along the region lying between the flank and the costal margin. Here the abdomen is exposed to kicks, horn thrusts and falls, in both horses and cattle, and thus more often sustains the kind of violence that will tear asunder the abdominal wall without perforating the elastic skin that covers it. The horse being exposed to a greater variety of conditions from the work it does than cattle, may in various ways be wounded most anywhere on the different parts of the abdomen and therefore very often sus-

tains ventral hernias not only about the flanks but also in the groin, around the sheath, the mammae, and inguinal canal or along the ventral surface as far forward as the xiphiod cartilage.

The location is especially important, because it bears most of all upon the prospects of successful intervention. High up they are favorable while low down the direct weight of the viscera operates to defeat the success of an operation. And again the muscular contraction of the respiratory act reflects most upon the lower parts of the abdomen.

The aperture. There is nothing regular about the shape or dimensions of the aperture of ventral hernias, as much in this connection depends upon the character of the object that

Fig. 201—Cow showing Very Large Ventral Hernia.
(Courtesy of Am. Vet. Review).

made it and upon the direction the blow was delivered. A small object like the end of a vehicle shaft may by delivering a glancing blow, tear an elongated rent of considerable length while a tuberous object like the stump of a tree or a large stone by striking square against the walls of the abdomen might cause only a small hole. It is sometimes circular, sometimes irregularly oblong and not infrequently its edges are torturous. The apertures of ventral hernias are sometimes very large, reaching the dimension of eighteen inches long and as much as a foot wide. Others may be eight to ten inches long and six inches wide and so on down to the smaller one whose openings are only an inch or two in their longest diameters. They are often limited by such hard structures as the linea alba, the pubis, or the costal cartilages

which circumscribe one side of the boundary. Hernias thus located have the most irregularly shaped apertures.

The sac may be composed of one or of two layers. The one having only one layer—the skin is the most serious of all ventral hernias because the viscera will be found adherent to the subcutem. The intestines, large or small, that find themselves contacting the raw subcutaneous tissue soon fix themselves to it from the inflammatory process that ensues the injury, and the adhesions are, except in very recent cases, inseparable by any form of dissection. Often thus the fusing of the intestines to the inner side of the sac is made still more annoying by the matted omentum which adheres firmly both to the intestines and the sac, forming a unit of all three

Fig. 202—Mule with a Large Ventral Hernia in the Groin. Photo by Dr. F. X. May, Ft. Smith, Ark.

structures with an intercommunicating circulation that creates a very difficult surgical problem.

Fortunately, however, most ventral hernias are not so constituted. Most of them have a sac composed of two layers—**the skin and the peritoneum.** Both of these integuments are so very elastic that they yield to violence by stretching, while the less elastic muscular and aponeurotic layers tear apart.

The skin is usually normal in appearance and in elasticity, being only occasionally scarred permanently from the initial trauma. The two layers are however adhered to each other quite firmly. That is to say, on examination of a ventral hernia it may be thought that the skin and peritoneum can be easily dissected apart like skin from a normal part of the body. This is not, however, the case as it always requires

considerable trouble to separate them in performing herniotomies. They are fused together, even though they may not appear so from the external manipulative examination, and when separation is attempted by sharp dissection it is always found that they have a common circulation which crosses the adhesion from one to the other. And besides the adhesions are so firm and inelastic that it requires a very painstaking dissection to divide the two layers. Besides, there is an annoying bleeding from numerous sources that is troublesome to control.

The peritoneum, which constitutes the inner layer of the sac, is normal in thickness on the recent cases, while in older cases it is often very thick. The peritoneum of a large and old ventral like that shown in Fig. 201 may be an inch in thickness. In others it may be only one-half that dimension, and in still others it may be even thinner. This thickening process the peritoneum undergoes as a hernia grows older is important because the heavier this layer is the better it will serve as a medium to utilize in closing up the aperture. A large ventral hernia with a thin inner layer and a large aperture is an unfavorable one for an operation, in fact incurable, but when this layer is thick, heavy and firm there are few that can not be successfully leveled up.

DIAGNOSIS.—An old ventral hernia is a non-painful, fluctuating enlargement at whose base an aperture can readily be felt. They are always reducible. Even when the contents adhere to the wall they can be lifted into the abdomen and the edges of the aperture can be traced. When the patient lies with the sac upward the contents disappear and leave the wrinkled redundant skin lying over the aperture. Along the linea alba they must be differentiated from umbilic hernia, which is done by searching for the navel cicatrix.

Recent cases are more puzzling, for there are fluctuant sacs about the abdomen due to traumatism that may be difficult to differentiate. This is particularly the case of the sanguinous sac that often develops at the flank after a kick or fall. Here the weight of the contents and the touchiness of the patient may prove an obstacle against a prompt diagnosis. A rectal exploration is always helpful when the location is within the reach of the hand but when well forward it is sometimes impossible from external manipulations alone to arrive at a correct conclusion as to the exact nature of such injuries. Exploratory puncture may be misleading because ventral hernia might be, and in fact is at first, complicated with more or less accumulation of serum or blood.

The recent abdominal contusion should be viewed with suspicion until the base of the sac can be explored for an aperture in the abdominal wall, and until it has been definitely ascertained that no such an aperture exists it is hazardous to evacuate the contents by lancing. The evacuation of the accumulated serum with a trocar and canula may, however, be practiced several times until the character of the injury is revealed.

MANAGEMENT AND TREATMENT.—A recently acquired ventral hernia in animals should be treated by holding the contents up with a strong body wrap or a truss until the shock and initial inflammation subside. It is our opinion that an immediate operation upon ventral hernias is not justifiable. It is only where there is exposure of the viscera (prolapse) that immediate surgical intervention is called for. The only exception is the case where the sac is so badly contused that sloughing is likely to follow. Here the bruised skin becomes infected and peritonitis is sure to supervene unless a drainage is provided, and the best way to provide a good drainage is by performing a well directed herniotomy. With these exceptions it is always preferable to treat the wounded abdomen by supporting appliances until it is determined whether or not an operation can be safely performed, or whether one is actually needed. For many ventral hernias are neither large enough to disfigure an animal badly nor injurious to its general welfare. It is good policy, always for a practitioner to act cautiously in dealing with these accidents, as often the cost of an operation is out of proportion to the benefit derived.

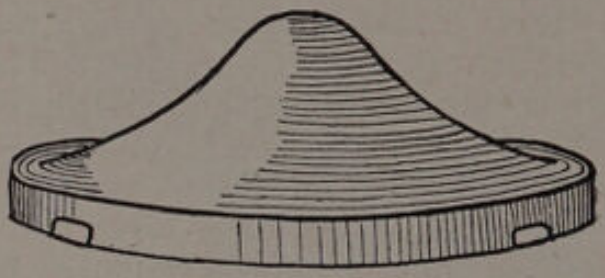


Fig. 203—Wooden Pad for Ventral Hernia Truss, Showing Slots where Straps must be Attached.

RESTRAINT.—Recumbent restraint and general anæsthesia is necessary. The hernia must be exposed uppermost, and the anæsthesia should be profound. No matter how small the hernia may be, local anæsthesia will not answer.

ANTISEPSIS.—The sac and a liberal area surrounding is clipped, shaved and washed with mercuric chloride before

the patient is cast. This may be done twenty-four hours in advance of the operation. At the time of operating a good washing with mercuric chloride followed by a bath of pure alcohol, is advisable. The instruments and the sutures are boiled and kept free from contamination while in use. The sutures especially, must be absolutely aseptic. The hands are covered with rubber gloves, or in lieu of these, they are covered with common gloves while preparing the patient, and then when the operation begins, disinfected in the usual manner.

INSTRUMENTS.—

1. Scalpel.
2. Tissue forceps.
3. Hæmostats.
4. Abundance of linen thread.
5. Tumor forceps.

TECHNIQUE.—Here again we advise against meddlesome intervention in hernias that do not cause discomfort nor corporal disfigurement, except where the operation is demanded strictly for cosmetic purposes.

PREPARATION.—The patient is subjected to a strict dieting for at least ten days during which time the volume of the ration is gradually reduced. During the last twenty-four hours before operating no solid food is given, but the patient may be allowed a small mash of oats and bran and a little hay to avert the enfeeblement that arises from an entirely empty stomach. The object of the reduced ration is to empty the bowels and thus diminish the weight of the hernial contents. It does not matter that the stomach contains a bit of nourishing food at the time of the operation, in fact it is better that it should, because the enfeebling influence of a low diet may detract from the chances of success in this as well as any surgical operation and must therefore not be carried too far. We therefore advise in serious herniotomies that the posterior bowels be emptied by a low diet for ten days and then lost strength accruing therefrom be at once restored by beginning to feed the patient already before the operation is done.

In addition to dieting, the field of operation should be disinfected before the patient is cast, in order to shorten the duration of the time the patient is down. We clip and shave the hernial sac and its environs before casting, and when possible, as for example in hospital practice, do this work twenty-four hours ahead, applying an antiseptic pack of mercuric chloride solution to the shaved region with a body

wrap. When the patient is finally cast for the operation the field is again briskly washed with mercuric chloride solution and then painted with tincture of iodine.

ANÆSTHESIA.—In all operations for ventral hernia, other than very small ones, good general anæsthesia is required. We administer in capsule one and a quarter ounces of chloral hydrate to horses and cattle two hours before operating. In the out-of-door practice where so much time can not be given over to this part of the anæsthesia this same dose is given as a drench at least a half hour before casting the patient. Then when cast and well secured, chloroform is administered. The pronounced stage of anæsthesia is advisable. For small hernias local anæsthesia in addition to the chloral hydrate will answer. For this purpose we recommend Pitman-Moore Company's Glycamphen, because it is non-toxic. Cocaine solutions are always dangerous where large areas must be anæsthetized and the solutions may not always be aseptic and would if not clean infect the field. Where aseptic water and a perfectly sterilized bottle are available a one-half per cent solution of cocaine hydrochloride and a two per cent solution of urea and quinine hydrochloride may be used with discretion. The solution is injected subcutaneously all around the circumference of the hernial aperture, creating an anæsthetized zone of the entire sac.

The first step of the operation is that of dissecting the skin layer from the peritoneal layer. This is done by first making a longitudinal incision across the sac and dissecting the skin from the peritoneum on each half consecutively. The dissection must be continued right down to the very edge of the aperture at every part. If it is found difficult to make this dissection right down to the edge on account of the great width of the aperture a transverse incision of each flap may also be made, making four instead of two flaps. The bleeding of this dissection is sometimes troublesome, coming from so many sources it is not easy to control without much delay. Only the larger vessels are handled by torsion or ligation.

The second step is that of folding in the peritoneal layer and suturing it securely in the folded position. This is done by depressing it in the middle along the whole long diameter holding it in the folded position at each end with tumor forceps and then suturing with an interrupted crucial suture (Fig. 65) or a continuous suture of the same variety. For this we use linen thread. Although this is a buried suture

that must remain in the body we have never found catgut strong enough nor secure enough to answer the purpose. It is needless to say that this suture must be aseptic so that it will become encysted without suppuration. This step must be done in such a manner that this layer (the peritoneum) will be stretched evenly across the aperture and yet not too tight, because tightness will favor tearing of the layer from the movements of the abdomen; breathing, defecation, micturation, getting up and down, etc. The idea is to "reef the fold" just tight enough to make a level floor across the aperture without tension.

The third step is that of closing the skin flaps. The edges are heaped outward and securely sutured in this heaped position, also with a continuous crucial suture of linen, again without attempt to take it up too tight. No redundant skin is removed no matter how large the sac should be.

The fourth step is that of applying a temporary body wrap to prevent tearing of the sutures while the patient is gaining its feet again. To leave this whole affair exposed to the stretching that will be given it while a big struggling patient is gaining the upright position would be hazardous, as something is certain to give way, and although some trouble will be experienced in pulling a body wrap under a lying patient it must nevertheless be done. For this we use a strong muslin cloth. By lifting upon the tail and with two men pulling back and forth on the cloth it can be worked forward to the desired position at the level of the field. It may be drawn tight (very tight) by sewing it with sac needle and heavy twine or even held safe enough with large blanket safety pins (skivers). To this we often add a wide surcingle or even two of them. Thus secured the patient may now be made to rise if sufficiently revived from the anæsthetic.

On gaining the upright position the patient is then dressed with the permanent body wrap that has been previously provided and which must be kept in place during the succeeding four or five weeks. This wrap should be constructed of heavy canvas and equipped with buckles and strap having a wide range of "take up." The field is washed free of blood and an antiseptic pack of cotton soaked in mercuric chloride solution about 1-500 before this permanent wrap is adjusted. When hernias are located where slipping forward or backward is likely to occur it must be fixed to a surcingle around the chest and possibly also tied backward with bands passed backward on each side of the tail to the loins.

AFTER CARE.—If no fever develops and there seems to be no distress this wrap may be left alone for several days. When dressing is necessary dusting with boric acid and iodoform along the suture and a re-application of the bichloride pack is the best kind of attention we have found. The patient is kept in the standing position for some days. At the end of a week or so lying down will do no harm providing the body wrap is so securely fastened that it will not shift. We were formerly very much afraid to allow such patients to lie down for three to four weeks but after having had patients fall down from sheer tiredness without doing harm we have become less anxious about this phase of the after-care and now do not hesitate to allow them to take rest after the seventh day. Whether much harm would come if one laid down even earlier than seven days we are unable to say. Obviously, the security of the body wrap is the essential factor in preventing harm from this source.

At the end of twelve days we usually remove the skin sutures. If the wound is not behaving well from suppuration and threatens to gap we sometimes replace the loosened sutures with interrupted sutures here and there where the gapping is most threatening.

SEQUELS. (a) **Peritonitis** is of course always a possible sequence of such an operation, especially where there has been no sufficient pains taken to avert infection. (b) **Shock** in very large hernias is also a possibility, although fatal cases have never occurred in our practice. (c) **Recurrence** may sometimes be expected and is due to the feebleness of the adhesion in the folded layer of the peritoneum, arising from careless attention to the supporting body wrap. If the weight of the viscera is allowed to press upon the unsupported peritoneum that stretches across the aperture it will again sacculate before adhesions have formed.

Ventral hernias having no peritoneal layer are usually non-operable conditions in domestic animals, as it is seldom possible to actually close up permanently a hernial aperture by bringing the edges together with sutures. In small animals or in very small hernias of the large animals this may be undertaken. Under all other conditions the veterinary practitioner is wise who advises against such operations. These hernias are furthermore complicated with adhesions that often cannot be safely broken down in attempt to return the viscera into the abdominal cavity.

OPERATION FOR INGUINAL HERNIA IN FEMALES

INDICATIONS.—In males bubonoceles descend through the internal abdominal ring into the tunica vaginalis, which constitutes the internal integument of the hernial sac. If the descent extends as far as the scrotum they are designated as scrotal hernia or oscheoceles, hence the difference between these two conditions is simply one of degree of descent.

In the female, whose inguinal canals are rudimentary and contain no peritoneal process, a bubonocele develops by the passage of intestines through the short canal, into the subcutaneous space beneath, dragging with it in its downward passage a fold of parietal peritoneum which normally seals over the internal abdominal ring.

Inguinal hernias of this variety occur frequently in bitches, but are rare in other domestic females. In the bitch they are the most common of all hernias, appearing in the form of large fluctuant masses which fill up the space between the last mamma and the thigh.

These hernias may contain intestines, omentum, a cornu of the uterus which may be gravid, and the bladder.

PRE-OPERATIVE PREPARATION.—The patient is dieted for some days and purged in order to facilitate reduction and to reduce the abdominal tension which would tend to tax the sutured orifice.

ANTISEPSIS.—The sutures used to close the orifice and the incision must be of the sterilized variety, the instruments should be boiled, the field shaved and cleansed, and the environs moistened to prevent loosened hairs from falling into the wound.

RESTRAINT.—The patient is anæsthetized and then secured in the dorsal recumbent posture, with the anterior part of the body inclining, and the hind legs spread apart as far as possible.

TECHNIQUE.—An incision is made through the skin along the long axis of the sac, without at first cutting the peritoneum which lines it. The peritoneal sac is then dissected free from the skin as far up as the level of the orifice. The sac is then incised and examined as to the character of its contents. Bloated intestines are collapsed by aspiration, the gravid uterus is emptied of its fœtuses by Cesarean section, the bladder, if distended, is catheterized or its contents aspirated with the trocar and canula. Attempt is then made

to reduce the contents by taxis, failing in which kelotomy may be found necessary. The kelotomy, when found necessary, is performed at the anterior extremity of the orifice in order to escape the large vessels that traverse in close proximity to the posterior commissure.

The sac is ligated close to the orifice with several wraps of catgut and then cut off. The stump is pushed into the abdominal cavity and the orifice sutured over it, with three or more mattress sutures to close the orifice, and a continuous suture to approximate the edges. The excessive skin previously constituting the sac is trimmed and then sutured with silk from commissures to center, leaving an opening for drainage.

Fig. 204—Inguinal Hernia in a Bitch.

AFTER-CARE.—Bandages are difficult to apply to this region and if applied they are equally difficult to retain in position to do any useful service. It is, therefore, as well to simply dust the region with boric acid and leave the wound exposed. Subcutaneous infection, which is difficult to prevent, is usually harmless. The buried sutures are not removed but the cutaneous ones are removed in eight days or as soon as they become loosened.

SEQUELÆ.—1. **Peritonitis** following the operation is due to infection with sutures, hands or instruments,—seldom to post-operative infection. Its appearance is ushered in by fever, malaise, etc., three to five days after the operation was performed. The treatment should consist chiefly of antiseptic irrigations of the subcutaneous cavity, in fear the hotbed of the infection is located therein. Internal administration of quinine is also helpful.

2. **Recurrence of the Hernia.**—The expected healing of the orifice may fail to occur. After the sutures have absorbed it may reopen and allow the intestines to again descend.

CHAPTER VIII

LITHOTOMY

DEFINITIONS.—Lithotomy is the incision of the bladder for the abstraction of calculi therein. In animals, the incision is usually made into the urethra, where it becomes superficial above the arch of the ischium, hence the correct designation should be **"urethrotomy,"** or, in order to better explain the objects of the operation, **"urethrolithotomy."** **Lithotripsy, lithuresis,** or **lithotrity** refer to crushing of calculi by means of the **lithotrite**—a crushing forceps specially devised for the purpose. **Litholapaxy** refers to the special operation of pulverizing calculi with the lithotrite and then evacuating the fragments by irrigation or suction.

INDICATIONS.—Vesical calculi occur in all of the domestic mammals. They are, however, most common **in the ox** and **in the dog.** In the **equine species** they are noted for their relative infrequency.

The operation for their removal is indicated as soon as they become incompatible with the health of the urinary organs by obstructing the flow of urine or by provoking inflammation of the tissues they press upon. They may sojourn for years without exciting any suspicion of their existence, but may at any time flow into the urethra and at once cause total obstruction, or they may gradually provoke changes in the walls of the bladder that are finally announced by a more or less pronounced distress in urination.

Although the bladder is the usual seat of their development, calculi may be found forming at any part of the urinary channel from the pelvis of the kidney to the meatus urinarius. Hence they may be **renal, ureteral, vesical or cystic,** or **urethral,** either by reason of having developed in these several organs or by having changed positions, from a higher level in the urinary tract. Thus a renal calculus may become ureteral, vesical or urethral by being carried downward with the current of urine.

The operation of removing calculi from the urinary tract does not modify the disease (lithuria) which causes their formation and is therefore not a curative procedure. It only rids the urinary tract of a harmful element and leaves the disease unchecked against recurrence. In dogs and in oxen the

removal of a pea-like calculus from the urethra is usually followed sooner or later by the descent of another one which necessitates reiteration of the operation, and when the bladder is evacuated of all of its calculi more will form. In the horse, the few calculi encountered are usually single bodies of considerable size, and since the formative process is undoubtedly slow, recurrence is not likely to occur during the

Fig. 205—Cystic Calculus Removed from a Gelding.

few remaining years of the patient's life. In the ox and dog, on the contrary, calculi sometimes develop rapidly; within a few months the urinary tract may become choked with them from pelvis to meatus.

OPERATION IN HORSES.—The removal of calculi from the bladder of horses is somewhat difficult on account of the great distance from the ischial arch to the bladder.

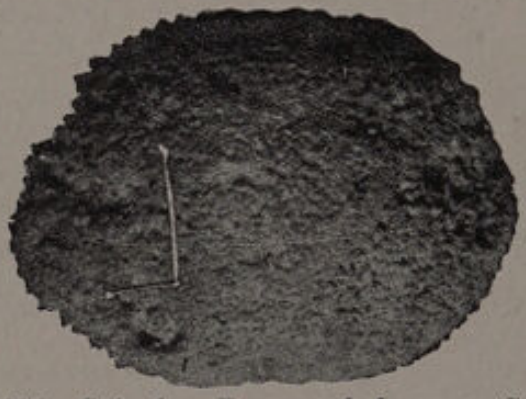


Fig. 206—Calculus Removed from a Gelding.

The operation can, however, be successfully performed even against a stone of enormous volume, and with minimum danger to the patient, if the following special technique is carefully carried out.

RESTRAINT.—Lateral recumbent restraint with profound anæsthesia is required. The anæsthesia must be pro-

found throughout the entire operation, but especially during the abstraction of a stone whose size necessitates perfect relaxation of the urethral wall. The contraction of the strong urethral muscle against the stone prevents successful abstraction.

INSTRUMENTS, ETC.—

1. Scalpel.
2. Tissue forceps.
3. Hæmostats.
4. Lithotomy forceps.
5. Lithotrite (if needed).
6. Evacuator (if needed).
7. Catgut, silk and needles.
8. Antiseptics.
9. Catheter.

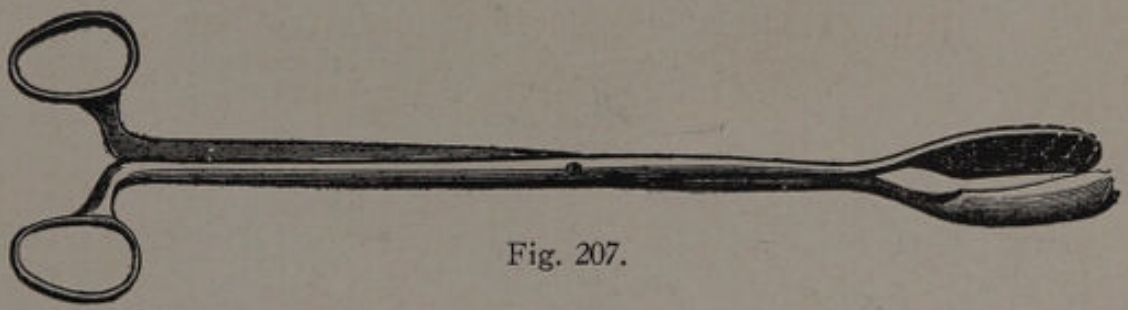


Fig. 207.

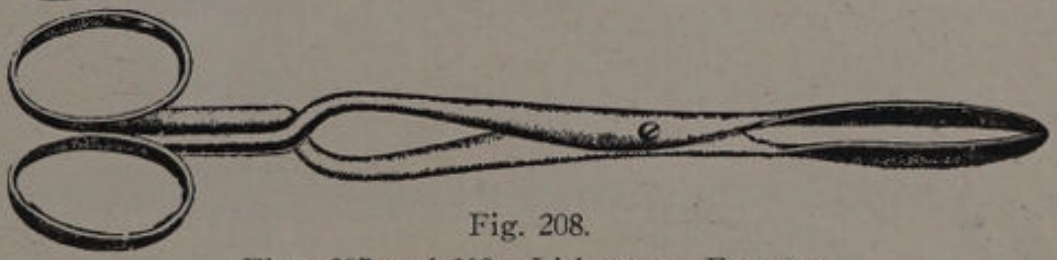


Fig. 208.

Figs. 207 and 208—Lithotomy Forceps.

First Step (Urethrotomy).—The catheter is passed into the bladder to facilitate incision of the urethra.

The incision is made two inches long from the anus downward, so that the urethra is approached from above rather than from behind. It is made in the median line and the following integuments, which are distinct membranes, are divided consecutively: The skin, the superficial perineal fascia, the deep perineal fascia, the accelerator urinæ muscle, and the urethral mucosa. As the urethra pitches forward at this point, the incision into it is almost horizontal.

Second Step.—Extraction of the Stone.—The catheter is now withdrawn, and a pre-operative estimate of the dimension of the stone having been made, a forceps of the proper size is passed into the bladder and fixed upon the stone with

the assistance of the right hand in the rectum. When a firm hold has been taken, the forceps are rotated to and fro or even turned one complete revolution to assure against a possible pinching of the vesical mucous membrane. The withdrawal now begins by pulling firmly backward upon the for-

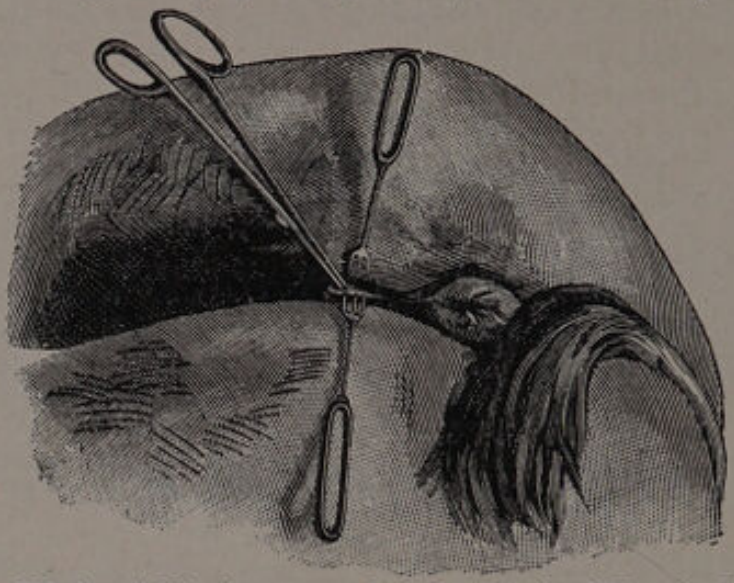


Fig. 208-A—A Urethrotomy for Removal of Cystic Calculi.

ceps. If the stone is a small one no trouble is encountered in effecting an immediate delivery, but if its dimensions tax the caliber of the urethra, the latter must be carefully "peeled" forward as the backward traction continues. The peeling process is effected with the fingers or with the handle

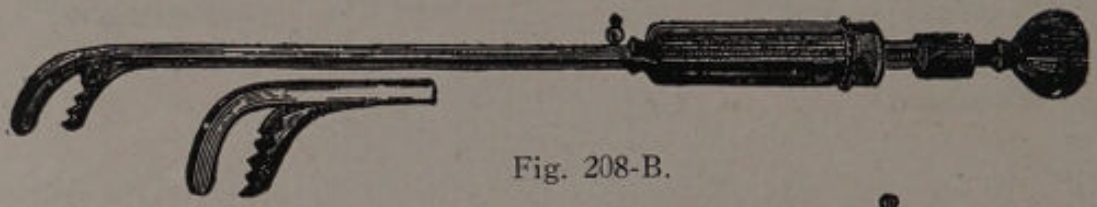


Fig. 208-B.

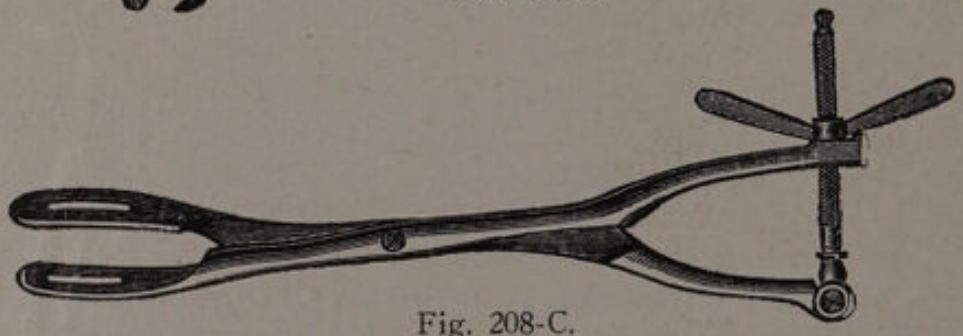


Fig. 208-C.

Figs. 208-B and 208-C—Lithotrites.

of a scalpel, and is patiently continued until the largest diameter of the stone is reached, at which moment it is found suddenly released. The speed with which this can be done will depend largely upon the character of the stone's sur-

face. If rough it may require considerable time and much patience, but if smooth the work is a matter of but a few moments. During the execution of these manipulations it is important that the anæsthesia be so profound as to eliminate all reflexes that would tend to provoke contractions of the urethral muscles.

The feat is not a difficult one when the incision has been made as described in Step I, but if made at a lower level the extraction of large stones without previously crushing them is either impossible or else inflicts irreparable injury.

Modifications of this technique may be found necessary, where the stone is large and the animal small. In this event pulverization and evacuation by irrigation or suction (litholapaxy) may be necessary. This is done by introducing the lithotrite into the bladder and then patiently pulverizing the stone piece by piece until it has been reduced to small fragments, which are then washed out by forcible irrigation,

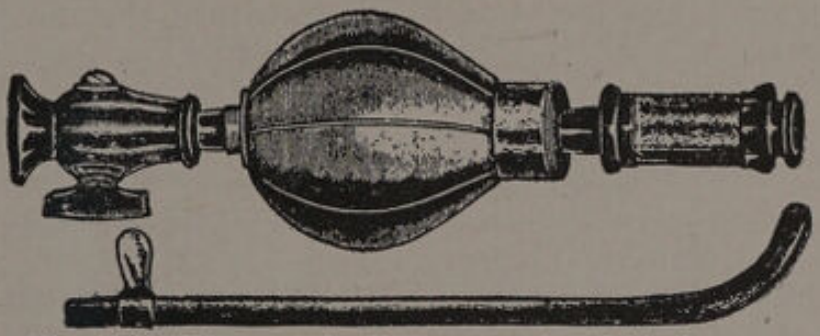


Fig. 209—Ultzmann's Evacuator for Litholapaxy.

or else by use of the evacuator,—a special instrument which abstracts the detritus by suction. (Fig. 209.) The fragments may also be removed one after the other with the forceps.

The crushing of stones in the bladder is, however, often impossible on account of their flint-like hardness which resists any instrument small enough to be introduced into the bladder of a horse through an urethral incision.

Third Step.—Suturing the Wound.—Although it has been the custom to leave the incision to slowly heal without closure, more recently it has been demonstrated that suturing shortens the period of convalescence, and forestalls complications. Between the two methods of suturing the wound and of treating it as an open one through which the urine is voided until spontaneous closure occurs some weeks or even months later, the author recommends the former, which coincides with the conclusions of White, who has performed many such operations upon dogs.

The urethra is closed by interrupted catgut sutures arranged close together; then the space intervening between the urethra and the deep perineal fascia is packed with iodoform gauze, the end of which is left to protrude from the inferior commissure of the fascia and cutaneous incisions, each of which (three in all) are sutured separately, the fascia integuments with catgut and the skin with silk.

AFTER-CARE.—The iodoform gauze is renewed daily with as little molestation of the sutures as possible, and the patient is kept standing to prevent injury of the wound by the movements of lying and rising. At the end of eight days the silk sutures are removed.

ACCIDENTS AND SEQUELÆ.—1. **Vesical and Urethral Hæmorrhage.**—In the extraction of a large and especially a rough stone, lacerations of the delicate and highly vascular mucous membrane through which it is pulled with more or less force, and copious bleeding seem inevitable. It is, however, not serious and may be abandoned to spontaneous arrest. The greatest harm resulting therefrom is that of masking the work of suturing the urethral incision. The blood gushes forth over the edges of the wound and thus causes considerable annoyance until the urethra is entirely closed. The coagulum in the bladder may sometimes be a temporary obstruction, but as it is soon liquefied and voided, little harm results.

2. **Cystitis.**—The chronic cystitis caused by the sojourn of the calculus is always excited into renewed activity by the operation and may produce serious pelvic pains manifested by harmful tenesmus.

The condition is managed by irrigation of the bladder once daily with hot antiseptic water, phenol one per cent, and by the internal administration of urinary sedatives; belladonna, saw palmetto, copaiba, etc.

3. **Urinary Fistula.**—This sequel, when the urethra is not sutured, is one of choice, and is not regarded as a serious matter, since the incision will eventually heal. On the other hand, if the sutures fail to bring about an immediate closure by healing, the discharge of urine through the incision may be looked upon as a decided misfortune, in that instead of the parts being healed entirely in ten days, several months may elapse before the patient can be discharged as a cured subject. Furthermore, urine often excites an annoying local irritation by dissecting its way subcutaneously into the region of the sheath.

The accident, is, however a rare one if asepsis prevailed

during the operation, and if the incision is sutured according to the specified directions.

OPERATION IN MARES.—In the mare the removal of a vesical calculus is much more simple and is attended with but little danger. It may even be performed in the standing position by means of the slings, twitch, and breeding hopples. The recumbent position with general anæsthesia is, however, preferable.

Technique.—The forceps of appropriate size are introduced into the bladder through the urethra, fixed to the stone with the aid of the right hand in the vagina, and then drawn upon firmly. A long, probe-pointed bistoury is then introduced flatwise into the urethra, so its blade overlaps the anterior part of the stone. As the forceps are drawn backward the blade is turned against the urethra, which is slit forward as far as is necessary to release the stone. In other words, the urethra is incised forward and the stone drawn backward, simultaneously, until the delivery is successfully effected. No after-care is required; the wound heals rapidly. The only untoward effect is a disturbance of urination in the form of frequent attempts to empty the bladder.

OPERATION IN DOGS.—In dogs, the prepubic operation should be selected on account of the small caliber of the urethral tract. The bladder is reached through a median line celiotomy, toward which the bladder is drawn with forceps. The incision through the walls of the bladder is made at the highest accessible point. Before proceeding to deliver the stone some pains are taken to arrest the bleeding, which is always more or less copious on account of the inflamed and thickened condition of the walls. The stone is removed with the forceps and the incision closed with Czerny sutures of No. 1 catgut. The abdominal incision is closed in the usual manner recommended for laparotomies.

The practice of temporarily fixing the bladder, at the incision, to an adjacent wall in order to protect the sutured parts against contraction that would prevent healing, has been adopted by White in the performance of these operations.

CHAPTER IX

Special Amputations

AMPUTATION OF THE PENIS

INDICATIONS.—This operation is indicated in all of the domestic mammals and sometimes in wild animals held in captivity. The conditions necessitating its performance are **paraphimosis, gangrene of the free end, hypertrophy of the prepuce, chronic erections** and **neoplasms.**

1. **Paraphimosis** is an indication for the operation only after every attempt to return the penis into the sheath has failed. In the acute swellings which so often physically obstruct the retraction of the organ into the sheath cavity, the operation is not hurriedly resorted to, but on the contrary it is postponed for a long time in hopes that treatment aiming to preserve the penis will eventually prove successful. Even in those states which clearly are due to paralysis of the retractor muscles, internal, hygienic and topical treatment must first have failed before the organ is sacrificed to amputation. These recommendations apply to all animals except those whose low value precludes prolonged medical attention. In stallions, bulls, favorite dogs and even valuable geldings, the operation should be delayed indefinitely, during which time constant effort is made to effect a cure. Although in cheap animals immediate relief may sometimes be demanded of the practitioner, there is seldom ever an excuse for an undue hasty decision to amputate the penis of valuable charges.

The **absolutely incurable paraphimosis** is, therefore, the only one that calls for amputation. When the incurability is, however, positively established by weeks or even months of unsuccessful treatment, it is the only available remedy. Moreover, it must not then be delayed, because the flopping, pendulent penis is always exposed to injuries which complicate matters if amputation should finally be decided upon. Again, early amputation may sometimes be prudently recommended where there are reasons to suspect that the long, careful, diligent treatment that paraphimosis often requires, will not be faithfully carried out to a successful issue. Under such circumstances amputation may as well be decided upon at once. (Treatment see page 253.)

2. **Gangrene of the penis** occurs in dogs and oxen from incarceration of the free extremity by the prepuce or sheath. The free end becomes swollen from some cause or other and then finds the sheath orifice too small to readmit it. The strangulation accentuates the swelling and gangrene of the exposed part supervenes. In horses gangrene of parts of the glans and prepuce sometimes follows paraphimosis due to enormous œdematous swelling that interferes with the circulation but the marked elasticity of the sheath protects them against extensive gangrenes that destroy the entire exposed portion by transverse pressure. But the most for-

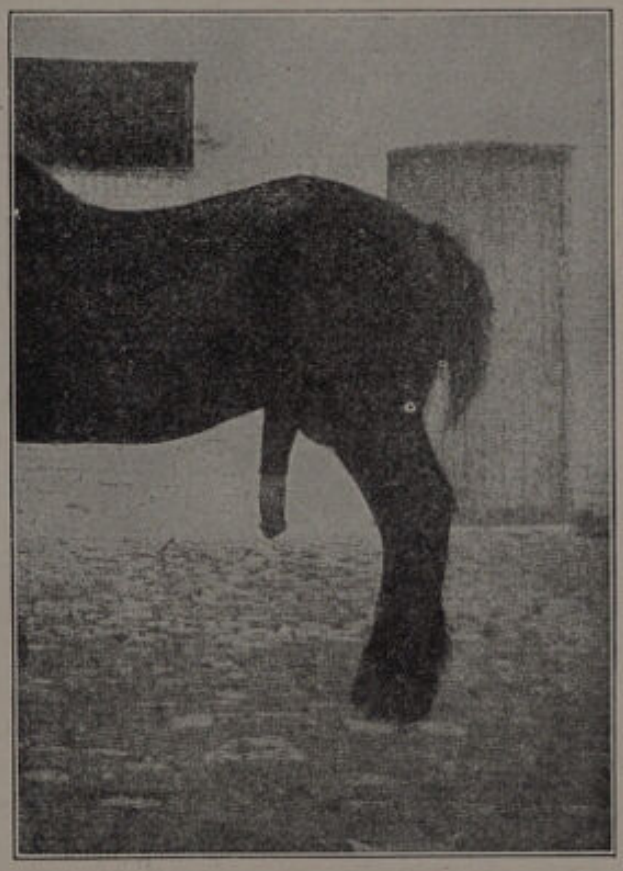


Fig. 210—Chronic Paraphimosis.

midable gangrenes of the penis occur from freezing. The penis is accidentally protruded on the cold floor or ground during sleep, and thus becomes fatally frozen.

In all of these various forms of gangrene, amputation is essential, as self amputation by sloughing off of the dead portion at the line of demarcation is always followed later by stenosis of the urethra, and generally there is obstruction to the flow of urine while the sloughing process evolves.

In gangrene of the penis amputation is postponed until the extent of the destroyed tissues can be determined, so that

the seat of section can be located safely in the healthly tissues above, and in order to prevent unnecessary loss.

3. **Hypertrophy of the Prepuce.**—The prepuce of the horse very frequently becomes enlarged by the formation of an abundance of connective tissue within its folds. Injuries from copulation, bruises and prolonged œdema are the most common causative conditions. In geldings or worthless studs, amputation of the penis is the safest remedy, while in useful stallions ablation of the prepuce must first be attempted. (See page 467).

4. **Chronic erection** is a somewhat rare cause of paraphimosis in an incurable form. The penis becomes hard along its entire extent and despite the administration of anaphrodisiacs and cold applications covering a long period, the erection persists for weeks and even months. The penis protrudes from six inches to one foot from the sheath, and the prepuce becomes slightly œdematous. It occurs in geldings as well as in stallions and no form of palliative treatment tends to effect a cure. Amputation of the protruding portion is the only remedy.

5. **Neoplasms.**—As a point of predilection for neoplasms the penis of animals stands in the first rank, and very frequently the growths are malignant. Epitheliomata frequently invade the penis, the prepuce and the sheath, often implicating all three simultaneously, and unless ablation is practiced early they sooner or later develop into serious and then fatal tumors. If recognized early ablation of the growth itself is sufficient, but often they are neglected until the widespread involvement necessitates the sacrifice of the entire free end of the penis, and not infrequently the involvement is too extensive for successful intervention.

RESTRAINT.—The operation requires dorsal recumbent restraint and profound anæsthesia. Local anæsthesia is insufficient and to attempt the operation without any effort to prevent pain is both cruel and dangerous from fatal shock. The casting harness is by far the best restraint although the operating table will answer providing it is arranged to admit the operator to the ventral surface of the abdomen.

If the harness is used the patient is tied as for inguinal operations, castrations, etc., and on the table the uppermost limb is drawn upward.

ANTISEPSIS.—The ordinary rules of antiseptic methods should prevail. The only special precaution to take is that of submitting the dirty rugæ of the sheath and of the penis above the proposed line of amputation to an exceptionally good washing first with plenty of soap and hot water and

then with a strong antiseptic solution. The skin of this field is very filthy, and as the wound is one that on account of its position, can not be submitted to much after-care, it must at all hazards be kept from being unnecessarily infected during the amputation.

INSTRUMENTS REQUIRED.—1. Scalpels, two or three, exceptionally sharp ones. The dissection of the urethra from the penis itself, which is hereafter recommended, necessitates the use of very keen edged knives.

2. Tissue forceps.
3. Hæmostat.
4. Needles and linen thread.
6. Catheter.
7. Ecraseur.

TECHNIQUE.—First Step.—Adjustment of the Tourniquet.—The penis is drawn out as far as possible and held firmly by an assistant and the muslin bandage, rolled into a loose cord, is applied around it at the level of the sheath orifice. The bandage is applied in the form of a double-half hitch, drawn very tight and then secured by a firm double knot. The protruding ends of the bandage now serve as a hold to keep the penis out in a perfectly exposed and controllable position.

Second Step.—Dissection of the Urethra.—Beginning at the meatus, leaving the normal urethral termination unmolested, the urethra is carefully dissected out as far back as the proposed point of amputation. The first incision to this end is a line through the skin from the point of section to the meatus, exposing the urethra along the entire part to be amputated. The incision is then carried around the red meatus, releasing it from the surrounding skin. The catheter is inserted into the urethra as far as the tourniquet, to facilitate the dissection, which is now continued from before backward until the point of section is reached. In dissecting the urethra care is taken not to cut into it here and there, as might easily be accidentally done if some pains are not taken to prevent, and equal care is taken not to leave any of the surrounding penal tissues attached to it. No part of the cavernous body which surmounts the urethra superiorly should be left attached to the dissected urethra. When the dissection has been completed, if properly done, only the mucous membrane and its surrounding muscular coat should be included, for if a part of the cavernous body is attached to it and can not as a consequence be ligated, troublesome bleeding is sure to follow the completion of the amputation.

Third Step.—Amputation.—The amputation, which is ef-

fected transversely with the scalpel, includes the skin and all of the penis except the dissected urethra, which is left entire. The amputation must always be made some distance from the tourniquet, to prevent the latter from prematurely slipping over the stump. The ecraseur may be used to amputate instead of the scalpel, but serious hæmorrhage may occasionally result therefrom. The sinuses of the cavernous body do not yield like blood vessels to the crushing effect of the ecraseur and may therefore bleed copiously after its use.

Fourth Step.—Hæmostasis.—Even when the ecraseur is used, bleeding is prevented by ligating the stump. The stump, excluding the urethra, is ligated by transfixing it through the center one-half inch behind the section, and tying each half separately, or by multiple ligatures if the stump is very large. Another very effectual method of ligation consists of first placing a tobacco-pouch stitch loosely around the stump, then weaving a second strand through the exposed loops, and then drawing the two as tight as possible. The first prevents the second strand from slipping off and the two together effect a perfect and a safe hæmostasis. These ligatures may be applied either before or after the amputation.

Searing the stump with a hot iron is also an effectual method of controlling the flow of blood, but the cauterization must be thorough. Slight cauterization will not answer.

Fifth Step.—Removal of the Tourniquet.—When assured that the ligation or the chosen method of controlling the flow of blood is safely completed the tourniquet is untied and the stump allowed to retract into the sheath. The urethra, which always contracts several inches towards the stump, is left hanging out of the sheath orifice.

AFTER-CARE.—The sheath is irrigated daily with an antiseptic solution by means of a large syringe, a fountain syringe or injection pump, until about the tenth day, when sloughing of the ligated end leaves no further demand for treatment. The hanging urethra gradually shrivels up or sloughs off by sections until it has finally taken its place, safely opened, at the new end of the penis.

SEQUELÆ AND ACCIDENTS.—The only untoward sequel is **stricture of the urethra,** which universally occurs if precautions to prevent it are not taken. Ordinary amputations which make no provisions to prevent strictures are absolutely unsuccessful, and amongst the various methods employed or described in veterinary literature the author has found none so universally preventive as the one described above,—that is, dissecting the urethra from the meatus to

the seat of amputation and allowing it to hang pendulent from the sheath while healing of the stump proceeds. The cause of stricture in almost every case lies in the marked elasticity of the urethral tube which, if cut off at or even near the stump, contracts behind the seat of amputation and allows the cicatrix to form over its end. By leaving a long portion to protrude, the shrinking up, sloughing off and healing of the urethra keeps pace with the healing of the stump, so that when the latter has entirely cicatrized the former is still protruding far enough to prevent its incarceration within the stump cicatrix.

Stricture of the urethra supervening amputations occurs at about the second week of convalescence, although in some cases where certain precautions to prevent were taken, it may be delayed for one month to six weeks. The patient will be noticed to urinate with some difficulty. The stream will become smaller and smaller until only drops are voided during the almost constant efforts to empty the fast-filling bladder. Later the bladder will become enormously distended, and by pressure upon the rectum the symptom changes into an attempt to defecate; the urinary signs almost entirely disappear. Upon examination of the stump the urethra, just behind the cicatrix, will be found fluctuant from distention with urine, and urine may be flowing drop by drop from the sheath.

The treatment, in order to be successful, should begin early, for after the bladder has been severely stretched for days fatal results may follow its successful evacuation. The first step to take in attempting to make a new permanent meatus is that of emptying the bladder with the trocar and canula passed into it through the rectum. (See cystocentesis page 70.) This precaution is necessitated by the danger of casting an animal whose bladder is so enormously full, and in order to prevent fatal shock where the bladder has been full for some days this rectal evacuation must be done with a canula of small caliber. When the bladder has been thus emptied the patient is cast, the penis drawn out from the sheath and an incision made into the end of the urethra. To prevent recurrence of the stricture, which is often impossible, the incision should be not less then one inch long, and a soft rubber tube four inches long should be inserted into it and retained by sewing the end to the surrouding skin. After ten days the tube is removed, and if at the end of ten days more the stream is becoming gradually smaller and smaller, indicating recurrence, it is reinserted for another similar period.

The accidents of the operation are **hæmorrhage** and **shock.** The former is prevented by effectual ligation of the stump and latter by anæsthesia. Bleeding from the cavernous body is a troublesome one, as the contractility, which in vessels assists in spontaneous hæmostasis, is absent. The openings (sinuses) in this body do not close automatically like those of blood vessels. Bleeding from the cavernous body, although very slight, may continue incessantly for hours and even days.

Note.—The above technique, while intended chiefly for the horse, will apply with trivial modification to the other domestic animals. In no case should the operation be performed without taking ample precautions to protect against stricture.

AMPUTATION OF THE TAIL

SYNONYM—Docking.

INDICATIONS.—The operation of caudal amputation is sometimes necessitated by disease and sometimes, in the horse, to prevent the dangerous habit of grabbing the lines. Under any other circumstance the operation, in most commonwealths, is illegal, and is otherwise a pernicious practice that should not be countenanced nor practiced by veterinarians. These facts, however, do not warrant its omission from works on veterinary surgery. It would be quite as logical to omit arsenic from the materia medica because it might sometimes be administered with criminal intent, or stramonium because it has sometimes been give to disguise the heaves; or, again, cocaine because it is sometimes administered to "dope" the thoroughbred. The moral duty in caudal amputation is to perform the operation when legal and to urge its discontinuance for illegal purposes.

The impression amongst coach-horse fanciers that the docked tail portends the absolutely correct appointment for the heavy harness horse has prevailed for years, and still prevails as strongly today, but the lawmakers of the various commonwealths of almost the entire civilized world, in their wisdom, have voiced the sentiment of the populace by proclaiming against the practice of docking except when the operation is actually necessary to the horse's welfare.

In the horse, docking is necessitated for various diseased conditions, notably, **tumors** of the tail. In white horses melanotic growths located some distance from the root can best be treated by amputation above the part affected. Then there is **necrosis of the tail** from various causes, especially the

practice of allowing tails to remain tied up for several days, that often requires prompt amputation to save the patient's life against systemic infection. And finally, the habitual **"rein grabber"** is at once made a safer driver by shortening the tail to eight or nine inches after having been submitted to a thorough myotomy of the depressors.

In the dog, there is little excuse for the operation, except here and there, for **serious injuries** which threaten the integrity of the organ by gangrene, and occasionally as a rapid method of dealing with the **refractory sore of the tip** that rebels against every other known treatment. In the latter event the tip of the tail becomes sore from lashing it against solid objects, (walls, post, etc.,) and despite the most ingenious contrivances to prevent constant injury therefrom, the wound is kept irritated and bleeding for months until the once trivial abrasion becomes a very formidable

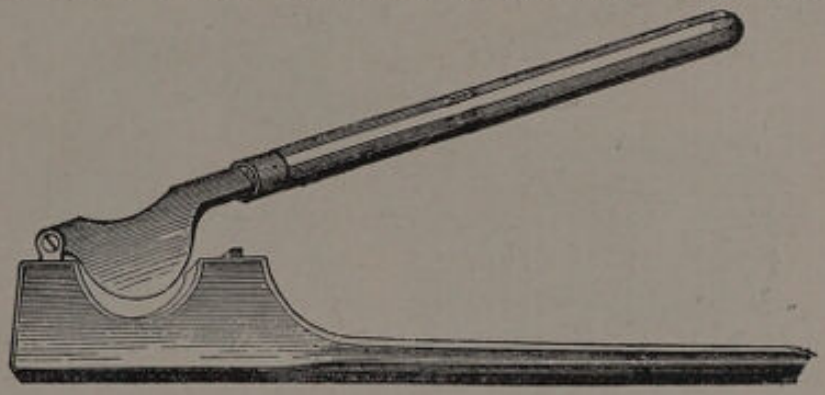


Fig. 211—Docking Shears.

lesion. The occurrence is chiefly in great Danes and bull terriers having a rather unnatural penchant for wagging the tail almost continually, and although the fancier may deplore the disfigurement, docking is by far the most effectual intervention.

In sheep, docking is practiced almost universally. It is customary to dock male lambs in large herds in order that the wethers may be more easily distinguished from the ewes. In the small herds the excuse given for the practice is that docking improves the general appearance and at the same time prevents accumulation of burrs or feces upon the tail wool.

In bovines, the operation is performed only for injuries of sufficient seriousness to threaten untoward complications. Freezing of the end in extreme cold climates ,and injections of black leg vaccine occasionally produce threatening conditions necessitating amputation.

RESTRAINT.—The operation is performed in the standing position with the aid of the twitch, and side-line to elevate one of the hind legs. The dog is simple muzzled and held by all four legs. The bovine is placed in the stanchion with the hind legs hoppled.

INSTRUMENTS.—

1. Docking shears. (Fig. 211.)
2. Special firing iron.
3. Forge.
4. Cord tourniquet.
5. For small animals, common scissors.

TECHNIQUE.—First Step.—Application of the Tourniquet.—The hair is parted transversely about one inch above the proposed seat of amputation. The hair above the part and

Fig. 212—Amputating the Tail with Shears. (Frick.)

the tail below it is held by an assistant while the operator encircles the tail with a double-half-hitch of the cord, which is then drawn as tight as possible and secured by a double knot against slipping loose. The ends of the cord are then passed once around the tail above, to keep the hanging hairs from overlapping the seat of operation. A second transverse part is then made in the hairs at the proposed seat of amputation and the hanging hairs above it are tied up against the stump with the same cord ,or with another one which is wrapped several times around the tail to prevent any annoyance from hairs.

Second Step.—The Amputation.—The assistant holds the tail on a straight line with the vertebral column with both hands, one on each side of the seat of amputation, while the

operator, after carefully adjusting the shears, snips it off at one forceful stroke. To prevent resistance it is important that the knife make a clean, unfaltering sweep through the entire tail at the first attempt.

It is not necessary to search for an intervertebral articulation through which to make the amputation: on the contrary, section through a segment is more desirable, because the exfoliation of the end of the segment will be more rapid than if the bisection had been made through an articulation.

Fourth Step.—Hæmostasis.—The tail is then pushed up-

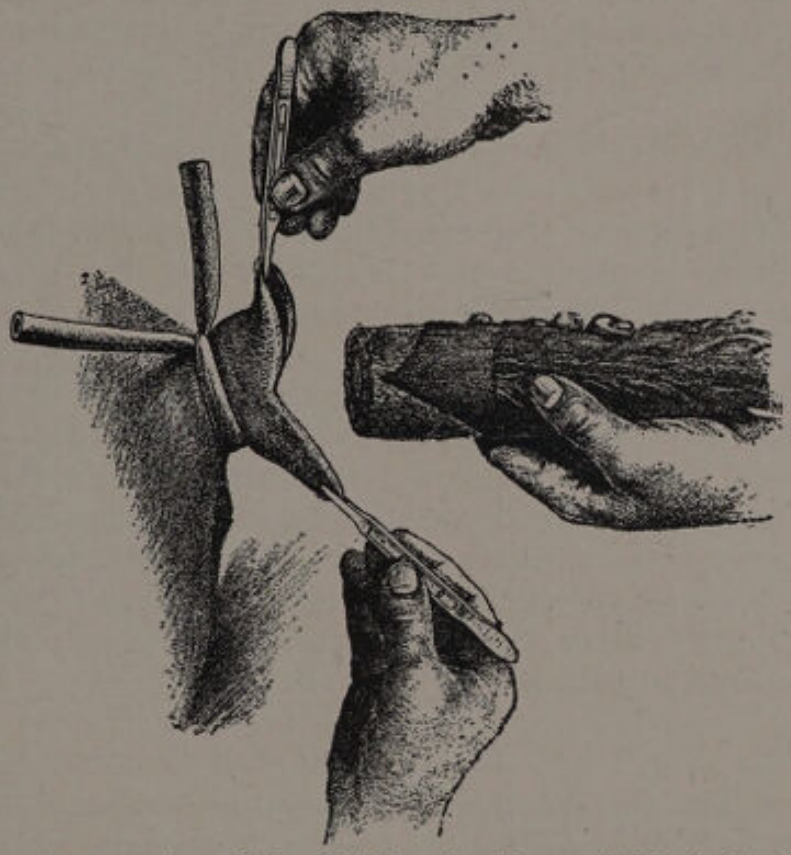


Fig. 213—Amputation of the Tail by the Dovetail Method. (Frick.)

ward with one hand and the end thoroughly seared with the hot iron. The searing is effected by simultaneously pressing and rotating the iron against the stump until the soft tissues surrounding the bone are burned into a perfectly smooth surface. The stump may then be sprinkled with a little rosin, which is melted into the scar with the hot iron.

The tourniquet is cut off or untied and the patient kept under surveillance ten to twenty minutes, to detect possible bleeding from the middle coccygeal artery.

THE DOVETAIL METHOD OF AMPUTATION.—This method, while the most surgical one, is tedious and dif-

ficult and is much more prone to end in annoying complications than the simple shears and hot iron method, although it has the advantage of leaving a haired stump instead of a hairless cicatrix.

To perform this operation well the tail must be submitted to a good disinfection which, on account of the hairs, is difficult of execution, and the patient must either be placed in the recumbent position of else the tail well cocainized.

The tourniquet is applied as described in Step 1, and then, after completing the disinfection, two lateral flaps one and a half inches long are made of the skin and muscles. The amputation is effected through an inter-vertebral disc located well upward, so that the bone stump does not extend between the flaps, which are then sutured with a continuous suture.

The bleeding is prevented by allowing the tourniquet to remain taut for two hours, at which time it may be safely removed. The sutures are removed at the end of eight days, and in the interval the patient should be kept in the standing position to prevent contamination of the wound from the stable floor.

As caudal amputations in the routine of country practice are rather few, and the equipment required to perform the shears and hot iron methods somewhat costly, the dovetail method may be deemed the most desirable, notwithstanding the greater safety of the former. By providing against pyogenic infection during the operation, and by administering a preventive dose of antitetanic serum three days after, untoward sequalæ will be few.

SEQUELÆ.—1. Tetanus is a very common complication of docking. The infection generally is traceable to some mishap occurring during the operation. After the amputation has been effected and before the searing has been sufficient to close the wound the patient may fall and soil the stump upon the floor or ground and as tetanic spores are very resistant to extreme heat the searing process creates a favorable environment for their propagation. Or, the skin of the tail at the seat of amputation may be harboring the microbes, which by resisting the burning process, find beneath the eschar the sheltered environment essential to their pathogenicity.

The facts that sterilization of the seat of operation is a difficult task to accomplish effectually, and that post-operative infection is always possible, render preventive inocu-

lation with anti-tetatnic serum particularly advisable after every caudal myotomy.

2. **Secondary Hæmorrhage** follows insufficient cauterization. It is generally observed from ten to twenty minutes after removal of the tourniquet and unless arrested considable blood will be lost before the flow ceases spontaneously. It is therefore advisable to watch the patient during the first half hour for this accident and to meet this possible accident the hot iron should be kept in readiness.

3. **Exuberant Granulations.**—If the tissues underlying the eschar become infected, exuberant granulations will precede cicatrization. The bony stump is seen protruding through their center and until its exfoliation is complete, little headway can be made toward healing the wound. Mild astringents pending the casting off of the bone and stronger ones after this event has occurred will be the only treatment necessary.

When the operation has been properly performed as regards thorough cauterization and thorough pre-operative cleansing, the cicatrizing process proceeds without apparent reaction and is almost complete when the eschar falls off at the end of three weeks.

CAUDAL AMPUTATION IN OTHER ANIMALS.—The hot iron cauterization following snipping off of the stump by means of shears or other instrument strong enough to cut through the tail at one suddent stroke, is by far the best method of amputation in all animals. The operation is finished at once; there is no after-care required, and the eschar is the best coating imaginable against infection of the healing stump, which on account of its location, is continually exposed to dangerous contaminations.

However, when the dovetail method is deemed desirable, it, too, may be performed upon the other domestic animals.

AMPUTATION OF THE TONGUE

INDICATIONS.—There are two indications for lingual amputation in the horse, namely, **lacerations or contusions** threatening its integrity and incurable **tongue lolling.** In the former, reparative surgery is always preferable whenever there is any chance of conserving the injured organ, but when gangrene is imminent there is no other choice. The operation is, however, postponed until the line of demarcation reveals itself so that the section can be located in the sound tissues above.

For **tongue lolling** (See Vol. 1). other methods of correcting the habit are first tried, and when they have failed, if the habit is thought sufficiently annoying, about five inches of the free end is amputated. The success in this case is universal, and the loss gives the patient only temporary inconvenience in prehension. The greatest objection to the operation is the fact that a horse with an amputated tongue will thereafter be pronounced unsound and is therefore less valuable.

RESTRAINT.—The recumbent position is essential. General anæsthesia, while decidedly helpful, may be substituted by a careful submucous cocainization.

INSTRUMENTS, ETC.—

1. Scalpel.
2. Tissue forceps.
3. Two or three hæmostats.
4. Needle and thread.
5. Tape tourniquet.

TECHNIQUE.—The tape is applied around the tongue above the proposed seat of section. In order to place it high enough to effect a high amputation the frænum is snipped and the tape slipped into the breach. A thread is then passed through the tip to serve as a hold with which to draw out the organ to a convenient position. The amputation is effected by the dovetail method, with a superior and an inferior flap. The first incision to this end is a circular one extending from the middle of one border over the dorsum to the middle of the opposite border. The incision is at once carried backward toward the tourniquet until one-half of the substance of the tongue is sectioned. The tongue is then turned over and a similar flap made with the under half. If the tourniquet has not already slipped off it is removed and an examination made for spurting vessels which may or may not appear. Despite the fact that the lingual artery is always divided, bleeding is generally too trivial to require any special attention. The edges are sutured with a continuous suture.

AFTER-CARE.—No attempt is made to apply local treatment to the stump; the antisepsis is left to the cleanliness of the mouth. Wet feeds are substitued for dry, and grass, in season, is given in preference to coarse hay. In eight days the suture is removed.

SEQUEL.—There is nothing dangerous about lingual amputations, and the wound, despite the motility of the organ, heals well under the influence of good nourishment.

The only untoward effect is the inconvenience to prehension and this, fortunately, is transient.

MODIFICATIONS.—Whenever the tongue is badly lacerated the dovetail amputation may be substituted by a simple transverse section of the remaining shreds, and if copious bleeding supervenes it can be easily controlled either with forceps or by hot iron cauterization.

TRIMMING THE EARS OF DOGS

SYNONYM.—Amputation of the concha; cropping.

DIFINITION.—Trimming the ears is an amputation of the posterior portion and the free end of the concha, practiced in certain breeds of dogs, for no other apparent purpose than that of satisfying the caprice of fanciers.

INDICATION.—The operation is practiced on bull dogs, bull terriers, Boston terriers, skye terriers, great Danes, and sometimes on black-and-tans. Other breeds, fortunately, escape. The ethics to respect in regard to conchal amputation is debatable. The practitioner is confronted on one side by a moral duty to a dumb brute, and on the other by an urgent demand from the expert cynologist and by the prevailing custom. If the veterinarian refuses to perform the operation it will, nevertheless, be performed by others, less qualified and generally much more brutal. It is the author's custom to discourage the practice as much as possible by emphasizing its brutality, and to perform it only at the demand of the obdurate fancier.

The operation should never be performed before the subject is four and a half months old. The preferable age is six months, and in dogs with limber ears it should be postponed until the age of nine to ten months, according to the development of the conchal cartilage. Splendid results can also be obtained on mature dogs, regardless of the age, provided the erection of the ears is fairly pronounced beforehand.

Trimming the ears is also sometimes necessitated when the concha has been deformed by injury.

Investigation among the leading veterinary practitioners of America and Europe, including those who practice canine medicine as a specialty, show that the operation is quite generally performed without thought of offering any apology therefor. It is nevertheless an illegitimate procedure, and described here for the benefit of those who elect to perform it.

RESTRAINT.—Large dogs are secured on the operating table and anæsthetized, while small ones are simply muzzled and held by an assistant sitting upon a low stool. In medium-sized dogs, two assistants are required, one, sitting upon a stool, holding the body between his knees, and the head with both hands, while the other holds the fore-legs with one hand and the hind ones with the other.

Delahanty, a dog fancier of some note, has invented a special table for the purpose, which affords, par excellence, the

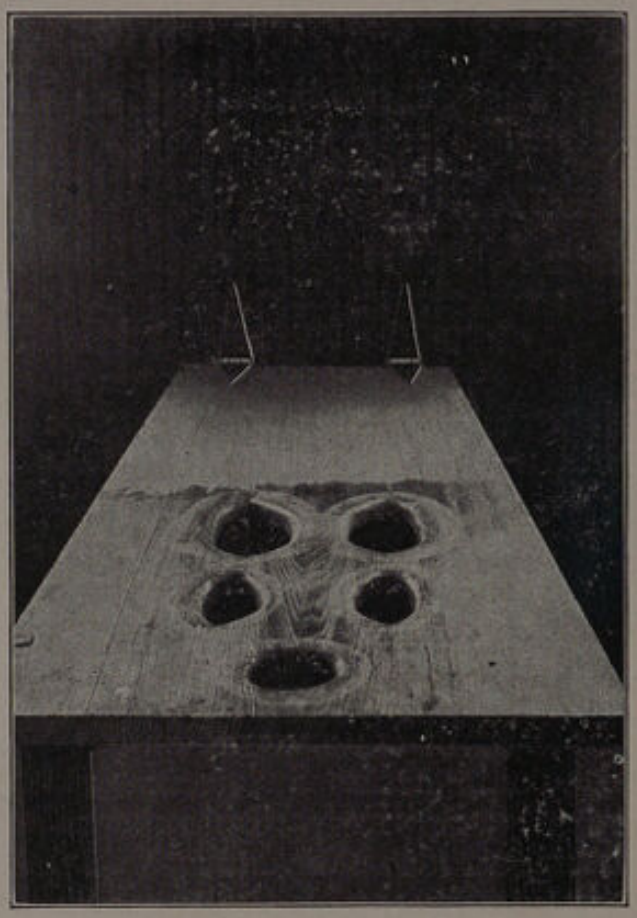


Fig. 214—Delahanty's Table for Trimming Ears.

best restraint for this operation. It consists of an ordinary smooth pine board two feet wide and about four feet long, in which five ovoid holes are made, one for each of the four legs and one anteriorly for the nose. The dog is secured by dropping the legs into the holes and tying them together beneath. The nose is tied with a tape muzzle with which it is drawn through the front hole and there held firmly. This exposes the poll and ears toward the operator and holds the head more securely against movements than any of the other means of restraint for this purpose. (Fig. 214.)

Another effectual manner of securing dogs for trimming the ears is to wrap them securely to a common carpenter's horse with the bandage encircling both the body and the horse from the loins forward as far as the neck.

INSTRUMENTS.—

1. Scissors.
2. Hæmostats.
3. Special ear-clamp, (not absolutely essential).

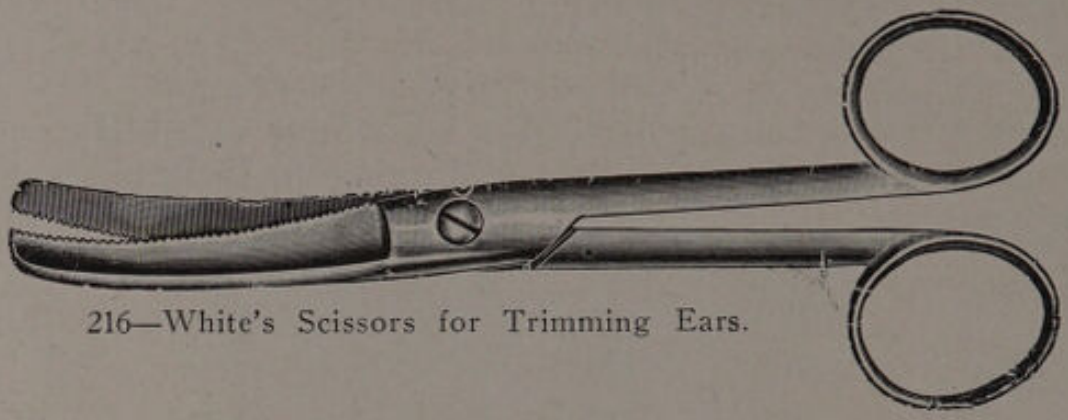
TECHNIQUE.—First Step.—Marking the Length.—The two ears are pinched together with the fingers and stretched

Fig. 215—Trimming Ears with Delahanty's Table.

upward to the center of the poll, where the anterior edge of both is marked by one snip of the scissors to assure uniformity of length. The direction of the snip should correspond to that of the proposed line of amputation of which it becomes a part.

Second Step.—The Amputation.—The tip and posterior border of the right ear is held in the left hand while the amputation is effected with two or three strokes of the scissors, cutting in the downward direction toward the base of the concha. The shape of the line of amputation in its downward

course, which determines the desired design of the trimmed ears, varies from a straight one, to one deeply incurved, according to the breed of the subject and also possibly according to the wishes of the fancier. The left ear, which is some-



216—White's Scissors for Trimming Ears.

what more difficult to trim accurately, is marked out with the amputated flap of the right one, whose bloody edges trace the proposed line of amputation. Here the left hand supports the base of the concha while the amputation is effected with

Fig. 217—Trimming Ears with Clamps.

strokes of the scissors that should correspond in length to those made on the opposite side. The posterior edge and tip may be given moderate support by an assistant to good advantage especially when the concha is frail and floppy.

The use of clamps of various designs is helpful to the novice, but since ears vary in size and shape, no one design will answer. When these are used they are applied to the ear at the proposed line of amputation, which is effected by cutting along the lesser curvature with the scalpel.

Third Step.—Hæmostasis and Suturing.—There is always some bleeding from one, and sometimes from two vessels, which spurt quite copiously. These should be at once picked up with the hæmostat and twisted.

Fig. 218—Ear Clamp.

The two edges of exposed skin are then sutured together with a continuous suture of catgut, beginning with the base and ending at the tip. The sutured edge is then varnished with collodion.

AFTER-CARE.—The ears are not molested after the operation except inasmuch as they may need to be kept in an upright position. There are various methods of "making ears stand," but none is better than that of varnishing them well with layer after layer of collodion.

CHAPTER X

ABDOMINAL OPERATIONS

ENTEROTOMY AND ENTERECTOMY

DEFINITIONS.—**Enterotomy** is the surgical incision of a bowel, while **enterectomy** signifies the excision of a section. **Enterorrhaphy** is the suturing of an intestinal incision. **Intestinal approximation,**—a name frequently used in intestinal operations,—refers to the reunion of the cut ends with sutures or other appliance; and **intestinal anastomosis** indicates the joining of one part of the intestinal tube to another.

INDICATIONS.—The indications for these intestinal operations in veterinary surgery are found chiefly, not entirely, in the ailments of small animals,—cats and dogs. In the large animals they are rarely ever done successfully, but in the small species, on the contrary, they are now performed with great regularity and with entirely satisfactory results. In view of the possibilities of modern antisepsis the practitioner of veterinary surgery can no longer dodge these operations on any pretense, once a diagnosis has been made with reasonable certainty of its correctness. When a foreign body or immovable fecal matter constitute an otherwise incurable obstruction, the plain duty of the practitioner is to operate promptly. If any damage to the intestinal walls succeeds the intervention **enterectomy** followed by simple **enterorrhaphy** completes the procedure, but if the tube has become unviable or necrotic from pressure, then **enterectomy** and **approximation** or **anastomosis** becomes necessary, according as the lesion indicates.

The principal indications, named in the order of their importance and frequency of occurrence are:—**Foreign bodies lodged in the bowels.** 2. **Coprostasis,** generally constituted of agglomerated bone fragments. 3. Intussusception. 4. Volvulus. 5. Intestinal strangulation. 6. Dilatations.

1. Foreign bodies found in the intestines of domestic animals vary with the species. Those common in carnivora are intestinal worms, marbles, coins, pins, hair-pins, corks, sponges, rags and sticks of wood; in bovines, bezoars, hair-

balls, calculi, clay, rags, wood and rubbish in general; in equines, sand, clay and calculi.

While these objects often sojourn for some time in the stomach, and may even remain there, they usually escape into the intestinal tract and then gradually work their way toward the rectum, whence they are voided with the feces, unless arrested at some point along the course. Although they may be found at any point between the cardiac portion of the stomach and the rectum, their course is generally unchecked until they reach the sphincter ani. However, only those which accidentally lodge between the stomach and the rectum are herewith concerned; rectal obstruction requires no intestinal incision.

2. **Coprostasis** may occur at any part of the intestinal tract, although the colon and rectum of carnivora and the floating colon of solipeds is the most common seat of fecal stasis. In dogs the desiccation of feces is a common occurrence, and generally the arrested mass is constituted of bones, sticks, etc, agglutinated with dry fecal matter. A long section of the tract may be thus affected.

3. **Intussusception and volvulus,** common enough, are seldom diagnosed in time for successful intervention.

4. **Intestinal strangulation** coexists with hernia, especially oscheocele. It is recognized by serious colic and local pain in the hernial sac. This indication demands prompt intervention to forestall inevitable gangrene, and when upon exposure the incarcerated bowel is found either gangrenous or unviable, the only possible chance of recovery lies in enterectomy and approximation. Although there are no substantiating data to offer in defense of these recommendations, as far as they apply to the equine species, their consecration by usage seems unnecessary in view of the hopelessness of the situation under any other treatment.

5. **Dilatations and strictures** are found in aged animals and a suspicion of their existence is created by recurrent attacks of obstinate colics. The exact nature of the lesion is determined only at the operation.

RESTRAINT.— Perfect recumbent restraint and profound anæsthesia answers best for intestinal operations.

In dogs several grains of morphia given hypodermically some twenty minutes before injecting a weak solution of cocaine between the different layers along the line of incision, will produce an anæsthesia under which intestinal operations can often be performed with a measure of success. And finally, spinal cocainization, which, however, has not as yet been adopted as a standard method of anæsthesia in animals, should answer well for intestinal work.

INSTRUMENTS, ETC.—Besides a full set of dissecting

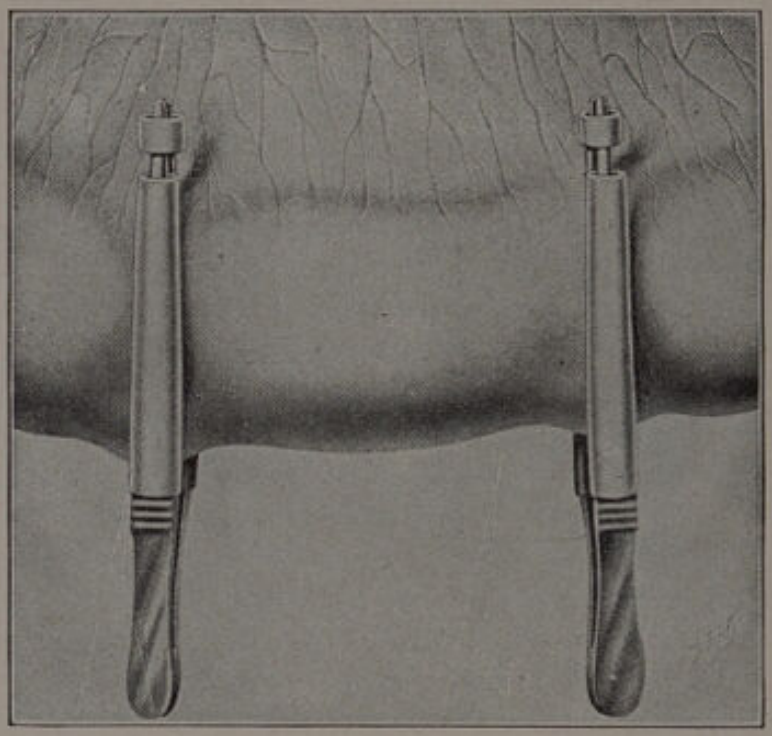


Fig. 219—Regulation Bowel Clamps in Position.

instruments, scalpel, thumb forceps, hæmostats, there must be included a number of round needles, curved and straight ones, previously threaded with chromatized catgut of the proper size, needles, forceps, rubber gloves, antiseptic solutions, razor, clipper, scissors and a pair of bowel clamps. In lieu of the latter Cecil French recommends a pair of common hair-pins, which he holds in place with forceps.

ANTISEPSIS.—The antisepsis of intestinal operations must be thorough in every detail. The room, first of all, should be clean and free from flying dust; the surgeon and assistants clean of person and fomites; the patient's body,

especially upon and about the surgical field, should be submitted to a cleansing process of exceptional thoroughness; the antiseptic solutions should be made of sterile water and contained in clean white-enameled basins; the sponges or cotton pledgets used for bailing must under no circumstances be of doubtful purity; the instruments and needles must be well boiled; and finally the asepsis of the sutures must be absolute.

While operating, all parts of the body except the surgical field are kept well covered with sterilized cloth (towels) to prevent the exposed viscera from resting upon unclean parts, and especially to prevent them from becoming contaminated with shedding hairs which are always legion at best.

The wearing of rubber gloves, while not absolutely necessary, is helpful in preventing infection, and in view of the fact that the surgeon must generally occupy himself with the task of handling, securing, and cleaning up the patient just before the operation, the omission of gloves seems sinful when much depends upon a successful result.

Strong antiseptics are uncalled for, except possibly to rinse the skin after it has been clipped, shaved and washed; elsewhere asepsis, and not antisepsis, is depended upon.

TECHNIQUE.—First Step.—Laparotomy.— The abdominal incision made for intestinal operations upon small animals need not vary as to position under any circumstance. It can be uniformly located across the umbilicus parallel to the linea alba, from which position every abdominal organ can be either inspected or palpated fruitfully. The incision may vary in length according to the size of the patient or nature of the lesion. An incision one and a half to two and a half inches long is generally ample, and it should be located so that five-eighths of its length overlaps the umbilicus anteriorly. By thus extending the incision well forward perfect access is gained to all of the abdominal organs, from the diaphragm to the pelvis.

The incision is made a little to one side of the linea alba, where the tissues are better nourished. The skin is first incised by one carefully drawn stroke, then the underlying muscles are divided down to the peritoneum, which is incised either with a probe-pointed bistoury, cutting outward, or else with the scalpel protected with a grooved director. When the patient has been dieted there is little danger of accidentally cutting an intestine, but often in diseased conditions requiring operative intervention the intra-abdominal

tension presses the bowels into the incision, bulging the peritoneum in such a way as to render its incision more hazardous.

Second Step.—Search for the Lesion.—The incision gives access to all of the abdominal organs. The retractors are applied to the wound and attempt is made to locate the abnormality by inspection. If found, the part affected is drawn out through the incision where it can be submitted to the required surgical treatment. If, on the other hand, inspection proves futile, then the entire alimentary tract within the abdominal cavity, beginning with the small intestines, is palpated with the index finger. Failing in this, the bowels are drawn out through the incision little by little until the

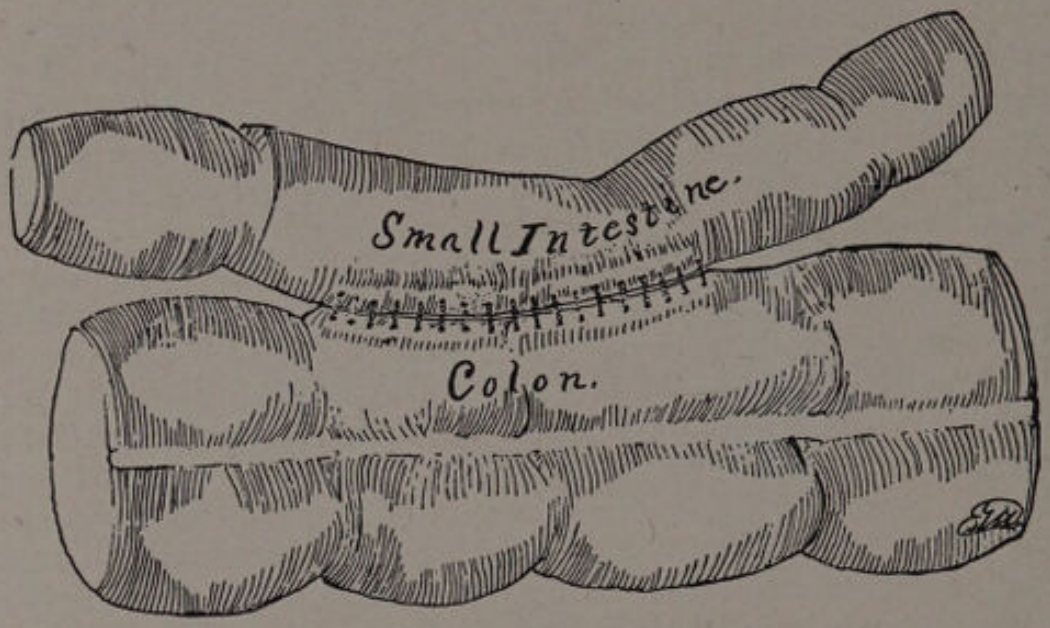


Fig. 220—Lateral Anastomosis.

lesion is found. By first drawing out the small intestines the cæcum, the colon and the stomach can then easily be brought out and exposed to inspection. When the lesion is suspected of being in the stomach, this organ may be first palpated and then drawn through the incision for further examination. The handling of the viscera in this manner is entirely without danger of serious results if gently replaced in the order of their withdrawal.

Third Step.—The Operation Proper.—In enterotomies of the small intestines the incision is made longitudinally, while in the large bowels transverse incision is preferable, and when serious dilatations exist the resection of an elliptical piece to reduce the size may be found advisable. In enterectomies, which in animals is performed only upon the

small intestines, the bowel is cut through transversely in the healthy part on each side of the lesion.

The first step in the execution of such procedures is to return all of the viscera into the cavity except the part to be operated upon, and then prevent them from constantly pushing through the incision by temporarily sewing it up with one or two interrupted sutures until the work is completed and the repaired portion is ready to be returned.

In ordinary enterotomies for the removal of foreign objects an incision is made just long enough to allow the object to be pressed through, but such incision should be made in adjacent healthy parts and not directly over the object where local inflammation caused thereby may interfere with healing. Closing the incision with a Czerny-Lembert suture of catgut completes this part of the procedure.

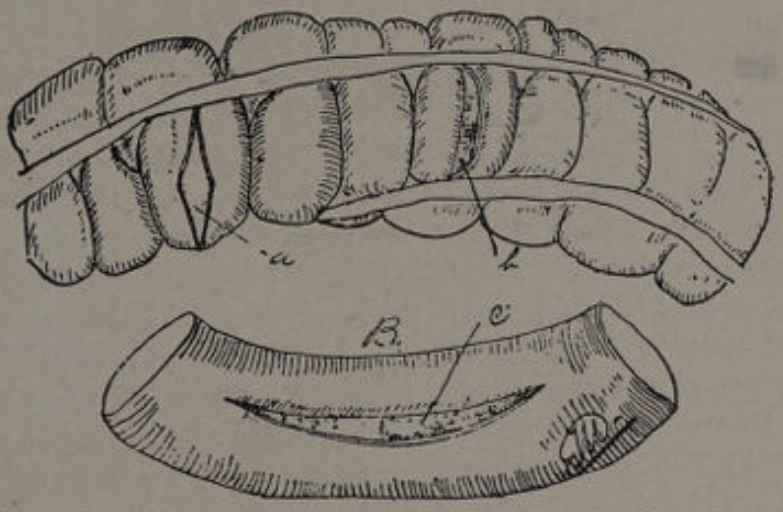


Fig. 221—Enterotomy. *A*, *B*, Transverse Incision. *C*, Longitudinal Incision.

Enterectomy is much more complicated and necessitates first the application of the clamps on each side of the lesion, one-half of an inch from the proposed lines of incision. Next the nutrient vessels supplying the part between the clamps are isolated with the view of ligating only those which supply the part to be excised. The nutrition of the adjacent portions must not be impaired by promiscuous ligation, because good nourishment will be needed to assure healing of the approximated ends. The establishment of collateral circulation will not come to the rescue soon enough.

The clamps being applied and the vessels ligated with catgut the exclusion of the diseased section of bowel including the mesentery within the ligatures may then be executed

by simply making a transverse section one-half of an inch from each of the clamps. The ends are then approximated and united by Czerny-Lembert sutures of catgut.

The Czerny series is first completed around the entire circumference of the bowel; then, without removing the clamps, the Lembert series is placed, leaving the stitch untied until all have been inserted. They are then all tied consecutively except one on each side of each protruding end of the clamps, which are left open to allow the withdrawal of the clamps which, save the protruding ends, are buried by the infolded edges of the bowel. The clamps are then withdrawn and the remaining four stitches are tied.

Fourth Step.—Replacing the Sutured Intestine and Closure of the Incision.—The intestine thus reunited is now replaced in the cavity after removal of the temporary sutures in the abdominal incision, which is then closed by means of the "removable buried suture." (See page 108.)

AFTER-CARE.—In order to arrest all peristaltic movements which would prevent union, the patient is given, per os, several doses of laudanum at different times during the first forty-eight hours after the operation, and the function thus suspended must not be revived for twelve days, at which time a laxative is administered. Only small amounts of liquid food are allowed during this interval, and the allowance of solid food must be limited until the end of the third week.

When such operations are not emergent the administration of opiates should precede them.

SEQUELÆ.—1. **Shock** is is a common occurrence in intestinal operations. It follows immediately the revival from the anæsthetic and is manifested by rigors, coldness of the periphery, whining, weak pulse, inability to stand, and pallor of the visible mucous membranes. The treatment consists of the administration of ammoniacal stimulants, subcutaneous injections of normal salt solution, and above all the application of a taut abdominal bandage.

2. **Peritonitis** supervening three to four days after the operation indicates errors in asepsis. Its occurrence may necessitate drainage of the wound to evacuate septic products. Internally quinine, iron, and nux vomica are indicated.

3. **Perforation** of the intestinal tube through failure of the approximated ends to unite after enterectomy, or of the incision of enterotomy, is the most serious mishap, and in animals is generally fatal owing to the improbability of success from a second operation.

RUMENOTOMY

SYNONYM.—Gastrotomy.

DEFINITION.—Rumenotomy is the surgical incision of the rumen, for the purpose of evacuating harmful contents. As the operation includes abdominal incision it should, correctly speaking, be known as **laparo-rumenotomy,** or laparo-gastrotomy.

INDICATIONS.—The operation is performed chiefly in oxen; rarely in the smaller ruminants. The conditions necessitating surgical invasion of the rumen are (1) **overloading** with foods that undergo an active fermentative process, (2) **impactions** without fermentation which cause suspension of rumination, and (3) the presence of **foreign bodies,** which ruminants are prone to ingest.

1. **Overloading** of the rumen with succulent grasses, new hay, frosted fodder, soft, unripe corn, swill, garbage, etc., devoured more or less ravenously, is a frequent cause of a threatening, serious abdominal bloat requiring instantaneous relief that can only be afforded by prompt evacuation. In these events the content of the rumen is a churning, bubbling, fermenting mass that can not be evacuated with the trocar and canula, sufficiently to make any appreciable impression upon the intra-abdominal tension, as only a limited amount of gas and ingesta will gurgle from the canula. The administration of antiferments, carminatives, antacids and purgatives is generally futile because, in the emergency due to the accentuating seriousness of the condition, they either fail to exert any beneficial effect or else come to the rescue after viscera have suffered irreparable damage. The only safe procedure is timely evacuation by rumenotomy. The intervention should be an early one; before the patient is in a dying condition. Delayed rumenotomies are usually unsuccessful.

2. **Impactions.**—The rumen sometimes becomes overfilled with drier contents than the foregoing, from overfeeding and lack of exercise, from inactivity of the rumen due to debilitating diseases or influences; from an insufficient water allowance, or from any of the innumerable circumstances and conditions that cause suspension of rumination.

In these instances the rumen is impacted one-half full, two-thirds full or even to the upper zone with relatively dry ingesta constituted chiefly of the rough forage feeds (hay, fodder, etc.) mixed sparingly with the small-grain feeds (corn, peas, wheat, rye, brewer's grain, etc.)

At times the impaction is the cause of the indisposition, while at other times it may only be an effect. In either case, however, it constitutes a serious condition that must be promptly corrected in order to save the patient's life. Here again, timely intervention by rumenotomy is essential to the best results, as delayed operations are usually futile.

3. **Foreign Bodies.**—Besides harboring single harmful objects, such as pointed pieces of iron, wire, or wood, the rumen often becomes the receptacle for foreign objects that accumulate gradually, such as strings, binder-twine, leather findings, sponges, bones, hairs, et. al.

The sojourn of such bodies in the rumen often escapes ante-mortem discovery, although they frequently produce a lasting indisposition that should at least create a suspicion of their existence. harp objects may penetrate the diaphragm and cause intra-pleural or even intra-pericardial abcess, while accumulated particles, by constant pressure upon the floor of

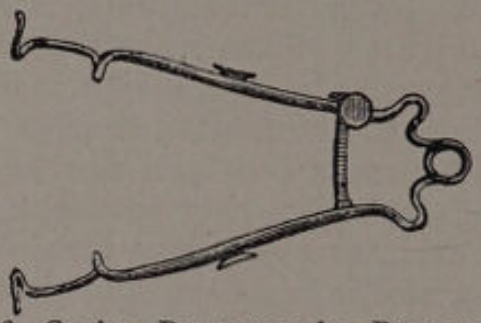


Fig. 222—Spring Retractor for Rumenotomy.

the rumen, cause circumscribed necrosis of its wall. In either instance a fatal ending is inevitable, unless removed before a serious morbidity has evolved therefrom.

In these cases, as in the preceding, early intervention is essential.

RESTRAINT.—The patient is restrained in the standing posture, by means of the stanchion to hold the head, by ropes to prevent decumbency, and by hopples to protect the operator against injury from kicks. In certain emergencies when the patient is down, dying, the crude rumenotomy, consisting of simply thrusting a large knife into the rumen to effect an immediate evacuation, may be performed in the recumbent position, but as soon as the patient is safely out of danger of immediate death the more methodical operation is continued in the standing position.

ANTISEPSIS.—The prevailing impression that cattle are not susceptible to septic complication following abdominal invasion is erroneous, and is the cause of numerous failures in

this and other abdominal operations. Except when instantaneous relief is needed to forestall impending death, rumenotomy should be performed under the strictest possible antisepsis. The field should be shaved, well washed and disinfected and the environs well moistened to prevent flying of loosened hairs. The instruments, and especially the needles and sutures, must be aseptic.

INSTRUMENTS, ETC.—

1. Scalpel, and probe-pointed histoury.
2. Tissue forceps.
3. Hæmostats.
4. Spring retractor.
5. Two strong tenacula or tumor forceps.
6. Needles, catgut and silk.
7. Collodion.
8. Antiseptics.

TECHNIQUE.—First Step. Abdominal Incision.—The incision through the abdominal wall is made five inches long, midway between the external angle of the ilium and the last rib, beginning about two inches below the transverse process of the lumbar vertebræ. The incision may be vertical or oblique, preferably oblique, so that all of the abdominal muscles are not cut transversely. The skin and muscles are incised with the scalpel and the peritoneum with the probe-pointed bistoury after it has been perforated inferiorly with the former.

Second Step.—Rumenotomy.—The spring retraction is now adjusted to the incision and the rumen incised in the same direction as the abdominal incision, but the length of the incision should be about one inch shorter. In order to prevent the flow of ingesta into the peritoneal cavity from the very beginning, the rumen is first punctured with the scalpel at that part occupying the middle of the abdominal incision. In acute bloat as the contents gush out with great force, the index finger is immediately hooked into the perforation thus made, and the rumen drawn out as far as possible (four inches or more) where it is held until the flow ceases from the gradual diminution of the abdominal tension. It is important not to make this perforation too long, because sudden evacuation may provoke shock that will manifest itself after the operation is completed.

The abdominal tension having now been relieved, the tenacula are hooked into each edge of the perforation and the incision enlarged upward and downward to the prescribed length.

Third Step.—Removing the Contents.—The contents are then removed, handful by handful, until the rumen is **entirely empty.** The prevailing practice of allowing a part of the contents to remain is inimical to the best results, and should be discontinued. If the hand is large the incision may be made longer than the prescribed four inches, and matter can be further facilitated by oiling the hand and arm to overcome, in part, the friction from the rough mucous membrane of the rumen over which they must travel so often before the enormous mass is removed.

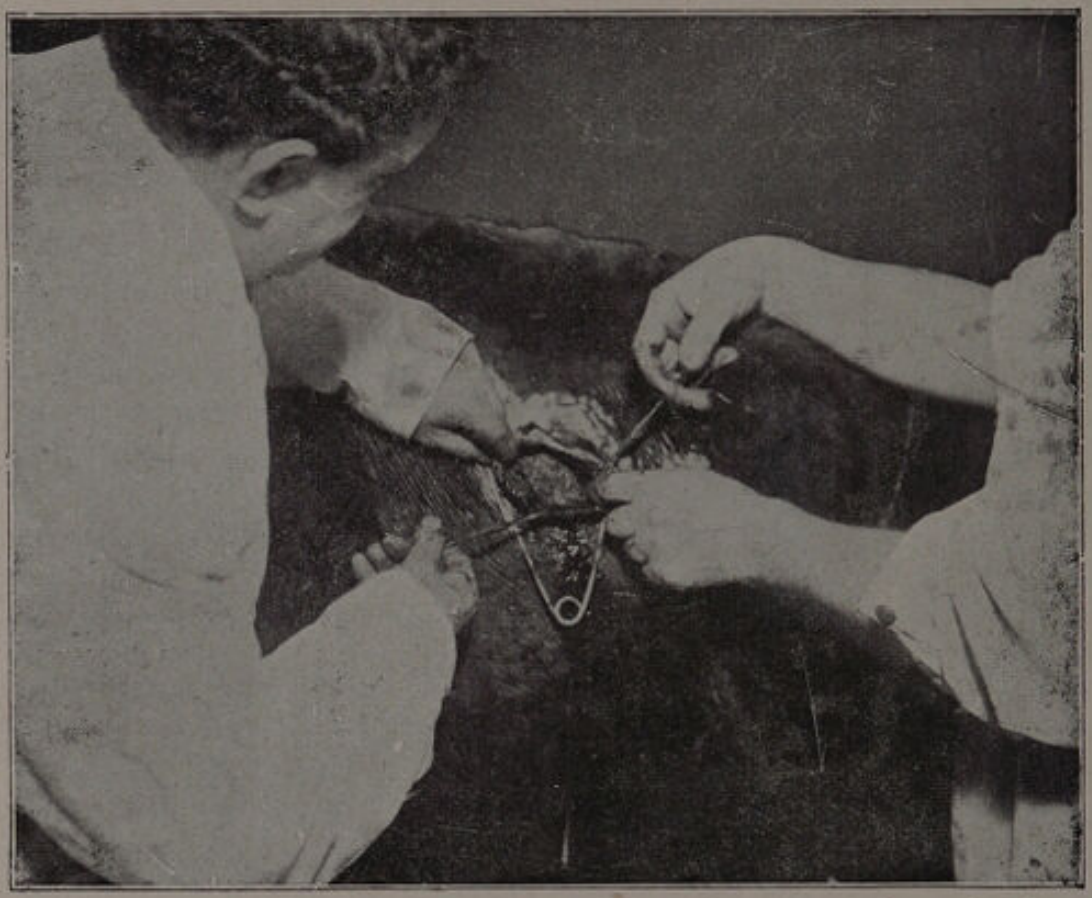


Fig. 223—Rumenotomy. Drawing the Incised Rumen through the Abdominal Incision.

When the operation is performed for the removal of single foreign bodies or accumulated particles previously mentioned, the hand is passed into the rumen, arm's length, and a search made for them.

Fourth Step.—Rumenorrhaphy. — The edges of the wound in the rumen are now cleansed of all adhering particles and then sutured with a Czerny-Lembert of catgut. The Czerny suture alone may answer, but to secure more certain healing the Lembert should be added.

The practice of leaving the wound wide open and depend-

ing upon the adhesion of the contacting peritoneal surfaces to prevent diffuse peritonitis and upon the slow process of cicatrization to finally close the resulting fistula after several months, has rightly been discontinued.

Fifth Step.—Suturing the Abdominal Incision.—The muscles and skin are closed with removable buried sutures or single interrupted ones. A small orifice, which is packed with gauze, is left open inferiorly for drainage.

Sixth Step.—Dressing.—The edges are dusted with iodoform and then coated thickly with collodion.

AFTER-CARE.—Feeding with only limited quantities of liquid food is essential, for if rumination is immediately stimulated by the ingestion of solids the contractions of the rumen will prevent all chances of primary union of the incision.

At the end of eight days the sutures in the skin are removed and the wound submitted to treatment indicated by its condition.

SEQUELÆ.—1. **Perforation of the Rumen** is the most common and the most formidable untoward complication, and while not necessarily fatal, many animals die therefrom, and the patient is always in a more or less critical state of health until cicatrization has finally closed up the breach. When the sutures fail to accomplish their purpose and perforation results there is no other choice than that of allowing the healing process to take its own course.

2. **Hæmorrhage.**—More or less profuse bleeding sometimes occurs into the peritoneal cavity after the wounds have been closed, but as the accident is seldom noticed except on post-mortem when the patient has died from other causes than the hæmorrhage itself, no treatment is ever administered.

3. **Peritonitis.**—Local peritonitis always ensues, and usually results in adhesions of the rumen to the parietes about the region of operation. Diffuse peritonitis, which always results fatally, follows unclean surgery, especially in debilitated subjects.

4. **Shock** is common when the disease for which the operation was performed was of too long standing. Bloats of several hours' duration and necrosis of the rumen from foreign bodies are among the conditions which, when relieved, end in post-operative collapse and death after a few hours. The state is prevented in acute bloat by slow evacuation of the rumen, and in the more chronic conditions by timely intervention.

ASPIRATION OF THE STOMACH OF HORSES

DEFINITION.—A method of evacuating the contents of an overloaded stomach by means of a stomach tube and force pump.

INDICATIONS.—The indication for the operation is the so-called case of "acute indigestion" induced by overeating. The gastric content is transformed into a semi-solid, fermenting mass that causes serious distress, manifested by colic, bloating and eructations of gas. The disease is often fatal and is always more or less refractory to medical treatment. The administration of antiacids, antiferments and purgatives often fails to afford relief until the stomach has suffered irreparable damage and the patient has become exhausted from the long duration of the pain and distress, and severe cases may end fatally in a few hours, or even less, despite the best medical treatment. These facts at once show the wisdom of immediately evacuating the stomach in all cases of ordinary severity and to rely upon medical treatment only in the exceptionally trivial ones. The relief is instantaneous, the cure is perfect and the stomach is protected against damage that would predispose to subsequent attacks. In short, aspiration should be adopted as the standard treatment of acute indigestion, because besides being effectual, it harmonizes with the trend of modern therapeutic ideals. It removes the cause without ceremony.

RESTRAINT.—The operation is performed in the standing position. The head is supported at a convenient height by an assistant. As the patient is already in great pain twitching is unnecessary; and besides the twitch would interfere with the entrance of the tube into the nares.

INSTRUMENTS, ETC.—1. A nine-foot stomach tube.

2. A pump equipped with a nozzle to which the stomach tube can be easily attached and removed.

3. Plenty of water in pails.

The tube should be marked at two points; one 16 inches, and one 5½ feet from the end. The first indicates the distance to the pharynx, the second the distance to the stomach.

The stomach tube having both an influx and reflux channel (the double tube) does not meet with our favor. In principle the idea seems good, but when put into practice side by side with the single tube it is soon found that in at least a majority of cases the actual force of the pump has very little influence in washing out material from the stom-

ach. It is the intra-abdominal pressure that brings out the contents.

TECHNIQUE.—First Step.—Passing the Tube Into the Stomach.—The **nasal route** is the preferable one, although some practitioners prefer the **oral route.** The disadvantage of the former is occasional epistaxis caused by inflicting injury to the nasal mucosa while passing the tube through the nasal meatus, while the latter is objectionable on account

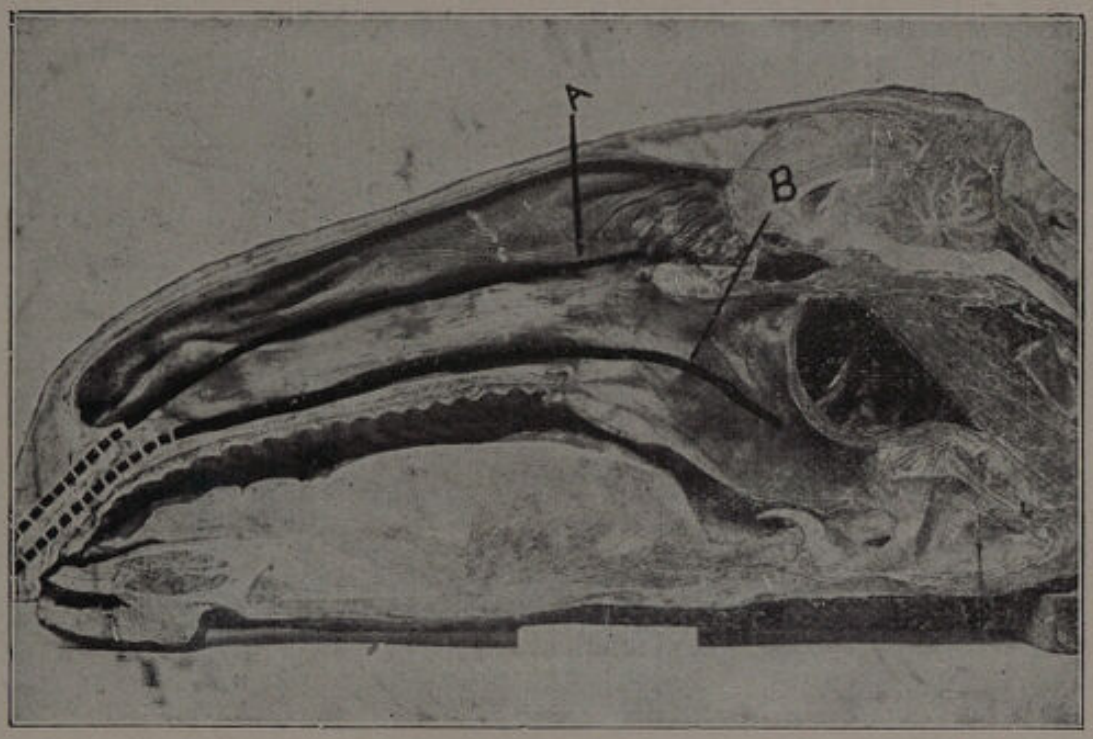


Fig. 224—*A*, Tube Passed in the Middle Nasal Meatus is Seen Blocked by the Ethmoid Bone. *B*, Tube Passed into Inferior Meatus Deflects Downward into the Pharynx and Backward toward the Œsophageal Infundibulum.

of the opposition the prolonged sojourn of a speculum always causes.

The tube, previously well oiled, is held in the left hand about fourteen inches from its end and passed into the lower commissure of the left nostril. As the end approaches the anterior extremity of the inferior turbinated bone it is depressed with the index finger of the right hand to direct its course into the inferior meatus. Should it deflect upward into the middle meatus it will pass over the posterior nares instead of into the pharynx, and will be blocked completely against further progress. **The precaution to pass the tube into the inferior meatus is the first important step of the procedure.** As it passes through the nasal chamber all force is avoided and injury from a sudden jerk of the head is pre-

vented by holding the head firm. When the tube has reached the middle of the pharynx, indicated by the sixteen-inch mark on its surface, the fingers of the right hand are placed against the throat while the left grasps the tube four inches from the nostril. In this position an act of deglutition is patiently waited for. It may come almost as soon as the end of the tube enters the pharynx, or some moments may elapse before any effort to swallow is attempted. If no attempt to swallow is made, after some moments the tube is moved gently forward and backward so as to make an impression of its presence upon the pharyngeal walls. When the fingers of the right hand feel the very first impression of an act of deglutition by the forward movement of the throat, the tube is quickly pushed forward the four inches intervening between the left hand and the nostril. The end of the tube in the pharynx thus meets the œsophageal infundibulum on its upward movement and thereby passes safely

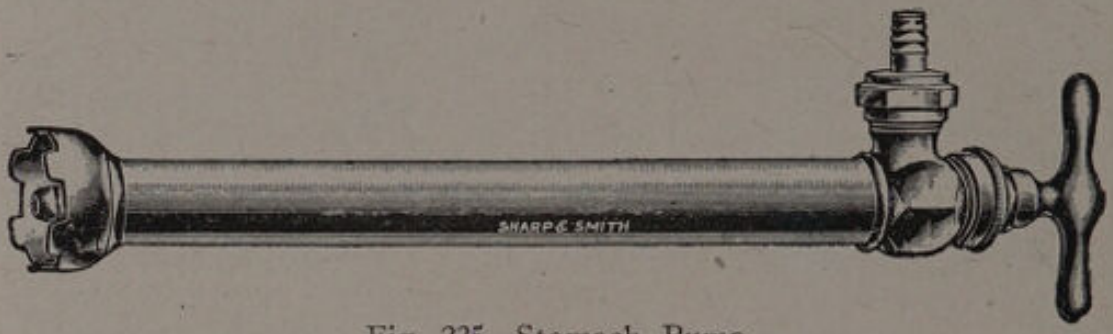


Fig. 225—Stomach Pump.

into it. **This manipulation is the secret of the successful introduction of tubes into the stomach of horses.** If ignored by simply pushing the tube onward without ceremony, the end may drop into the larynx and then pass downward through the trachea into the bronchi before the unfortunate diversion is discovered. The successful introduction of a tube into the œsophagus requires the assistance of an act of deglutition.

When the tube has entered the œsophagus, it is quite rapidly swallowed. It requires only a little assistance of the left hand to push it onward foot by foot with each act of deglutition.

As it approaches the stomach, the gurgling of escaping gas and the sour odor of fermenting ingesta give positive assurance that it has not passed into the air passage, which accident is indicated by soft blowing sounds, synchronous with the exhalations, heard at the outside end of the tube.

The entrance of the tube into the stomach is generally announced by an outward gush of semi-liquid chyme or the escape of considerable gas. In the absence of this occurrence, as for example when the tube is inserted for some other reason than the treatment of acute indigestion, its entrance is determined by the approach of the five and one-half foot mark to the nostril, allowance being made for variations in the size of the patient.

Another method more effectual than the former is that of first passing a rattan stylet into the tube to stiffen it and then push it right down into the stomach without ceremony. This plan is particularly to be recommended for tubes that have

Fig. 226—Tube for Stomach Pump.

become limber from long use and which could not be of longer service otherwise.

Third Step.—Siphonage and Irrigation of the Stomach.—As above stated the invasion of the cardiac compartment by the tube is immediately announced by a gush of chyme and gurgles of gas. The tube, however, is soon blocked with solid particles which arrest the flow. These are dislodged by driving the obstruction into the stomach with a few spurts of the pump, which then allows another quantity of chyme to discharge. Each time the flow ceases the pumping is repeated, and then alternate pumping and siphonage is continued as long as any of the chyme can be thus encouraged to flow out. When the flow ceases entirely by this process, quantities of water (a gallon or two) are alternately pumped into and drawn from the stomach until the major portion of the contents has been abstracted, and dilution has arrested

the fermentation in the coarser particles that could not be withdrawn through the tube.

At first the intra-abdominal pressure forces the contents out, but when the pressure has been diminished by evacuation of gases and chyme it must be restored by repeatedly filling the stomach with water, which, upon being drawn off each time, brings out a certain amount of solid ingesta. Later, as the intra-abdominal pressure becomes normal, the water flows into the intestines and further aspiration becomes impossible, but by this time the stomach and contents have been submitted to a lavage that has effected a thorough cure of the disease.

Fourth Step.—Administration of Medicaments Through the Tube.—Mild antiacids like well diluted aromatic spirits of ammonia may be pumped into the stomach before removing the tube, but we advise against the administration of oleaginous or other purgatives at this time.

Note.—The water injected should be warmed to about 110° Fahr. The practice of dissolving sodium chloride in the water, recommended by Phillips, is helpful, but the total amount of salt injected should be limited to less than a pound. A larger amount, in addition to the large quantity of water that finds its way into the intestines, frequently causes excessive purgation on the following days.

Some notice should be taken of the amount of water injected in excess of that withdrawn, by injecting from one pail and withdrawing into another, in order to prevent overfilling the alimentary tract unconsciously.

SEQUELÆ AND ACCIDENTS.—1. Epistaxis sometimes occurs from wounding the Schneiderian membrane with the tube. The accident occurs while the tube is being introduced or withdrawn, and is prevented by passing it safely and slowly into the inferior nasal meatus, and by avoiding force in withdrawal. A jerk of the head while the end of the tube is invading the middle of the nasal fossa must be provided against, and if the progress is blocked by curling of the tube in the pharynx the use of force will bend it in the nasal meatus and thus injure the turbinated bone.

Epistaxis is never serious but it is always exceedingly annoying and is certain to create anxiety that can not be easily dispelled. The bleeding is seldom profuse and requires generally no special attention, although cold baths over the nasal region and the administration of ergotin hypodermically may be prudent.

2. **Super-purgation** induced by injections of large quantities of water and predisposed by the weakened condition of the intestinal walls, although rare, sometimes supervenes. It is prevented by limiting the amount of water injected to less than five to six gallons. The treatment consists of withholding water and the administration of nux vomica and alcohol in repeated medicinal doses. Opiates seem harmful.

3. **Mechanical Pneumonia** is not usually due to the operation itself, but to the inspiration of regurgitated chyme, and serious bloating may ensue before relief can be afforded. It follows the neglected case, and the case treated by drenches during the sojourn of the gastric tension, but sometimes is caused by unconsciously passing the tube into the bronchi.

4. **Failure to Pass the Tube into the Œsophagus.**—Despite everything, the end of the tube may persist in passing into the larynx instead of into the œsophageal infundibulum. The prevention of this annoying circumstance lies largely in abiding by the recommendations laid down in step 1. The stiffness of the tube is also an important factor. If too limber it drops too sharply after passing through the posterior nare and thus glides over the superior surface of the epiglottis into the glottis. The texture of the tube should be sufficiently firm to prevent bending in the pharynx.

CHAPTER XI

CHOKE

RADICAL OPERATION AGAINST CHOKE IN SOLIPEDS

DEFINITION.—A method of washing out œsophageal impactions by means of the stomach-tube and force-pump.

INDICATIONS.—This radical intervention against choke in horses is indicated as a last resort after the more simple methods have failed. Choke in horses is best described as an impaction of the œsophagus with masticated food;—hay, oats, corn, etc. It is often predisposed by a dilatation in the thoracic portion of the tube, due to previous impactions. When food is arrested en masse in the œsophagus of horses the walls are stretched, weakened and then permanently dilated, leaving a cavity that is prone to overload at any time. Dry feed is devoured too rapidly for the defective œsophagus to handle. In the first few attacks the cure may be spontaneous from the contractions of the walls and the copious flow of saliva swallowed, or it may respond to such simple remedies as drenching, washing out with a stomach tube, or the administration of eserine or arecoline hypodermically; but when repeated attacks have produced a dilatation of considerable size and the dilated cavity becomes impacted with feed, a more radical interference becomes necessary.

Formidable chokes are seen chiefly in old horses which have suffered from minor attacks during previous years. On account of the tendency to spontaneous cure the first few attacks may have escaped notice.

In the management of choked horses the practitioner must be governed largely by the age and history. In young animals there is no urgent demand for radical intervention, as the mass will usually dislodge spontaneously, even after sojourning two days or more, if all feed is withheld and abundance of liquids are swallowed or forced into the œsophagus. On the other hand, in older animals, especially those presented with a history of previous chokes, operative relief must not be postponed beyond the first twenty-four hours.

RESTRAINT.—The operation is performed in the stand-

ing position, with the twitch to the nose and cocaine solution injected into the seat of operation.

INSTRUMENTS, ETC.

1. Scalpel.
2. Tissue forceps.
3. Hæmostats.
4. Rubber stomach tube, nine feet long.
5. Force pump with attachment to fit the stomach tube.
6. A piece of tape one foot long.
7. Needles and silk sutures.
8. Clipper and razor.
9. Antiseptics.

TECHNIQUE.—First Step.—Exposing the Œsophagus in the Middle Third of the Cervical Region.—After a space of two inches wide and four inches long, in the jugular groove about the middle of the left side of the neck has been clipped, shaved and disinfected, an incision four inches long is made over and parallel to the œsophagus through the skin and underlying muscles. The dissection is continued until the finger can be easily hooked around the œsophagus, in the center of the incision.

Second Step.—Passing the Stomach Tube.—The stomach tube, previously oiled, is passed into the œsophagus by way of the left nostril until its buried extremity reaches the impaction.

Third Step.—Ligating the Œsophagus.—The tape is passed around the œsophagus where it has been exposed in the depths of the cervical incision, and tied firmly with an easily released bow-knot. The object of the ligature is to prevent flooding the air passages with the water pumped into the tube to dislodge the mass.

Fourth Step.—Washing Out and Aspirating the Impacted Mass.—The pump is now attached to the tube and water is slowly pumped into it until the intra-œsophageal tension, determined with the finger below the tape, is sufficient to force the water through the mass and yet not sufficient to threaten rupture of the weakened walls around it. As the tension diminishes by the downward dissemination of the water the pumping is resumed and the tension is eagerly guarded to forestall possible rupture. If the water fails to flow downward it is syphoned out by disconnecting the tube from the pump. The syphoned liquid will disclose the character of the impacted mass, which is now dislodged by alternate pumping and syphonage until the water finally flows freely downward into the stomach. The success or

failure of the operation depends upon the judgment displayed in preventing rupture while washing the mass down, or the patience displayed in the slow process of syphoning it outward.

Fifth Step.—Treatment of the Wound.—The tape is untied, the stomach tube withdrawn and the wound closed with interrupted sutures, after dusting it well with iodoform. A drainage orifice may be provided at the lower commissure.

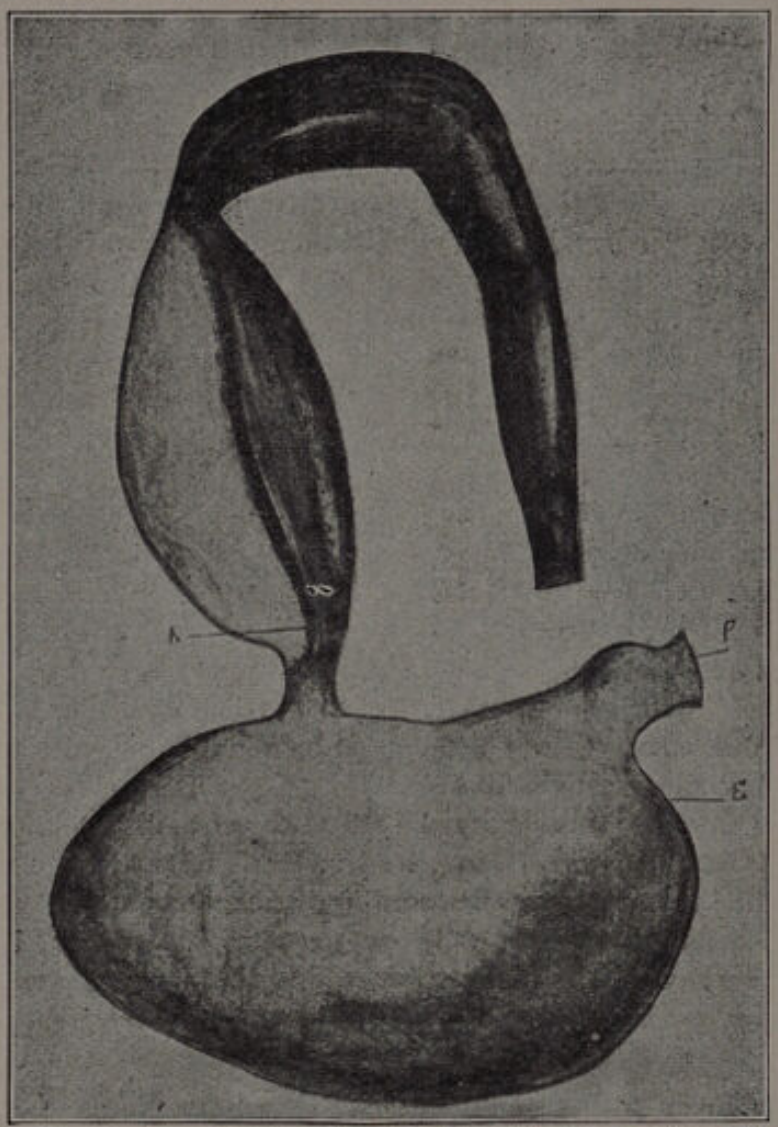


Fig. 227—Stomach and Œsophagus Showing a Large Dilatation of the Latter. (Jabot.)

AFTER-CARE.—The patient is allowed only liquid diet for some days, and then, when the grain and hay ration is resumed, provision must be made to prevent rapid eating. The grain may be fed by spreading it out over a wide surface upon the clean floor, and the hay placed in an almost inaccessible place, a closely fitted rack. This mode of feeding should be continued until the walls have recovered from the influence of the attack.

SEQUELÆ AND ACCIDENTS.—1. Rupture of the œsophagus at the seat of impaction is a common accident, when poor judgment is displayed in the use of the pump. It is manifested by an almost immediate appearance of a state of collapse that ends fatally in a few hours.

2. **Recurrence of the choke** is also common, but this can in no way be attributed to the effect of the operation. On the contrary, the operation would tend to prevent recurrence by coming to the rescue of the weakened walls. Recurrence indicates a serious incurable dilatation.

WASHING OUT CHOKE IN SOLIPEDS WITH THE STOMACH TUBE

INDICATIONS.—Although recent chokes in horses usually dislodge and pass down without mechanical assistance, the practitioner for policies sake must often attempt to give relief forthwith. The probang being worse than useless and washing with a tube and pump dangerous to the air passages, the following safe method may be practiced under such circumstances. It is, however, somewhat difficult in intractable subjects:

MODUS OPERANDI.—The choked patient is backed into a narrow stall flush against the manger to prevent backing, and a rope or scantling is fixed across the breast to prevent forward movements. A strong ring or steeple is then fastened into the floor and the horse haltered with a strong rope halter. The stomach tube is passed down the œsophagus to the choke and then the head is drawn down to within a foot of the floor by means of the halter rope passed through the ring or steeple. In this position water ad libitum may be pumped against the obstruction ,the reflux flowing to the floor through the nostrils and without danger of descending (ascending) into the lungs. If the patient does not become restive almost any ordinary œsophageal obstruction can thus be washed out in a few minutes.

PROCEDURES AGAINST CHOKE IN RUMINANTS

INDICATIONS.—In ruminants choke presents an entirely different proposition from choke in solipeds. Here the obstruction is generally a solid object lodged on account of hurried ingestion. The obstruction is as frequently cervical in the ruminant as it is thoracic in solipeds, on account, of the anatomical disposition of the œsophagus in the two

species. In solipeds the lumen diminishes toward the stomach, while in the ruminant it is trumpet-shaped inferiorly.

The treatment of choke in ruminants consists of a number of radical efforts to dislodge the obstruction and ends by sending the subject to the slaughter house if all of them fail.

The routine is as follows:—1. Attempt to move the object into the pharynx, whence it is removed manually. 2. Attempt to push it into the stomach with the probang. 3. Attempt to slice it into small pieces with a fine tenetome passed into it from without. 4. Œsophagotomy.

TECHNIQUE OF ŒSOPHAGOTOMY.—The operation can only be successfully performed in the cervical region. The field over and around the protrusion is cleansed and the œsophagus exposed by a longitudinal incision, overlapping the obstruction superiorly. The œsophagus is incised just above the obstruction, and not immediately over it. At first only a very small incision is made over the anterior part of the object, through which the nature can be determined. If found to be a vegetable or other substance that can be cut into pieces, it is reduced into fragments and removed piece by piece with forceps. On the other hand, if it consists of a more solid body the incision is enlarged anteriorly and the object squeezed or drawn out through it.

The incision is closed with a number of removable buried sutures of catgut (see page 108) and the skin with interrupted silk sutures arranged to provide draining at the lower commissure.

AFTER-CARE.—The success of the operation depends largely upon the length of the incision. When it is found possible to remove the object through a small incision the operation is but a trivial matter, but on the other hand if the incision is long, and especially if the local inflammation provoked by the sojourn of the object in the œsophagus is acute and verges upon gangrene, the chances of successfully closing the incision permanently are indeed meager. **An œsophageal fistula** will develop despite everything.

The patient is allowed only liquid diet for seven days, and that in such limited quantities that rumination will cease. Healing of a sutured œsophageal incision in ruminants is impossible if its forcible contractions are not in some way prevented.

OPERATION FOR CHOKE IN FOWLS

SYNONYM.—Ingluviotomy.

INDICATIONS.—In fowls, choke takes the form of impaction of the ingluvies (crop) with grains, corn, peas, oats, etc., that may sometimes end fatally if not relieved. The condition is diagnosed by a general malaise, and palpation of the craw, which stands out prominently. The economic importance of operation is small except in selected individuals reserved for special purposes. Frequently during the author's career, prize cocks and pullets, pit cocks, homer pigeons, pet fowls and parrots, presented for treatment have been found suffering with this condition, and in every case the evacuation of the contents by incision was successful except where the walls of the crop were found gangrenous when incised.

TECHNIQUE.—The operation is preceded by plucking the feathers from the surface of the crop and disinfection with mercuric chloride solution. A longitudinal incision is made on the median line about two inches long, varying with the size of the patient. The cutaneous incision immediately exposes the impacted sac which is then opened by an incision somewhat shorter than the former. The contents are removed by pressure, the cavity washed out and then closed with interrupted silk sutures, dusted with iodoform and painted with collodion.

AFTER-CARE.—The patient is made to subsist upon a limited semi-liquid ration of mush for one week, at which time the cutaneous sutures are removed.

CHAPTER XII

MISCELLANEOUS MINOR OPERATIONS

OPERATION FOR HOOF CRACKS

INDICATIONS.—Hoof-cracks or sand-cracks, as they are usually called, are classified according to position into **toe-cracks** when located anteriorly and **quarter-cracks** when situated in the quarters. They are **complicated or uncomplicated** according to whether or not they extend into the sensitive laminæ or the coronary cushion.

Natural thinness of the wall, brittleness of the horn, contraction of the hoof, dropping of the sole (pumice foot) and certain definite conformations are so many predisposing states which leave the wall susceptible to fracture under the influence of more or less violence in the form of severe traction or hard pounding. There are, however, numerous toe-cracks, especially in the hind feet of draft horses, that develop in the absence of any perceptible predisposing influence, apparently from sheer violence. Predisposition, as a cause of hoof-cracks, is more influential in quarter-cracks than in fractures at the toe. The most formidable hoof-cracks, however, although not the most common, are those caused by a diminished production of horn at an isolated spot on the coronary cushion, due to previous disease or injury. The tread of a sharp calk, a necrotic inflammation, a quittor or any wound that destroys a part or all of the coronet at a definite spot, often results in the outgrowth of a "through and through" seam, because the production of horn from the injured point does not keep pace with the growth from the parts immediately adjacent. This variety of hoof cracks is either incurable or else will yield only to a special treatment hereafter mentioned. (See after-care.)

As regards surgical treatment, hoof-cracks should be divided into two classes, viz.;—(1) Those in hoofs having an integral coronary cushion, and (2), Those in hoofs whose coronary cushion possesses a local defect. The former will yield to treatment, whilst the latter, owing to a serious loss of coronary substance, may be incurable. In the selection of cases for operation the condition of the coronet is, there-

fore, of capital importance, and when the defect therein is extensive, there is little chance of success from any method of treatment. On the other hand, in cracks of purely accidental origin in fairly good feet whose coronary cushions have suffered no local damage, operative intervention is usually successful.

The object of hoof-crack operations is to start a sound (uncracked) growth of horn from the coronet by destroying the spot in the cushion where the separation of the horn-fibers begins. To this end various methods are practiced, the simplest of which is the burning of a tranverse fissure through the hoof at the uppermost end of the crack, followed by blistering, clamping of the crack, and special shoeing. That this simple procedure is often successful, even without

Fig. 228—An Incurable Quarter Crack.

incapacitating the horse for work, is not denied, but the failures are too numerous to warrant its general adoption.

RESTRAINT.—The recumbent position on the operating table and cocaine anæsthesia of the volar nerves, is the preferable restraint, although with the aid of volar cocainization and the twitch it is possible to perform the operation in the standing position, especially if but one foot is affected. In bilateral cases, the work is very tiresome in the standing posture and the opposition provoked is inimical to the best results.

ANTISEPSIS.—In order to be successful it is necessary to forestall infection of the surgical wound by pre-operative, operative and post-operative antisepsis. Infective inflammation, while not especially dangerous, prolongs the period of

convalescence and often causes an annoying claudication. The field about the coronet must therefore be clipped and shaved, rinsed with mercuric chloride solution 1-500 and then painted with tincture of iodine. The instrument must be sterilized.

TECHNIQUE.—First Step.—A rubber tourniquet is wrapped around the metacarpus to prevent bleeding; a V-shaped piece of hoof is removed along the crack from the coronet downward about two inches for toe-cracks and one and a half inches for quarter-cracks. In toe-crack the base of the V extends about one inch on either side of the crack;

Fig. 229

Fig. 230

Figs. 229 and 230—Forms of Incurable Hoof Cracks.

that is to say, it is about two inches wide across the top. For quarter-crack this dimension should be only about one inch long, in order to conserve to the quarter as much weight-bearing strength as possible.

The piece is removed by cutting the two grooves from above downward completely through the wall and then prying it off with a strong chisel or special forceps constructed for that purpose. By removing the piece as a unit instead of paring it off with the hoof-knife the laminæ and coronary cushion are left clean without any mutilation.

Second Step.—Destroying the Focus of the Crack in Coronary Cushion and Laminæ.—With the horn thus stripped off the involvement of the sensitive structure is plainly seen.

The crack may be seen to extend deeply into the coronary substance and completely through the sensitive laminæ to the periosteum. Sometimes the existence of small exostoses along the crevice announces a previous involvement of the os

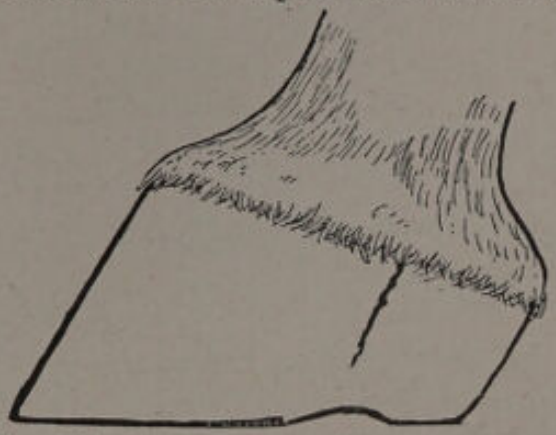


Fig. 231—Form of Curable Hoof Crack.

pedis itself, and in acute cases sloughing of the laminæ and exfoliation of a segment of bone is a common occurrence.

The aim in this step is to remove harmful elements and then to shave off the coronary cushion uniformly along the

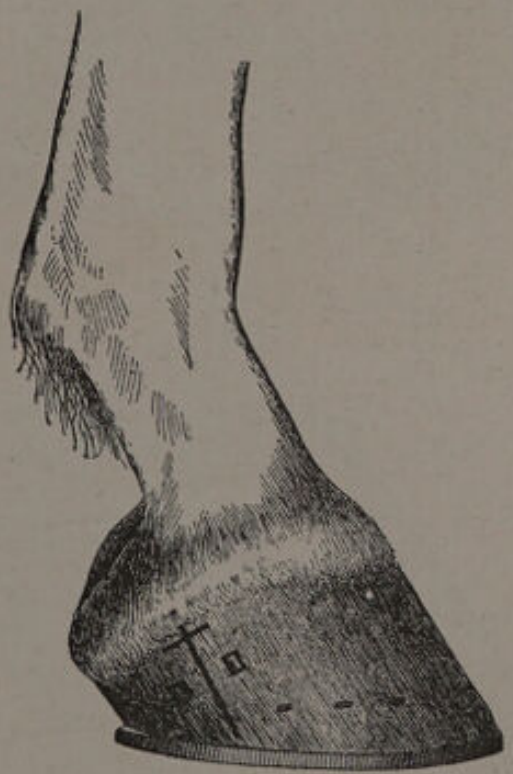


Fig. 232—Farrier's Simple Procedure against Hoof Cracks.

whole exposed portion, as deep as the crack extends into its substance, so that the hoof will thereafter grow out as a unit. The laminæ are trimmed slightly along the crevice, especially of its black, dirt-containing portions.

Third Step.—Dressing.—The exposed tissues are then treated to a strong antiseptic, covered with cotton and bandaged taut to prevent bleeding. The most effectual antiseptic

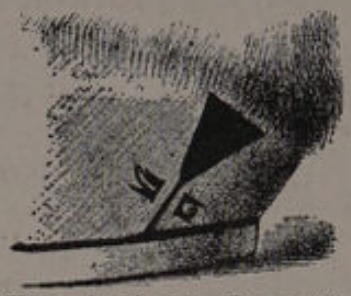


Fig. 233—The Author's Operation Complete.

treatment consists of painting the raw space with tincture of iodine and then dusting it liberally with pure iodoform.

AFTER-CARE.—The bandage is removed every twenty-

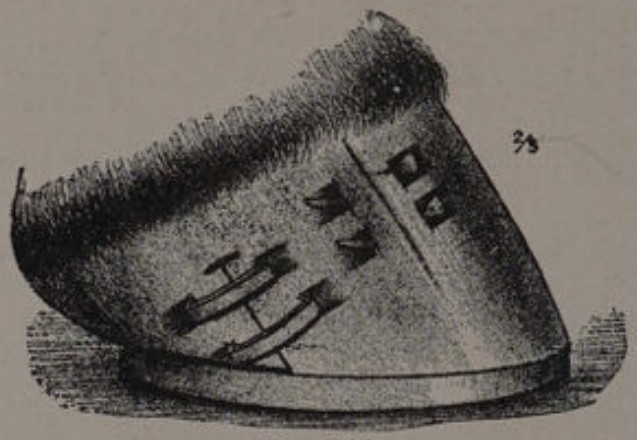


Fig. 234.

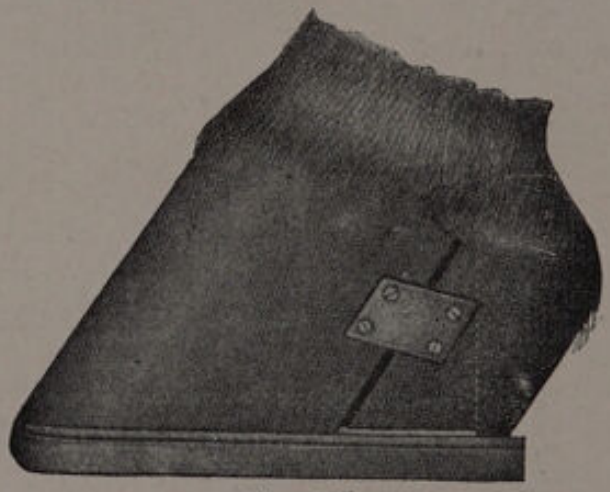


Fig. 235.

Figs. 234 and 235—Clamp and Nailing Operations.

four hours and the same treatment applied until the growth of horn covers the whole V-shaped area.

The success met in preventing a recurrence of the crack

will now depend upon paring off the new growth as soon as a crack appears in it and when there has been a previous damage to a spot in the coronary cushion that retards the production of horn thereat, the horn at each side of the damaged spot must be pared frequently so that the whole will grow evenly. Four to six weeks' idleness is advisable.

SEQUELÆ.—Infection.—If such an operation is performed without regard for antisepsis a serious infective inflammation supervenes, and results in annoying lameness, the growth of troublesome granulations, and generally failure of the whole enterprise. Although rare, it is possible

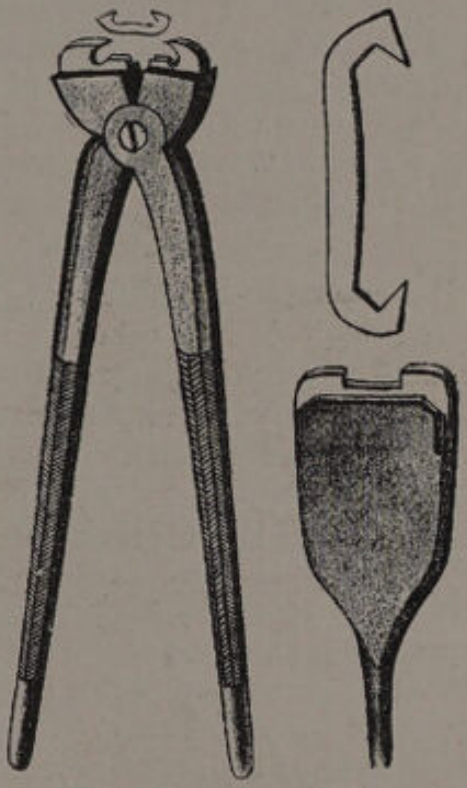


Fig. 236—Clamps and Pincers.

for such inflammation to implicate the underlying tendon and bone, and even end seriously.

2. **Recurrence of the Crack.**—As the operation does not help the predisposing cause recurrence at any future time is common. The hoof may be too weak, too deformed or too brittle to withstand the strain to which it is submitted, and if protection by special shoeing does not prevent re-fracture of the horn, the condition may be given up as hopeless.

SHOEING AND CLAMPING.—For toe-cracks the bar shoe, fitted to support some weight at the frog, is the best. The shoe should be nailed tight with four nails on each wing and two at the toe, and in addition, three toe-clips should be

turned up, one at the center of the toe and one on each side to serve as immobilizing clamps. It is also essential to clamp the crack just below the apex of the V-shaped excavation with plate, clamp or shoe nail. The latter gives the best service, as well as being the easiest to apply.

For quarter-cracks a bar-shoe with a light bar that does not touch the frog is the preferable one. The bearing should be uniform throughout the entire circumference of the wall. The practice of removing any part of the pressure from the affected quarter by paring away the wall so that it does not contact the shoe, is exceedingly harmful. Friction between the edges of the crack is increased thereby instead of being diminished. The wall lying posterior to the crack, if not supported, moves with each step and thus maintains a state of irritation along the crack; and besides, it tends to cause fracture of the new growth above. The shoe should be nailed tightly and if possible a special nail should be driven behind the level of the crack for the purpose of producing perfect immobilization of the part. In addition, clamping may be practiced, but as the wall of the quarter is often very thin, care must be exercised to avoid injury to the sensitive laminæ. The brass plate, fastened with short screws, is the safest method of clamping quarter cracks.

OPERATION FOR THE CURE OF SLIT EARS

INDICATIONS.—The conchal cartilage of horses and oxen are sometimes accidentally slit from contact with sharp objects, and where animals run at large slitting is often practiced for the purpose of identification. The demand for curing the disfiguration comes as soon as such animals are offered for sale or fall into the hands of fastidious owners. In the case of valuable horses the permanent obliteration of such damaging blemishes is always a matter of serious moment.

When the breach is accompanied with loss of substances the permanent union of the edges is not always possible, but when the solution of continuity is but a simple incision the following intervention seldom fails:

RESTRAINT.—The operation can only be performed in the recumbent position. It is quite a long, tedious procedure, to which any horse will object by movements of the head that would interfere with its proper execution.

INSTRUMENTS, ETC.—

1. Scalpel and scissors.
2. Tissue forceps.

3. Artery forceps.
4. Small curved needle and silk suture.
5. Razor.
6. Antiseptics.
7. Collodion.

TECHNIQUE.—First Step.—Preparation.—The ear is shaved within and without about one-half inch from each edge of the breach and then submitted to a thorough disinfection.

Second Step.—Preparing the Edges.—The cicatricial tissue along the edges is trimmed off with the scissors or scalpel, so as to expose the two layers of skin and the cartilage between them. The cartilage along each edge is then excavated from between the two layers of skin to the depth of

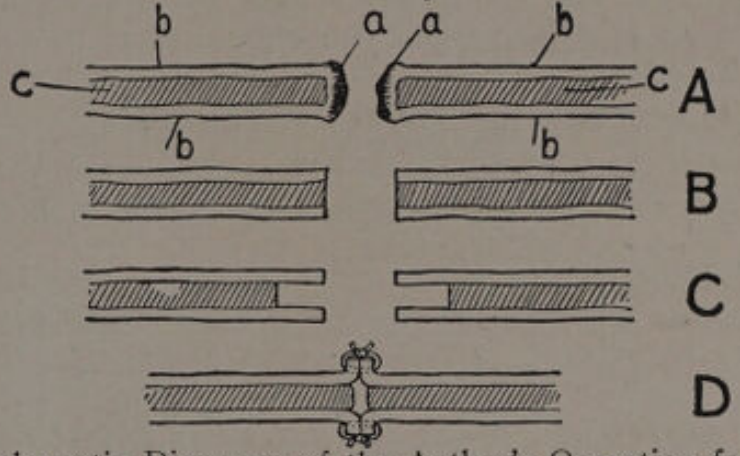


Fig. 237—Schematic Diagrams of the Author's Operation for Slit Ears.
A—*a*, *a*, Scar Tissue. *b*, *b*, *b*, *b*, Skin. *c*, *c*, Cartilage.
B—The Edges Denuded of the Scar Tissue.
C—The Cartilage Excavated beyond the Edges of the Skin.
D—The Skin Flap Sutured.

about three-sixteenths of an inch from the skin margin, thus leaving two skin flaps on each side which can be united to each other separately.

Third Step.—Hæmostasis.—The subcutem of the concha contains several large veins that may be divided in the course of the above dissection, the bleeding from which must be arrested before proceeding with the next step. Otherwise the space intervening between the two sutured flaps will fill up with a harmful clot, and the flow of blood through the sutured edges will delay the application of the adhesive dressing. The bleeding is met by searching for the vessels and then twisting them with hæmostats. The capillary oozing, which sometimes persists stubbornly, is allowed to stop spontaneously before the suturing is attempted.

Fourth Step.—Suturing the Edges.—The edges of the skin of each side are united to each other separately (Fig. 237). The suturing begins on the internal surface owing to the fact that the convexity renders the edges of skin rather inaccessible after the external flaps have been closed.

The suturing is effected by means of closely placed interrupted sutures adjusted so as to positively prevent infolding of the edges, which accident would prevent union. The external flaps are then united in the same manner.

Fifth Step.—Dressing.—The part is rinsed with an antiseptic solution, dried, dusted along the sutures with iodoform, and then coated over with several thick layers of collodion.

AFTER-CARE.—If the patient shows any inclination to rub the ear against the manger, it is tied on the pillar reins. No dressing is required until the eighth day, at which time the collodion is teased off and the sutures inspected. If union of the edges seems safe they are removed.

McQueen's Operation for Conchal Hæmatoma.

DEFINITION.—A method of applying sutures through the concha for the purpose of obliterating the sac and encouraging cicatrization of traumatic sanguineous sac of the ear.

INDICATIONS.—The ears of both the dog and the cat are susceptible to the development of an exceedingly refractory sanguineous or serous sac located upon the internal and sometimes on both sides of the concha. It is caused by violence that causes the accumulation of blood or serum beneath the perichondrium, and since cartilage is little inclined to undergo any active regenerative process the sac refills as often as the contents are evacuated, until finally a marked distortion of the cartilaginous tissue results. Repeated evacuation by aspiration or lancing with or without antiseptic irrigations, is seldom successful, and spontaneous recovery is rare. Injections of tincture of iodine, adrenalin, and strong astringents have been recommended, but the results are seldom satisfactory. The method of McQueen, herewith described, is the most effectual treatment against this obstinate condition:

TECHNIQUE.—The hair covering the area affected is clipped and shaved internally and externally, and the surface is washed with a potent antiseptic. The content of the sac is then evacuated through a liberal incision located at the most dependent part. Then a series of interrupted sutures

arranged in the form of a leaf are passed through the ear so as to bind down the separated perichondrium against the cartilage. The sutures are tied rather loosely to prevent sloughing. (Fig. 238.)

White's method consists of an incision of the whole sac longitudinally, and the insertion of one or two through-and-through sutures on each side, one quarter of an inch from the edges. He further treats the parts beneath the edges with tincture of iodine. Deformation of the concha from this method is rare in dogs, but is frequent in cats.

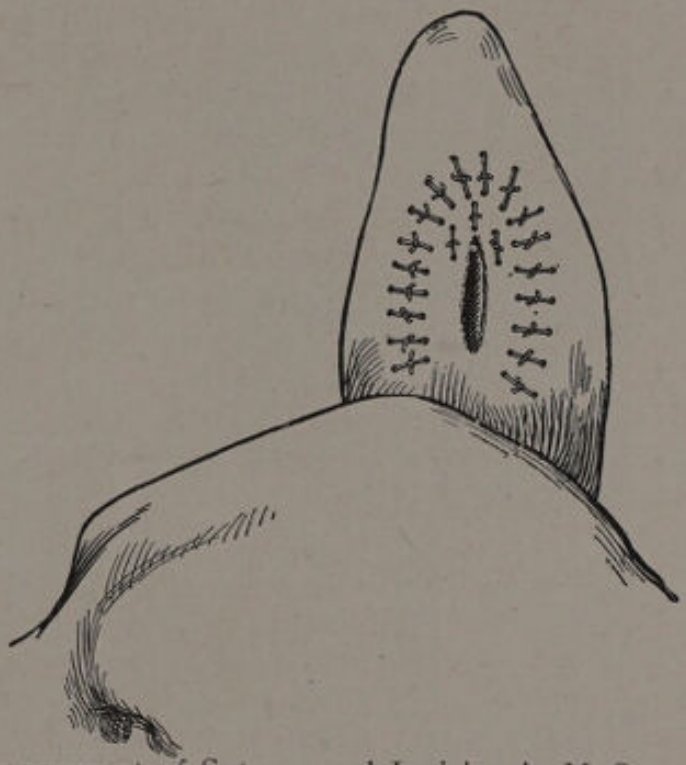


Fig. 238—Arrangement of Sutures and Incision in McQueen's Operation for Conchal Hæmatoma.

AFTER-CARE.—The after-care consists of squeezing out the fluid that accumulated amongst the sutures, protection of the ear against self-inflicted injury by the application of a hood, and the removal of the sutures at the end of eight to ten days.

ABLATION OF SHOE-BOILS

INDICATIONS.—The hygroma of the elbow whose walls have hypertrophied into a permanent neoplasm under the influence of constant injury, can be removed only by total ablation. So long as the walls are thin and the enlargement is constituted largely of a sac, lancing, antiseptic irrigations,

and protection against further injury is usually successful, but after the growth has hardened and the sac has been almost obliterated by encroachment of the hypertrophied tissue, the deformity will persist despite any kind of palliative treatment. A hardened shoe-boil may diminish in size by accidentally escaping injury for a long time or from the constant protection of a "shoe-boil roll," or by preventing decumbency; but a part of the growth always remains, ever ready to suddenly enlarge under the least provocation until ablation is practiced.

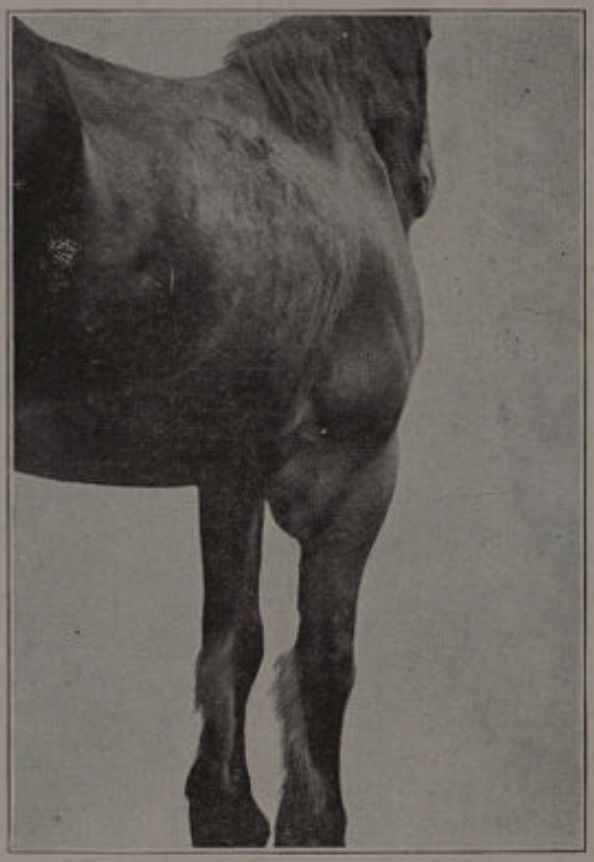


Fig. 239—Typical Specimen of Shoe-Boil.

While a shoe-boil is undergoing transformation from a temporary soft enlargement to a permanent hardened body, the wisdom of radical intervention may be doubtful, since so many of them disappear from simple treatment; but as soon as the permanency of the growth is established beyond doubt, ablation may be insisted upon as positively the only effectual remedy.

RESTRAINT.—The operation can be successfully performed only in the recumbent position, and for the ablation of the larger specimens general anæsthesia is advisable. Ex-

ception may be made of very small growths whose entire surroundings could be anæsthetized with a non-toxic agent like glycamphen or urea and quinine solution.

INSTRUMENTS, ETC.—

1. Scalpel and scissors.
2. Tissue forceps.
3. Hæmostats.
4. Two tumor forceps.
5. Needle and braided silk sutures.
6. Razor and clipper.
7. Antiseptic solutions.

ANTISEPTICS.—Ordinary antisepsis, indicated for dissections in general, is essential. This includes sterilization of the instruments, cleansing of the field and disinfection of the hands.

PREPARATION.—The cleansing, shaving and disinfection should precede casting, and as this is being done the proposed lines of incision to make the resection of an elliptical section of skin (see step 1) are marked out by snipping the skin here and there along the course with the scissors. This is necessitated by the changed relation of the skin to the growth when the patient is recumbent. If this trivial matter is not respected the sutured incision, when the horse regains the standing position after the operation, may be found to be markedly oblique instead of vertical.

TECHNIQUE.—First Step.—The Cutaneous Resection.—An elliptical piece of skin is resected perpendicularly across the whole growth, following the lines previously marked out. The width of the section must vary according to the amount of redundant skin that will result from the dissection, and it must in addition include within its area all of the orifices of fistulous tracts the growth may contain.

Second Step.—Dissection of the Growth.—The growth is then grasped with the tumor forceps and drawn up firmly by an assistant as the skin is carefully dissected loosely around the entire surface. As the growth is composed largely of hypertrophied corium the separation can only be done by sharp dissection which is carried as near to the epiderm as possible. A thick flap is avoided, but care must be taken not to "button-hole" the flaps as the dissection proceeds.

Spurting vessels encountered are twisted with the hæmostatic forceps.

When the dissection has reached the base of the growth its remotest boundaries are sought in order that every vestige

of the hypertrophied tissue be removed. Beginning above, the growth is then detached from the elbow to which it is attached by loose areolar tissue. At this point of the dissection, the nutrient vessels, if observed, are ligated, but if they escape notice the ligation or torsion follows the ablation.

Third Step.—Hæmostasis.—The success of the operation depends much upon the thoroughness with which the bleeding is controlled before the flaps are united by sutures. To simply suture the flaps and then leave the cavity to fill up with a large blood clot destroys the chances of success. The bleeding is patiently combated with forceps and ligatures,

Fig. 240—Wound Properly Sutured after Ablation.
(Bayer & Frohner.)

and then after waiting some ten minutes for the appearance of a secondary bleeding from vessels previously unobserved, the wound may be closed.

In tractable horses the suturing may be done in the standing position to excellent advantage, an hour or even more after the ablation has been completed. The bleeding has then ceased and the accumulation of a clot in the cavity is prevented.

Fourth Step.—Suturing.—The flaps are drawn together by two sets of sutures—a set of mattress sutures about three-quarters of an inch from the edges and continuous sutures to complete a perfect approximation. At the lower end a drainage orifice is provided and is packed with gauze.

Fifth Step.—Dressing.—The sutures are treated with a dusting of iodoform and then covered with collodion.

MODIFICATION.—The large clamp (Fig. 240-A) is fastened tightly at the base of the growth, squeezing out the growth into a bloodless mass. The butterfly used for tightening must be turned with pliers, as the hands can not tighten them enough. When well set into position the steel spikes are driven into the holes at for or five different points to hold it securely against slipping off when the growth is removed. The growth is now cut off one inch from the clamp and the patient without further ceremony is returned to the stall and kept standing for five hours, when the clamp is carefully removed. There will be no bleeding. The wound, which will now gap, is sprinkled with iodoform or bismuth subiodide. Twenty-four hours later the patient is again placed upon the operating table and the skin edges are hemstitched to the subcutaneous tissue and underlying muscle without attempting to bring them together.

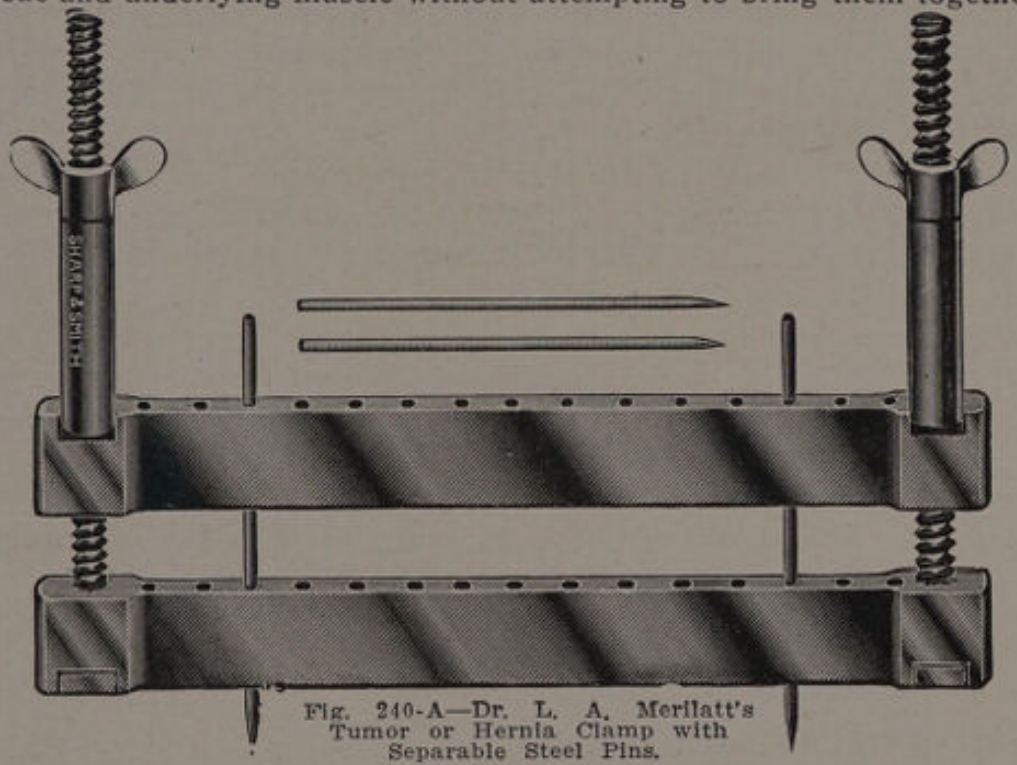


Fig. 240-A—Dr. L. A. Merillatt's Tumor or Hernia Clamp with Separable Steel Pins.

The edges are not stretched but simply laid down flat to the level of the region. The gap between the edges may be on to two inches wide, but this, if not infected, will rapidly cicatrize into a smooth, flat surface. Thus a perfectly bloodless ablation of a shoe boil may be done.

AFTER-CARE.—The patient is made to suffer the discomfort of remaining in the standing position for at least twenty days, and under no circumstance must this feature of the after-care be omitted or neglectfully performed. Lying down, even for a moment, will eliminate all chances of success. To relieve the patient from fatigue as well as to assure against accidental decumbency slings, after the first week has past, are an excellent safeguard. The mattress sutures are removed on the sixth to the seventh day and the continuous sutures some days later. If at the time of their removal the union seems frail or imperfect at any part the breach is mended with well adjusted interrupted sutures.

The drainage orifice is kept open by daily renewals of the gauze packing and by moderate injections of hydrogen peroxide.

SEQUELÆ AND ACCIDENTS.—1. Shock is a common sequel of operations upon very large shoe-boils, performed without anæsthesia. The loss of blood and the pain of a long, tedious dissection is a trying ordeal to which even

the most vigorous animal may succumb. The prevention lies in the administration of chloroform and in rational hæmostasis, during as well as after, completion of the dissection.

2. **Failure of the flaps to unite** is the chief misfortune, since the wound must then undergo a slow process of cicatrization as an open wound that often ends in the formation of a new growth quite as large and always much more unsightly than the original one. The cause of this accident may be sepsis, inadequate drainage, stitch suppuration, decumbency, or unusual movements of the leg from walking, fighting at flies, etc. With these causes provided against, union always occurs at the proper time and the internal cicatrization is practically complete at the end of twenty days.

The treatment of this accident consists of re-suturing the edges after having trimmed off the granulations they now contain. In the restive horse that seems destined to move despite all usual means of prevention, a leg brace that will immobilize the carpus, by thus limiting the elbow flexion, is often helpful. When re-union is found impossible on account of the swollen condition of the flaps, open wound treatment is the only recourse. The wound is then treated frequently with strong astringent washes (zinc sulphate ten per cent.) and the standing position maintained until cicatrization has well advanced.

HUGHES' OPERATION FOR BOG-SPAVIN

DEFINITION.—Ligation of the vena saphena above and below a bog-spavin, for the purpose of diminishing the size of the fluctuant tumefaction.

INDICATION.—Bog-spavin belongs to that class of synovial distentions that are predisposed by lack of support of the capsule. The stimulation of synovial secretion incident to severe exertion, rheumatic diatheses or aberrations of growth and development, cause the capsular ligament of the tarsus to bulge between the tendon of the tibialis anterior and the medial ligament, a triangular space unsupported by any structure except the elastic common integument. This space is traversed diagonally by the large vena saphena, which, if slightly varicosed, adds to the size of the enlargement.

By ligating this large vein a clot forms within its walls, which, after undergoing the usual transformation into a firm

connective tissue thrombus, produces a substantial support to the distended capsule, and generally a marked diminution in its size.

The exact value of this operation has not been determined by sufficient experience to warrant its absolute adoption in the treatment of bog-spavin. Hughes, however, recommends it highly and even claims that it cures the lameness that sometimes accompanies old bogs by incarcerating within the ligature the one or sometimes two internal saphenic nerves that follow the course of the vein. The fact, however, that this nerve is little concerned in supplying sensation to the tarsal structures leaves the theory somewhat unsupported.

RESTRAINT.—The operation can be performed in the standing position by the aid of the single side-line to raise the opposite leg, and local cocainization of the two small fields of operation. The recumbent position on the operating table with the addition of cocaine anæsthesia is preferable.

INSTRUMENTS, ETC.—

1. Razor and clipper.
2. Scalpel and tissue forceps.
3. Aneurism needle, or common full curved needle.
4. Sterilized catgut.
5. Antiseptics.

TECHNIQUE.—Two spots, one on the course of the vena saphena **above the medial malleolus** of the tibia, and one at the point where the vein **traverses the 2nd and 3rd tarsals,** are clipped, shaved, cocainized subcutaneously and disinfected. At each of these points, beginning at the uppermost one, an incision is made over the vein three-quarters of an inch long, and after dissecting the skin loose from around the vein a catgut ligature is slipped around it by means of the aneurism needle or the simple full curved needle. Before tying the ligature the undermost point is treated in the same manner; then both are tied with double surgeon's knots and a crucial stitch placed in each of the cutaneous incisions, which are then dusted with iodoform and coated with collodion or clay dressing.

AFTER-CARE.—The cutaneous stitches are removed in eight days, which is the first interference the wounds, if properly made, will require. The catgut absorbs and therefore requires no further attention. The horse is ready for work in twenty days.

SEQUELÆ AND ACCIDENTS.—There are no special

known sequelæ of the operation, although it would only be reasonable to suspect that **embolic conditions** might sometimes follow unexpectedly, as sometimes happens after the ligation of large veins. Accidental incision of the vein while dissecting it out may occur, but beyond delaying matters for a few moments while adjusting the forceps no complications result.

EVACUATION OF THE GUTTURAL POUCHES

The guttural pouches are sometimes, although rarely, the seat of a purulent accumulation which manifests itself by more or less dyspnœa and by a nasal discharge that becomes conspicuous during mastication and during exertion. The accumulated product, at first liquid, becomes desiccated by its long sojourn in the dependent part of the pouch, and on account of the constant churning to which it is subjected by the movements of the jaws it becomes rolled into spherical bodies resembling whitish marbles. Recently the author found the right guttural pouch of a horse impacted with oats. Its evacuation can be effected by two methods, **hyo-vertebrotomy** and **staphylotomy,** the former of which is the preferable one.

Hyo-vertebrotomy is performed in the lateral recumbent position under general anæsthesia. The parotid region is clipped, shaved and disinfected, and an incision made through the skin along the posterior border of the inferior maxillary and just anterior to the border of the wing of the atlas. It is intended that the incision should approach the pouch between the jaw and the anterior border of the parotid gland, where it can be safely carried inward without danger of cutting any of the large vessels for which the region is noted. The cutaneous incision, to gain a good view of the tissues underlying the skin, should be no less then four inches long and held apart with retractors, as the subjacent dissection proceeds. The incision of the tissues beneath the skin may be much shorter; one inch long is sufficient. It is carried inward with the border of the parotid posteriorly and to the thick edge of the jaw anteriorly, in plain view. As the round stylo-maxillaris muscle comes into view anteriorly just beneath the edge of the jaw, the pouch is already open; the finger can be pushed into it, and when distended with purulent products these immediately flow out. The evacuation is effected by pressure, spooning and irrigation. Subsequently, drainage is provided by keeping the incision plugged

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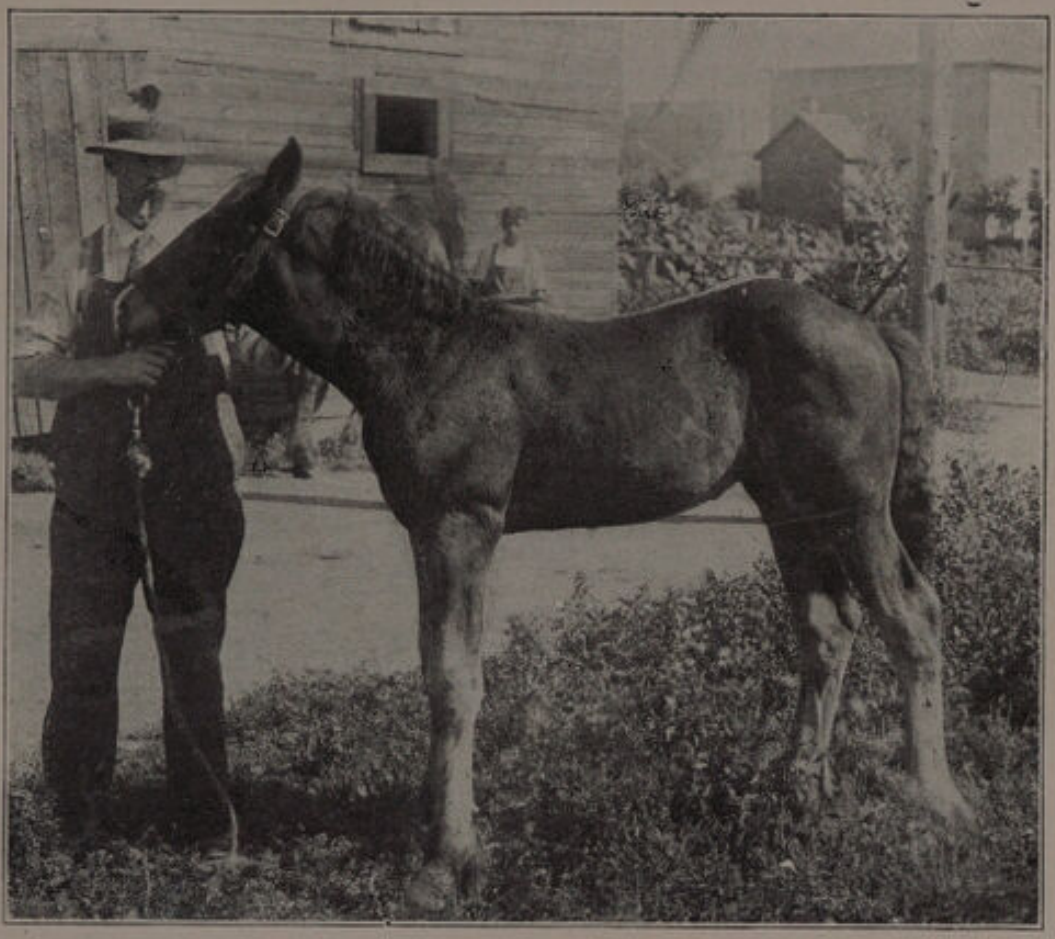
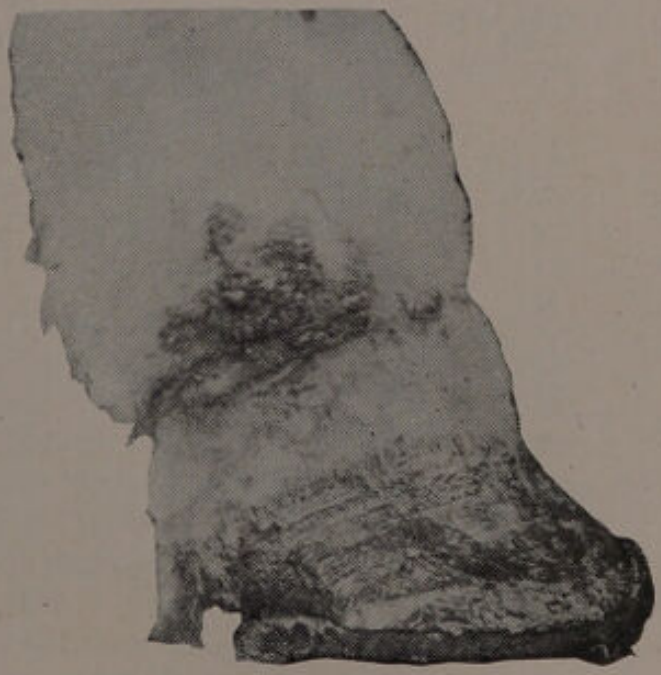
TABLE III.



Emphysema of the Guttural Pouch.

Hughes' Operation for Bog Spavin.



Grease Heel.

evacuating the accumulated air through an external incision the patient is cast and positioned. The mouth is opened wide with a mouth speculum and the soft palate incised along the median line from behind forward with a hooked shaped knife tied to a long stick. The speculum is removed to allow the patient to rid its throat of the accumulating blood. When the bleeding has ceased a curved probe pointed bistoury, also tied to a long curved stick, is carefully guided into the auditive tube turned downward and made to cut backward about an inch. If the wound heals without having disarranged the valve-like mechanism the operation will be unsuccessful.

OPERATION AGAINST RETENTION CYST (ATHEROMA) OF THE FALSE NOSTRIL

The integument forming the superior boundary of the false nostril of the horse is often the seat of a uniformly characteristic retention cyst about the size of a walnut, constituted of a well defined membranous wall enclosing a gelatinous, creamy or caseous substance.

When submitted to simple evacuation by lancing, the sac refills within a relatively short time, and if attempt is made to destroy the secreting membrane by injecting strong caustics a threatening, acute, local reaction supervenes. Several injections are required. The skin sometimes sloughs through; finally the cicatrization is exceedingly slow, and the patient becomes keenly sensitive about the head.

The only prompt curative treatment is total excision of the sac, by peripheral dissection, which should be carefully executed without evacuating the contents or accidentally snipping the skin boundary.

The cutaneous incision is made over the parallel to the axis of the false nostril. To facilitate access to the entire circumference it should overlap the enlargement above and below, and be held apart with the retractors. Hæmostats are applied to spurting vessels, which are numerous, and when the dissection is complete a painstaking hæmostasis is effected by torsion and then by packing the cavity firmly but not tightly with iodoform gauze. The cutaneous incision is then closed by three mattress sutures one-half inch from each edge, and interrupted sutures placed close together along the margin. These are clothed with collodion.

Twenty-four hours later the packed cavity is incised within the false nostril and the gauze removed; or the gauze may be pulled into the new incision with the forceps and allowed to sojourn another day, at the end of which time a good drainage orifice requiring no further attention will have been

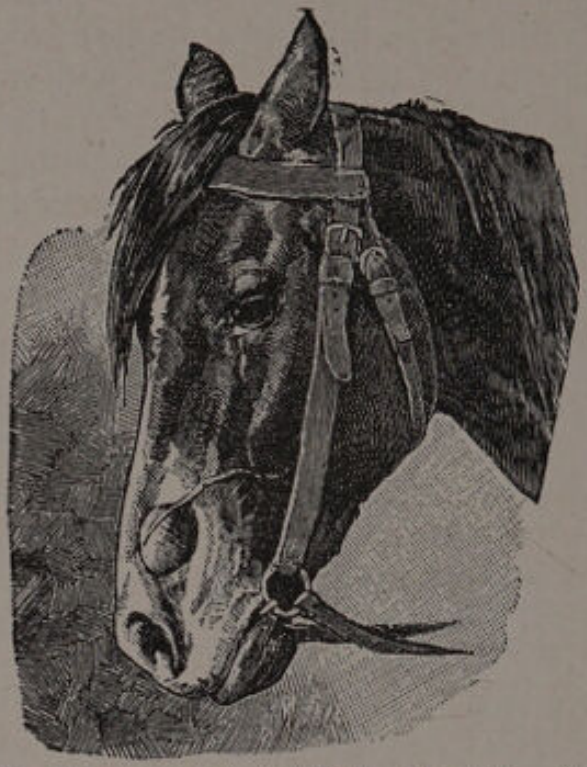


Fig. 243—Atheroma of the False Nostril. (Bayer.)

provided. The sutured incision heals by primary union and the cavity which discharges its secretions into the nostril cicatrizes rapidly.

OPERATION FOR ANAL ATRESIA

Anal atresia is only amenable to surgical correction when the blind extremity of the incomplete rectum approaches the anus. If the rectum is wanting entirely, as is often the case, or if it extends only partially through the pelvic cavity, there is no help. It is only when the skin alone remains imperforate that surgical relief can be successfully afforded. The congenital defect exists in variable degrees of extensiveness. The rectum may end in the vagina, in the bladder, in the urethra, or at the meatus urinarius by various cloacal arrangements; it may end in a blind extremity at any point in the pelvic cavity with impervious connective tissue intervening between the blind end and the undeveloped anus; it may be non-existent, the intestinal tube terminating with the

colon; or it may terminate in a blind end adjacent to the anus. The latter is the only operable one in animals.

If the malformation is discovered at birth intervention is

Fig. 244—Inoperable Anal Atresia. (Bayer.)

postponed until the rectum becomes more conspicuous by filling up with feces and intestinal gases two or three days later. Often the defect is not noticed at all until straining

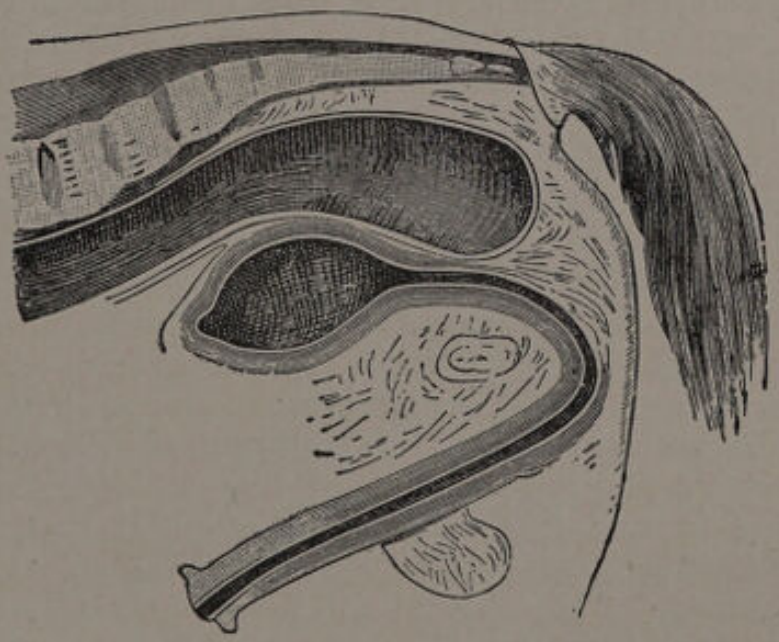


Fig. 245—Operable Anal Atresia.

to defecate attracts attention, and not infrequently the subject dies and is disposed of without the nature of its trouble having been determined. This is particularly the case with

sucklings receiving little individual attention, as pigs, pups, and kittens.

In males the perineum is a smooth surface with little to indicate where the anus should be, while in females the vagina serves as a guide for making the artificial perforation.

The technique consists of first excising an elliptical piece of skin and then searching for the rectum through the adjacent connective tissue by dissection with scalpel and thumb forcep. If after thus excavating to the depth of one to one and a half inches no trace of the blind end is found, the case may be given up as hopeless. On the other hand, should the end be encountered it is incised vertically, evacuated of its contents and cleansed and then approximated with the edges of the cutaneous incision by means of a continuous suture **without the least disturbance of its surrounding attachments.** If the distance between the skin and rectum is too great to effect the approximation by stretching it may be dissected loose and then drawn upon with forceps until the edges meet. It is rare, however, that this latter intervention ends favorably.

OPERATIONS AGAINST PROLAPSE OF THE RECTUM

Rectal prolapse may be **partial** or **complete.** When a part of the rectum becomes tumefied from injury the swollen part may protrude through the anus in the form of a rounded glistening mass that is more or less pedunculated from pressure of the sphincter ani. The proper procedure against this form is to administer a laxative, feed with soft, succulent feeds, return the mass manually and then administer frequent copious enemata to soften the stools. If the protrusion recurs only at the time of each act of defecation the manual replacement is repeated as required until the volume of the swelling has diminished. After two or three days, however, if the protrusion is extant, excision of the tumefied part by ligation becomes necessary. This is accomplished by weaving a tobacco-pouch suture of braided silk into the mucous membrane around the peduncle, drawing it taut, and then amputating the growth a safe distance from it. The subsequent behavior of the wound will depend entirely upon preventing injury from harsh feces by administering frequent enemata of plain water, three or four times daily.

In complete prolapse, which in fact is a real intestinal invagination, entirely different intervention is required. Here too, however, attempt should first be made to replace

and retain the displacement, which sometimes meets with flattering success. The author once restored a mare to perfect health by the following proceeeding: A dose of chloral hydrate (twelve drams) was administered in a drench. The protruding rectum was washed with a mixture consisting of cocaine hydrochloride, one per cent. and morphia hydrochloride, three per cent., after having emptied the rectum with a copious enema. The prolapse was then replaced and a strong tobacco-pouch suture was woven deeply around the anus, drawn fairly taut, and tied with a bow-knot. After two hours two ounces of laudanum were administered in a drench. During the succeeding two days the suture was untied at intervals of six to twelve hours and the rectum evacuated with enemata. Subsequently the suture was

Fig. 246—Anal Atresia with Cloacal Arrangement between Rectum and Vagina (Incurable). (Bayer.)

abandoned entirely, but the enemata were continued thrice daily for a week. The cure was permanent. Several similar procedures on small animals have been equally successful, but as this method is often contra-indicated on account of gangrene, approaching gangrenous states, and especially owing to uncontrollable straining, amputation is often the only possible recourse.

The technique is as follows: The patient is secured and anæsthetized; the rectum is drawn out so as to expose a healthy zone in front of the prolapsed portion; a series of interrupted sutures are placed around the whole circumference as near the anus as possible, and an amputation effected with the scissors one inch behind them.

In order to include every part of the circumference in the sutures the best plan is to use the tug-suture.

This is done by threading a needle at each end of a linen suture long enough to complete the circle and then sew off the protruding organ near the anus just as a harness maker sews a tug; the needles passing each other in the same tract for each stitch. To assure complete hæmostasia the stitches should not be more then ¼ in. long. In a long prolapse where the suturing would be difficult because of the long distance to reach to push the needle from within outward the rectum is incised longitudinally from the proposed point of

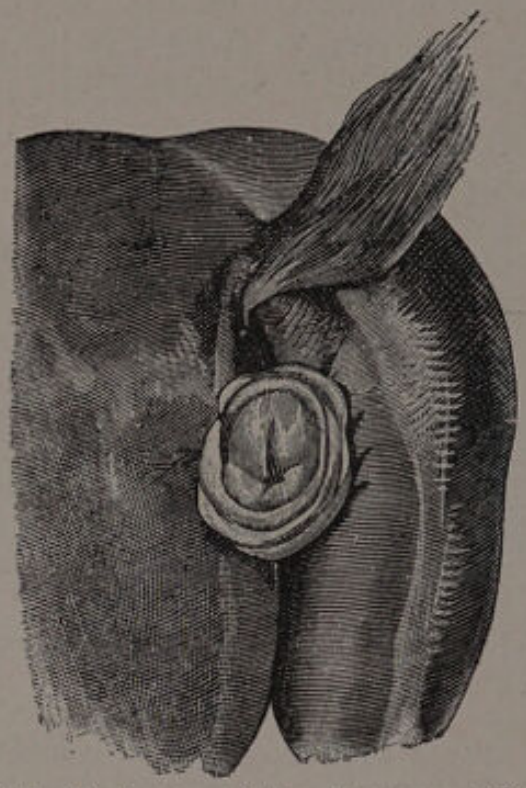


Fig. 247—Prolapse of the Rectum. (Bayer.)

amputation to the free end. This lays it wide open and give good access to the field to be sutured.

The rectum is then cut off with the scissors one inch from the suture line. It immediately disappears within the anus.

The very best subsequent management of the patient so operated upon consists of the administration of frequent copious enemata of warm water to prevent harsh friction from dry feces. Laxatives, drenches and succulent feeds are also helpful in the same direction. The sutures require no further attention.

The success depends upon whether or not the sutures

succeed in maintaining the continuity of the rectum until union by healing is safely affected. In large animals recoveries are rare, on account of the impossibility of immobilizing the sutured rectum against the movements incident to defecation. The artificial suspension of all intestinal movements by the administration of opiates, which brings a measure of

Fig. 248—Complete Prolapse of the Rectum. (Bayer.)

success to similar operations in human beings, is not practiced in animals, on account of the certainty of causing fatal intestinal complications.

OPERATIONS AGAINST PROLAPSE OF THE VAGINA

Like prolapse of the rectum this condition may be **partial** or **complete**. The **partial** form, which is common in dogs, is treated in the same manner as that of the rectum. Attempt is made to replace and retain it by simple means, and when this fails ablation by ligation and amputation is practiced, care being taken not to engage the meatus urinarius.

In the complete form, which exists chiefly in the larger animals, replacement and retention are usually successful. The technique consists of cleansing, manual replacement and then retention by means of quilled sutures applied to the vulval orifice. Two pieces of soft but firm rubber tubing

about five inches long, and braided silk, are employed for this purpose. Simple stitching of the vulva, packing the

Fig. 249—Prolapse of the Vagina in the Bitch.

vagina with gauze or similar substances, the application of rope trusses of various designs, are so many more or less

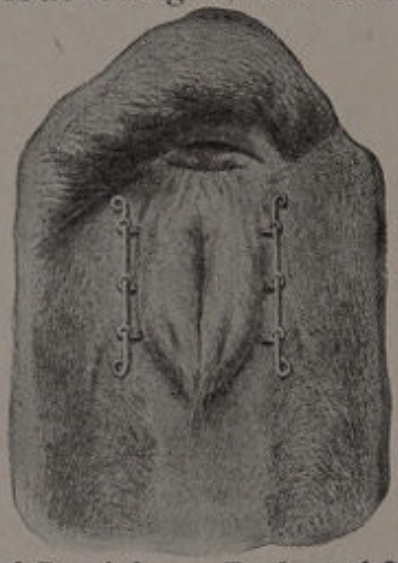


Fig. 250—Method of Retaining a Prolapsed Vagina in the Cow.

popular methods of accomplishing the same purpose. Another very popular method is to transfix the vulval lips with two

strong wooden skewers one above the other and then runing a figure eight retaining cord over the protruding ends.

When the prolapse recurs despite these efforts, amputation, as in prolapse of the rectum, is indicated. The operation is performed in precisely the same manner as in prolapse of the rectum, with the one exception that care must be exercised not to engage the urinary channel.

REPLACEMENT AND RETENTION OF UTERINE PROLAPSE

Prolapse of the uterus occurs chiefly in cows and mares. It is a post-partum accident whose cause has never been satisfactorily explained, but whose nature places it in the category of tubular invaginations. At the beginning it is uncomplicated by any pathological condition of the organ itself, but owing to the weight of the hanging mass the circulation is soon impaired and on account of its exposure to cold, to the filth of the litter and to the excrement that is certain to be voided over its surface, serious complications are sure to arise, unless immediately restored to its normal position.

The success of treatment depends, therefore, upon prompt reposition. The chances of recovery diminish with the duration of the prolapse, although they may also be influenced by the nature of the exposure.

TECHNIQUE.—The first step of the treatment is to remove the afterbirth without resorting to any force to detach it from points to which it adheres firmly. Shreds are left attached by trimming them closely rather than to wound the mucous membrane by tearing them loose. Particles of litter and dirt are removed with the fingers and the excrement on its upper surface may be moderately wiped off with a moist sponge. Further, no cleansing at this stage should be attempted, because washing with water, no matter how applied, cause straining that will defeat the purposes of operation, and besides ablutions are more apt to wash infectious matter into the recesses of the relaxed mucous membrane than to wash dirt out. **In fact, this cursory cleansing is better than washing.**

The next step is to reduce the size of the protruding mass by wrapping it tightly from fundus to vulva with a long muslin bandage after the fashion of Esmarch, which, in addition to compressing it into a smaller body, facilitates handling of its slippery surface. The patient is positioned in an

inclined plane by roping the legs and drawing the hind quarters toward the ceiling with a tackle.

The replacement is now effected by pressing forward as fast as the bandage is unwrapped from the vulva backward.

Fig. 251—Prolapse of the Uterus in the Cow (Lateral View).

(If the protruding mass is small the bandaging may be superfluous.)

After the organ has successfully fallen into its normal position, and the patient has been induced to rise it is ir-

Fig. 252—Uterine Prolapse (Rear View).

rigated with abundance of hot water which may, to advantage, contain a small amount of sodium chloride (one per cent.). The irrigation is continued until the clearness of the reflux indicates that all the dirt has been washed out.

The irrigation may be made more perfect by washing the walls of the uterus with a sponge or palm of the hand as the water is being pumped into it. **Straining at this stage usually indicates that something is wrong; probably the inversion is not completely corrected at every part.** In this event walking exercise will tend to help matters or the hand may be pressed here and there in each corner until all folds or misplacements are straightened out.

RETENTION.—Various methods may be employed to prevent recurrence. Packing the whole uterine cavity with sterilized cheese-cloth or towels, a method recommended by Martin, is given as an exceptionally successful measure. Among the methods of adoption, however, which seem to

Fig. 253—Method of Retaining a Prolapsed Uterus in the Cow.

be the most popular with veterinary practitioners, is the application of a rope truss that encircles the neck, the chest and the abdomen, passes backward on each side of the mammæ and over the pudendum, where three knots are tied, one below the vulva, one below the anus and one above the root of the tail, whence the two strands pass forward over the shoulders to be tied in front of the sternum. Still others depend entirely upon the skewers as recommended for prolapse of the vagina.

AMPUTATION OF THE UTERUS IN PROLAPSE (VAGINAL HYSTERECTOMY)

When the various methods usually employed to retain an inverted uterus have failed, or when the organ, by reason of its exposure, has become irreparably damaged, amputation becomes necessary. It is however, always, a **dernier resorte.** It may be employed in any of the animals, but is utilized to the best advantage and with the greatest measure of success in the cow. In mares the mortality is high; in fact recovery is very rare, while in cows favorable results

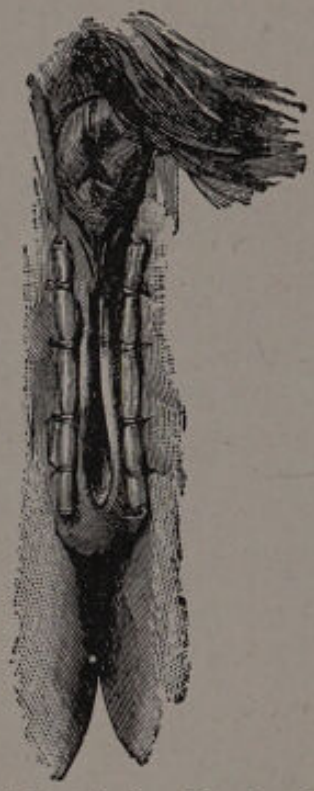


Fig. 254—A Method of Retaining Uterine Prolapse in the Mare.

are frequently obtained. In dogs prolapse requiring amputation does not often occur, and when the uterus does require ablation it is removed by prepubic abdominal section.

The operation of amputation of the uterus is an exceedingly simple procedure, performed as follows: The fundus of the protruding bag is incised and the hand inserted in search of a possible concurrent prolapse of the bowels. When this complication has been excluded, or, when extant, the bowels have been returned in the abdomen, a rope the size of a lead pencil (sash cord) and about a yard long or more, after being well disinfected and soaped to make it slippery, is double-half-hitched around the neck of the mass at the

vulval orifice, and drawn tight by all the power of two men, one at each end of the rope. To still further expedite the pulling the ends of the rope may be wrapped around wooden handles. The traction upon the rope should be slow and constant, allowing plenty of time for the tissues to yield to the pressure. When finally drawn as tight as possible the rope is secured with a knot and an amputation effected with the scalpel no less then four inches from the ligature. The stump is then replaced and retained against straining by packing the vagina with gauze and stitching the vulval orifice. This dressing is removed in twenty-four hours, after which gentle irrigation of the vagina with hot antiseptic solutions once a day completes the treatment.

Death from shock several hours after the operation, or from peritonitis later, may be anticipated.

OPERATIONS FOR ENTROPION AND ECTROPION

These inward or outward deflections of the eyelids are seen chiefly in dogs, the former being the most common. Although generally attributed to cicatrization of pre-existing traumas or inflammations, the cause is usually by no means plain. In fact the condition seems to develop independently of any perceptible lesion. In horses, however, both entropion and ectropion, can always be traced to the cicatrization of a definite injury to the eyelids, an incomplete laceration, a through-and-through laceration, a contusion, or a surgical wound necessitated in the ablation of a tumor.

Operative treatment, the only cure, is indicated as soon as the condition is discovered and should be given before the cornea has sustained serious injury from the inflammation provoked.

Operation for Entropion.—The operation consists of a simple excision of a section of skin, of melon-slice shape, with its concavity toward the ciliary border, and about one-quarter of an inch from it, followed by approximation of the edges with interrupted silk sutures. The excision is made adjacent to the most inverted part, the scalpel and thumb forceps being employed for the purpose. The wound thus made must be of sufficient width to bring the lid into slight eversion when drawn together with the sutures, otherwise slight inversion will recur. Failure to entirely correct the inversion may often be turned into success by excising the

hair follicles along the most inverted portion. (See Trichiasis, p. 478.)

Operation for Ectropion.—This operation is not always successful, but usually partially corrects the defect. It is performed by excising a triangular section of skin adjacent to the everted portion of the lid, and then bringing the two lateral edges together so as to fold up the skin along the base. In addition an elliptical piece of the conjunctiva may be excised. The cicatricial tissue formed during the healing of this peculiar wound builds a support for the flopping eyelid, while the cicatrization of the conjunctival wound tends to assist by drawing the edge inward. Resection of the conjunctiva alone, which is usually mentioned as the classical operation for ectropion, has never, in the author's hands, been successful.

Operation for Trichiasis.—When only the lashes fold against the cornea the best intervention is summary excision of the hair follicles without previous ceremony. This feat is executed by making a deep incision along each side of the eyelashes, beveled so that the bottoms will meet under the hair roots, and this effects a permanent destruction of the entire row of hairs by completely up-rooting it in situ.

OPERATION AGAINST COLD ABSCESS OF THE SHOULDER

Draft horses, rarely the lighter classes, are susceptible to the formation of a formidable, slow-forming abscess in the depths of the muscles underlying that part of the collar-seat that receives the major portion of the draft. This is located just above the articulation at the point traversed by the mastoido-humeralis, which muscle is therefore most frequently involved. The evolution of this characteristic condition of horses is analogous to that of cold abscess in general. The initial focus is a small abscess cavity in the prescapular lymph nodes while the surrounding connective tissue, at the expense of the muscular elements, forms into a more or less extensive fibrous mass (a new growth) that becomes permanent unless removed surgically. If left to run its course unmolested such an abscess usually shrinks up into a smaller permanent body, but its dormant pyogenic center will sooner or later become active again from the draft of the collar, and cause a recurrent phlegmasia more formidable than the preceding one. The remittent exacerbations each

expand the fibrous zone until the region becomes deformed with a permanent sclerotic growth of enormous dimensions whose periphery permeates the muscular elements, root-like, in every direction. Or, the abscess may point after sojourning apparently unchanged for several weeks, shrink up as if almost cured, point again, and then finally, after several such stages, end the same as the course just mentioned.

That some of these abscesses sometimes are botriomycotic is not denied, but that the botriomyces is the specific agent of all of them has been proven erroneous by numerous bacteriologic examinations and experiments.

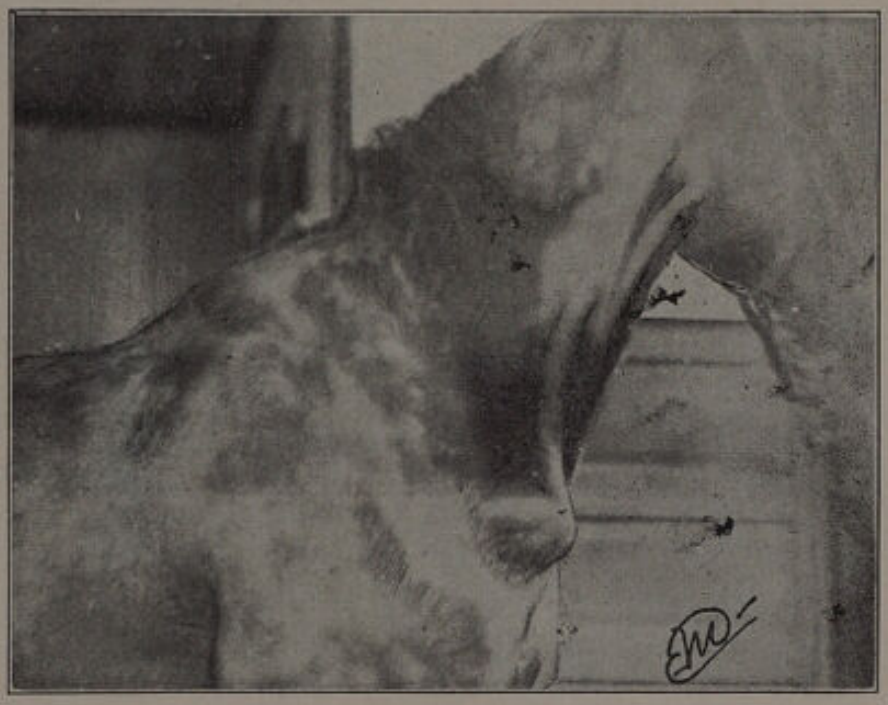


Fig. 255—A Typical Cold Abscess of the Shoulder.

In the face of the certain unfavorable course these characteristic abscesses always run, prompt surgical intervention should be recommended in every instance. The only occasion for delay is the existence of peripheral œdema, which always subsides after several days.

The operation described below is universally successful only if performed during the earlier stages of the disease, for if the pyogenic process has ended and the permanent growth has already become well rooted, total ablation is the only help.

EXTIRPATION.—The extirpation of such a fibrous mass permeating irregularly into the surrounding musculature from the prescapular nodes beneath requires careful dissection. There are vessels to manage in front, behind

and at each side of the growth, and beneath it a radical of the carotid artery and several radicals of the jugular must be ligated. In spite, however, of this dangerous field we succeed with proper use of hemostats and ligatures to control bleeding so completely as to obviate packing the cavity afterward. The dissection begins at the sides. The growths are drawn out with great force as the muscular tissue is separated from the fibrous tissue with the scalpel and tissue forcep. In this tense condition there is no bleeding. From time to time hold of the tumor forcep is relaxed so as to disclose any vessels that may have been cut. This dissection continues downward until the fingers can be pushed into the areolar tissue under the growth which can now be undermined by blunt dissection. Both sides having been thus dissected loose the growth now hangs by each end. The attachment posteriorly is tied off in sections and cut loose, then the growth is hinged forwards out of the cavity. The few bleeding vessels are snapped up and the cavity baled out. Often this exposes the jugular vein to full view and the pulsations of the carotid visible or easily felt with the fingers. The growth is still attached—anteriorly. The external part of this remaining attachment is muscle that must be tied off and detached. The internal or deep part consists of the prescapular lymph nodes, a large artery and several veins. A clamp forcep is now snapped on this remaining peduncle and the growth cut loose. Sometimes we have reinforced the clamp with a ligature and leave both to assure a safe hemostasia of these large vessels. More recently we have trusted entirely to the clamp which is left on forty-eight hours. The cavity is loosely wadded with gauze or with cotton dripping with mercuric chloride solution and the cutaneous lips held together with a tumor forcep. The cavity is sprayed several times daily with iodoform and ether mixture or with a solution of iodin and ether. Cicatrization is rapid.

TECHNIQUE. — (Enucleation.) — In fairly tractable horses it is possible to perform the operation in the standing position by aid of the twitch and side-line or stocks. The recumbent position is, however, always much more satisfactory, and is in fact, essential when a restive horse is to be dealt with.

The tumor is clipped, shaved and well washed with antiseptic water, after which a vertical incision, generally about four inches long, is made across its most prominent part. (If any fistulous tracts exist an elliptical resection including the

orifices in the excised zone is substituted for the straight incision). The incision is then carried carefully forward through the sclerotic wall into the abscess cavity, which, on account of small dimensions, may sometimes be difficult to find. When the contents have been evacuated the major portion of the growth is excised from center toward the periphery on both sides of the incision by slicing it piece by piece with the right and the left sage knives, each for its respective side. The slicing is continued outward in both directions as far as the pure fibrous tissue extends, and is discontinued as soon as a predominance of muscular tissue appears in the foreground.

Following this enucleation, the cavity is well seared with hot irons until all bleeding is arrested. The searing should be a thorough one, but some care must be exercised not to needlessly burn the skin along the edges of the incision nor the large bloodvessels at the bottom. It is the sides that need searing. Bleeding from the large vessels, sometimes cut in abscesses located near the jugular groove, should be arrested with forceps.

If any deep-seated bleeding that cannot be reached with the hot iron exists, it is controlled by packing, and if necessary by suturing the packing into the cavity.

Very little after-care is required. Dusting with a preservative powder (boric acid) to prevent putrefaction of the eschar and astringent washes after it has sloughed out, is the only treatment required. Cicatrization is rapid and the normal physiognomy of the shoulder is soon restored.

PROCEDURE AGAINST SEROUS SACS AND HOT ABSCESSES OF THE SHOULDER

In contra-distinction from the characteristic cold abscess previously described, draft horses are also frequently incapacitated for work by superficial lesions of no small importance. These are affections of young horses taxed with arduous labor for the first time, or of farm horses whose shoulders in the spring are tender after a winter's rest.

Serous sacs, sometimes erroneously designated as serous abscesses, are accumulations of blood serum in the subcutaneous or sub-fascial space, due to bruising. They are located just above the level of the articulation at the lower part of the collar seat. They may be unilateral or bilateral and of a variable volume, first small and more or less diffused over a space as large as the hand, and then becoming

conspicuous, fluctuant and tense from the outpouring of more serum. If the affected part becomes invaded with pyogenic microbes, a hot (acute) abscess results.

The importance of these apparently trivial injuries lies largely in the fact that they incapacitate horses for work at a time when their services are in great demand.

No matter what line of treatment is followed, it requires

Fig. 256—Serous Sac of the Buttocks.

some time to restore the affected part to its normal condition, or even to a condition that will not immediately react against collar pressure. The skin having been detached and separated from its underlying relations by the fluid, will undergo a slow process of re-attachment from periphery to center, despite every effort to hurry matters.

TECHNIQUE.—Our plan of handling these injuries and the plan applies equally well to serous sacs of the but-

tocks (Fig. 256) caused by breechment bruises, is as follows:

Wash and disinfect well a small field about two inches square at the very lowest part of the sac, shave the hair and paint well with tincture of iodin, then evacuate the contents by an incision three-quarters of an inch long made with a sterilized scalpel. Part the lips of the incision with a sterilized forcep and press out every drop of serum by gentle strokes of the hand over the sac. Control completely any bleeding from the small vessels that may have been cut. Generally there are one or two vessels that bleed stubbornly. These must be controlled, otherwise the bottom of the cavity may fill up with a blood clot that will complicate matters. If the horse is in the hospital where aseptic attention is assured we simply wad the incision loosely with a wick of iodoform or sterilized gauze twice a day and at each dressing carefully press out the serum that is accumulated. After four to six days of this careful dressing the sac is already closed above; only the lower part still yields a limited amount of serum when pressed with the hands, and even if through some error the incision has become infected the suppuration is slight and the infected zone limited to its immediate environs. At the end of a week to ten days no further attention is required.

In the outside practice where aseptic wound dressing can not be expected we apply a drainage tube instead of the gauze wicks and then forbid any interference except that of faithfully pressing out the serum twice a day by gently stroking the sac with the hands from above downwards. The tube for this purpose is a quarter-inch soft rubber hose about one and one-half inches long. We perforate one end with two holes and then transfix the hose just behind them with a finishing nail one and a half inches long. The tube and nail are then passed through the incision into the sac, leaving the other end protrude. The nail prevents the tube from falling out, as it now lays transversely across the incision within the sac. The tube may then be fixed by taking a stitch in the skin just above it. The tube and nail must have been previously sterilized and then handled so as to avert contamination while being put into place. The wound around the tube may be peppered each day with iodoform to prevent infection from without. At the end of six days the tube is removed but the stroking of the sac with the hands should be continued as long as there is any discharge.

A trial of these methods of handling serous sacs of horses will soon convince the most skeptical that such procedures

are far superior to lancing and packing with oakum soaked in turpentine and linseed oil.

Unfortunately the foregoing plan applies only to the more recent cases. When a serous sac becomes old it is bounded with a pretty well organized wall consisting of fibrin permeated with fixed cells and leukoccytes which later may even develop into a membrane of connective tissue. The corpuscles in the serum dissolve and leave a pure amber colored fluid as the contents of a sac that will sojourn indefinitely. When this stage has been reached it is best to lay the sac wide open, wipe out the interior with a sublimate caustic and then treat it as an open wound. Such cases will disable horses for six weeks or more, while the recent ones should be well in two weeks.

Note.—The success of this simple operation depends upon absolute repose of the affected area, and upon strict asepsis. If the sac is harshly handled in the operation, or if attempt is made to work the patient with a padded collar, the method is useless, because the sac, stimulated by injury, will refill, become painful and finally will require lancing.

HOT ABSCESSES of this superficial variety are analogous conditions with the exception that they develop under the influence of pyogenic infection,—a circumstance which at once suggests entirely different treatment. Small abscesses of this kind will cicatrize promptly after being simply lanced and evacuated, but when the sac is large and a wide zone of skin has been separated from the underlying muscles, healing will be slower than in the serous sac above described.

TECHNIQUE.—The very best method of encouraging a rapid restoration is to evacuate the contents through a small incision, irrigate the cavity with a weak but clean antiseptic solution and then apply a perforated, soft rubber drainage tube which is retained with a stitch or two at the incision. The tube, which should extend to the uppermost part of the sac, is retained about five days, at the end of which time the abscess cavity will have almost narrowed down to the space occupied by it. Thereafter the pus is squeezed from the tract from above downward twice or three times, until cicatrization is complete.

Note.—Delayed cicatrization of shoulder abscess is often due to meddlesome interference, e. g., injections of strong antiseptics and caustics, or packing with oakum, gauze, etc.

COLLAR GALLS.—Common galls of the callar seat are due to the rubbing off of the epiderm, partially or entirely. These are usually trivial matters if properly managed, but

when neglected day after day as the horse is forced to work on, the dermis becomes bruised and infected and a more serious lesion is produced. The proper attention of a collar gall is of course rest, but in lieu of this such expedients as drawing out the padding of the collar at the level of the sore or padding it above the sore are often worth recommending. It is, however, a fact that no changes of the collar are entirely satisfactory. The collar seems to rub the sore despite such attempts and not infrequently a sore develops at the new seat of pressure. A breast collar so often recommended for a horse affected with sore shoulders is a mighty poor substitute for a hame collar in a horse that must work hard. They generally cause breast sores that are more disabling than those on the shoulder. The best treatment for a simple fall is mercuric chloride solution one part to five hundred of water. This solution is rubbed briskly into the gall with pledgets of cotton at noon and at night. There are no astringent remedies that will equal this excoriation. In addition the collar is well cleaned twice a day and at every opportunity during the day the sweat is rinsed off of the shoulder. When the dermis has become tumefied there is no better remedy than common white lotion. A more popular wash for a veterinarian to prescribe as a general gall cure consists of methylin blue, one dram, tannic acid, one ounce and denatured alcohol, one quart. This will dry up sore shoulders very fast and while no means an adequate substitute for rest—the real cure—it usually gives good satisfaction.

PROCEDURES AGAINST CUTANEOUS HYPERTROPHY OF THE COLLAR SEAT (BULL'S EYE SHOULDER)

On the shoulders of work-horses there frequently develops a characteristic disc-like enlargement consisting of a loose, circular zone of thickened common integument upon whose surface is a central denuded spot averaging about one inch in diameter. The growth is naught but skin that has hypertrophied and then loosened by constant collar friction and pressure. In the center where the pressure is greatest the epiderm is destroyed and refuses to undergo sufficient regenerative activity to effectually re-clothe the breach against subsequent collar friction. The hypertrophied zone will contract into a smaller body and the denuded zone will re-cover with epithelium, if adequate protection against pressure is

provided or if the patient is given complete rest for several months, but as soon as work is resumed the same condition recurs until finally it becomes permanent.

This lesion, although by no means painful to pressure, requires prompt surgical intervention to prevent it from increasing into a larger and larger growth that will require an interference of proportionately greater magnitude, with possible permanent deformation of the collar seat.

Technique of Ablation by Dissection and Suturing.—After washing, shaving and disinfecting the growth and its surroundings, an elliptical incision that includes within its outlines the denuded zone and adjacent scar tissue is made across the growth from above downward. The incision should overlap superiorly and inferiorly, better to expose the growth for dissection.

The best plan of operating is to pinch up the disc tightly in the ecraseur chain and then cut it off without further ceremony. There is less bleeding if the ecraseur is tightened as the cutting proceeds. The operation must be done with sterilized instruments and only after having shaved and thoroughly disinfected the whole surface of the disc and its immediate surroundings, and as the wound is one of large dimensions located in a place inconvenient to protect against contamination we paint the whole raw surface with tincture of iodine after the operation and then twice a day during the first four days. After that we apply white lotion until the healing is complete which is usually six weeks.

The other plan that has given us good results is the resection of the disc with an oblong island of skin large enough to include the denuded circle. When the resection is complete the redundant skin is trimmed along the wound edges until the flaps lay flat to the body without tension, then each edge is separately hem-stitched to the body with a continuous suture. Before suturing it is important to effect a perfect hæmostasis because the cavity formed by the blood clot under the edges invite complications, retards healing and tends to ridge the surface by filling up with connective tissue. Suturing the edges of the skin flaps together is never a good operation even when they heal by primary union because the cavity under them prevents the skin from fixing itself to the body, and when union does not take place there is an ugly gaping wound and cavity to fill up with granulations before healing actually begins. This usually disables a horse indefinitely. On the other hand by trimming off the redundant skin and then hem-stitching the edges down to the body

there is no cavity to fill up and the wound never gaps even if it becomes infected.

Weber's Method.—After cleansing the field as above the ecraseur is passed over the growth, skin and all, and tightened so as to severely tax the strength of its chain. The skin around the entire peduncle is now incised through and through about one-half inch outward from the chain. Usually this causes the inner edge of the skin to slip through the chain-loop, which thus spontaneously transfers the chain into the incision. The chain is again drawn tight and after waiting a few minutes for the tissues to yield to the pressure, the growth is at once cut completely off with the scalpel.

If the skin should refuse to slip through the loop when incised, the chain is loosened slightly and transferred into the incision, after which the operation proceeds as before mentioned.

Although the wound produced by this peculiar operation is a large one, often stretching over an area that is alarming, it heals with remarkable rapidity and always leaves a much smoother shoulder than ablation by dissection and suturing, and the resulting scar, while hairless, is less susceptible to collar injuries.

OPERATION FOR SITFAST

Sitfast, a name consecrated by usage, refers to local, cutaneous dry gangrene, resulting from harness pressure. The constant pressure of a part of the harness or collar upon a circumscribed spot destroys first the epiderm and papillary layer of the skin and the slowness of the destructive process leaves ample time for the moisture to evaporate therefrom. If the pressure continues the process finally extends through the skin, a groove of demarcation forms around the circumference, infection enters the subjacent space, the mass falls out in a single, leather-like body, and then cicatrization proceeds. The evolution of this process is often very slow; a sitfast may sojourn without adjacent reaction for months, and as it is accomplished with considerable pain and tends to spread inward, excision (the only successful treatment) should be immediately effected. This is particularly the case with sitfast of the neck, which often extends into the ligamentum nuchæ and causes fistula of the withers.

TECHNIQUE.—After shaving the surrounding skin and disinfecting the field the edge of the sitfast is lifted up at one part by dissection in order to determine the depth of the

dead elements. When this has been determined the dissection is carried around the entire circumference at the same depths and then evenly underneath. If upon lifting the part off ischemic zones are found to exist here and there, the excavation is made as deep as is necessary to bring a uniform capillary oozing over the whole surface. It is rarely ever necessary, except in old, advanced cases, to carry the dissection entirely through the skin.

The wound must be treated with mild antiseptic powders and astringent remedies avoided.

As the operation is attended with considerable pain, adequate restraint is essential.

ABLATION OF THE EYE BALL

The globe of the eye, including its closely attached appendages, sometimes requires ablation in horses, dogs, and oxen. The most common afflictions necessitating the operation are malignant neoplasms, serious infections supervening penetrant wounds and lacerations of the cornea, and forward dislocations of the ball from violence. The first two are encountered in all the animals, while the latter is exclusively an accident of dogs.

The operation is one that must not be too hastily employed for these several afflictions. It is a serious operation and sometimes ends fatally from intra-cranial complications, especially purulent cerebral meningitis. In view of this fact the possible benefits of simple procedures, such as enucleation of the contents of the globe, or excision of harmful portions alone, should be given first consideration. The major operation of excising the entire globe and attached appendages, from the ciliary margin to the optic foramen, must be reserved for serious conditions actually demanding it, the chief ones of which are extensive cancerous conditions of horses and oxen and incurable dislocations of dogs. In the treatment of growths, however, ablation may be prudently decided upon early on account of suspected malignancy, and in order to prevent the disease from developing into a diffused inoperable condition by encroaching upon the surrounding inaccessible structures. Since cancer of the eye, which is a very common affliction of horses and oxen, may develop rapidly from a small granular elevation on the conjunctiva to an enormous, cauliflower mass implicating all of the structures of the orbital cavity, the intervention must come early enough to head off the march of the disease in

every direction, and in order to prevent recurrence every diseased part must be excised by liberal transgression into the healthy surroundings, even if the entire globe must be sacrificed.

When such growths have advanced into the surrounding tissues after already having destroyed the globe, they may be deemed incurable and the subject should be condemned for slaughter.

TECHNIQUE.—The operation is performed in the recumbent position under profound anæsthesia. Local anæsthesia is not sufficient, and the strictest asepsis must be respected.

The eye is held open with strong silk threads stitched through the center of each eyelid.

An incision, encircling the entire eye is made through the conjunctiva, about one-half inch behind the ciliary margin, excepting at the canthi, where it more nearly approaches the border. After carrying the incision inward equally at every part so that the knife passes easily into the sub-conjunctival space, blunt dissection with the handle of the scalpel or with the index finger is continued backward toward the optic foramen until the globe hangs loosely in the orbit, attached only by its constricted peduncle. A double-half hitch of strong braided silk is now passed over the globe and fixed upon the peduncle as far back as possible. It is drawn as tight as the finger tips can draw it, and then secured against slipping by adding a knot or two. The globe is then excised well in front of the ligature, leaving a funnel-shaped stump to prevent slipping.

The cavity is irrigated moderately with mercuric chloride solution, and then packed with antiseptic gauze, which is retained by tying together the two sutures used to separate the eyelids during the dissection.

In removing large growths which obstruct free admission into the cavity, each canthus may be incised outwardly to enlarge the orbital opening.

AFTER-CARE.—The wound must at all hazards be prevented from becoming infected, and the ligated stump from putrefying, by painstaking irrigations of hydrogen peroxide followed with liberal dustings of iodoform.

RADICAL NAIL PRICK OPERATION

DEFINITION.—By "radical nail prick operation" is meant the evacuation of purulent synovia from the navicular sheath by removing a part of the plantar cushion and dividing the plantar aponeurosis.

INDICATIONS.—When a street nail pierces the side of the frog at the level of the navicular bursa and then penetrates through the perforans tendon (plantar aponeurosis) serious consequences usually ensue. The wound discharges

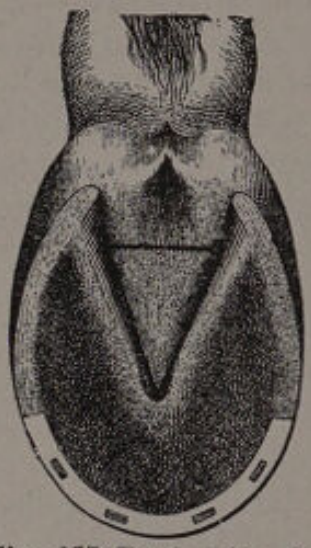


Fig. 257–Dark Line Indicates Position of Incision through the Frog. (Reeks.)

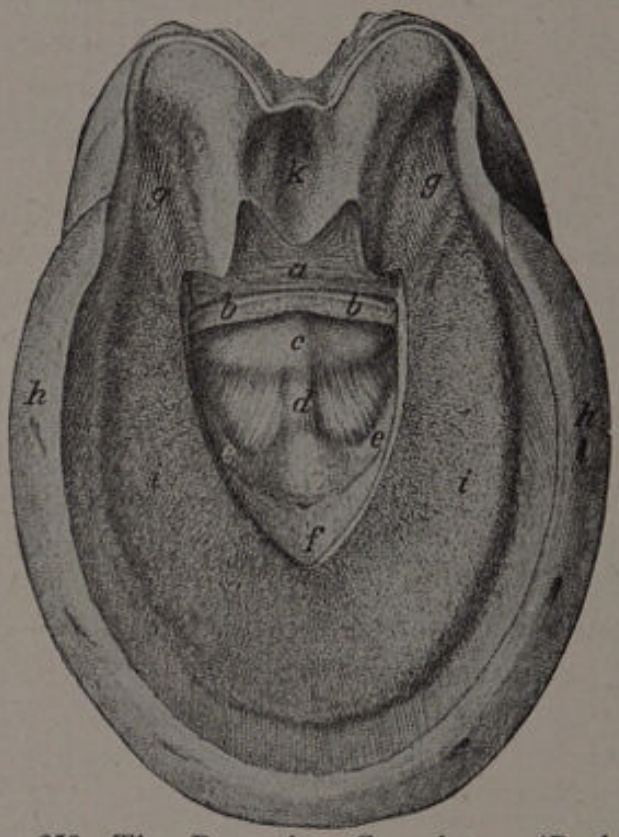


Fig. 258—The Resection Complete. (Reeks.)
a, Anterior Wall of Frog after Excision.
b, *b*, Section of Perforans Tendon.
c, Navicular Bone
d, Inferior Navicular Ligament.
e, *e*, Semilunar Ridge.
f, Exposed Part of Os Pedis.
g, *g*, Bars.
k, Remainder of Frog.
h, Shoe.

purulent synovia, the patient falls sick, and unable to support weight on the affected leg for weeks and sometimes months, often breaks down in the opposite fetlock and hock, becomes emaciated and bedridden and frequently succumbs to exhaustion after having successfully escaped the first stages of the indisposition.

Dependent upon the acuity of the infection, the cases vary in severity from the mild one that passes safely toward recovery without ever developing any more threatening symptom than that of walking upon the toe for several weeks, to the severe case that ends fatally after eight to ten days of total disability and horrible suffering. Between these two extremes are all the intermediate ones, some of which make excellent recoveries from ordinary treatment after several months, while others are left permanently lame. The decision to submit a patient so affected to this operation (which is by no means a trivial intervention) must not be a hasty one. The operation itself, almost universally, leaves the patient more or less permanently lame, no matter whether the condition for which it was performed was trivial or seri-

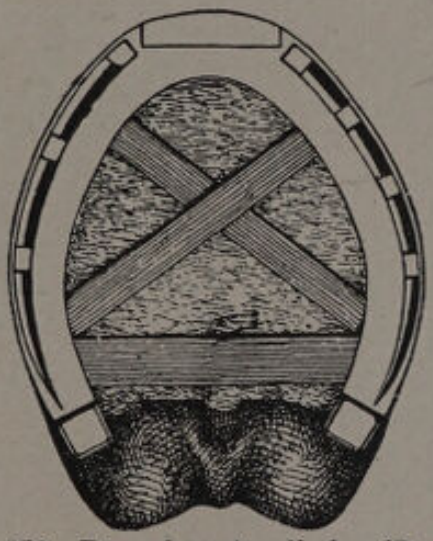


Fig. 259—Dressing Applied. (Reeks.)

ous, because in sacrificing the navicular bursa, adhesions which form between the plantar aponeurosis and navicular bone, retain a persistent hyperæsthetic state for many months and finally end in deforming the foot and constraining the pedal articulations, for all time thereafter. In view of the fact, therefore, that the trivial cases and those of moderate severity, terminate quite as well, or even better without this intervention, it is evident that its usefulness is limited to the serious cases only. In fact it can be prudently recommended only where the life of the patient is in danger from pain, infection, advancement of the inflammation into the articulation or adjacent zones and exhaustion. In these events it is an emergent intervention of unquestioned value, as in every instance the threatening symptoms immediately subside. The fever drops, the accelerated respirations diminish, the appetite returns and the patient for the first time takes a

good sound rest in peaceful decumbency. The claudication, however, does not immediately disappear. On the contrary, it may even accentuate. The patient, which before the operation may have supported some weight on the toe, supports no weight whatever for at least three weeks afterward, and then goes slowly onward to incomplete recovery.

TECHNIQUE.—The patient is placed in the recumbent position, the digital nerves on both sides of the affected leg are cocainized, and a tourniquet is wrapped upon the cannon. If secured upon the table the affected foot should be undermost because the sole can then be made to face upward by

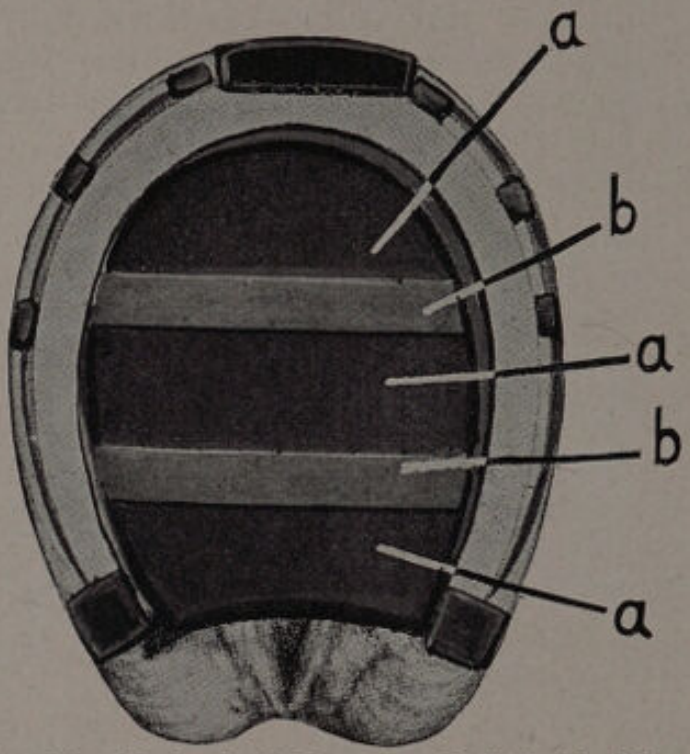


Fig. 260—Method of Dressing Nail-Prick Wound.
a, *a*, *a*, Sole Leather.
b, *b*, Retaining Plates of Hoop Iron.

simply placing a padding beneath the leg. If the leg is uppermost the sole will face downward into an almost inaccessible position. If ropes are used the patient should be rolled into the dorso-lateral position so that the soles will face in an upward direction toward the operator.

After clipping the hair from the lower part of the leg and paring the horny sole and frog as thin as a wafer (which step might precede the casting) the entire sensitive frog from a point about one inch from the heel to its apex, is removed. This excision is effected by first making three incisions, one across the frog one inch from the heel carried down to the very depths (about two inches) and one on each side of the

frog from the transverse incision to the apex; and then grasping and drawing upon the triangular island thus isolated with a strong tumor forceps, while it is dissected from the plantar aponeurosis from before backward. Portions of the frog which still remain attached to the plantar aponeurosis are then carefully shaved off until the tendinous fibers become visible and the outlines of the navicular bone can be traced with the fingers. It might be well to remind the reader that the sensitive frog (plantar cushion) is firmly fused with the plantar aponeurosis and cannot be separated from it except by sharp dissection.

A through-and-through transverse incision of the plantar aponeurosis is now made over the level of the navicular bone, whose axis it should follow as near as possible in order to avoid cutting into the inferior navicular ligament if made too far anteriorly, or the superior ligament if made too far posteriorly, which accident would at once invite the spread of the infectious matter directly into the articulation. Necrotic portions of the tendon around the tract of the nail are excised, the fibro-cartilage on the inferior surface of the bone is curetted off and the whole area of the sheath is swabbed with pure tincture of iodine and then packed with iodoform gauze.

The foot is dressed by packing the surgical cavity with antiseptic cotton and wrapping with abundance of muslin bandages.

At the end of twenty-four hours the dressing is removed, the sheath irrigated with hydrogen peroxide and then swabbed with tincture of iodine, the surface of the wound dusted with iodoform and the cotton and bandages reapplied.

On the second day the foot is shod loosely with a flat shoe which is utilized subsequently to retain the daily antiseptic and protecting dressings, consisting of iodoform dusted over the wound, cotton wadding, a piece of stiff leather that fits evenly but loosely into the inner circle of the shoe, and two pieces of hoop-iron to hold the latter in place. (Fig. 260.)

This daily dressing is continued until granulations have filled the cavity and all discharge has ceased.

OPERATION AGAINST URACHAL URINATION

Previous urachus of the young is a very common affliction of all domestic mammals. The navel extremity of the urachus fails to close and as a consequence the urine, instead of being voided through the urethra, continues to flow through the

pre-natal channel. The abnormality, which is usually noticed a few days after birth by the wetness of the skin surrounding the navel, either corrects itself without interference in a week or so or else persists until complications from infection end disastrously. Only small quantities of urine may flow through this unnatural channel, or the entire capacity of the bladder may be discharged at each act of micturition. Generally, however, the discharge occurs through both channels, a small part through the urachal and the major part through the urethral route.

The disease is very frequently complicated with navel ill and other afflictions of navel origin whose causative microbes are afforded a free portal of entrance, while the pervious condition persists.

Various methods of treatment have been recommended, and among those in vogue are: (1) Antiseptic washings of the umbilical region to prevent microbian invasion as the urachus undergoes spontaneous closure. (2) Daily irrigations of the urachus with antiseptics and astringents. (3) Local antisepsis and frequent catheterization. (4) Irrigation of the urachus followed by the introduction of caustics into the orifice. (5) Actual cautery of the orifice following antiseptic irrigation. (6) Closure by ligation after having thoroughly irrigated the urachus with strong antiseptics.

The latter, besides being the author's choice, seems to be the most popular procedure among the experienced practitioners in the great breeding districts of the Mississippi Valley.

Pervious urachus would be a rare affection if the umbilical cord of animals were given proper attention at birth. A clean bed, ligation of the cord with an aseptic ligature and thorough antisepsis of the navel until it has healed would not only prevent many of the cases of pervious urachus but would also almost entirely eliminate the infections of navel origin.

TECHNIQUE.—The patient is placed in the dorsal recumbent position and the umbilical region clipped, shaved and thoroughly washed with mercuric chloride 1-500. Although the cleaning up of the umbilical region is somewhat difficult on account of the loose, delicate and wrinkled condition of the skin, and the opposition of the patient, the obstacle must not be made an excuse for perfunctory disinfection. The operation must start with a clean field, and with a well secured patient.

The urachal channel is first patiently irrigated with pure hydrogen peroxide by means of a long-piped syringe (ample

time being allowed for each syringeful of the injected liquid to foam from the orifice) and then with mercuric chloride solution 1-1000 until good disinfection is assured. The hydrogen peroxide may be injected into the bladder with impunity while the latter, on account of its toxicity, should be used more prudently.

The protruding urachus is then drawn up with tumor forceps or with a piece of suture passed through its end, and a ligature fixed to its base as follows: A needle armed with two strands of strong braided silk is passed through the loose skin behind the urachus at the level of the abdominal surface, back at the same level in front of it and then tied as tight as possible.

The parts are protected against putrefaction by cleanliness of the litter and by antiseptics. In hot seasons special care in this connection is essential.

When urachal urination is accompanied with systemic complications, especially if the articulations are already announcing the existence of navel ill by tenderness and swelling, closure of the urachus by ligations should not be practiced. In such cases antiseptic and astringent irrigations must be depended upon exclusively as local treatment and the systemic complications must be managed by internal medication of the young and the mother.

RESECTION OF THE PREPUCE IN HORSES—(CIRCUMCISION)

Circumcision is practiced in horses for **hypertrophy** of the **prepuce,** when this condition causes impotence or chronic paraphimosis. Inflammations of the penis, obstinate œdemas of the penis and sheath, or even local injuries to the prepuce itself are always very prone to end in a thickening of the preputial fold into a hardened mass that obstructs the free movement of the penis, and in stallions prevents normal copulation. When the condition causes chronic paraphimosis in geldings or when, in stallions, it incapacitates the individual for breeding purposes, the only resource is resection of the hypertrophied mass and approximation of the skin gap resulting therefrom.

TECHNIQUE.—The horse is secured in the dorsal recumbent position. A general anæsthetic may be administered, but local cocainization of the penis subcutaneously just behind the enlargement to be excised will answer. For this latter purpose a two per cent solution is injected hypo-

dermically in a circle around the entire organ. The penis is held out by means of two pieces of tape, one hitched tightly some distance behind the enlargement (which also serves as a hæmostatic tourniquet) and one just behind the glands. The dangling ends of these two tapes are placed into the hands of an assistant who thus holds the organ firmly stretched into an operable position. The penis and internal surface of the sheath are given a good washing with brush, soap and water, and then with a strong mercuric chloride solution.

Fig. 261—Paraphymosis due to Chronic Erection in a Gelding 9 years old.

Two incisions encircling the enlargement are made so as to meet at each side of the raphe inferiorly, and so that the distance between them superiorly will dispose of the redundant skin. Superiorly, they should be separated four inches, or even more, according to the size of the enlargement, gradually converging as they approach the raphe inferiorly. A subcutaneous resection of the hypertrophied tissue is then made by sharp dissection with scalpel and thumb forceps. The skin flap, to facilitate matters, may be drawn out of the way with tenacula in the hands of an assistant who is also engaged in bailing blood. When the dissection has reached the level of the penis the enlargement may be detached by blunt dissection, as it has no firm connection with the body of the penis.

The uppermost tourniquet is then removed to allow the vessels, requiring attention, to bleed. These are carefully managed with forceps or ligatures according to their size.

The gap is closed with two sets of sutures,—mattress sutures about an inch apart, placed an inch or so from each edge of the wound and interrupted sutures, a quarter of an inch apart along the edges.

The part is dusted with iodoform and the penis replaced into the sheath, where it is retained by taking a stitch or two across the sheath orifice. On the third or fourth day the sheath stitches are untied and the penis withdrawn, to be submitted to the necessary antiseptic treatment, after which it is replaced and retained by again tying the same stitches.

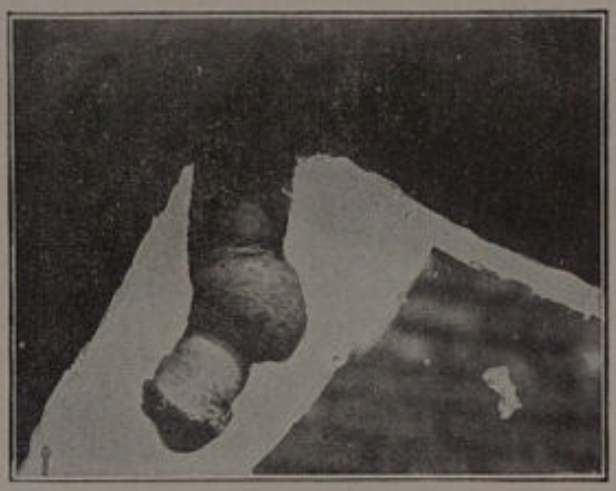


Fig. 262—Paraphymosis due to Chronic Hypertrophy of the Preputial Fold. An Indication for Circumcision.

At the end of eight days the wound stitches are removed and if primary union has occurred the penis is allowed its freedom.

Prof. John W. Adams performs this operation in preference to amputation for all cases of paraphymosis in geldings but removes a cuff 4 to 6 inches long of even dimensions around the whole penis, and then brings the edges together with a special suture that dips into the substance of the penis at the middle of the denuded zone to secure against gaping.

EXTIRPATION OF THE MEMBRANA NICTITANS

INDICATIONS.—Removal is sometimes necessitated when this cartilaginous organ obstructs the cornea or irritates the eyeball. In certain rare cases, difficult to explain, the membrana nictitans permanently lies in an outward position so as to partially cover the internal zone of the cornea, and thus causes defective vision and maintains a constant

watery condition of the affected eye from the irritation provoked. Extirpation of the redundant portion is the only remedy.

The most common disease, however, requiring extirpation, is tumors of the mucous membrane. The conjunctiva covering the membrana nictitans is very frequently the origin of growths which, if not promptly extirpated, soon encroach upon the adjacent structures and thus develop into conditions requiring interventions of greater magnitude,—ablation of the eyeball, etc.

Then finally there is deformity of the cartilage following traumatisms. A serious inflammation of the membrana nictitans occasioned by violence may cause the cartilage to crimp along the free border and thus press upon the globe with harmful effect.

TECHNIQUE.—The operation is best performed in the recumbent position with aid of local anæsthesia, induced with cocaine ten per cent dropped into the field. Attempts to extirpate even portions of the organ in the standing position often are unsatisfactory on account of the impossibility of immobilizing the head.

The eye is first disinfected with boric acid solution and then anæsthetized with the cocaine solution. The latter is given ample time to penetrate the mucous membrane.

The lids are held apart with two stitches hitched into the borders of each and the membrana nictitans is drawn out with a third stitch hitched through its free edge. An assistant holds the eye open with the two lid stitches and the operator draws upon the organ with the third one as it is dissected loose with the scalpel or scissors.

The best dissection to effect a rapid ablation of the membrana nictitans is made as follows: The organ is drawn outward with the stitch, and the mucous membrane which connects it to the eyeball beneath is incised through and through from above downward. Then after drawing it forward as far as possible the incision is carried through the mucous membrane covering its external surface. A snip at each border (superior and inferior) now liberates the cartilage so that it can be torn out by traction, with the assistance of blunt dissection effected with the handle of the scalpel. If the cartilage resist avulsion the refractory attachments are snipped here and there with the blade of the scalpel as the traction continues.

By employing this method bleeding will be nominal and can easily be controlled by packing the cavity with gauze and

holding it in place by tying the lid stitches together. To facilitate removal of the gauze its end is left protruding from the canthus.

After two or three hours the lid stitches are untied and removed and at the end of twenty-four hours the gauze is withdrawn.

Cicatrization follows without much reaction if asepsis is respected throughout the operation. Irrigations of the wound are not resorted to unless pronounced sepsis ensues, as they tend to provoke opposition from the patient.

ABLATION OF THE MAMMAE

INDICATIONS.—Ablation of the mammæ may be found necessary in all of the domestic mammals, when these organs are affected with incurable disease that threatens the general health or else tends to advance beyond the limits of the affected gland. **Tumors,** both benign and malignant, very frequently develop in the mammary glands of mares, cows, bitches and sows. In fact these organs are relatively more susceptible to tumors than any other part of the body, and as such morbidities will yield to no medical application, ablation is the only choice. Extirpation of tumors that transgress into the glandular tissue, without sacrificing the whole gland, is always an imprudent intervention, because of the certainty of recurrence in the case of malignant neoplasms, and because in the case of benign growths the partially removed gland will behave badly at each new period of lactation.

In meat producing animals parts of a mamma invaded by a new growth may be removed, preparatory to fattening for market, but in animals to be kept for breeding or working purposes total ablation of the affected gland and all of the integument implicated, should be at once performed, in order that the general health be protected against troublesome recurrences and complications.

TECHNIQUE.—The patient must be secured in the dorsal recumbent position. In the mare and in the cow a general inhalation anæsthetic is administered, while in the bitch partial general anæsthesia with subcutaneous injections of morphia will answer.

Two curved incisions are made along the whole axis of the gland in such a way as to form an elliptical island which contains the teat. The width of the island must vary according to the amount of redundant skin to be disposed of. The

growth at the island is grasped with the tumor forcep and drawn outward while the skin is carefully dissected from it as high as the level of the abdomen to which the gland is attached by loose areolar tissue. Before proceeding with the ablation the dissection of the skin must be so complete throughout the whole circumference that the boundary of the gland where it attaches to the abdomen can be plainly seen. The first step in effecting the ablation is to ligate the nutrient artery and the vein. In the mare the artery will be found entering the gland antro-superiorly where its pulsation can be felt after careful search. The vein will be found leaving the gland postero-superiorly. Sometimes there are two, three or even four exit veins, all of which must be ligated to prevent a reflux bleeding from anasto-

Fig. 263—Method of Casting Cows for Operations.

mosing veins. The mammary veins are valveless and hence will not offer much resistance against reflux bleeding. These veins parallel each other and can therefore be ligated together as a single body.

The vessels having been thus handled and cut off, the growth is then torn out by traction or ablated by blunt dissection.

Bleeding vessels not previously controlled are now twisted or ligated and the cavity packed with gauze, which is retained with sutures.

AFTER-CARE.—The packing is removed twenty-four hours later and the cavity managed as an open wound with potent antiseptic washes and powders. Healing is usually rapid.

In the cow there are large cutaneous veins which must receive attention during the skinning process, and the nutrient vessels of the gland are much more difficult to find than those of the mare. The arterial mechanism consists of a short branch of the main artery for each mamma, which enters each gland in the center of the udder superiorly. These must be searched out individually and ligated for each gland to be extirpated, unless the whole udder is to be ablated. Then the main trunk is ligated, but the ligation of the main trunk must be sacredly avoided when only one or two of the mammæ are to be removed, because the remaining glands would be deprived of their nutrient supply, and would suffer accordingly. The veins must be handled in the same careful manner because ligation of the main trunk would cause a troublesome passive hyperæmia and œdema pending the establishment of an adequate collateral circulation. The numerous cases of gangrene, septicæmia and pyogenesis following ablations of one or two mammæ in cows are usually due to promiscuous ligation of vessels that are essential to the healthy life of the remaining glands.

Fig. 264—Lines of Incision for Ablation of the Mammæ of Cows.

IN BITCHES no special attention need be given to the blood vessels until the gland has been removed, at which time the spurting ones can be managed with the forceps before any serious loss of blood has occurred.

WHITE'S HAIR-LIP AND CLEFT PALATE OPERATION

The common deformity called hair-lip which is so often combined with cleft palate, is met frequently in dogs of fancy breeds. Blenheims, Boston terriers, French Bulls, King Charles spaniels and Japanese poodles, are the ones in which the deformity occurs most frequently. In uncomplicated hair-lip the operation is performed only for cosmetic purposes, but when combined with cleft palate the operation is a necessity because the impaired power of prehension interferes with proper nourishment and at once leads to malnutrition and non-development.

There are several varieties of the deformity:—(1) Simple, uncomplicated hair-lip, unilateral, medium or bilateral; (2) Hair-lip, unilateral or bilateral, complicated with single or double cleft palate. Of these the cleft may be complete or incomplete, anterior and posterior, wide or narrow. The deformity to which these varieties belong sometimes extends upward to the eye and backward through the velum. It is only the simplest forms of hair-lip and cleft palate that are amendable by surgical treatment in animals. The veterinarian is not expected to interfere with the complicated forms because the complexity of the procedure is out of proportion to the value of the individual affected. Notwithstanding the fact, however, that these operations have never been extensively attempted in the history of veterinary surgery, the author coincides with White's opinion that the possibilities are as wide and the general results as good in pups as similar operations amongst babies.

TECHNIQUE.—The deformity involves the skin, mucous membrane, periosteum and bone, constituting the lip, alveolar processes, palatine process of the superior maxilla, and the hard palate. The operation involves denudation, relaxation, coaptation and retention, of the structures and each of these processes must vary according to the character of the deformation.

First Step.—Denudation.—In making raw edges to unite with sutures, strict economy of tissue must be practiced because there is never any tissue to spare, and when the fissure is a wide one it may tax the ingenuity to construct a covering for it. In babies it is sometimes found necessary to perform two, or even three, consecutive "crowding" operations to effect a complete closure, hence the advisability of saving all the tissues in denuding the border for coaptation. Marginal incisions are made along the borders of the cleft

through the skin in the lip and through the mucous membrane and periosteum in the palate. These incisions are lifted up into flaps that can be sutured.

Second Step—Relaxation.—In the lip two lateral incisions are made through the skin some little distance from the denuded margin; or, if the fissure is wide, the cheek may be detached from the bone to allow the lip structure to be brought inward. In the mouth a U-shaped incision is made through the hard palate and periosteum following the line of the gums. This loosening process must allow the denuded margins to come together without tension, otherwise the operation will fail.

Third Step—Coaptation and Retention.—The margins are now sutured from behind forward with a continuous catgut suture.

No after-care is required.

R. C. MOORE'S OPERATION FOR RECTO-VAGINAL FISSURE

DEFINITION.—Moore's operation is a plan of exposing the torn recto-vaginal wall so as to make it accessible for suturing. Its salient feature is an incision upward through the upper part of the anus, made with this object in view.

INDICATIONS.—The operation is best suited to the recent case of torn perineum but is recommended by Moore also for chronic cases. It is less effectual against recto-vaginal fistula. It will be remembered that these parturient injuries sometimes consist of communicating apertures from rectum to vagina without external damage. In many of them however perineum is torn through and through so as to make a common orifice of the anus and vulva. This latter variety is the one usually presented to the veterinarian for treatment. The character of the rent varies with each case. It may be short or long, straight or irregular. Some extend from the perineum forward twelve inches or even more while others are only four inches long. The line of cleavage is not always straight, nor located in the center of the rectovaginal wall. A major part of the flap may be on one side and not infrequently there is loss of substance, direct, or from sloughing of non-viable parts. All of these variations must be taken into account in predicting the results of attempts at closure. When the rent is straight and medial and no tissue has been lost the prospects are better

than if the line is irregular or lacking in sufficient tissue to complete the repair without too much stitch tension.

The cause is the protrusion of a foot of the foetus through the recto-vaginal wall in delivery.

The accident occurs to mares and occasionally in cows, and while it may be compatible with the general health, the affected subject is repulsive from the constant passing of flatus and the abolished control of defecation.

TECHNIQUE.—The patient should be secured on an operating table and placed under profound anæsthesia, after having been dieted, purged and cleansed of all accumulated fecal matter.

First Step.—Incising the sphincter ani.—The anus is incised by a vertical incision extending to the level of the ventral face of the tail and the walls of the wound thus made are held apart with tumour forceps, one on each side. By drawing upon these forceps the torn mucous membrane is brought backward into an accessible position for suturing.

Second Step.—Suturing the rent.—This is done from before backward with either continuous or interrupted sutures of strong silk, linen or chromatized cat gut (20 day). The suturing is continued back to and including the torn anus which is brought into careful approximation.

If the case is a chronic one the suturing must be preceded by a painstaking removal of the scar tissue along the edges of the rent.

AFTER-CARE.—The incision is treated as far as feasible with dry antiseptics applied after painting with tincture of iodine.

OPERATION FOR STRICTURE OF THE TEAT OF MILCH COWS

There are several forms of teat obstructions in cows, some of which are operable and others not. They vary in size, character and location. Some are small wart-like nodules located near the meatus while others are large growths adjacent to or even in the galactophorous sinus the exact nature of which has never been explained. The cicatricial constriction at the aperture of the sinus, effectually closing it is the most serious form, while the new growth in the teat duct itself is the most favorable.

TECHNIQUE.—The cow is cast and secured with the hind legs stretched backward to keep them out of the way and give the operator free range to work and good access to the udder.

The teat is washed with mercuric chloride solution of proper strength and then painted with tincture of iodine. The teat is taken well squeezed into the left hand to tense the tissues and then an incision one-half to three quarters of an inch long is made along its long diameter right into the teat duct, endeavoring to cut directly upon the nodule. By squeezing with the hand the wound is inverted and the nodule brought into view. It is snipped off with the scissors. A hæmostatic tourniquet may be wrapped above if there is space and this left on four hours after which no secondary bleeding will occur. If located too high for the application of such a tourniquet the bleeding vessels must be found and twisted with the hæmostats.

There are two ways to manage the wound. Dr. Wray advised that the wound be left open, caring for it with frequent applications of tincture of iodine and iodoform. More recently the author has found better success with sutures. The wound, after controlling the blood, is sutured with stitches running deep into the substance of the teat and then a self-retaining drainage tube is inserted to drain out the milk. A flutted tube well perforated along its whole length is recommended, because milk otherwise settles around it and infects the wound. The tube may be retained with adhesive plaster wrapped around the teat end of the teat and extending over the protruding part of the tube. This may be removed and cleaned daily or when there is neither pre-operative nor post operative reaction it can be left alone for several days until the sutures are ready to remove.

Douglas, (New Orleans) removes these nodes with a delicate scalpel through the teat duct protecting the meatus against injury with a small tubular dilator which he inserts before introducing the scalpel. Gordon, (Illinois) performs the same operation without the use of a dilator claiming the damage to the teat orifice is insignificant. The scalpel or rather the slender tenetome used for this purpose is passed into the teat and then by carefully adjusting to the right place the node is cut off at its base. It is then squeezed or "fished" out with a hook. A special combination scalpel and hook can be used for the purpose.

Note:—The old slitting operations being seldom helpful and frequently harmful are no longer performed by the veterinarians experienced in dairy practice, these methods having superseded them, and while some improvement in the technique is yet possible the general plan of direct extirpa-

tion has been proven preferable to that of blindly digging at these obstructions with mutilating instruments.

OPERATIONS FOR CANKER OF THE FOOT

Canker of the foot is a granuloma of unknown origin. It is a persistent, encroaching, recurrent pathological process that clinically simulates cancer. It has the physiognomy of epithelioma and some of the histological features of sarcoma. It is however neither being due no doubt to the intrusion of a specific micro-organism yet to be discovered. It usually begins to develop upon or adjacent to the frog, the velvety tissue of this part of the foot being the seat of origin. At first but a small patch it slowly but surely extends in every direction until the whole frog becomes a softened, bleeding mass. Later it extends into the solar surface until this too becomes entirely destroyed, and the subject must be destroyed as worthless.

TECHNIQUE.—Old cases invading the whole frog or the frog and part of the sole are incurable. Circumscribed ones on the contrary are curable by radical and repeated cauterization following extirpation of all the effected part and a liberal periphery of healthy tissue. The patient is cast, the digitals are cocainized and the hoof submitted to a good paring that will rid it of all superfluous and ragged portions. A tourniquet is then applied to the leg to limit the blood loss and the whole diseased part is extirpated, down to and including plenty of underlying healthy tissue. The surface is then submitted to a good searing with the hot iron. The cauterization must be deep enough to completely control the bleeding when the tourniquet has been removed.

The foot is shod with a removable protective pad which is removed each day for the purpose of submitting the eschar to a preservative ablution of boric acid solution. When the eschar has been sloughed off the underlying grauulations are treated each day with a one per cent solution of formalin. If all of the diseased tissue was removed there will be no recurrence. On the other hand any trace not removed will become a focus for recurrence.

The operation may be repeated in recurrent, incurable cases to prolong the usefulness if not to effect a complete cure.

OPERATION FOR GREASE HEEL

Grease heel like canker of the foot is an infectious granuloma whose specific cause is still unknown. It occurs chiefly in draft horses and especially those carrying a large feather-Clydesdales and Shires. The disease begins like canker of the foot in a small focus, and from this it spreads in all directions, slowly but persistently. It never heals spontaneously nor under the influence of local applications of antiseptics and astringents. It consists of multiple granulomata which crowd each other closely and between which issues a foetid

Fig. 265—A Case of Incurable Grease Heel, held in check for years by treatment with Merhyline Blue and Latunce Acid, and occasional Cauterization.

Fig. 266—A Case of Grease Heal Entirely Healed by Cauterization. Only Scars Remain.

tissue. In some cases the growths are large like a bunch of grapes and are surrounded by smaller ones extending in every direction over the adjacent skin.

TECHNIQUE.—The cure will depend entirely upon the amount of surface envolved. If circumscribed it is curable but if a wide zone is invaded there is little hope of effecting a complete cure. In all cases radical intervention holds the disease in check and prolongs the working days of the subject.

The patient should be placed under good restraint on the operating table or in ropes with the affected place on the leg

held accessible and under good control. The hair is clipped and trimmed off over the diseased part and its immediate surroundings. A tourniquet is applied to control bleeding and then all of the granulomata are trimmed off with scalpel or scissors. The whole bare zone is well seared with the hot iron. The searing must be severe enough to control all bleeding when the tourniquet is removed. Where the disease covers a wide zone the parts most seriously affected may be thus treated and the surroundings held in check with chemical treatment. The best remedy to inhibit the spread of grease that we have found is methyline blue and tannic acid, two drams of the former in one gallon of a saturated solution of the latter. This is rubbed briskly into the effected skin twice a day. By giving a badly affected leg a good cleaning with bichloride of mercury solution one to two hundred occasionally and applying this astringent wash frequently grease can be controlled although never cured. It is only when submitted promptly to extirpation and actual cautery, before it has spread over a wide surface, that grease can be permanently cured.

CHAPTER XIII

ACCIDENTS

STREET NAIL PRICKS

The "picking up" of street nails occurs chiefly to urban work horses, of which it is the most common of all accidents. In rural horses and in cattle it occurs more rarely.

Nails penetrate any part of the solar aspect of the foot, but the most delectable place is the region of the frog, especially in the lateral lacunæ one inch from the point. In depth the penetration is likewise varied. Most nails only perforate the horn and velvety tissue, their course being deflected or arrested by the more firm overlying tissues,—the bone and plantar aponeurosis. When the latter is perforated formidable complications in the form of thecal or articular abscesses usually follow. The character of the infection also varies, from feebly virulent infections which cause only a local and trivial suppuration to highly virulent death-dealing bacteria, whose presence in the velvety tissue is soon announced by a threatening, advancing inflammation that may prove fatal in a few days. Tetanus and malignant œdema are amongst the infections that are sometimes inoculated into the foot by nail pricks.

The seriousness of nail pricks depends, therefore, upon (1) the depth and the course of the puncture, (2) the nature and virulence of the infection, (3) resisting powers of the patient, (4) the soundness and conformation of the foot, and finally upon the promptness with which proper treatment is employed.

PREVENTIVE TREATMENT.—Nail pricks may be prevented by the application of a protecting plate that covers the solar surface. Thin sheet iron, sole leather or several layers of heavy canvas are the materials usually employed for the purpose. Although these are not entirely impenetrable, even the latter (the softest of the three) is almost universally preventive, because the mechanism which facilitates the "picking up" of nails is thereby destroyed. The nail lying flat upon the street is tipped against the frog by the toe of the shoe striking its head, and as the foot is simulta-

neously sliding forward the point is at once forced into the frog. At first it only enters the horn or is only wedged into the lacuna, but with each successive step it is driven inward more and more until it meets with resistance that causes the protruding part to bend against the foot. If the nail is pointed and favorably directed it may be driven inward step after step until the head reaches the level of the shoe. Sometimes in this manner a long nail or spike may completely transfix the foot from the side of the frog to the pit between the heels, following the perforans tendon on its upward course. By the simple application of a smooth cover to the solar surface nails are intercepted from attaching themselves to the frog as the point is tipped upward by treading upon the nail head, and thus penetration is successfully prevented. It is only the nail fixed point upward upon the street that penetrates protective pads and since such nails are rare as compared with those lying flat, street-nail punctures are almost entirely eliminated by them.

The economy from protecting pads can hardly be overestimated in large establishments, in view of the annual loss from this single disabling and often fatal accident.

TREATMENT.—The horse-shoer's method, which consists of paring the hoof thin and excavating the horn around the perforation and then submitting the wound to a thorough cauterization with hydrochloric acid, is commendable because of the certainty with which the inoculated microbes are destroyed. It is only where the caustic does not reach the depth of the tract, or where the inflammation has already advanced into the inaccessible surroundings that such treatment fails or becomes more harmful than beneficial. This "first aid" can in no light be discredited if immediately employed, and especially if the penetration is superficial. On the other hand, when the tract is a deep one or the puncture is of several days' duration, the cauterization may do harm by producing an impervious eschar that will subsequently obstruct the drainage.

The veterinarian usually arrives upon the scene when the inflammation is already well advanced, the claudication is accentuating, and the patient is beginning to show systemic derangement. At this stage the following routine is recommended:

RESTRAINT.—The operation may be performed in the stable or at the horse-shoer's in the standing position. In the restive horse cocainization of the digital nerves is helpful.

Thoroughness however in many cases demands recumbent restraint. The operating table is par excellence the best.

First Step.—The unshod hoof is submitted to a thorough paring not only around the puncture but over the entire sole and frog which are patiently trimmed and "smoothed up" until the whole surface is compressible.

Second Step.—The horn around the puncture as far as it has become detached from the velvety tissue is then carefully removed without drawing blood by invading the healthy surrounding zone or wounding the bulging soft tissues.

Third Step.—The nail tract is then cleansed with a solution consisting of hydrogen peroxide, 20%, and mercuric chloride, 1-1000, 80%. The cleansing process is executed by a gentle syringing that will not force the fluid beyond the tract and pus cavity, and the injected solution must be afforded a free, unobstructed reflux around the canula. Then, after the wound has been dried by bailing it with cotton or sponge and the bleeding has ceased, the tract is injected with a saturated solution of iodine crystals in ether.

Fourth Step.—The shoe is then nailed on loosely with two or three nails on each side, and the solar surface covered with cotton saturated with mercuric chloride solution, 1-500, which is held in place with a piece of heavy leather that fits evenly into the sole, and two transverse pieces of hoop-iron which are sprung beneath the shoe to hold the leather securely in position. (Fig. 264.) This dressing assures perfect cleanliness against stable filth, is easily removed and replaced, maintains good antisepsis about the wound and freely absorbs the discharges.

AFTER-CARE.—Three or four times daily a few ounces of mercuric chloride solution 1-500 is poured into the cotton at the heel, and each day the dressing is removed and pus-soaked cotton replaced by a clean supply which is kept constantly saturated. At the time of dressing each day, or at least every second day, the horn around the wound is pared away as far as it is found to be detached from the velvety tissue.

This intensive antiseptic and protective treatment is continued until the discharge ceases and the velvety tissues have become reclothed with new horn.

If the lameness is refractory and the pain intense the foot is wrapped in a woolen swab soaked repeatedly with hot antiseptic water.

Continuation of the pain, accentuation of the lameness,

and especially general symptoms,—fever, anorexia, accelerated respirations, etc.,—indicate invasion of the navicular bursa. The suspicion is at once confirmed when the wound begins to discharge a thin, watery liquid-synovia that coagulates upon the dressing. This complication may require more radical intervention. See page 490.

It is also always advisable to administer an immunizing dose of antitetanic serum.

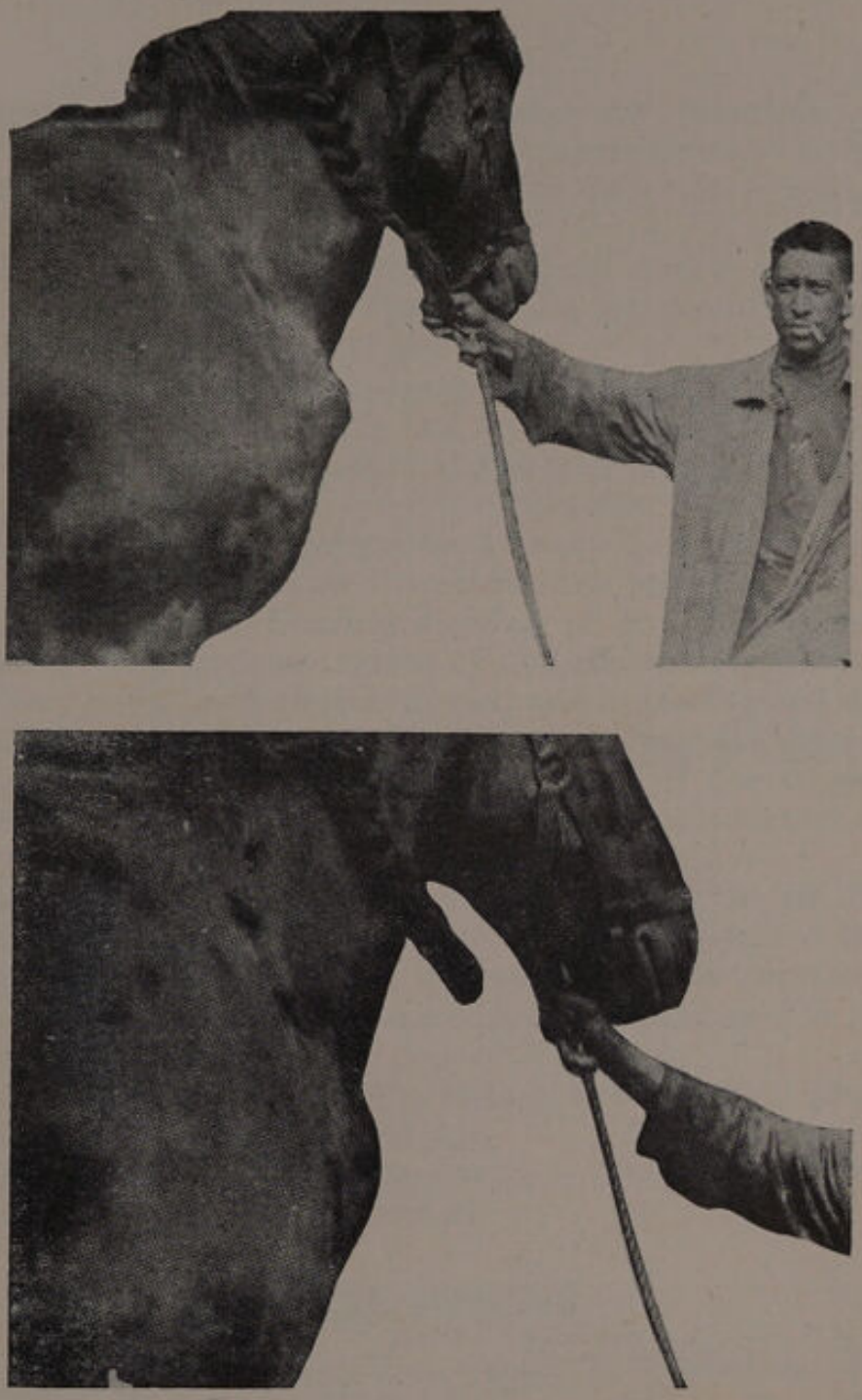
NAIL-TREADS

Nail-treads is the name we apply to pricks from one or more nails caused by treading upon a shoe partially wrenched from the foot. The nails of a loose, clacking, badly worn shoe, drawn from their tracts with the shoe about to be cast off, are sometimes trampled into the foot along the solar margin, but the most common cause of the accident is the forcible wrenching of a shoe whose toe-calk or heel-calk becomes fixed into a crevice in the street pavement, railroad switches, defective street-car tracks, drawbridge, etc. While these menaces may thus cause the shoe, and sometimes the whole hoof, to be torn off completely, more often the shoe is only wrenched from one side of the foot and the protruding nails whose heads are still tightly wedged in the sockets, penetrate the sole at the next step. This form of penetrant nail presents entirely different phases from the typical "picked up" street nail. The latter usually invades the region of the frog, and complicates matters by implicating the navicular synovial bursa, while the former invades the border of the sole, and when serious involves the affected zone in an acute osteitis and laminitis that end in a more or less extensive necrosis of the os pedis and laminæ, and not infrequently in quittor.

PREVENTIVE TREATMENT.—The fact that it is usually the toe-calk that becomes caught in the defective street suggests the advisability of so shaping this part of the shoe as to reduce these accidents to the minimum. This may be done by making the toe-calk curve to the contour of the shoe instead of extending straight across the toe. The curved calk, three to four inches long according to the size of the shoe, seldom ever catches in street crevices. At the heels adequate protection is found in rubber pads.

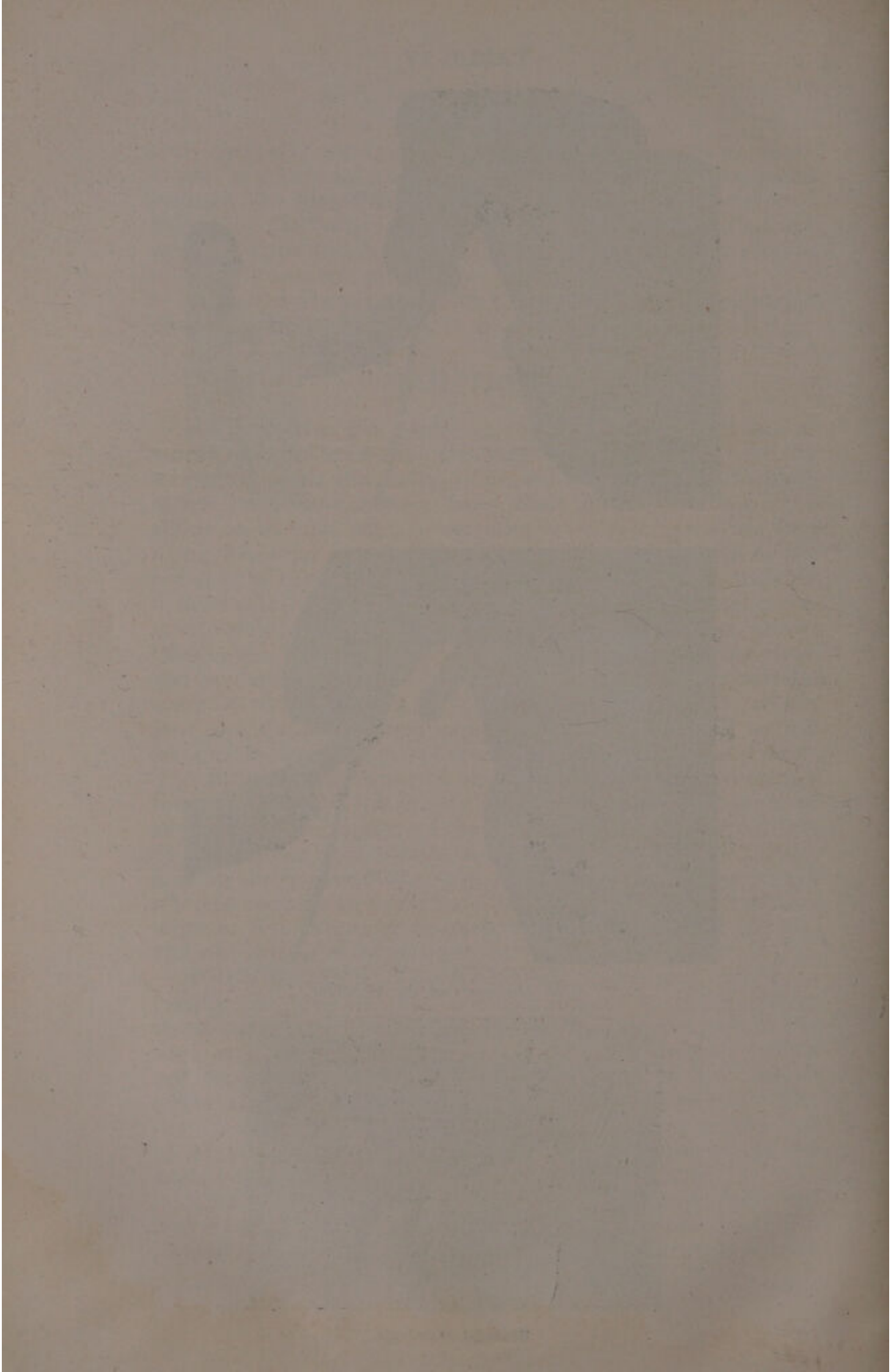
TREATMENT.—The "first aid" treatment does not differ from that of the street nail. Paring the hoof thin around the puncture and cauterizing with hydrochloric acid

TABLE IV.



Cold Abscesses of the Shoulder.

Brachial Paralysis.



is sufficient treatment when the stabs are superficial, but when severe pain indicates a deeper injury prompt surgical intervention is always prudent. The procedure is as follows:

RESTRAINT.—Cocainize the digital nerve on the affected side and operate in the standing position; or, better still, secure the patient upon the table.

First Step.—After submitting the sole and frog on the injured side to a good paring and trimming off all of the detached horn around the puncture, the foot is well disinfected with a strong solution of mercuric chloride.

Second Step.—After applying a tourniquet to the metacarpus a V-shaped section of wall is then stripped or pared off from the weight-bearing border of the wall upward. (Fig. 267.) The laminæ externally and the velvety tissue beneath, that have been thus exposed, are then resected down to the bone and over as much surface as they are found to be involved in the inflammatory process. If the os pedis, indicated by roughness, is found denuded of periosteum over any part exposed, it is curetted.

Third Step.—The wound is then submitted to an intensive antiseptic treatment, with chlolazene 2%, injected freely into the soft tissues bordering the wound with a hypodermic syringe, and then with a pack of gauze soaked in the same solution.

Fourth Step.—The cavity is packed firmly with a pledget of antiseptic gauze and bound up.

AFTER-CARE.—This treatment is continued until the pain and suppuralion is controlled.

FORGE PRICKS

Forge pricks is the name we apply to punctures of the keratogenous tissue by misdriven horseshoe nails. These are the most insidious of all hoof punctures. The initial injury is often so trivial, the infection so feebly virulent, and the seat of invasion into the laminæ so deep and sheltered, and the lameness so slight at first that the cause of the claudication may escape discovery for some days after the accident has occurred.

The accident is sometimes due to careless driving, but more often the forge pricks encountered in practice are attributable to attempts to nail shoes securely to feet having thin, badly broken walls. In such feet the shoer always recognizes the necessity of driving the nails to a high level in

order to assure retention of the shoe and to prevent further mutilation of the lower part of the wall. In these attempts nails may parallel the laminæ closely enough to cause inflammation by pressure without penetrating, or the wound they inflict to the laminæ may be slight, or it may etxend along the whole or part of the course of the nail. Carelessly driven nails may enter the velvety tissue, nick the border of the os pedis, and then wound the laminæ from the border of the bone to the point of exit.

Forge pricks, if treated promptly, are relatively less serious than street-nail pricks and nail-treads, because everything connected with the accident is more clean. The nail

Fig. 267—Schematic View of Operation against Forge Pricks and Nail Treads.

is bright and clean, the hoof has been pared of all dirt-containing recesses, and the shoe has just come from the fire, all of which combined constitute a favorable condition for the infliction of a wound, as compared with the filthy conditions under which the other hoof punctures are sustained. In fact, few misdriven nails that are promptly withdrawn ever cause either lameness or inflammation, and indeed many of them that sojourn for several days, promptly end favorably by no other treatment than that of readjusting the shoe. It is the delay in discovering the cause of the lameness and the inadequate "first aid" that renders these accidetns serious, in certain cases.

TREATMENT.—The "first aid" usually administered by the horse shoer is seldom properly directed at the hot-bed of the infection. Usually the paring to evacuate pus is done at the sole while the hot-bed of the infection is higher up beneath the wall, at a point seldom ever invaded by the horse shoer's knife.

The general recommendations for the treatment of nail-threads will answer for forge pricks with the one exception that the V-shaped excavation in the wall should extend higher in order to overlap the diseased area. In fact it is usually necessary to exend the apex of the excavation to the

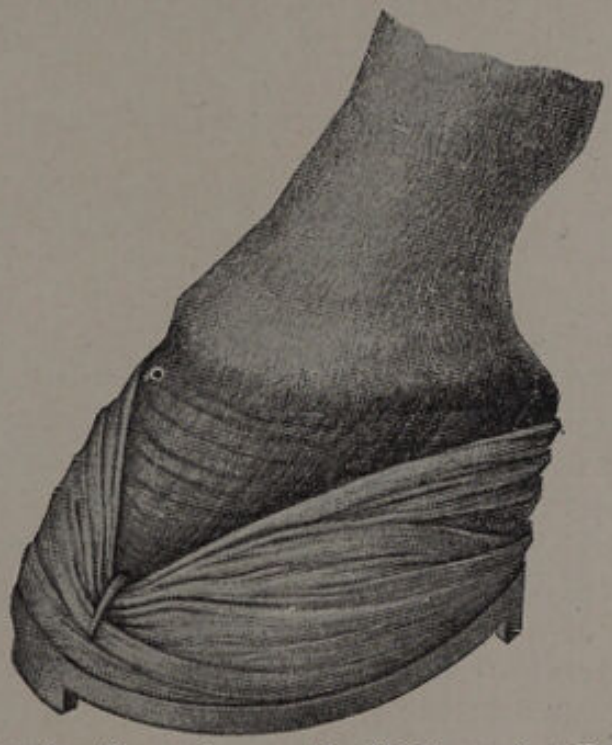


Fig. 268—Dressing for Operation on the Wall, against Forge Pricks and Nail Treads.

lower border of the coronary cushion. The dressing, shoeing, and after care do not differ from that of nail-treads.

WRENCHING OF THE HOOF

When a firmly nailed shoe caught in a defective street does not yield to the traction exerted by the horse's momentum or struggles, the hoof receives the force of the accident, and sustains injuries of variable severity and character. **Generally this accident results in the detachment of the wall, one or three inches along the coronet, and one to two inches downward over the laminal surface,** but in other cases the injury may be much more complicated. The whole hoof

may be wrenched off; the wall may be fractured longitudinally and one-half or one-third of the hoof detached; the wing of the os pedis may be fractured, and one or more of the phalangeal articulations may be severely strained.

TREATMENT.—These cases, under favorable conditions, are usually curable, although in the complicated cases some time may be required to restore the horse to full usefulness. The exceptions are found in cases neglected for several days, at which time infection will have eliminated all chances of curing the severe cases and will have allowed the milder ones to develop complications which will delay matters considerably. Septicæmia, exhaustion, and synovial and articular complications will prove the undoing of serious cases that are neglected, and quittor often follows the milder cases that are permitted to undergo an infective inflammation.

A horse so injured should be immediately transported to the hospital after having the injured foot temporarily protected against contamination with dirt, and then submitted to an intelligent surgical treatment.

RESTRAINT.—Recumbent restraint is essential, as thoroughness would be impossible in the standing position. To control the pain, the digital nerve on the affected side is anæsthetized with cocaine.

First Step.—After applying a tourniquet to the leg to control bleeding, the foot is given a liberal washing with abundance of water. The hose from the hydrant or the large fountain syringe should be turned upon the foot for ten or fifteen minutes as the hand washes it clean with cotton or sponge. At the same time the hair around the coronet is clipped and shaved and rinsed off with the stream.

Second Step.—The detached part of the hoof, no matter how extensive, is now removed by paring or by cutting a groove through the wall and effecting the extirpation with the pincers. Especial pains are taken to invade every part detached.

Third Step.—The denuded surface is now examined for earth, cinders, sand, dirt, or hairs that may have been ground into the tissue at the time of the accident. These are managed by dissecting away the tissues containing them, as they can not be otherwise dislodged or rendered innocuous. This mechanical disinfection must be thorough, even though the whole surface must be shaved off with the scalpel. This dissection may be made more effectual by employing a stream

of water from the fountain syringe to wash off the shreds and dirt as fast as they are dissected away.

Fourth Step.—The surface is sumbitted to a prolonged irrigation with mercuric chloride as a final disinfection, and then bound up in cotton and bandage soaked in the same solution.

AFTER-CARE.—The dressing is removed in twenty-four hours and the wound treated to a liberal dusting of iodoform daily until amply protected against infection by the new horn, which develops rapidly where the genetic tissues have not been destroyed. Where these have been destroyed the granulations will require the application of astringents to prevent excessive growth.

BARBED WIRE CUTS

The phrase "barbed-wire cuts" is quite generally used by American veterinarians and stockmen when referring to lacerated wounds sustained on barbed-wire fences. These wounds possess certain uniform characteristics as to cause, location and physiognomy that deserve a nosological consideration, and while the name applied to them is admittedly ordinary it has been consecrated by usage.

Whilst lacerations from barbed-wire fences may be sustained at various parts of the body, there is a surprising analogy in the four points of predilection at which they are usually found. Named in the order of frequency these locations are: (1) **In the region of the fore heels;** (2) **In the flexion surface of the hock;** (3) **In the pectoral region;** and (4) **In the anterior surface of the forearm.**

1. **In the Region of the Heels.**—These wounds are sustained by the horse rearing or striking into the fence, generally while rollicking with animals in the adjacent pasture. The foot usually is caught in the second or third wire from the ground, but sometimes on the topmost one. In the attempt to withdraw the foot thus caught the wire falls into the space behind the lateral cartilage that extends from its anterior extremity to the median lacuna of the frog, where it soon saws a ragged laceration, the depth and extent of which depends upon the maneuvers executed in the frantic efforts to release the leg. Sometimes one, or even both quarters, are almost severed from the body, but the real seriousness of the wound depends more upon whether or not the navicular or sesamoidean synovials have escaped direct injury. Strangely enough, these structures are not as fre-

quently invaded by the wire as might be supposed from the relations they bear to the traumatic cavity.

When these wounds are allowed to become infected, and especially if the synovials are involved, a serious, distressing lameness ensues that may incapacitate the patient for months, leave a deforming indelible horn-like blemish, and even terminate fatally.

TREATMENT.—As a proper nosocomial operation and after-care must usually be substituted by ordinary stable treatment, much the best procedure is to promptly submit the wound to an **"intensive antisepsis"** amounting to cauterization. Shreds should be trimmed off, bleeding arrested and dirt particles washed out; then, without further ceremony, every part of the wound is touched up with the following solution: **Mercuric chloride, four drams, hydrochloric acid one ounce and alcohol twelve ounces,** after which it is filled full of boric acid and bound up loosely with cotton and bandage. Each day the boric acid is wiped out with pledgets of cotton without washing, and the walls of the wound painted with the solution, after which it is again filled up with the former. The strong cauterant solution will promptly destroy any microbes invading the living tissues, and the boric acid may be depended upon to prevent putrefaction of the dead cauterized elements. Thus, after eight days of treatment the eschar separates, falls out, and leaves behind a wound well carpeted with rosy granulations that will soon fill up the wound and be transformed into a scar. After separation of the eschar the boric acid may be continued to prevent infection of the granulations, or it may be substituted by iodoform or any potent antiseptic powder. Exuberant granulations will require astringents, trimming or even actual cautery, but these are rarely ever in evidence in the absence of infection with pyogenic microbes.

When the wound is of some days' duration, and of course badly infected, its walls should first be submitted to a thorough mechanical disinfection, curettage, dissection of the infected walls, etc., and then treated as above directed for a recent case.

Implication of the synovials requires no change from the above procedure, except that the copious discharge will necessitate renewal of the dressing two or three times daily.

Other drugs may be substituted for the cauterant mixture above recommended, amongst which are phenol, equal parts of phenol, tincture of iron and glycerine, and butter of antimony.

2. **In the Flexion Surface of the Hock.**—This wound is sustained by kicking through the fence, and sometimes, but rarely, by an unsuccessful jump. In this case the wire saws a ragged laceration into the region, in the attempt to release the leg. The wound varies from a simple cutaneous breach to a serious articular injury in which the tibio-astragular articulation is laid bare and the tendons of the flexor metatarsi and extensor pedis are severed. Frequently, indeed, the capsule of the articulation is torn open. This wound is always a serious affair, even when the tendons and synovials are not injured, because the flexion movements of the joint interfere with healing during the acute stage of the inflammation, and always end in promoting the formation of a blemishing scar that leaves the patient practically unsalable thereafter.

TREATMENT.—The most annoying phase of the treatment of this injury is the patient's formidable opposition to bandages. As soon as the bandages are nicely applied the horse at once opposes them by executing a series of contortions with the leg which are continued until the whole affair is disarranged and much damage has been done to the wound. Braces, paddings, or any of the various immobilizing contrivances are likewise resented to the extent of rendering their application both useless and harmful. Furthermore, the patient is often an unbroken youngster that will not take kindly to any form of interference.

All things considered, a special form of open-wound treatment seems best, except when the tractability of the patient indicates that the protective dressing would not be thus disturbed. In the latter event the "intensive antisepsis" mentioned in the foregoing variety, and the packings with abundance of boric acid, which is renewed according as it becomes soaked with secretions, is advisable, but when the bandaging is opposed by movements of the leg the following procedure is recommended: Trim off all unviable shreds, including dangling pieces of skin; remove all dirt by washing or by dissecting away the tissues containing it; spray the wound, after the bleeding has ceased, with a solution of iodine crystals in ether,—two drams to eight ounces,—and then insufflate the surface liberally with iodoform. During the first three to four days this medication is repeated three to five times daily. Washing the wound is harmful; but the parts below it should be kept free from accumulations of dried secretions by inunctions of vaseline and daily cleansing with soap and water. The iodine spray and the iodo-

form are continued until a bed of granulations has formed; then repeated applications of **white lotion** to control exuberant vegetations become necessary, and these should be continued until the scar formation is complete.

When there is a synovial discharge of articular origin the same treatment will answer, but in addition the whole hock surface excepting the wound itself should be promptly blistered at the beginning with a strong cantharides ointment, one to four. Copious discharges of synovia from the tendon sheaths must not, however, be mistaken for "articular" synovia.

3. **In the Pectoral Region.**—These are sustained by running headlong against the uppermost wire of a too low fence.

Fig. 269—Large Scar Supervening Barb-Wire Cut on Flexion of Hock.

An attack upon a horse in the neighboring pasture, accidental contact at night, and defective vision are among the circumstances attending the infliction of this variety of "barb wire cuts." This wound usually consists of a more or less extensive tearing of the skin. Sometimes only a small patch is torn loose, while at other times the whole pectoral region is rent of its cutaneous covering which hangs down like an apron.

TREATMENT.—In this variety painstaking repair of the breach is the only sensible course to pursue. Although some part of the great skin-flap will surely prove to be unviable, it is nevertheless prudent to preserve it intact until the unviable zones are distinguishable by the formation of lines of demarcation some days later.

The operation begins with a patient shaving of the cir-

cumference of the wound and the circumference of the flap so as to make a hairless tract for the sutures no less than three inches wide. In addition the flap should be shaved in spots here and there, to serve as entrance points for the "quilting sutures" to be applied subsequently.

The general plan of procedure, after the field has been mechanically and medicinally disinfected with unmistakable thoroughness, is to (1) "quilt" the patch to the body from the attached part toward the free end, by means of a series of Mayo's running loop; (2) to hold the edges together with continuous sutures; and, (3) to provide numerous drainage orifices to prevent the accumulation of subdermal serosity.

The sutures are covered with a thick layer of collodion and the drainage orifices are kept open by wadding them for a few days with gauze plugs which are renewed frequently.

If fluctuant areas appear which cannot be drained through the orifices previously provided, they are lanced.

At the end of eight days the sutures that are no longer of service, either on account of primary union or stitch necrosis, are taken out, and the dead areas resected. The latter, however, should not be molested if still serviceable in holding viable parts in place. The Mayo loops are the last to be removed.

Compared with the practice of hurriedly sacrificing the skin flap in these cases where successful repair seems impossible the above procedure is always attended with much better final results, as some of the skin, and sometimes all of it, is always thereby preserved to the patient and the blemish is always less conspicuous.

4. **In the Anterior Surface of the Fore Arm.**—This wound is sustained by headlong contact with a low fence unsually one having its uppermost wire broken. The wound, as to character, varies from a cutaneous laceration of variable extent to a serious mutilation that severs the continuity of the antibrachial group of muscles. The seriousness depends largely upon the extent of the muscular injury. Often extension is permanently impaired and the impediment is manifested by frequent stumbling.

TREATMENT.—When only the skin is involved, or when the muscular injury is slight, reparative treatment is in order. The wound is disinfected, its surrounding shaved and the flap sutured with button and interrupted sutures, and drainage is provided. On the other hand, the wound invading the muscles extensively had better be left to the open wound treatment recommended for the first variety de-

scribed, on account of the tendency of secretion gravitating downwards amongst the muscles and tendons of the region. The patient should be kept exceptionally quiet, and if the wound permits the immobilizing brace (Fig. 281) may be helpful.

PENETRANT ABDOMINAL WOUNDS
(EVENTRATION)

This accident is caused by violent contact with pointed objects, such as shafts of vehicles, protruding, broken fence boards, horns of cattle, etc. These objects usually strike the body at an angle, penetrate the surface at one place and then pass obliquely through the abdominal muscles for some distance before perforating the peritoneal cavity. The wound thus inflicted is an elongated, mutilated laceration of the muscles and internal inguments, with but a small cutaneous breach. The opening into the peritoneal cavity, on the contrary, is of considerable size, and usually allows the viscera to fall into the traumatic cavity, where they may be retained by the narrowness of the entrance orifice. At other times, when the tract is short and quite direct through the wall, they may prolapse externally, gravitating more and more until parts of them trail the ground.

The seriousness of this accident depends upon the extent of the visceral injury sustained, either directly by the wounding object or by external exposure to filth and bruises, and also upon the promptness of the treatment.

TREATMENT.—As a patient soon develops a fatal state of shock delay in reaching the scene and in promptly administering relief adds materially in the poor success usually met in the treatment of such injuries. To end successfully the treatment must be prompt. The "first aid" is important. If the prolapsing intestines were promptly supported with a clean wrap pending the arrival of the surgeon and the conditions met upon arrival were favorable to the performance of an abdominal operation, many of these apparently hopeless cases could be successfully treated. On the farm, and in the city stable, it is seldom possible for the surgeon to hurriedly surround himself with conditions upon which successful intervention would depend. Much the best management consists of flushing the wound, its surroundings, and the intestines if protruding externally, with abundance of water, warm if obtainable, manually returning the viscera into the abdominal cavity, and then wrapping the body tightly to retain them until adequate preparations can

be made for the operation. If possible the patient should be conveyed as quietly as possible to the hospital, where a more thorough operation can be performed. If the prolapsed bowels can be returned and safely retained, the emergency has been met and some time may then be allotted to complete the preparations for the following procedure:

Restraint.—The patient is cast or secured upon the operating table and anæsthetized with chloroform.

Fig. 270—A Penetrant Abdominal Wound Safely Healed.

First Step.—The region is washed, shaved and disinfected with more than ordinary thoroughness, and to provide against soiling the intestines that may subsequently be forced out through the surgical wound about to be made, sterilized cloths are laid below the field. The surface of the body around the wound is moistened with wet sponges to allay loosened hair which may fly into the wound.

Second Step.—It is now necessary to lay bare the entire

tract from the wound in the skin to the opening into the peritoneal cavity. No matter how long or how short the tract may be, it must be opened completely. Sometimes its course is just beneath the skin; at others it enters at once through one or two layers of underlying integuments. In either case the structures constituting the outer boundary of the tract are incised from one end to the other. The bleeding may be considerable, but this is arrested with the forceps or by ligation. If only the skin is incised the bleeding will be trivial. The edges of the incision are now parted with tenacula or

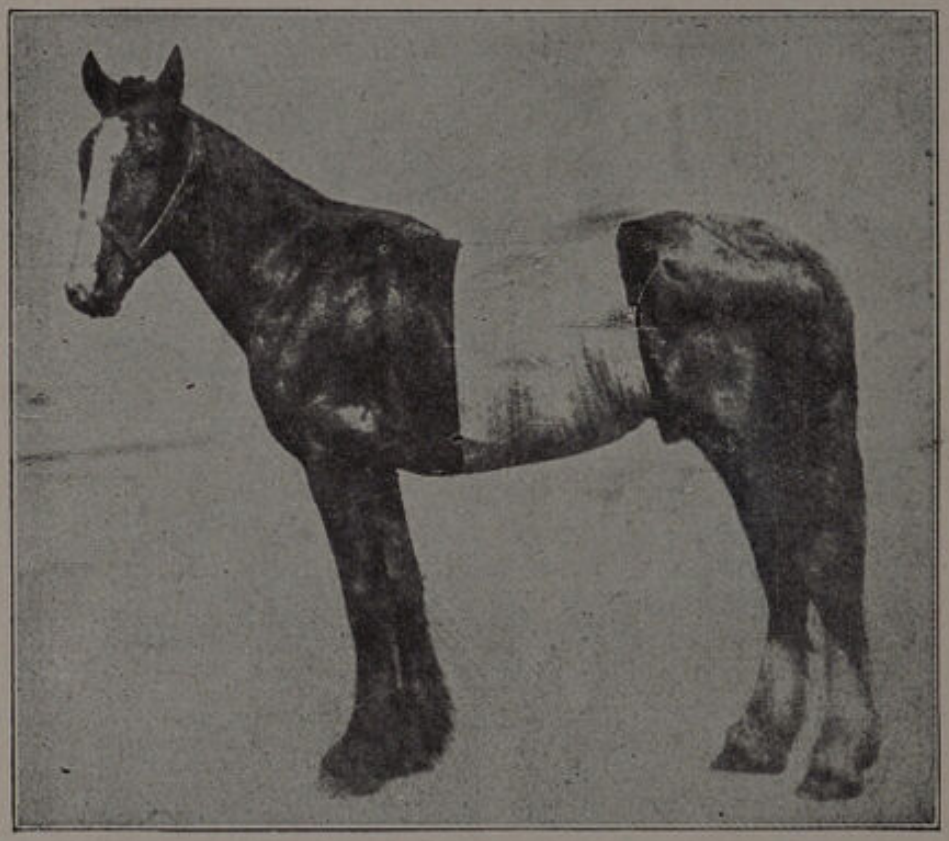


Fig. 271—Dressing in Operation for Penetrant Wounds.

tumor forceps and the tract submitted to a thorough trimming that will destroy its anfractuosity, and remove the soiled and mutilated shreds and all of the dirt particles or foreign bodies it may contain. Attempt is made to construct a favorable channel for drainage.

Third Step.—Abdominal lavage is not attempted. If the viscera have been soiled and were not cleansed in the preparatory washing, they are left to the resisting powers of the body, as any attempt to carry out an effectual washing of the enormous volume of bowels and abdominal cavity is more apt to do harm than good. The wound itself, however,

is cleansed with mercuric chloride, after which it is sprinkled liberally with iodoform.

Fourth Step.—A perforated rubber drainage tube is now placed along the tract so as to invade the abdominal cavity about one inch and protrude from the external orifice about two inches. Over this the muscular layers are sutured with strong catgut interrupted sutures placed no less than one-half inch apart. The cutaneous wound is sutured first with button sutures (Fig. 63) and then with interrupted sutures of strong braided silk. At the orifice a stitch or two is taken into the rubber tubing to prevent it from working outward by the respiratory movements.

Fifth Step.—Strong wraps of muslin are then encircled around the body and fastened securely to prevent slipping. At the orifice a perforation is made in the bandage for the drainage tube.

AFTER-CARE.—The patient is sustained on a light, succulent diet. Constipation is combated with linseed oil and rectal injections, and the strength is maintained with ammoniacal stimulants.

At the end of four days the bandage is removed temporarily to treat the wound to a sprinkling of iodoform. The drainage tube is kept open by probing to dislodge desiccated products that accumulate around the opening. In ten days the tube is extracted and the tract allowed to close, and the cutaneous sutures removed. Fever and general malaise that is certain to ensue is treated medicinally according to the indications presented.

PUNCTURED WOUNDS OF THE THORAX

These wounds should at once be divided into (1) **penetrant wounds** and (2) **non-penetrant wounds.** The former enter the thoracic cavity with or without injuring the viscera, while the latter only invade the structures constituting the chest wall.

They are usually located on the anterior face of the pectoral region and are sustained in a large percentage of instances in collisions with vehicles, the shafts of which perforate the body by the force of the clash. The puncture may be shallow when the force is slight, or when the object is arrested by the sternum. If located high it may at once perforate the thorax along the course of the trachea, sometimes wounding large vessels, or even the heart, and cause death in a few moments. The usual course, however, is between

the shoulder and the costal surface after glancing off of the keel-like sternum. In this space the puncture may reach the depth of six inches, one foot, two feet or even more. The posterior end of the tract is often located just within the olecranon. A case was reported at the 1907 meeting of the Illinois Veterinary Medical Association in which the object, —a fence board,—perforated the pectoral muscles, passed between the shoulder and ribs and then followed backward subcutaneously as far as the stifle.

These wounds may be complicated by fracture of the sternum, fracture of one or more ribs, tearing loose of the costal cartilages, and sometimes by the foreign bodies—a part of the object having broken off within the tract.

Inter-costal penetrations are rather rare in animals because the overflapping arrangement of the ribs causes objects to glance off instead of perforating the thorax. A glancing clash against a pointed object may, however, tear a rent through the cartilages of the false ribs and enter the abdominal cavity, causing breach of the thorax, diaphragm and abdomen. The author has observed several such wounds in horses, and White refers to their frequency in dogs. Direct inter-costal perforations of the thorax are, however, sometimes sustained by horn-thrusts, malicious blows with tools and by kicks from sharp-shod hoofs.

1. Penetrant Wounds

TREATMENT.—In solipeds the free admission of air into the thorax at once provokes a distressing dyspnœa that reflects over the whole organism and materially mitigates against recovery from the wound itself. Inflammation of the pleura and lungs is also difficult to prevent or control. In bovines and canines a unilateral chest wound is much less serious because the supervening phenomena are more prone to remain unilateral. As there is no communication between the two pleural sacs in these species, the inflammation is less inclined to invade the opposite side, but the favoring element is the possibility of maintaining drainage without producing the distressing bilateral pneumothorax that always accompanies the application of drainage tubes in the thorax of horses, whose pleural sacs communicate with each other.

In the animals having non-communicating pleural sacs the procedure consists of first submitting the environs of the wound to a thorough shaving and cleansing, and the wound

itself to a mechanical and medicinal disinfection. The ragged parts are trimmed and the whole channel treated to a good soaking with tincture of iodine. Irrigations that might wash infectious matter into the thoracic cavity are avoided. The disinfection having been properly completed, a perforated rubber drainage tube is placed into the tract so that its inner extremity invades the thorax. The outer end is then fixed to the skin with a stitch or two and the wound closed tightly around it with interrupted sutures. A coating of collodion to the sutures to protect against infection, and a tight body wrap of muslin to immobilize the costal movements as much as possible, complete the procedure.

The **after-care** consists of probing into the tube to prevent blocking up with dried secretions. At the end of eight days the tube is removed and the wound packed loosely with gauze daily until closed.

In solipeds penetrant wounds, after being submitted to a thorough disinfection, must be closed tightly with sutures or else drained with an apparatus that will prevent the admission of air into the thorax with each inspiration. This apparatus is constructed as follows: A flexible rubber hose is attached to the end of the drainage tube and then dropped into a quart bottle of water hung from a surcingle. The wound secretions overflow the bottle, whose neck is unobstructed by the small tube.

2. Non-Penetrant Wounds

The deep puncture that enters the anterior face of the pectoral region and invades the space between the scapula and the ribs concerns us most. The first step in its treatment is to assure against the possible existence of foreign bodies by examining the object that made the puncture. If such exist their removal at all hazards is imperative. When there is reason to suppose that the wound extends almost to the space behind the olecranon, a long sound is passed into the wound and attempt is made to find its end through an incision through the loose skin that passes from the olecranon to the costal surface. In addition to the skin it may be found necessary to carry the incision through the latissimus dorsi, provided the end of the sound can be felt beneath it.

Whether this posterior opening is made or not, the subsequent proceedings are the same. The horse is placed backward into a narrow stall and allowed as little freedom as possible by tying the head tightly between the pillars. A

fountain syringe as large as possible, equipped with a long hose, is then filled with chlorozene solution 1%. The hose is carefully passed to the very bottom of the tract and fastened to the skin with a stitch so adjusted as to not obstruct the orifice. The stream is then turned on and allowed to flow continuously for no less than four hours, after which a long, dry strip of gauze soaked in the same solution is inserted into the tract. The orifice may be wadded moderately, or else sprinkled with iodoform. This treatment is repeated for three or four days, after which the gauze packing alone will be sufficient. The wound, thus being prevented from becoming a veritable microbian incubator, as is usually the case in such wounds, cicatrizes rapidly and the horse returns to work, within three weeks.

When an opening has been made posteriorly, the only change necessary is to place the end of the hose at a point in the tract whence the liquid will flow from both openings, and thus come into contact with every part.

LACERATED WOUND OF THE BUTTOCKS

This wound is usually caused by the kick of a shod foot. It is generally a stable accident, but sometimes occurs to horses in harness from other cause than kicks amongst which is backing against sharp objects protruding from a load.

The wound is located on the hip behind the articulation, on the level of the os innominatum or slightly below it. The biceps rotator tibialis and the triceps abductor femoris are the muscles usually invaded. In addition to a triangular rent in the skin whose dimensions vary from three to six inches on each side, the muscles are more or less torn. Owing to the bluntness of the object inflicting the wound there is seldom much bleeding.

TREATMENT.—There are two courses to choose in the treatment of this wound; one is open wound treatment, and the other is suturing and draining. The former is much the preferable one when the patient cannot be conveyed to the hospital; on the other hand if nosocomial accommodations are within reach, the latter should be selected.

Open wound treatment should begin by a thorough mechanical disinfection in which the shreds and the dirt are disposed of by trimming the surface. Then, after the bleeding has ceased, the whole surface is painted with the following solution: **Mercuric chloride four drams, hydrochloric acid** one-half ounce, and alcohol twelve ounces, and then

filled up with as much boric acid as will pack into the recesses and adhere to the prominent parts. The boric acid is reapplied frequently during each day, and the cauterant solution once daily until a bed of rosy granulations has formed beneath the eschar. Thereafter, mild astringents—white lotion—will answer.

The proper procedure against this wound, however, is the surgical method. The patient is confined on the table, or, if very tractable, with the single sideline. The skin around the wound is shaved about four inches from the edge. Before shaving the cavity is packed with cotton to prevent the shaved hairs from falling into it, and before the cotton is removed the shaved surface is disinfected with mercuric chloride 1-500 and then given a good friction with alcohol. The cotton is now removed and the cavity submitted to a thorough uncarpetting that takes away all soiled tissues and the unviable elements and conspicuous protrusions of flesh that would obstruct the flow of secretions toward the drainage orifice to be provided subsequently.

SUTURING.—A continuous suture is first sewed around the two sides; then these are drawn together neatly approximating the edges. A small orifice is provided inferiorly and superiorly for the drainage. The several lines of Mayo's running loop are inserted to hold the patch securely in place. The whole surface is then coated with collodion.

The after-care consists of preventing physical injury to the part and attending to the drainage.

A dose of antitetanic serum should always be administered to valuable charges, as such wounds are decidedly tetanogenic, whether treated as open or closed.

SUBPERIOSTEAL FRACTURES

Fractures without immediate displacement occur with considerable frequency in horses, generally from kicks of other horses. The points of predilection of these injuries are (1) **the medial surface of the tibia,** especially the middle and inferior thirds; (2) **the distal third of the dorsal** surface of the radius, "just above the knee," and (3) **the proximal third of the lateral border of the radius** "just below the elbow." At these three points the bones are exposed with no protecting envelope except the skin, and the periosteum is so thick and of such unusual toughness that a wicked kick may shatter the underlying bone without causing an immediate displacement. The fracture may be complete or partial,

transverse or oblique, simple or comminuted, and yet produce no immediate lameness or indisposition to harmonize with the seriousness of the injury. A horse so injured will sometimes walk for several miles or even perform an ordinary day's work before any pronounced lameness develops, and then after several days of rest the lameness may disappear, leaving the patient apparently ready for service again. Dependent upon the character of the fracture, ten to twenty days may elapse before the segments separate, and for the first time reveal the nature of the injury by a sudden dangling of the leg, crepitation and inability to support weight. Moller mentions a case in which one hundred and twenty-seven days elapsed between the date of injury and the date of separation. Hughes reports several cases in which the final dissolution of the bone occurred from three to four weeks after the accident, and the author observed the following interesting circumstance: A trotting stud twelve years old was kicked in the lower third of the radius by a mare about to be served. There was but a slight abrasion of the skin, and although he limped conspicuously after the accident, the claudication entirely disappeared after twenty-four hours. In ten days he was entered in a matinee race, apparently entirely recovered. He trotted the first half mile in one minute and six seconds, and then fell suddenly so lame as to be unable to proceed further. After limping to the stable with great difficulty he was conveyed home some ten miles in a horse ambulance, where an examination by a competent veterinarian still failed to disclose the serious nature of the trouble. On the morning of the twenty-third day the bones parted, and an examination post mortem revealed an oblique fracture extending from the seat of injury at the lower third of the radius to the superior part of the upper third. Analogous cases occur with great regularity.

The displacement of the segments in subperiosteal fracture is not always due to accident; it is sometimes the inevitable termination of a serious injury. The periosteum holds the bone intact until it has undergone inflammatory changes; then the segments collapse from non-support. A slip, a sudden transfer of the weight upon the affected leg in rising, etc., may precipitate a dissolution prematurely, but in many cases separation cannot be avoided.

TREATMENT.—At the onset subperiosteal fracture can not be diagnosed; the pathognomonic symptoms of fracture are wanting. Its existence should, however, **always be suspected** when dealing with injuries at one of the three

points of predilection above enumerated. The wise practitioner never fails to announce, and even emphasize the possible seriousness of contusions, or even apparently trivial abrasions, located on the internal surface of the tibia, the anterior surface of the radius and the external border of the radius.

When displacement has occurred the patient is shot as incurable. Before this event has occurred the patient is placed in slings and the wound submitted to a good antiseptic treatment for at least twenty days, after which time a moderate exercise may be allowed.

When located upon the radius and there is ample reason to suspect unmistakable fracture the leg brace (Fig. 281) should be applied.

FRACTURE OF THE PHALANGES OF HORSES

Fracture of the os suffraginus or os corona is usually caused by various forms of violence, notably slipping upon a smooth street, traction upon a foot caught in a street crevice, fence or defective stall, violence sustained in runaways, etc. These are only the curable fractures that occur to the long bones of horses. Fracture of the others is usually regarded as incurable, and rightly so, because recoveries are rare, the disability permanent and the expense an excess over the salvage.

Even in the case of the first and the second phalanx the results are none too inviting. While the life can usually be saved, if the patient is not aged, there is always the permanent claudication and deformity to be considered before advising the long, tedious and expensive treatment necessary to effect the partial cure.

As fracture of these phalanges is almost always articular, the osseous tissue deposited in the regenerative and reparative process must needs invade the articulation and thus interfere with the normal movements thereafter. While nature's processes often construct and ingeniously repair, perfect restoration of the joint to its normal condition seldom ever occurs.

TREATMENT.—The patient is retained in slings for at least four weeks, after which it may be allowed the freedom of a loose box. As there is little displacement of the segment "setting" is not found necessary, but to immobilize the segments against friction produced in the attempts to support weight, a hard bandage extending from the upper third of

the cannon to the level of the floor must be applied. Plaster of paris is strictly contra-indicated on account of the pressure-necrosis of the skin it is so prone to produce, and the opposition its weight always provokes.

The most successful procedure against these fractures is as follows: First trim the long hairs of the fetlock and ergot,

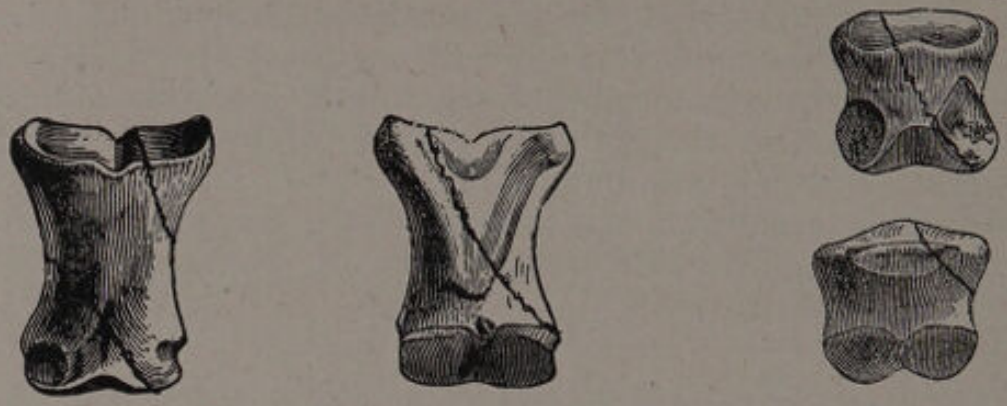


Fig. 272—Forms of Fracture of the Phalanges.

submit the leg to a good cleansing with soap, hot water and mercuric chloride, and then when dried and the hairs smoothed down, sprinkle the whole area to be bandaged with talcum powder. The first bandage is of four-inch cheese cloth wrapped neatly and evenly from the upper third

Fig. 272-A—Fracture of the 2nd Phalanx.

of the cannon to the level of the coronet. The talcum powder may be sprinkled into the hair as this bandage is being applied. A retention bandage consisting of electrician's insulation tape is then wrapped neatly, layer after layer, from the upper third of the cannon to the floor until it reaches a uniform thickness of about an inch. A piece of soft wood, whit-

tled to fit loosely into the hollow of the fetlock is then adjusted and retained by enough additional wraps of the tape to fix it firmly.

After two weeks the bandage is removed and refitted to afford an opportunity to treat any wounds it may have produced by pressure. At the end of four weeks it is dispensed with and substituted by an ordinary fabric bandage which may be removed and reapplied daily.

During the first two weeks it is important to draw the slings tight enough to prevent the injured foot from supporting weight, providing too much discomfort is not produced thereby.

FRACTURE OF THE OS INNOMINATUM

This is the most common of all fractures of horses. In almost every case it is caused by falling heavily, but in some cases occurs by slipping or by striking the side of the stable door.

The most common varieties of these fractures are: (1) Fracture of a part of the tuber coxæ; (2) fractures of the whole angle at different points toward the center of the bone; (3) fracture of the shaft of the ilium; (4) fractures through the acetabulum; (5) fracture of the shaft of the ischium; (6) fracture of the ischial tuberosity; (7) fractures of the pubis—often bilateral; (8) separation of the ischiopubic symphysis; and (9) fracture of both ischii.

I. **Fracture of a Part of the Tuber Coxæ.**—The distal portion is the part broken, and the seriousness depends upon the size of the segment, which may vary from a very small section of the very angle to a piece as large as a man's hand, extending from the uppermost angle backward toward the shaft.

This is the least serious of all the pelvic fractures. When only a small segment is broken the accident causes only a passing inconvenience to the patient, and may even go unnoticed. The deformity is slight and almost imperceptible, especially in horses in good flesh. On the other hand when the fracture invades the greater part of the whole angle there is a marked lameness lasting two to three weeks, and the deformity is thereafter a conspicuous deformity in the affected hip.

When the lesion becomes infected an abscess forms and then after bursting at the surface develops into a chronic fistula that can only be cured by extirpation of the segment.

When large and entirely free the segment is usually drawn downward toward the stifle by muscular contraction.

2. **Fractures of the Whole Tuber Coxæ** vary but slightly in the size of the segment and direction of the fracture. The line usually extends from the anterior border obliquely backward to the shaft. In the scale of seriousness this fracture stands second. It causes a pronounced lameness, a dragging of the leg, and a bias gait, that gradually disappears during three to four weeks succeeding the date of injury. The permanent deformation of the hip is always conspicuous, but the patient is restored to full usefulness. As in the foregoing, infection may end in the formation of a chronic fistula. In this case the tract may extend behind the segment, which, on account of its size and position, offers a serious obstacle to successful surgical intervention. The segment falls downward toward the stifle in juxtaposition to the peritoneal cavity, and instead of separating from the surrounding soft tissue it becomes more closely fused to them and at the same time enlarges into a larger body from the activity of its still well-nourished periosteum. The extirpation of such a body is a hazardous undertaking on account of its close relation to the abdominal cavity with whose walls it is often firmly fused.

3. **Fracture of the Shaft of the Ilium** is a serious fracture, causing at once a serious claudication and later a pronounced deformity and defective gait that render the subject unsalable and in fact almost useless. In brood mares it is a serious hindrance to pregnancy and parturition.

The patient is totally incapacitated for three months, and although able to support weight on the affected side, suffers considerable pain that reflects over the whole organism. The lameness never entirely disappears, but sojourns permanently in the form of a hitch and short anterior stride. The deformation of the hip is pronounced. The whole hip anterior to the level of the articulation is depressed by the sinking of the bone and atrophy of the gluteals. In some cases the injury is complicated with visceral injury. The sharp end of the fractured shaft may penetrate the abdominal or pelvic viscera, and sometimes wounds large vessels with serious if not fatal results.

4. **Fracture through the Acetabulum** is announced by an immediate inability to support weight and by great pain and suffering. Recovery is rare, and when the patient does survive the long painful ordeal, the lameness is permanent.

This fracture is rare except in rickety colts but is sometimes mistaken for fracture of the shaft near the acetabulum.

5. **Fracture of the Shaft of the Ischium** is usually accompanied with fracture of the pubis from the obturator foramen to the symphysis, and then backward along the symphysis to the ischial arch. It is caused by falling upon the haunches. The lameness is pronounced and the pain intense, although the full weight is supported on the affected side. The patient is incapacitated for work for six weeks to two months and is never entirely sound thereafter. The buttock is depressed and lameness continues indefinitely while trotting.

6. **Fracture of the Ischial Tuberosity** would appear to be a rather trivial injury as compared with the other pelvic

Fig. 273—Fractures of the Os Innominatum.

a, *c*—Fractures of the Tuber Coxae. *b*—Fracture of the Shaft of the Ilium. *d*—Fracture of the Acetabulum. *e*—Fracture of the Shaft of the Ischium. *g*—Fracture of the Ischial Tuberosity.

fractures. On the contrary, it is always a serious affair in that chronic lameness supervenes despite a long period of rest, and the deformity is conspicuous enough.

7, 8 and 9. These fractures implicating the pubes and ischii are always serious. They are usually complicated with visceral inflammation or visceral injury, besides producing a disability lasting for months, often ending in the inability of the patient to rise unassisted from decumbency after the use of the slings has been discontinued.

Treatment of Pelvic Fractures. In all the uncomplicated cases (fistulæ, visceral injury, etc.) the treatment is similar. The patient is placed in slings from two weeks in the less

serious cases to six weeks to three months in the more serious ones. Decumbency, even for a few minutes, is always harmful, because of the injury inflicted to the soft tissues by the movements of the jagged segments, incident to rising. Often the suffering patient will refuse to rise unassisted after the first attempt and not infrequently, especially in pubic and ischial fractures, it refuses to remain standing, even after having been raised with the slings.

In addition to the slings, succulent feeds and laxatives are essential to the best results. Coprostasis of the floating colon and rectum which is prone to occur on account of the pain produced by defecation is prevented by occasional enemata, and dysuria is met by catheterization.

External applications are useless, although if properly continued for some hours daily, steaming hot blankets applied over the affected parts should be helpful in reducing the amount of pain. Liniments and blisters only add to the patient's discomfort.

When it is thought prudent to dispense with the slings the patient is given the freedom of a large loose box where there is ample room to "give a lift" if found necessary.

RUPTURE OF THE PERONEUS TERTIUS
(Flexor Metatarsi)

This injury has often been erroneously described under the name of "sprain of the flexor metatarsi," in spite of the fact that the tendinous portion (peroneus tertius) of this complicated muscle is not only sprained but actually torn completely in twain. The injury may be sustained by any accident that will bring traction upon the anterior tibial group of muscles by an excessive sudden extension of the hock. Falling suddenly with one hind leg extending backward and falling in the shafts after having kicked over the cross-bar with one leg are the two chief accidents which result in this injury. The author has seen one horse so injured by the slipping backward of the leg supporting the weight while secured in the standing position with the single sideline for firing, and two cases from pulling frantically upon the uppermost hind leg while secured upon the operating table.

As soon as the accident occurs a most remarkable phenomenon ensues. The leg, while able to support weight, dangles helpless in the posterior stride, as if affected with a serious fracture. (Fig. 274.) The anterior stride is wanting,

and hock flexion nil, but the pathognomonic symptom is the curling up of the tendo-Achilles while walking and the extreme relaxed condition found on palpation when the leg is not supporting weight. In our post-mortem we have always found the injury at the level of the stifle near its origin. The swelling in front of the hock so often seen is due to strain occurring with the accident.

TREATMENT.—The patient is kept in the standing position with slings for two weeks and then given the freedom of a loose box or paddock, or else turned out alone in the pasture. The surface of the anterior tibial region may be medicated with liniments, and later with a good cantharides blister.

Fig. 274—Rupture of Posterior Metatarsi.

PROGNOSIS.—Recovery occurs in eight weeks to three months in a horse in the prime of life. Aged horses recover more slowly, and rare cases are incurable.

TRAUMATIC DISLOCATIONS

The truly ginglymoid character of the joints of quadrupeds, the interlocking arrangement of most all of the articular surfaces and the strength of the binding ligaments protect animals against luxations. Animals are more exposed to the very kind of injuries that should cause luxations than human beings, but on account of these anatomical features their occurrence is rare.

The coxo-femoral articulation, in exceptionally rare cases, is dislocated in dogs and oxen; the scapulo-humeral in still more exceptional instances may be dislocated in horses; and partial dislocation of the cervical vertebræ have been reported (torto collis). But these occurrences are too rare to warrant any special attention. The more common ones, and these are indeed rare enough, are:—(1) Dislocation of the fetlock of horses; (2) Dislocation of the patella from the femoral trochlea in horses; and (3) Dislocation of the temporo-maxillary articulation in dogs.

1. **Dislocation of the Fetlock of Horses.** This accident occurs to work horses, and is caused by catching the shoe calk or the foot in a defective pavement, street-car rail, bridge, railroad switch, etc., while walking fast enough to be thrown violently to the ground in a forward and lateral direction. The foot is fixed and as the body topples from its momentum the extremity is broken at a right angle at the fetlock. When released the phalanges dangle. There is no displacement requiring forcible reposition; the joint falls into place automatically, although it can be worked laterally like a hinge.

The injury is serious in that the binding ligaments and the capsule are lacerated and the surrounding soft tissues are more or less bruised from the tension to which they were subjected.

TREATMENT.—The patient is placed in the slings and the leg bandaged in the manner recommended for fractures of the phalanges (page 531) after the swelling has reached its climax. During the first three days a good, firm and thick muslin wrap is depended upon as a retaining bandage. The permanent bandage of electrician's tape is removed and readjusted after ten days to fit the decreasing size of the leg, incident to the disappearance of the swelling. In four weeks it can be safely dispensed with and substituted by an ordinary muslin support. At the end of six weeks firing and blistering is indicated to assist in curing the lameness that usually sojourns stubbornly. A protracted rest at pasture is helpful, but in almost every instance the joint is permanently enlarged, and not infrequently the lameness is chronic.

2. **Traumatic Dislocation of the Patella from the Trochlea** must not be confounded with simple "pseudo-luxation of the patella" (stifle-cramp). This is both a rare and a serious injury. It usually occurs in some mysterious manner by stall maneuvers at night, and is manifested at once by inability to reach the floor with the foot of the affected leg.

The foot is held one to one and a half feet from the floor, and it can not be drawn further down by manual traction. In one case observed by the author the toe was held at the level of the hock. The stifle is painful and the patella stands out in bold relief amid a mass of swelling.

In simple stifle cramp, which the "old school" practitioners thought was dislocation of the patella, the foot is fixed to the floor; here it is fixed above the floor.

TREATMENT.—A rope is attached to the pastern and the leg is drawn backward with all of the force of five or six men until the operator, standing at the stifle, is able to push the patella over the lip of the trochlea. In one case observed by the author it snapped in unassisted after the leg had been drawn upon with sufficient force to "straighten out" the femora-tibial angle. To properly execute this

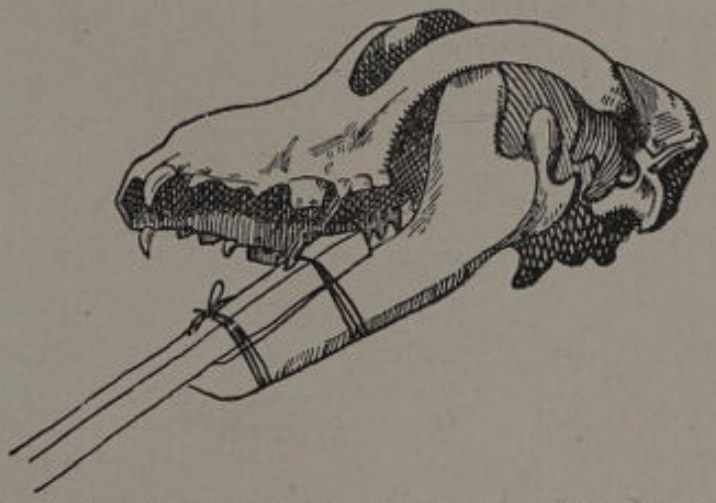


Fig. 275—Lever Fixed to Jaw to Effect Reduction of Dislocation of Temporo-Maxillary Articulation.

maneuver, the horse is placed in a narrow stall where there is ample room behind for the men to work. To prevent the patient from being drawn backward by the traction a rope is passed beneath the tail and tied forward on each side of the manger. Decumbency may be prevented with slings or a rope passed around the body and secured over a ceiling beam.

When the reposition has been successfully effected the foot falls to the floor and walking becomes possible. A pronounced lameness, however, always follows this injury, and this must be met by fometations, liniments, and later by blisters. A protracted rest will be found necessary on account of the continuation of a disabling claudication.

3. **Dislocation of the Temporo-maxillary Articulation of Dogs** occurs occasionally. It is said to occur from yawning,

but is probably always the result of attempts to gnaw upon bones of large size or to seize large objects. The accident is manifested by the absolute inability to close the mouth by the use of force. The mouth stands open and the watery saliva flows out of each side. The accident in human beings is both unilateral and bilateral, and the same is usually said of dogs. The author has never seen the unilateral form in dogs, although its existence is not doubted.

The displacement is backward; the condyle slips behind the glenoid cavity. French describes the accident as a forward dislocation, but an examination of canine skulls clearly shows that such an occurrence is a physical impossibility.

TREATMENT.—The reduction of this dislocation is effected by simply depressing the jaw posteriorly, but as sufficient force is difficult to apply at this point a special appliance must be used. The humane surgeon simply depresses the jaws with the thumbs after wrapping them with cloth to provide against a bite as the jaw snaps shut. The length of the jaw of dogs renders this procedure impossible.

The operator first provides himself with a hardwood stick two and a half feet long, wide enough to ride both posterior molars of the lower jaw and thick enough to assure against bending. After the dog is anæsthetized with ether the stick is passed into the mouth so that its end rests upon the posterior molars, where it is tied firmly to the jaw with wrap after wrap of good strong tape or cord. The assistant now supports the head with both hands and the operator takes hold of the outer end of the stick with the left hand and the part bound to the jaw with the right. By pressing downward with the right (the fulcrum) and upward with the left (the lever) the jaw (the weight) immediately falls into place with the greatest ease. Feeding with easily masticated food is the only after-care required.

BRACHIAL PARALYSIS

Brachial Paralysis is the name applied to a paralysis of the nerves proceeding from the brachial plexus due to a direct injury to the plexus itself. The injury may be a contusion from falling or lying heavily upon the shoulder, from decumbency during serious illness or surgical restraint, from traction upon a fixed leg in surgical restraint, or from slipping upon the street without falling. The nerves constituting the brachial plexus wind around the upper third of the first rib, and when arranged into a plexus lie between the

rib and the scapula. If the first rib is fractured the contractions of the scalenus muscle displace the segments anteriorly and draw upon the nerves which pass around its anterior border, and thus paralyze them. This accident constitutes the most serious form of the disease—**the incurable form,**—as the displaced rib permanently prevents the nerve from functionating. When the disease is due simply to a bruising of the plexus or a stretching of the nerves the nervous lesion may be capable of undergoing a successful regeneration, and recovery may follow sooner or later, according to the severity of the injury to the nerves—**the curable form.**

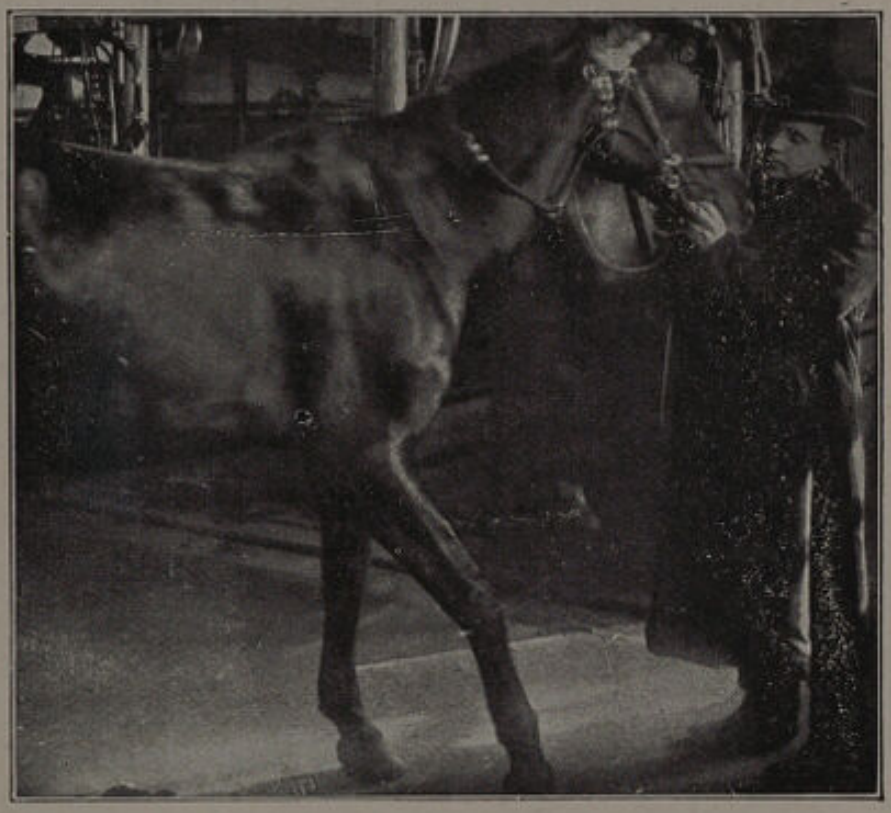


Fig. 276—Horse Affected with Brachial Paralysis in its Curable Form.

Differentiation is not always possible at the onset, although the former may be suspected when the patient suffers considerable pain, is perfectly helpless, cannot be induced to move even when punished, and the leg is entirely helpless. When, after four weeks, there is no amelioration of the paralysis, the muscles have atrophied, and the patient has become emaciated from pain and discomfort, the diagnosis of brachial paralysis with fracture of the first rib may then be announced. On the other hand, if the strength of the leg is gradually restored after the second week it is

evident that no such serious lesion as fracture of the rib exists and that a rapid recovery is forthcoming.

The symptoms of the disease are shown in Fig. 277. The elbow drops, the foot is held one foot to eighteen inches in advance of the opposite one, the caput muscles are flaccid and if attempt is made to support weight the leg collapses. The pathognomonic symptom is the ability to support the entire weight of the body when the knee is forcibly prevented from collapsing forward.

Fig. 277—Incurable Brachial Paralysis.

TREATMENT.—The patient is retained in the standing position, with slings if necessary, and the knee is prevented from collapsing forward by means of a brace (Fig. 281) extending from the foot to the elbow. A strong piece of iron shaped to follow the curves of the leg and equipped with straps and buckles at the foot, at the cannon, and two at the forearm, will answer the purpose. The leg must be well padded with bandages at the points encircled by the straps, especially at the upper third of the forearm, to prevent pressure necrosis of the skin.

The author's special method of accomplishing the same

effect is as follows: The saddle and breachment of a common buggy harness, including back-strap and crupper, is

Figs. 278 and 279—Two Views of Fractured Rib Found Post-Mortem in Horse Shown in Fig. 277.

placed on the patient and buckled snugly to the body. The holdback straps are buckled together in the middle of the

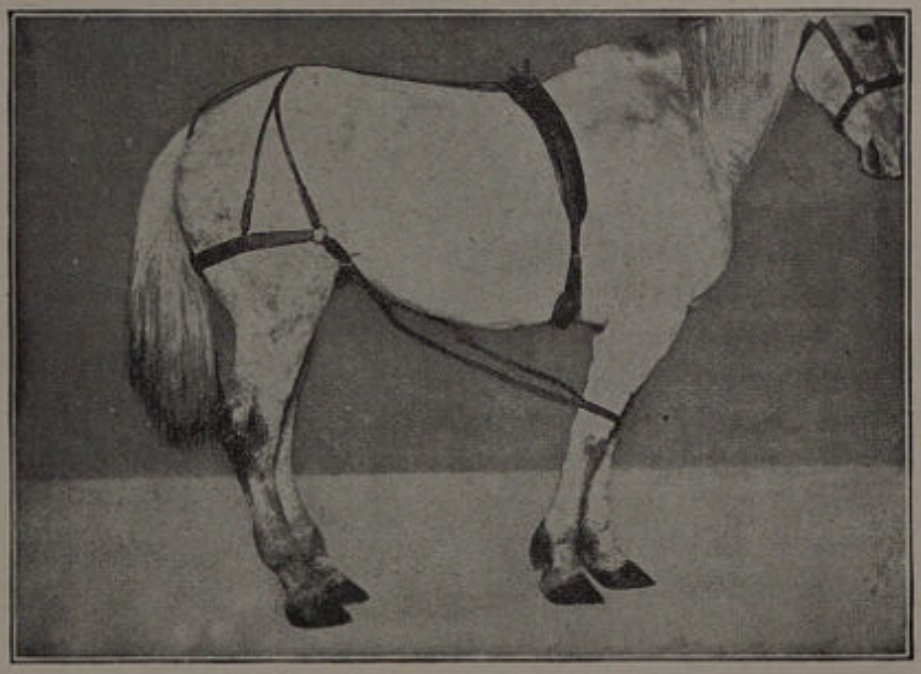


Fig. 280—Author's Method of Fixing Knee in Brachial Paralysis

ventral surface in front of the hind legs. From these a strap is passed to the knee of the affected leg and buckled up until the leg is drawn into its proper vertical position. The

force required to hold the leg in position thus falls upon the buttock, and as this region is accustomed to breachment pressure no discomfort is provoked, and the horse wears it day after day without display of opposition.

The essential part of the treatment is to keep the leg continually in a vertical, weight-bearing position until the function of the paralyzed muscles is sufficiently restored to enable the patient to walk about. After this time a limited amount of exercise will assist in restoring the leg to its normal condition. As long as the leg collapses, however, when the patient stands, the apparatus must be readjusted after

Fig. 281—Schematic View of Leg Brace for Brachial Paralysis.

each period of exercise. It is only dispensed with when the patient holds the leg in the normal position unassisted.

Local applications to the flaccid caputs, such as fomentations, liniments, blisters and setons, have very little effect in hastening the restorative process.

BROKEN KNEES

The phrase "broken knee" is the name applied by veterinarians and horsemen to more or less serious abrasions of the anterior surface of the carpus. These injuries are sustained by the friction of the knees against the road-bed after stumbling and falling upon them. The seriousness of the

accident depends upon the character of the road-bed and the distance slid after the knees have struck it. Macadam and gravel roads produce the most formidable varieties. In regard to extent, the injury varies from a trivial abrasion to an extensive excavation of the whole anterior part of the knee, including the tendon sheaths and the tendons, even exposing the carpal bones. And in addition, road dirt, sand and gravel are ground into the mutilated tissues and defy removal except by dissection. The accident is usually a grave one. Some may even prove fatal; others heal with a rigid scar that limits flexion, and nearly all of them leave an indelible, conspicuous, denuded blemish, thereafter interpreted as an evidence that the horse is an habitual stumbler.

TREATMENT.—The wound must be disinfected with more than ordinary care. The leg is showered with water to rinse off all the sand and dirt, the hair is shaved from the immediate surroundings, the dirt-containing tissues carefully dissected away, and finally the wound is irrigated with mercuric chloride 1-1000 for no less than one-half to one hour. The wound having thus been disinfected and all of the bleeding arrested, a brace (Fig. 281) is placed upon the leg to prevent flexion and a dressing composed of boric acid 75% and iodoform 25% is bound to the wound with cotton and bandage. The antiseptic powder is used in abundance and renewed twice daily during the first eight to ten days. When the synovial discharge is copious it may be changed three times daily. After the granulations have filled the cavity and the discharge has ceased, astringents are applied until healing is well advanced. The brace is dispensed with as soon as the formative tissue is substantial enough to prevent it from fissuring from flexion. If kept on too long a stiff knee may result, in the more serious cases. A little exercise when the healing has progressed to a safe point is advisable, but the standing position must be maintained until the scar has become a quite substantial affair.

Cherry's operation, which consists of excising an island of skin shaped like a melon slice, with the abrasion within, and then bringing the edges together with sutures assisted by two lateral relaxing incisions, is a special method of removing the blemish of broken knees. But in spite of the fact that it has been recommended as a classical procedure to no less than two generations of veterinarians, it has never gained popularity, because it is only applicable to the circum-

scribed abrasion that will heal with even less blemish than that produced by the lateral relaxing incisions.

HYGROMA OF THE KNEE

Bruise of the knee from falling upon hard streets without solution of continuity of the skin causes an "acute hygroma," a serious sac or a sanguineous sac that appears in the form of a large fluctuant enlargement, slightly painful at first but finally sojourning for weeks, and even months, in the absence of all pain and inflammation. In rare cases they become purulent and then cause considerable pain until the pus is evacuated.

Hygroma of the knee is seen chiefly in draft horses, although the lighter breeds sometimes sustain it. It is caused by slipping, usually when starting a heavy load. The toe calk fails to hold, the foot slips backward and the knees strike the street violently. The accident occurs quickly, often entirely unnoticed by the teamster. It is rarely bilateral at first, although both knees may sustain the injury consecutively.

The trend of this lesion is toward permanent tumefaction of the knee, either by thickening of the skin or by the formation of a chronic hygroma. In either case the blemish is permanent.

TREATMENT.—The greatest obstacle in the treatment of knee bruises of this variety is the constant repetition of the accident. While it may sometimes be directly attributed to insufficient calking during the slippery season more often it is an habitual fault of the horse, which will continue to injure the half healed sac of a former accident, and thus prevent cicatrization.

To successfully cope with the affliction absolute rest of four weeks is required, for if the animal is kept at work the enlargement becomes chronic.

To effect a perfect cure the sac is lanced at bottom, after having shaved and disinfected the seat of operation with due thoroughness. The opening should be no longer than one-half inch. The bleeding, which usually consists of a spurting vessel or two in the skin on each side of the incision, is arrested by touching up the spots with the thermo-cautery. The opening is then wadded snugly with a small pledget of sterile or antiseptic gauze, and the leg placed in a brace (Fig. 281) for ten days to two weeks. At first twice per day and later once daily the wad is removed and the accumulated secretion gently pressed out. At the end of two weeks the

horse is given gentle exercise and is ready for work in twenty days, almost entirely cured.

The secret of success lies in the prevention of infection and in the immobilization of the leg with the brace.

CAPPED HOCK

This hygroma is caused by lying upon the unbedded floor, and sometimes by kicking against the stall. It is a subcutaneous hygroma, but sometimes implicates the bursa of the flexor pedis perforatus. It is one of the formidable accidents of horses. In good horses it is a veritable calamity on account of the great liability to end in a chronic conspicuous enlargement.

TREATMENT.—The first step is to determine the cause and control it. Treatment is futile if the cause is extant. In proceeding against them there is the choice of three methods: (1) Repeated aseptic aspirations, (2) medical applications, and (3) lancing. The first and second are sometimes successful if the patient is kept standing for two to three weeks and not permitted to irritate the seat of injury by moving about. Decumbency, kicking against the stall, and exercise are positively harmful by stimulating a new quota as fast as it is aspirated or absorbed. The third method (lancing) is probably the best, although it will leave an indelible blemish if the wound and the cavity are allowed to become infected, and may even result disastrously by extension of the infective inflammation to the underlying bursa. The success of the operation depends upon asepsis throughout the entire period of exposure and immobilization. The latter is not as easily effected as in the fore-limb, because braces applied to the pelvic limb are opposed by the patient, and can not very well be retained in position.

The modus operandi of evacuating the capped hock is as follows: The patient is restrained with the twitch and side line. The distal part of the sac is shaved and disinfected with mercuric chloride 1-500 and then perforated with a small lance. When the fluid has been squeezed out the opening is wadded with antiseptic cotton. The horse is tied up in a narrow and short single stall which restricts movement and prevents kicking against the pillars. The after-care consists of daily injections of adrenalin chloride 1-1000 under the strictest aseptic precaution, and wadding of the wound to prevent infection. Injections of sterilized methyline blue 2% are also markedly effectual in arresting the secretion and promoting more prompt cicatrization.

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