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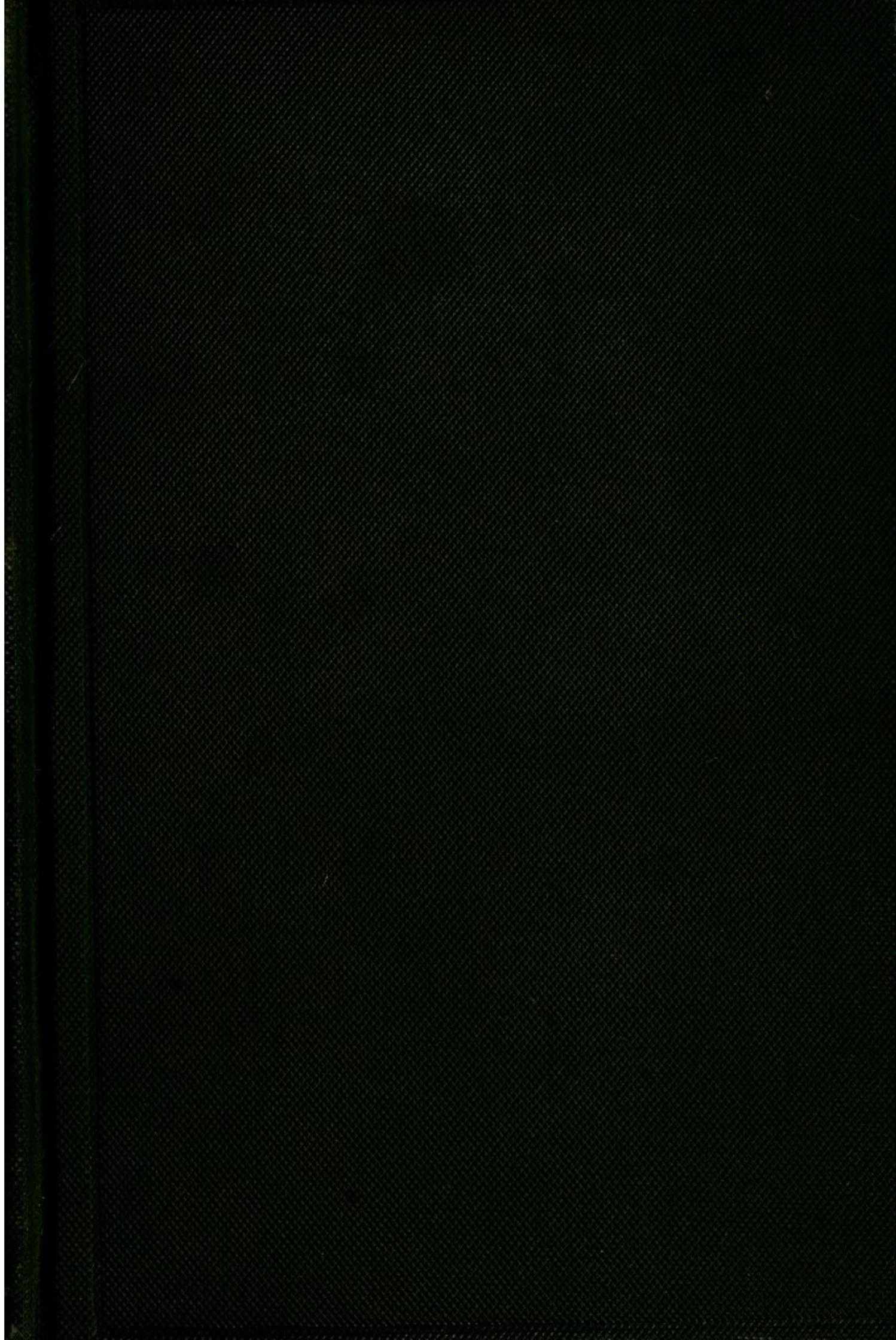**Publication/Creation**

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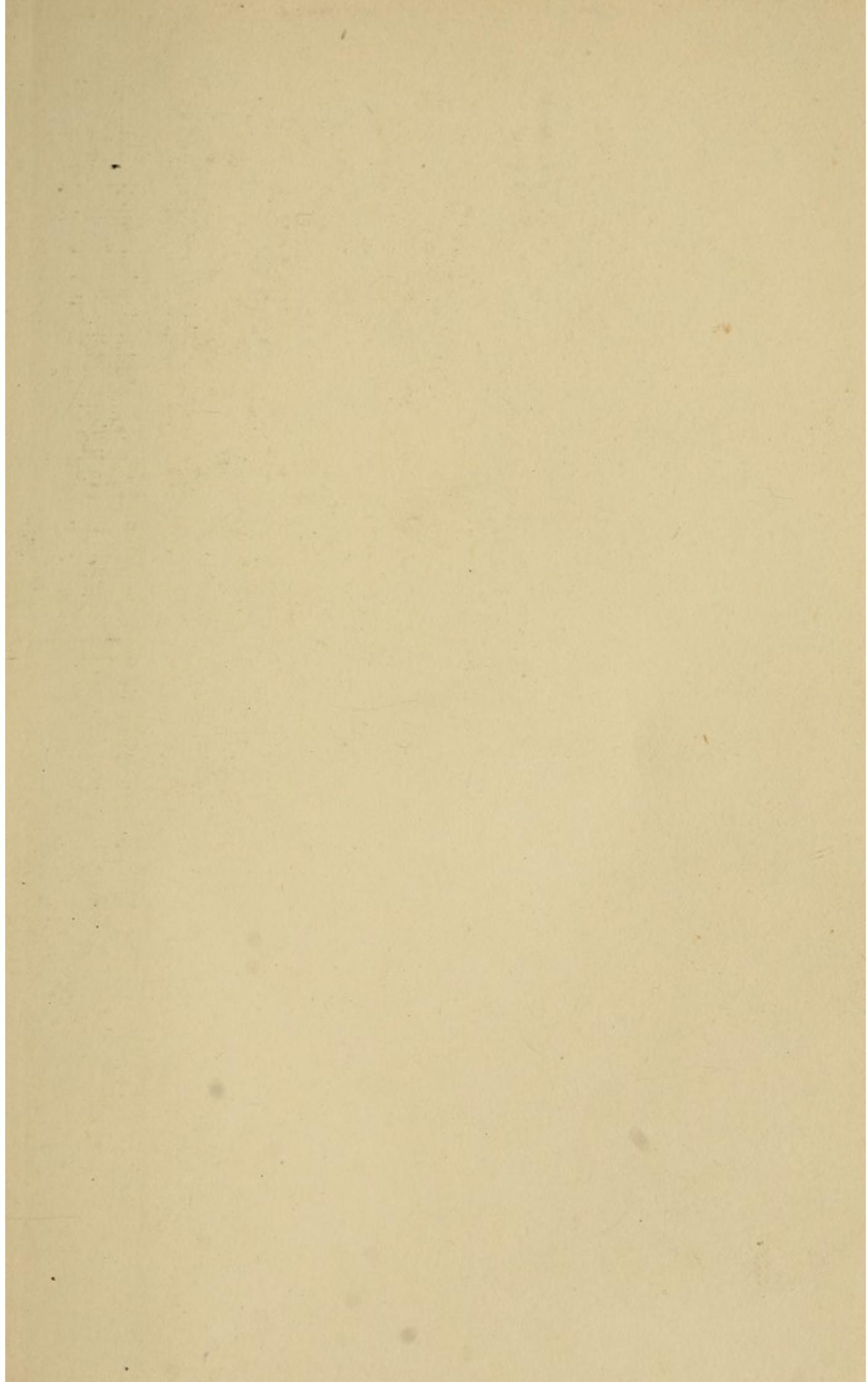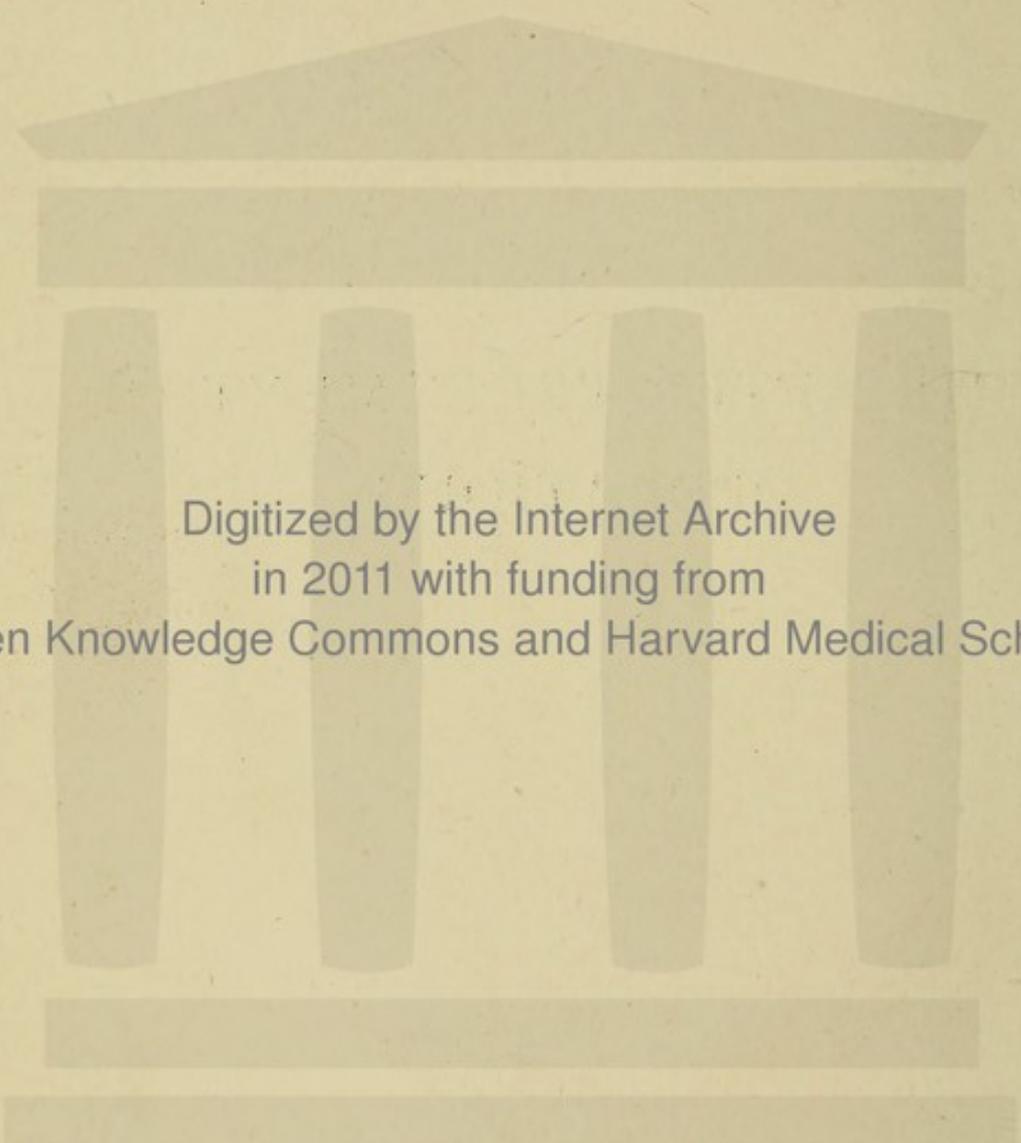
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THE AFTER-TREATMENT OF
OPERATIONS

THE AFTER-TREATMENT
OF OPERATIONS

A Manual for Practitioners and House
Surgeons

BY

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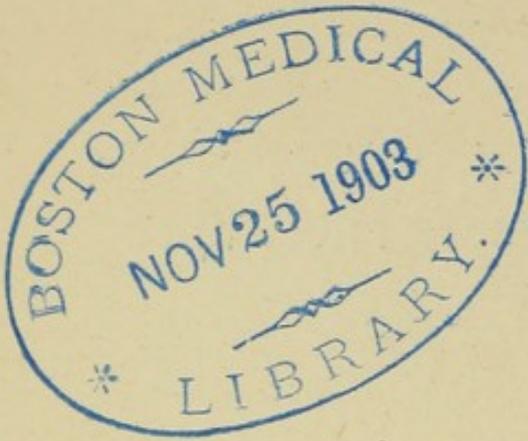
PREFACE

THE after-treatment of operation cases is a subject of such importance that it is not a little surprising to find how little has hitherto been written about it. What has been written is to be found, for the most part, in a somewhat fragmentary form in the larger text-books, and is not convenient for reference.

I have attempted in the present manual to put the subject in a useful and practical form for ready reference by those who, having to treat such cases, wish to know what complications may be expected, and how they are to be met when present.

The after-treatment of operation cases adopted by different surgeons varies very considerably. But as no good purpose would be served by a recital of all the different methods, I have given in each case that line of treatment which seems to be the most practical, and have avoided entering into any discussion upon the relative merits of the different forms of treatment sometimes adopted.

In the chapter on shock, a short description of the more recent physiology of this condition has been included, in the hope that it may assist the reader in the treatment of this most important complication.

Considerable space has been devoted to the after-treatment of abdominal cases, as it is here, perhaps more than anywhere else, of importance.

I have to offer my best thanks to Mr. Herbert Allingham for kindly looking through the manuscript, and to those others of my friends who have assisted me.

I have also to acknowledge my indebtedness to J. H. Montague for the loan of blocks 14, 22, and 29, and to Messrs. J. and E. Ferris for the loan of blocks 24, 25, 26, 27, and 28.

<div align="right">P. LOCKHART MUMMERY.</div>

10, CAVENDISH PLACE, W.
   September, 1903.

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THE AFTER-TREATMENT
OF OPERATIONS

CHAPTER I

INTRODUCTORY

THE after-treatment of operation cases is one of the most
interesting studies in surgery, and at the same time one
of the most important. Nothing will better repay
careful and intelligent observation by those having such
cases under their care. Whether an operation is
successful or otherwise depends, of course, to a large
extent upon the manner in which the operation is
carried out and upon the skill of the operator, but it
also depends to no small extent upon the care and
attention which is paid to the after-treatment. The
operation is the most showy and impressive part of the
treatment of the disease or condition, and, in conse-
quence, it has become too common to think that the
operation is everything, and that the after-treatment is
merely a matter of course. This is, however, not the
case. Many operations depend for their success on the
way in which the treatment afterwards is carried out,
and many an almost hopeless case has been saved by
skilful after-treatment.

I

To no branch of medicine or surgery does the old maxim ' Prevention is better than cure ' apply more aptly than it does here.   The best results will always be obtained by anticipating complications, and taking steps to prevent their occurrence, rather than by treating them after they are well established.   Our line of treatment should be to put the patient under the most favourable circumstances for rapid recovery, and by bearing in mind the complications that are liable to occur, to anticipate them, and so treat the patient that they are avoided.   A surgeon may perhaps get great credit for saving a patient by brilliant treatment when he is *in extremis*, but the best surgeon will, nevertheless, be he whose patient has never got into this condition.   Artificial conditions should be avoided as far as possible, and when a patient has a natural desire for any particular thing, it should be gratified, unless there is some reasonable objection to doing so.   Nature is, after all, the best judge of what is good for a patient and what is not good, and, as a rule, the patient will not wish for those things which are dangerous in his condition.   There should be a definite reason for every course of treatment, and rule-of-thumb methods must especially be avoided.   No two cases are exactly alike, even after an almost identical operation, and exactly the same treatment need not necessarily be adopted.   When, after an operation, complications occur, the treatment should be prompt and thorough.   Meddlesome interference, however, must be avoided, and as long as the patient is doing well he should be left alone.   The after-treatment of operations may be said to be the study of details, and the two most useful adjuncts to success are careful observation and common-sense.   There is a saying of the great physician Sydenham which is well worth bearing in mind : ' More

importance is to be attached to the desires and feelings of the patient, provided that they are not excessive, than to the doubtful and fallacious rules of medical art.'

The Importance of Posture in the After-Treatment of Operation Cases.

It seems to have become an accepted dictum with many people that, after operations of a certain degree of severity, the proper position to nurse the patient in is the dorsal recumbent one. This seems to have been assumed on somewhat insufficient grounds. As regards the comfort of the patient, this position is not a success. It is not a natural position. Few people sleep on their
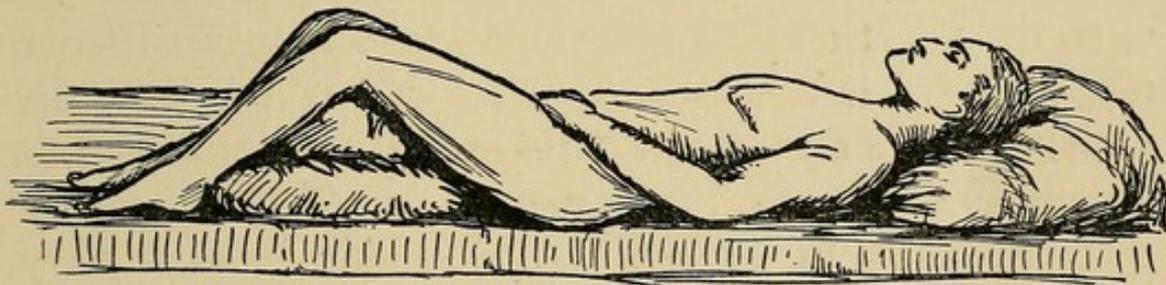
FIG. 1.—DORSAL RECUMBENT POSITION.

backs, and when those who are unaccustomed to it are obliged to do so they are often unable to sleep well. It is a very common experience to hear patients who are under treatment for fractures or some other complaint necessitating the dorsal position complain that their backs hurt them more than the injury, and who say that they would be quite comfortable if they were allowed to turn on to their side. Often their only complaint is the discomfort of the position.

The recumbent position on the back is not anatomically sound. The skin covering the sacrum and lower lumbar region is very badly supported for withstanding

continuous pressure. The sacrum is very superficial, and in the majority of individuals there is but little fat and muscle between it and the skin. The same may also be said of the other bony points on the back. The angle of the spine of the scapula is just beneath the skin, and but slightly covered. The spines of the vertebræ also are immediately beneath the skin, and the latter is unduly subjected to pressure, owing to the prominent position of the spines. There are many other objections to the position. Women who are kept long in this position are very liable to develop cystitis from the presence of residual urine in the bladder, as most women are unable to empty their bladders completely when lying on their backs. This fact should be remembered, as it is a very common cause of cystitis in women after operations. It may be prevented by passing a catheter occasionally, but a much better way is to allow the patient to turn on to her side in order to micturate, or, if possible, to sit up for the purpose.

THE PRONE POSITION (Fig. 2).—This is often very much better than the dorsal position, and is particularly suitable when it is desired to drain a wound opening upon the anterior surface of the body, as in some cases of appendix abscess, psoas abscess, etc., or, again, when the dorsal position has resulted in the formation of bed-sore, or it is feared will do so. In this position the patient lies on the face with a pillow under the chest, and another is placed to rest the side of the head upon. Patients soon become accustomed to this position, and often find it more comfortable when unable to move than the dorsal one. The front of the body is well provided against pressure, and bed-sores are practically never seen. (The knees are the only places where sores are at all likely to occur.) The tendency to distension of the

abdomen, which is common in the dorsal position, and especially when the patient is on a fluid diet, is much less, and the cystitis just mentioned in connection with the dorsal position in women does not occur, as the bladder is able to empty itself easily by gravity.

Mr. Allingham has also pointed out the value of this position after injury to the main femoral vessels. Under such circumstances the integrity of the limb depends
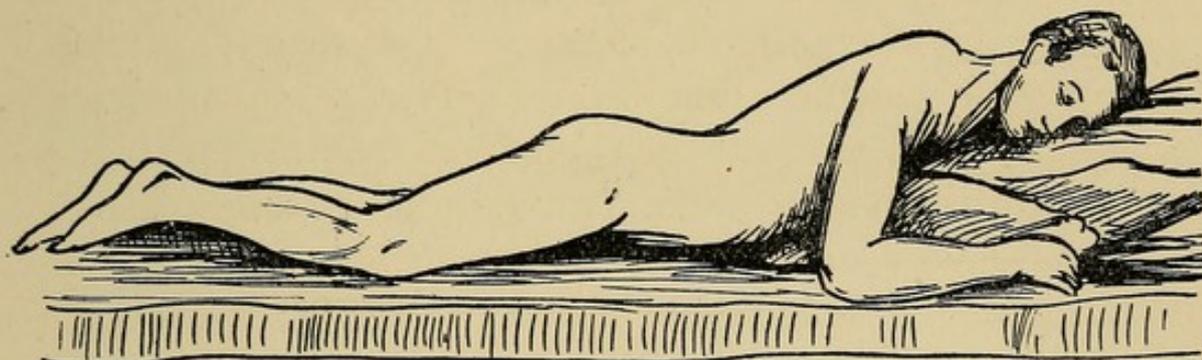
FIG. 2.—PRONE POSITION.

upon the rapid development of a collateral circulation, and it is therefore of the greatest importance that the collateral vessels should be relieved from all pressure. As many of these collateral vessels are in the gluteal region and back of the thigh, the dorsal position is very unsuitable to this end, and the prone position should be adopted. Mr. Allingham recites a case where it was necessary to resect a portion of both the main femoral vessels in removing a tumour of the femur, and in which the prone position was adopted; the collateral circulation was soon established, and the limb recovered perfectly.

SEMI-RECUMBENT POSITION (Fig. 3).—Here the patient is propped up into a half-sitting posture with pillows and a bed-rest; a bolster is also placed under the thighs to prevent the patient from slipping down in the bed. Care must be taken to see that there is not undue pressure

on the lower part of the sacrum, otherwise bed-sore is apt to occur at this spot ; this may be prevented by flexing the knees over a bolster or junk, and allowing the weight to
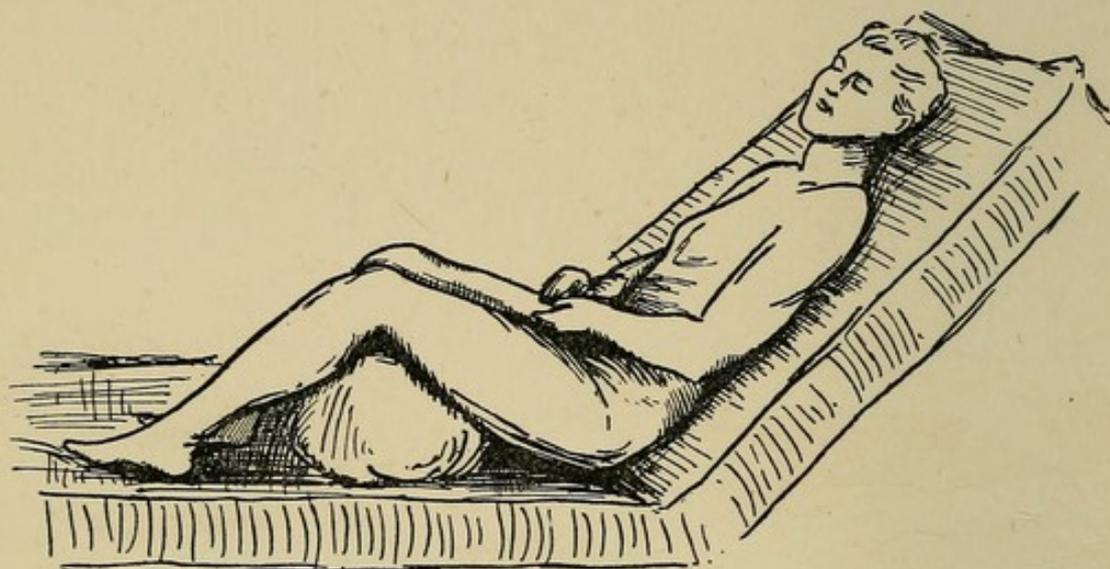
FIG. 3.—SEMI-RECUMBENT POSITION.

be taken on the under-surfaces of the thighs.   There is now a special support called the ' Sister Dorris,' which is made by Messrs. Allen and Hanbury for maintaining this position.

This is the position in which all elderly people should be nursed whenever possible.   The recumbent position is particularly unsuitable for such patients, as, although their lungs may have been previously healthy, they are very liable to develop a moist bronchitis, or hypostatic congestion of the lungs if kept lying down for any length of time, and this is particularly the case when the opera-tion interferes with the thoracic or diaphragmatic move-ments, as after removal of the breast or operations on the stomach, etc.   This position is, however, suitable for many other patients besides elderly ones ; it is the best position after most operations on the stomach, after operations on the thorax, and many others which will be mentioned later.   It is also preferable to the recumbent

position in many cases of weak or failing circulation, when this weakness or failure is in any way dependent upon deficient aeration of the blood in the lungs. This is probably to be accounted for by the greater freedom of the chest movements allowed by the position.

THE LATERAL POSITION (Fig. 4).—This is the natural resting position of most people, and it is the most comfortable position for many patients when circumstances
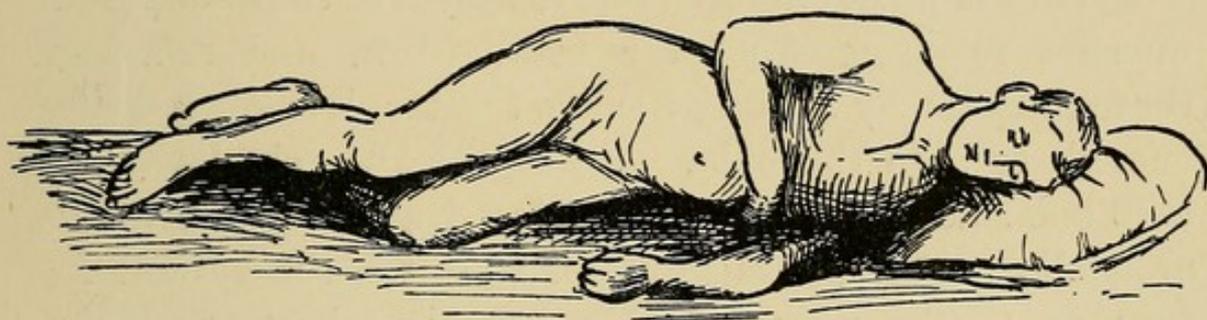
FIG. 4.—LATERAL POSITION.

will allow of its being permitted. The patient lies on the side with the under-knee well flexed and the upper one slightly so; the trunk should also be a little flexed. Many patients are rendered more comfortable if a pillow or bolster is put to support the back.

POSITION AFTER LAPAROTOMY.—It has been, and to a large extent still is, customary to consider that the best position for patients after abdominal section – at any rate for the first few days—is lying on their backs; this is, however, unnecessary and inadvisable except in special cases. Comfort and sleep are here of the greatest importance, and if the patient can be got quietly to sleep during the first twenty-four hours after the operation, much will have been gained. As it is advisable in these cases to avoid the use of opiates as much as possible, it becomes all the more important to secure the patient's comfort. Patients after laparotomy are, as a rule, much easier if

allowed to turn on to the side; they should be moved on to that side on which they are accustomed to sleep, and carefully assisted into the position which they find most comfortable, and in many cases they will drop off to sleep in a few minutes.   No harm to the wound need be apprehended, and the position on the side with the knees well drawn up, by relaxing the recti muscles, often gets rid of the pain which sometimes follows the operation. This pain is no doubt often due to spasm of the abdominal muscles resulting from the traumatism, and relaxing these muscles by slightly flexing the trunk is often quite enough to stop the pain.   When the abdominal wound is to one side and has not been closed, as in colotomy and appendix abscess, it is best not to allow the patient to turn on to the wounded side, as this might result in prolapse of the intestine; he may, however, be turned on to the opposite side with safety.

After abdominal section in children it is particularly important that no unnecessary restraint should be insisted upon.   No child, unless it is very ill indeed, will remain for long in the recumbent position without constant watching or the use of some retentive apparatus; and constraint soon renders children restless and irritable, and prevents them sleeping.   If allowed to move about as they choose they seldom come to any harm, and, as a rule, keep much quieter than if subjected to restraint. In young children it is best to fix the dressing with broad pieces of strapping encircling the body; this prevents the movements of the child from disturbing the dressings, and at the same time supports the stitches. When it is necessary to keep a child on its back for any length of time, a preferable method to the use of shoulder straps is to apply extension strapping to the child's legs and to sling both legs up to a cross-bar, as in the treat-

ment of fractured femur by Bryant's method. This is a much more effectual method than the use of shoulder straps, and children do not object to it so much; it also enables the child to be kept clean very easily.

As little restraint as possible should be put upon a child's movements after an operation, and the younger the child the more important this becomes.

Lastly, it should always be remembered in connection with the position of a patient after an operation, that the position of greatest comfort is also that of greatest rest, and therefore the best.

Sleeplessness after Operations.

This may be due to a variety of causes, and must be treated accordingly. When due to pain, morphia must usually be given so as to secure a good night's rest. The commonest cause is undoubtedly discomfort, and everything should be done to make the patient as comfortable as is possible under the circumstances. If the patient complains that the bandages are too tight, these may be loosened a little; if he finds his position uncomfortable, he should be moved into a new one, and especially into that position in which he is accustomed to sleep; if he is thirsty, he should be allowed a drink of water, milk, or lemonade, etc. An ounce of whisky or brandy given in hot water will often act as a most effectual sleeping-draught, and can be very seldom contra-indicated. A very useful sleeping-draught for use after operations is the following:

℞ Liq. morphinæ tartratis - - - ♏xxv.
   Aquam pimentæ - - - - ad ʒi.

If morphia is not advisable chloral may be given, or any of the numerous drugs which are now in use for

insomnia; of these trional is one of the best, and should be given in 20-grain doses; it is often rendered more effective if administered with a little whisky and hot water. Paraldehyde is a very effective drug, but owing to its unpleasant property of making the patient's breath smell it often cannot be used; it should be administered in peppermint water with some syrup to disguise the taste:

R Paraldehyde - - - - ʒi.ss.
Tinct. aurantii - - - - ʒii.
Aquæ menth. pip. - - - - ʒi.ss.

It is always better to avoid the use of sleeping-draughts if possible, and they should never be made use of as a routine practice.

Pain after Operations.

A certain amount of pain after an operation is common, and may be due to a variety of different causes, such as tightly tied sutures, tight packing with gauze, powerful antiseptics in contact with exposed nerve-endings, etc. In an ideal operation on a healthy subject there should be no pain afterwards, and after many operations, where healthy tissues have been cleanly cut, there is no pain. Unfortunately, a certain amount of pain is the rule after most operations, and it ought to be our object to prevent, or at least ameliorate, this as far as possible. There is probably nothing which will make patients more grateful or bring the surgeon more credit than the relief of pain after an operation; and if patients find that they can undergo operations without suffering pain, much will have been done in making operations less dreaded by the general public than they are at present.

Pain is due to the stimulation of nerve-tissue, and more

especially of nerve-endings, and in a clean-cut wound this stimulation ceases when the cutting is finished ; any pain that occurs after that is either the result of movement in the part wounded or of tension, and in some cases of stimulation of the nerve elements by irritants. Movement taking place in the wound can be guarded against by proper splinting, etc., except in the neighbourhood of the thorax, where it is more or less inevitable. Tension may occur in several ways : it may be from too tight splints or bandages, or tight sutures ; in many cases it is due to congestion and swelling of the tissues of the wound. Pain from this cause is particularly well marked in acute inflammation. Thus, during the formation of an acute abscess, the tension in the abscess causes pressure upon the nerve-endings, and pain is the result, the severity of the latter being proportionate to the elasticity and nerve-supply of the part affected. Thus, when acute inflammation attacks the tightly bound-down skin of the nose (as when boils occur at the margin of the nostril), or the pulp of the finger (as is the case in whitlow in this neighbourhood), the pain is out of all proportion to the severity of the inflammation. A certain amount of inflammation is set up locally after any traumatism, and it is the congestion resulting from this that gives rise to the pain in most cases.

In order, therefore, to prevent pain after operations, we should try to relieve this local congestion. The most effectual way of doing this is by elevation of the part. The pain which often follows amputations is often much relieved by well elevating the stump. Any bandages or clothes which, by pressing upon the veins on the proximal side of the wound may tend to keep up this congestion, should be loosened. By keeping in mind this cause of

pain, much may often be done by the simplest means to relieve the pain following operations.

Another cause of pain after operations is spasm of the muscles in the neighbourhood of the wound.   This spasm sometimes causes intense pain, and prevents the patient going to sleep.   Pain from this cause can often be prevented, if the affected muscles are in the limbs, by flexing the joints or altering the position of the limb so as to relax the affected muscles.   Spasm is much more likely to occur in a tense than in a relaxed muscle.   Gentle smooth rubbing of the muscles, if it can be carried out, will immediately and effectually stop this spasm.

The value of heat for relieving pain, applied either in the form of fomentations or stupes, is well known, and it may sometimes be made use of in these cases.   Unfortunately, it is seldom possible to make use of fomentations or stupes for the relief of pain after operations, as the wound is covered up with dressings which it is not advisable to remove.   Cold applied by means of an ice-bag may sometimes be used ; after operations upon joints, such as the knee, it is often efficacious in relieving the pain.   A heavy ice-bag should not be allowed to rest upon the wound, as its weight will cause more pain than the cold will relieve.   The bag must be suspended from a cradle or some other arrangement made to take the weight off the wound.

There are certain operations after which pain is generally severe for a time, and after which, therefore, it is advisable to administer a hypodermic injection of morphia before the patient comes out of the anæsthetic.   The operation for piles by ligature is one such, and a suppository or hypodermic injection of morphia should be given. Operations involving interference with bones seem to be peculiarly liable to be followed by severe pain,

and especially such operations as excision of joints. Well-fitting splints which are not too tight and elevation of the limb will do much to relieve the pain in these cases, but morphia is often necessary as well. The pain after operations on the stomach or intestines is best relieved by small doses of morphia or laudanum given by the mouth.

Drugs should not be given indiscriminately for the relief of pain, but should only be made use of when other means fail, or in conjunction with them. Opium in some form, and especially its derivative morphia, is the most valuable drug we possess for this purpose, but there are several other drugs which are sometimes of value. Phenacetin in 15 to 20 grain doses will often relieve pain if not very severe, and is a very safe drug to give. In all severe pain, however, morphia should be given in doses of from $\frac{1}{4}$ to $\frac{1}{2}$ grain hypodermically, unless contra-indicated for some other reason. The dose of morphia that has to be given varies very considerably, both as regards the individual and as regards the severity of the pain, and it is well to bear this in mind. In some cases a small dose is quite as effectual as a much larger one would be; in other cases, a very large dose may be necessary. Pain after operations on the genito-urinary tract or rectum is often more effectually relieved by administering morphia in the form of a rectal suppository ($\frac{1}{2}$ grain) than by giving it subcutaneously. Morphia must never be given continuously for more than a few days, as there is great danger of setting up the morphia habit. A week is probably the outside that it is safe to continue using the drug, without either intermitting the dose or reducing it. The pain after operations usually ceases after twenty-four or thirty-six hours at most; but when it does not do so, and it is necessary to continue

the administration of morphia for its relief, the best plan after the first two or three days is to either reduce the dose by a half or to give an injection of plain water instead of, and at the time for, the usual morphia injection.   The moral effect of this renders it often quite as effectual as the morphia would be, and this does not apply only to neurotic individuals; the most strong-minded people will often be quite satisfied by an injection of sterilized water if they imagine that it is morphia and it is given at the usual time.   The results of the continuous use of morphia are so bad and so common that the greatest care must be taken to prevent the habit being established, and renders such an innocent deception perfectly justifiable.

Thirst.

Thirst is a very common complaint of patients after an operation.   This thirst is no doubt partly due to an actual loss of fluid from the body.   There is generally free perspiration either during or immediately after an operation; the salivary glands also secrete freely, and there may have been fluid in the shape of blood or serum lost from the wound, so that the total fluids lost from the circulation during a long operation may be considerable.   It has been shown experimentally that after operations on the peritoneum there is a considerable loss of fluid from the body, as evidenced by the increased specific gravity of the blood afterwards.   Also after operations of any degree of severity there seems to be a tendency for the secretion of mucus from the mucous membranes to be inhibited for a time.   This results in the mucous membrane of the mouth being dry, and makes the patient feel thirsty.

The practice of only allowing patients after an operation to have sips of hot water is to be deprecated. It is neither sound in theory or practice. The body is in need of fluid, and nothing is to be gained by withholding it. Unless there is some very definite contra-indication, which is but seldom the case, the patient should be allowed to slack his thirst with water or any other suitable fluid, the only restriction being that a large quantity is not swallowed at one time (the quantity should not be more than $\frac{1}{2}$ pint at a time). The contention raised against the practice of allowing fluids in proper quantities is that it causes sickness. As a matter of fact, it does not often do so, and when it does the fluid is beneficial in washing out the stomach, and the patient is much more comfortable afterwards; while, on the other hand, sips of hot water are just as liable to cause vomiting, and neither satisfy the patient's thirst nor wash out his stomach if he is sick. Hot tea is often very comforting, and can do no harm. Thirst should be looked upon as the natural call of the body for more fluid, which may be administered either by the mouth or rectum, according to circumstances. It is difficult to see how, apart from its causing sickness, water can do harm under any circumstances. It needs no digestion, and does not cause peristalsis.

Bed-Sore.

This troublesome complication will occasionally arise in spite of the greatest precautions. It is, however, usually a preventable complication, and should not occur when proper trained nursing is obtainable. The question of the relation of the position of the patient after the operation to the formation of bed-sores has already been spoken of (p. 4). Soiling of the bedclothes, due to

lack of proper care after the patient has micturated or the catheter has been passed, rucking up of the patient's nightdress or of the bedclothes, are all frequent and easily preventable causes of bed-sore.   By far the most potent cause of bed-sore is a moist condition of the skin where it is subjected to pressure, and the greatest care should always be taken to keep the skin as dry as possible.   After a bed-sore has formed, the part must be relieved from all pressure, either by turning the patient into another position or by the use of ring air-cushions, etc. The sore itself must be kept dry, and must not be treated with strong or irritating antiseptics; boracic powder or Fuller's earth are the best applications to use, but they should not be allowed to form crusts over the sore.   If much sloughing takes place, the patient must be turned over upon the face or side and the sore dressed frequently and kept as clean as possible.   Dry dressings are much preferable to wet ones, unless it is desirable to hasten the separation of the slough, when the following dressing will be found useful :

℞ Unguenti sambuci viridis   -   - partes ii.
   Unguenti elemi -   -   -   -   ,, xvi.
   Copaibæ -   -   -   -   -   ,, iii.*

This dressing should not be allowed to come into contact with the healthy skin round the sore.

Painting the sore over with Friar's balsam will sometimes hasten the healing process.   If there is much destruction of tissue, Thiersch grafting should be employed to hasten healing and prevent scarring.   The sore should first of all be got quite clean, and then all the granulation tissue should be scraped away and the grafts laid on the underlying fibrous tissue; the dressing should not be removed for at least a week.   Thiersch grafting, if

* St. George's Hospital Pharmacopœia.

properly done, often gives most excellent results in these cases, and considerably hastens the healing process.

The worst cases of bed-sore are those which occur in pyæmic cases and cases associated with some spinal lesion; in many of these cases a bed-sore will form in spite of the utmost care.

The separation of the slough is often a very slow process in the bad cases, and it is sometimes advisable to hasten it by occasionally cutting through the toughest bands of fibrous tissue with a pair of scissors, care, of course, being taken not to cut into healthy tissue. Hydrogen peroxide is a most valuable disinfectant and antiseptic to use in these sloughing cases; it should be painted or sprayed on frequently. Sanitas on lint is also a good dressing in bad cases.

Post-Operative Insanity or Mania.

This is a rare condition which is but seldom met with. It does not seem to bear any definite relation with the operation—that is to say, as regards cause and effect. The symptoms usually first show themselves during convalescence. The onset of insanity or mania is probably to be attributed to the mental anxiety and morbid brooding over the operation by a mind which is naturally unstable rather than to any direct effect of the operation itself. Sometimes a patient who is the subject of recurring attacks of insanity may get an attack after an operation; in this case the operation acts merely as an exciting cause. The condition is more often seen in women than men. It is said that a suicidal tendency is a common and well-marked feature of most cases.

Professor Clifford Allbutt describes the condition as one of neurasthenia rather than of insanity, and says that

a certain degree of it more commonly follows operations than is generally supposed.   He does not, however, point out why this should be the case; and it is possible that in some of these cases a patient of a particularly morbid turn of mind has thought herself to be suffering from some affection, and has so far deceived her medical attendant that he has advised operative interference, which, having been duly carried out, has subsequently been ascribed as the cause of her mental condition.

Many of the earlier cases of acute and fatal post-operative insanity which have been reported, or have found their way into the literature on the subject, were in all probability cases of acute sepsis or cerebral abscess resulting from the operation, and were therefore not in reality insanity at all.   In one case of supposed post-operative mania which came under the observation of the writer, this was found to be the case at the post-mortem examination.

Under the name post-operative psychoses, several forms of mental derangement have been described which only affect the intellectual functions; the symptoms are mainly a melancholic type of insanity commonly accompanied by delusions.

This type of insanity seems to be most common after operations, such as removal of the breast in women, castration, and colotomy.   It has been pointed out that operations upon persons of a highly-strung and nervous temperament may occasionally be followed by a complete nervous breakdown and general neurasthenia, which may persist for a considerable time, and thus greatly delay recovery.   Dr. Burr quotes a case where a young man of highly nervous temperament, but whose previous health had been good, was attacked by appendicitis and operated upon.   After the operation he made, from a

surgical point of view, a good recovery; but he remained prostrate in bed, unable to do anything from complete nervous breakdown, and it was some months before he was well again.

Before operating upon all such patients the greatest care should be taken to prepare them beforehand for the operation. An attempt should be made to get them into a better mental condition by careful attention to the general nutrition and hygiene, and they should be given, as far as possible, a complete rest in both body and mind, so as to get them into a normal condition of mind before performing the operation. There can be no doubt that in the careful preparation of the patient beforehand lies the chief safeguard against post-operative mental conditions.

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CHAPTER II

TREATMENT OF THE WOUND

In these days the vast majority of wounds are aseptic and run an aseptic course, and it is not necessary or even advisable to change the dressings often. From one cause and another, however, suppuration will sometimes take place, and it is therefore a matter of considerable importance to detect the presence of suppuration when it does occur at the earliest possible date, so that it may be promptly dealt with; and not to discover, perhaps at the end of a week, on removing the dressings that the wound has all broken down and the dressings are soaked with discharge. The temperature chart is a most valuable guide to the condition of the wound if it is properly interpreted, and a chart of the temperature should always be kept after any operation.

It is important to remember that a rise of temperature during the first thirty-six or even forty-eight hours is the rule after an operation of any magnitude. On examining a hundred consecutive cases after operation in the wards of St. George's Hospital, in all of which the wound ran a perfectly aseptic course, the writer found that a rise of temperature occurred in 85 per cent. within the first forty-eight hours. The following table will show the results of this investigation:

TABLE OF THE TEMPERATURES DURING THE FIRST FORTY-
EIGHT HOURS OF 100 CONSECUTIVE CASES OF OPERA-
TION IN WHICH THE WOUND REMAINED ASEPTIC.

Per Cent.

There was a rise of temperature to or above
100° F. in 27

There was a rise to or above 99° F. in 46

There was a rise above normal, but below 99° F. in   12

The temperature remained normal or fell below it
in...   15
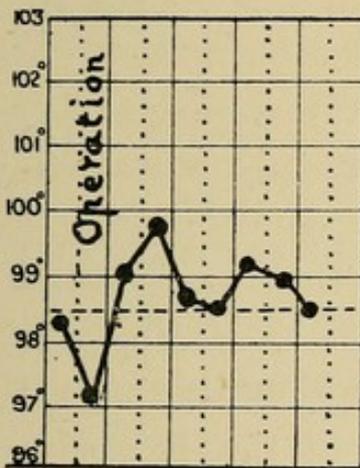
FIG. 5. — RADICAL
CURE OF HERNIA
(ASEPTIC).
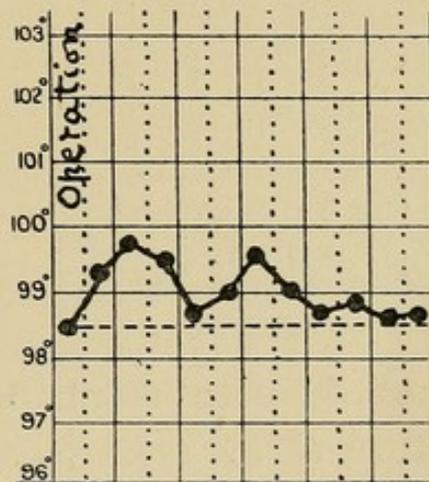
FIG. 6.—AMPUTATION OF
THE THIGH (ASEPTIC).
This shows the double rise.
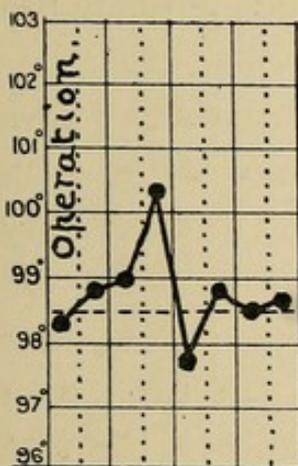
FIG. 7. — AMPU-
TATION OF THE
BREAST (ASEP-
TIC).

It is further noticeable that in children this rise of temperature is often much more marked than in adults; the high temperature is often a morning one, and is followed by an evening drop. The rise in children may be very high sometimes, and in the above 100 cases one child had a temperature of 104·5° (Fig. 9), though there was no cause discoverable beyond the operation. After operations involving interference with bone, it is

remarkable that the post-operative pyrexia is often high ; the operation for the ligature of piles also
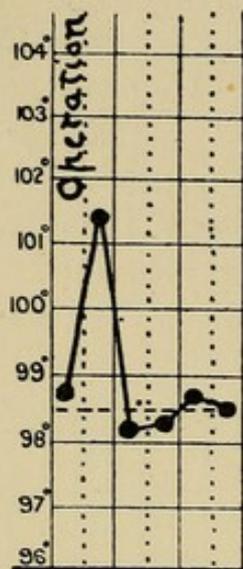
FIG. 8.—OPERATION
FOR HARE-LIP ON
A CHILD FIVE
MONTHS OLD.
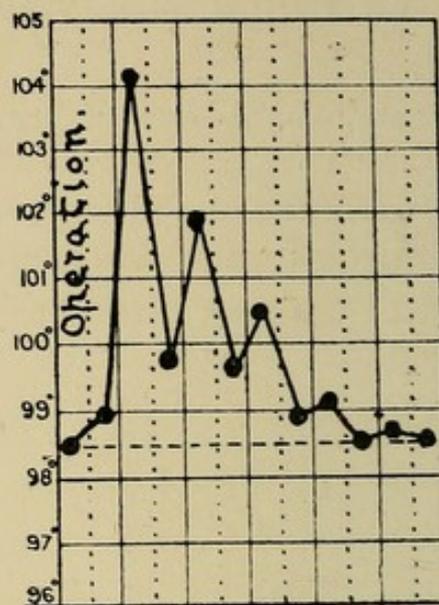
FIG. 9. — LAPAROTOMY
FOR INTUSSUSCEPTION
ON A CHILD AGED TWO
YEARS (ASEPTIC).

seems often to result in an exceptionally high temperature (Fig. 10). It was found in the investigation of the above 100 cases that a second slight rise in the temperature not uncommonly followed the first (see Fig. 6).

This rise of temperature is probably due to reaction, and is what the textbooks describe as aseptic fever. There is generally a preliminary drop to a subnormal temperature immediately after the operation, followed by reaction and a rise to about 99° or 100° (Fig. 5). In some cases, and especially in children and young adults, the rise is considerably higher ; this would naturally be expected, as young patients always react much more

FIG. 10.—OPERA-
TION FOR PILES
BY LIGATURE
(ASEPTIC).

violently than older ones.   Again, in the case of patients who are in exceptionally good general health at the time of the operation, the reaction and consequent temperature is often high.   The rise of temperature usually takes place on the first night after the operation, sometimes on the second.   This rise of temperature is a good sign, as it shows reaction, and is very much better than a drop to a subnormal temperature which persists.   This post-operative temperature or aseptic fever should therefore
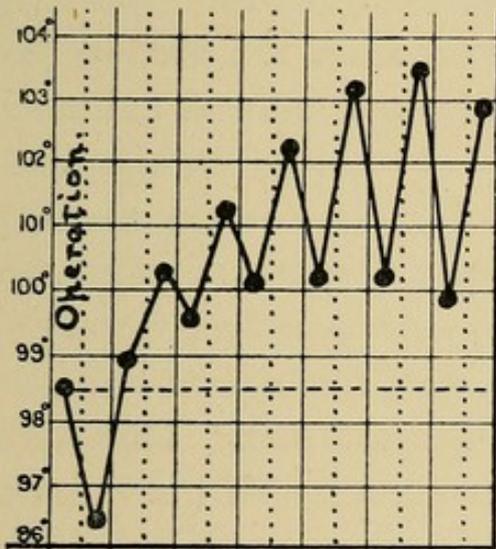
FIG. 11.—OPERATION ON THE KNEE-JOINT (SEPTIC).
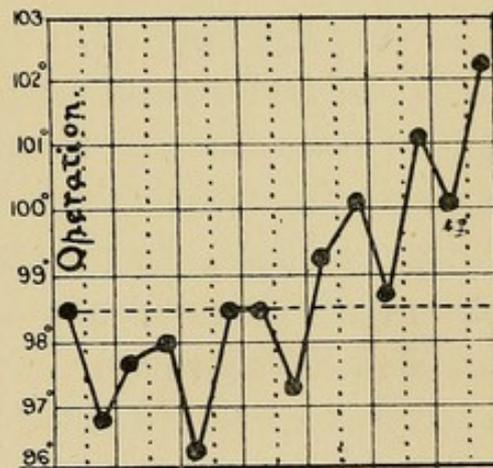
FIG   12. — OPERATION   FOR RADICAL CURE OF HERNIA (SEPTIC).*

be expected, and must not be confused with a temperature due to sepsis ; it usually falls again at once, and the subsequent temperature is normal.   After very severe operations involving much shock, this post-operative temperature, as one would expect, is often delayed until the shock has passed off.

When the wound is septic, this preliminary rise in temperature is not followed by a drop, but persists, often to become intermittent later on (Fig. 11); or the preliminary rise is absent, being replaced by a slightly subnormal

* There was pus in the wound on the fourth day.

temperature for the first two or three days, and is then fol-
lowed by a rise to 102° (Fig. 12) or higher. In most cases
when the wound has become septic the temperature rises
on the evening of the second or third day, and sometimes
as late as the fifth or sixth day after the operation. So that
a rise of temperature during the first forty-eight hours,
unless accompanied by other local or general signs of
sepsis or unless it remain up, need not be looked upon as
evidence of sepsis, but, on the other hand, as a favourable
sign ; persistence of this temperature, however, especially
in the morning, or a rise occurring after the second day
following the operation, is to be looked upon as evidence
of sepsis, and should be followed at once by an examina-
tion of the wound.   Unfortunately, in a certain number
of cases the chart shows a perfectly normal temperature,
except, perhaps, for the reactionary rise; and yet when the
wound is examined some days after the operation, it is
found to have broken down and contain pus.   These are
mostly cases where blood-clot has been left in the wound,
and some comparatively non-pathogenic organism, such
as *Staphylococcus pyogenes albus* or *citreus* or the *Bacillus
epidermidis*, has obtained access to it and converted it
into pus.

In such cases there is usually but little local inflamma-
tion in the wound, but a cavity is found containing pus
which originally contained blood-clot.   The condition
does not, as a rule, cause any temperature or pain,
though the patient may sometimes complain of dis-
comfort at the site of the wound. Fortunately, this
condition is not of very serious import, and such wounds
heal very rapidly after the removal of the pus, providing
that care be taken to prevent the wound becoming
subsequently infected by some more virulent organism.
Pain referred to the site of the wound, if it continues, is

often a sign of inflammation and sepsis. After the first twenty-four hours an aseptic wound, unless it be in some special situation, is, as a rule, painless.

Aseptic Wounds.

1. WHERE THE DRESSINGS HAVE NOT BEEN SOAKED THROUGH BY OOZING.—Unless the dressings have become loose or soiled, the wound need not be dressed until the time has come for the removal of the stitches. The time at which the stitches should be removed varies considerably in different cases. In moderately small wounds they should, as a rule, be removed about the sixth or seventh day after the operation. In wounds on the face or neck they may be removed earlier, as healing in this situation is rapid, and it is particularly desirable to avoid scarring. They should be removed about the second or third day. In the case of large wounds, or wounds the edges of which are subject to tension, the stitches should be left for ten days or a fortnight. It is also advisable to leave the stitches somewhat longer when the skin round the wound is not well nourished, as is often the case in wounds for the removal of varicose veins of the leg.

Some surgeons habitually dress all wounds on the second or third day after the operation. This, however, seems unnecessary and inadvisable in the majority of cases. Usually a certain amount of blood oozes from the wound immediately after the dressings are applied. This soaks into the dressings, and, hardening, sticks them to the wound and surrounding skin, thus forming a sort of splint to the wound, which acts very beneficially in keeping it and the surrounding skin at rest. Of course, when this oozing has come to the edge of the

dressings, and has come in contact with the air, it should at once be changed, as otherwise it may act as a tract for the entrance of septic organisms.

A pair of scissors and forceps which have been sterilized by boiling should be at hand in a tray containing carbolic lotion. The bandages should then be cut through with a *different* pair of scissors, and removed, together with the cotton-wool, so that the wound remains covered only with the gauze. A warm towel which has been previously sterilized, either by boiling or immersion for some time in carbolic lotion, should then be placed round the gauze covering the wound. The surgeon should then clean his hands in the ordinary way, by first scrubbing them with soap and water, and then immersing them for a minute or two in some antiseptic solution, preferably an alcoholic solution of biniodide of mercury (1 in 1,000). The gauze should next be removed from the wound. If it is much stuck, it is best to soak it well with some lotion before removing it. As soon as the gauze is removed the wound should be covered with a swab or a piece of gauze, and the skin round swabbed over with lotion to clean it. If the wound appears to be healed, which will probably be the case, the stitches should be removed.

Removal of Stitches.—This is best done with a pair of blunt-pointed scissors which cut well at the points. All the stitches should be divided first before any of them are removed. The scissors should be used on the flat, one blade being inserted below the stitch, and then the latter cut as close as possible to the skin surface. The forceps should be used to steady or lift the stitch if necessary. After all the stitches have been cut they may be removed by pulling on one end with the forceps. If the stitches are not cut through close to the skin an elbow or kink

will probably be left in the stitch which will cause pain when it is drawn out through the stitch-tract. This applies especially to stiff sutures, such as fish-gut. If the stitches are removed in this way, very little pain will be caused, and with a nervous patient this is a point of some importance. When the stitches have become buried in the skin, as is often the case in abdominal wounds, especially in fat people, the cut ends of the suture, which can always be seen, should be pulled on with forceps until the knot comes into view; then the points of the scissors (held on the flat) must be passed down behind the knot, and the suture divided and withdrawn. It is often advisable not to remove all the stitches at one time, but to leave a few till a later date. If after removal of the stitches the wound is found to be dry and does not gape, it may be sealed up by placing over it a piece of dry gauze cut to the required shape, and painting over the whole with flexible collodion. A large pad of cotton-wool is then placed over it and the bandage applied, or the latter may be dispensed with altogether if the wound is a small one. Should there be any gaping or other reason rendering it undesirable to seal the wound, it may either be redressed as before with wet gauze, or powdered over with boracic acid powder or dermatol, etc., and covered with dry gauze and cotton-wool. When there is much gaping of the wound after removal of the stitches, the edges should be drawn together with strapping. The so-called American or Mead's strapping should be used for this purpose, and the part crossing the wound should be cut very narrow. A good plan of cutting the strapping is shown in the illustration (Fig. 13). Two pieces AB and CD are cut of the shape shown; the part C is fixed to the skin on one side of the wound, and the part B on the other. The part A

is then passed through the gap in CD, and D and A are pulled upon in opposite directions until the gap is closed and the edges of the wound well approximated ; they are then stuck down.
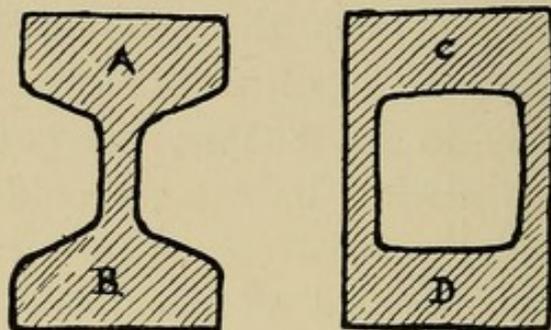
FIG. 13.

2. WHERE THE DRESSINGS HAVE BEEN SOAKED THROUGH.—When blood from the wound has soaked through the dressings and stained the bandages, the wound should at once be dressed. This should be done in the same way and with even more care than in the case of a wound which is not dressed until the stitches are removed. Even if only a little blood has soaked through at one part of the dressings it is better to change them, as otherwise the blood which has soaked into the dressings may act as a tract for the entrance of organisms to the wound.

3. WHERE DRAINAGE HAS·BEEN PROVIDED FOR BY A TUBE OR GAUZE PLUGGING AT THE OPERATION.—As a rule, it is better to remove the tube at the end of twenty-four or forty-eight hours. This will, however, depend a good deal on the reasons for which the tube was used. It is not desirable to leave a tube in an aseptic wound longer than is absolutely necessary, as a very unsightly scar with inverted edges is apt to result, and the healing of the wound is delayed. Also there is seldom any necessity for the use of a tube after the first forty-eight

hours. A very good plan is to pass a stitch through the skin on each side of the tube and to leave the ends untied. The stitch can then be tied up after the tube has been removed. Great care should be taken in dressing these wounds, as there is of necessity an open tract into the depths of the wound, and healing is at a stage when infection can readily take place. Special care should be taken to clean up the skin round the wound with antiseptic lotion and swabs. This should be done from the wound, and not towards it. Thus a swab which has been used for cleaning the outlying areas of the skin must not subsequently be placed in contact with the wound. The dressing should be carried out in the same way as before, except that the wound should not be sealed up with collodion, and it is best not to apply any of the antiseptic powders, as they are often not sterile.

In many operations, notably in abdominal section for localized peritonitis and operations for necrosis or abscess of bone, a cavity is left plugged with gauze, the end of the gauze being left protruding from the wound so as to act as a drain. When a large cavity in the abdomen has been plugged in this way, it is often rather difficult to remove the plug without causing the patient a considerable amount of pain. The best plan is to leave the plug in for five or six days or even longer until it has become loosened; it will then, as a rule, be found to come away quite easily. While the gauze is being removed it should be wetted from time to time with some suitable antiseptic lotion, as it is much more easily removed when it is wet than in a half-dried condition. It should be drawn upon first from one side and then from the other, and considerable patience is often necessary in order to avoid hurting the patient. In cases of acute necrosis of

bone, etc., when a cavity in the bone has been packed with gauze, it is not advisable to wait until the gauze has become loose, and the packing should be removed in twenty-four or forty-eight hours; as this is frequently a very painful proceeding, an anæsthetic should be administered. Nitrous oxide is quite sufficient for this purpose, and under its influence the gauze can be quickly removed, and the cavity, if necessary, repacked.

4. WHEN THE WOUND HAS BECOME SEPTIC.—When from the condition of the patient's temperature or from some other indication it is suspected that the wound has become septic, it should at once be dressed, the same care being exercised as if dealing with an aseptic wound. It is sometimes thought that it is not necessary to take the same aseptic precautions in dressing a septic wound as with one which is aseptic. This is quite erroneous. Sepsis may result from many different kinds of organisms of varying pathogenicity and virulence, and if the wound is carelessly dressed fresh organisms may get in, which will find a congenial soil in the already septic wound, and a much more serious type of sepsis may be the result.

The wound having been exposed and found to be inflamed and septic, a sufficient number of stitches should be cut through to allow a free exit to the pus and to relieve all the tension on the tissues. This is a very important point, as if the pus is subjected to tension in any part of the wound it will be much more liable to find its way into the lymphatics and veins, or to push its way along the planes of cellular tissue, than will be the case if it is given a free exit through the skin. All pus should be removed from the wound, and the wound itself dried out with swabs or sponges. Opinion differs a good deal as to whether during the acute stage of the inflammation

the wound should be irrigated with some antiseptic lotion or not. The chief objection to the irrigation of the wound with strong antiseptic solutions is that the antiseptic irritates the already inflamed and injured tissues, and is liable to break down the delicate lymph barrier which has probably formed between the pus and the lymphatics, so allowing organisms which before were only local to gain an entrance to the general circulation; while, on the other hand, washing out the wound with an antiseptic will not destroy all the organisms in the tissues surrounding the wound, and therefore cannot arrest the septic process. It is to the tissues themselves that we have to look for an arrest of the condition, and care should therefore be taken to avoid injuring them. There cannot, however, be any objection to gently irrigating the wound with normal salt solution or with some weak antiseptic, so as to wash away as much as possible of the pus and infective material present in the wound. Saline solution previously sterilized is undoubtedly the best fluid for this purpose, though a weak solution of carbolic or biniodide may be used if this is not at hand.

In cases of very severe sepsis, where the tissues show little reactive power and there is evidence of general infection, such as the enlargement of the neighbouring lymphatic glands, lymphangitis, or the presence of severe general symptoms, an attempt may sometimes be made to destroy as far as possible the organisms present at the source of infection, with the hope of so preventing any further absorption of their toxic products. To carry this out the wound should be freely opened up and well, swabbed out with some powerful antiseptic, such as pure carbolic acid or 1 in 500 biniodide in alcohol. Unfortunately, almost all the present antiseptics in use coagulate albumen, and when used in this way a thin coagulum is

formed over the surface of the tissues, so that the action of the antiseptic is limited, as a rule, to the superficial parts of the wound. This method of dealing with septic wounds is not a safe one to use when the wound has an extensive surface, especially in children or old people, as under such circumstances it may be followed by symptoms of poisoning by the drug used. Drainage-tubes should be inserted into all the pockets of the wound, and steps taken to keep the wound open by packing it *lightly* with gauze. If there is much local inflammation, hot fomentations may be made use of with advantage. For this purpose the ordinary boracic fomentation is very unsuitable, as it only remains hot for a very short time, and has very slight absorbent properties, not to speak of the fact that its antiseptic power is practically nil. Most of the ordinary septic organisms can be grown upon it with ease. A very good fomentation can be made by using a thick layer of gauze wrung out in a towel after it has been well soaked in a hot solution of 1 in 100 carbolic acid; the carbolic, besides insuring the asepticity of the fomentation, acts as a local anæsthetic and reduces the pain.

Gauze is one of the most absorbent dressings we possess, and it is very important to use a dressing that will quickly soak up all the discharge from the wound. Gauze is, unfortunately, rather expensive, but plain unmedicated gauze can be used; this is much less expensive than the cyanide or alembroth varieties, and is equally useful for this purpose. A very good fomentation may also be made by using ordinary absorbent cotton-wool instead of the gauze; it has the advantage of remaining hot for a very long time. Whatever is used for the fomentation should be put on as hot as possible, and changed as soon as it has cooled down to the body

temperature. This will usually mean changing the fomentation every fifteen or twenty minutes. Fomentations may be made to keep hot for longer than this if they are made very thick, and a thick layer of cotton-wool is placed outside them.

A fomentation to be effective must be *hot*, and must be capable of soaking up all the discharge from the wound. This latter factor is very important, as the discharge from an acutely septic wound not only swarms with organisms, but contains toxic material formed by these organisms. This toxic material acts as a poison to the tissue cells, tending to paralyze or destroy them, and so prevent their dealing effectually with the organisms.

As soon as the acute inflammation in the wound has to some extent subsided, the fomentations may be left off and the wound dressed with damp gauze—*i.e.*, gauze with a layer of oil-silk or jaconet over it. Damp gauze has the advantage of being more absorbent than dry gauze. The wound should at first be dressed at least twice a day, and as long as there is any discharge the wound ought to be dressed often enough to insure its being kept free from the accumulation of pus, etc., in it. At this stage the edges of the wound may with advantage be drawn together with strapping, as already described. When all inflammation has subsided, dry dressings may with advantage be substituted for the damp ones.

In the case of septic wounds on the extremities, good results often follow the use of the water-bath if the wound is in a suitable position. The water in the bath should be kept as far as possible at an even temperature, and should be kept constantly flowing through, so as to keep the water clean. Most limb-baths are now made with a tap at the bottom end, to which an indiarubber tube can

be attached passing to a bucket beneath the bed. Another tube connected with a suitable receiver should be arranged to allow water to flow into the bath.

General Treatment of Sepsis.—In all cases where sepsis occurs in the wound a free purge should be administered at the earliest opportunity. Calomel (5 grains), followed in four hours by a dose of salts, is one of the best purges for this purpose, and will do a great deal to cut short sepsis and bring down the temperature. A purge administered immediately there is the slightest sign of sepsis will occasionally prevent the wound breaking down, and when it does not succeed in this, will at any rate do a great deal to relieve the symptoms. The way in which a purge acts in diminishing the effects of sepsis in a wound has not been satisfactorily explained. That it does so cannot be doubted. Purgation now takes the place of the blood-letting which was so popular in the treatment of all acute inflammatory conditions a hundred years ago, and no doubt it acts in much the same way— *i.e.*, by depletion. The most probable explanation of the value of purgation in the treatment of sepsis is that, by removing a large quantity of the fluid constituents of the blood, it renders the tissues of the body drier and less œdematous, and a wound, the tissues of which are not sodden or œdematous, will react to sepsis much more favourably than one that is.

With regard to drugs, no drugs except those used as aperients are of much value. Quinine is supposed to be efficacious in some cases, and especially in those where there are signs of general septic infection. To be of service it should be given in large doses, 5 or 10 grains three times a day.

5. CASES WHERE SYMPTOMS OF SEPTICÆMIA OCCUR.— These cases are now, fortunately, rare. They still occur

occasionally, however, and, when they do, require prompt and energetic treatment. The chief points in the treatment of these cases are :

(1) Disinfection of the wound as effectually as possible and the prevention of tension in it by free drainage.

(2) Keeping up the patient's strength by judicious feeding. These patients need to be fed every two or three hours.

(3) Keeping the bowels acting freely.

(4) Alcohol in the form of brandy or whisky should be given freely—5 or 8 ounces daily.

(5) The administration of quinine or quinine and iron is often useful.

CHAPTER III

HÆMORRHAGE AFTER OPERATIONS

THE occurrence of hæmorrhage from the wound after an operation is one of the most troublesome complications that can arise. There are several reasons for this besides the mere fact of its seriousness. There is nothing which is so calculated to alarm a patient, or to make him lose confidence in his medical adviser, as hæmorrhage from the wound, even though it may be quite trifling in amount. Blood seems to have a particularly frightening effect upon most people, medical men excepted; and hæmorrhage after an operation, coming on as it usually does quite suddenly and unexpectedly, often has the effect of reducing the patient to a condition of panic, though the amount of blood lost may not be serious. It is also a trying complication to the surgeon. He has, as a rule, to meet it unexpectedly and at a moment's notice. Moreover, no two cases are exactly alike. In some the bleeding is easily stopped, and again in others the greatest difficulty may be experienced. Frequently the proper instruments are not at hand and reliable assistance is unobtainable.

In the following description, hæmorrhage will be divided into recurrent and secondary. The treatment of primary hæmorrhage does not come within the scope of

this work. By recurrent hæmorrhage is meant any bleeding which occurs within twenty-four hours of the operation.

Recurrent Hæmorrhage.

This may result from various causes. The hæmorrhage may have been entirely stopped before sewing up the wound, but owing to the patient's circulation being feeble and the blood-pressure low at the end of the operation, from shock or some other cause, no bleeding takes place from some of the smaller vessels that have been cut. When, however, the patient comes round from the anæsthetic, and the shock has passed off, the pressure in the vessels increases with the improved circulation, and hæmorrhage occurs. Again, some vessel or vessels have become occluded by clot, and so long as the patient remains quiet this is sufficient to prevent bleeding. On coming round from the anæsthetic, the patient moves about, and bleeding results from the displacement of the clot. These are very common events, and account for most of the cases where hæmorrhage occurs about four or five hours after the operation. A less common cause, but one which may, nevertheless, give rise to serious trouble, is the partial division at the operation of some small artery. The bleeding may be so trifling that it is not noticed, or it is thought that it will stop when the bandages are applied. When an artery, however small, is only partially divided, the contraction of the muscular coats and sheath tends to keep the wound open, so that a vessel thus divided will go on bleeding almost indefinitely. An artery bleeding into a confined space acts like an hydraulic press, and the pressure thus exerted upon the interior of the wound may be very considerable. When bleeding is taking place in this way into a wound, a very

large hæmatoma may form, and the skin round the wound be stripped up for a considerable distance. Also, owing to the small size of the vessel which is bleeding, the hæmorrhage takes place slowly, and often does not give any external evidence of its presence for some hours after the operation.

The following case illustrates this form of recurrent hæmorrhage:

A man of about forty-five years of age had his right testicle removed for tubercular disease. All bleeding was stopped at the operation, and the wound was sewn up. At 12.30 p.m., and about eight hours after the operation, the patient noticed that the dressings were wet, and on examination the nurse discovered that there was a quantity of blood on them and in the bed. The house-surgeon was sent for, and on his removing the dressings it was found that an enormous hæmatoma had formed under the wound and had stripped up the skin over the abdominal wall halfway to the umbilicus. It was at first thought that the ligature on the cord had given way. An anæsthetic was administered and the wound opened up; it was then found that the bleeding was taking place from a small subcutaneous artery not much larger than a pin in diameter. The vessel was partially divided, and had no doubt been wounded by the needle in sewing up the wound. The vessel was clipped and ligatured, and the wound sewn up again after clearing out the clot. In this case, in spite of the slowness with which the bleeding must have taken place, and the comparatively small amount of blood lost, the patient was suffering from very pronounced symptoms of shock.

Other causes of recurrent hæmorrhage are softening or slipping of a ligature, and failure to secure the distal end of a divided artery; in the latter case, bleeding will take place as soon as the collateral circulation is established.

Treatment of Recurrent Hæmorrhage. — The best treatment, when it can be carried out, is to at once reopen the wound and ligature or secure the bleeding vessel. In some cases pressure alone may prove sufficient, but, as already pointed out, this cannot be relied upon.

An anæsthetic should, as a rule, be administered, as it is next to impossible to make certain how much may have to be done before the bleeding is stopped ; also, the various steps of opening the wound and securing the vessel that is bleeding can then be carried out with much greater deliberation, and there will, in consequence, be less danger of the wound becoming infected.

If the hæmorrhage is found to have stopped by the time the surgeon reaches the patient, or if it should stop after the administration of the anæsthetic, the wound should nevertheless be opened if the previous bleeding has been at all severe, as it will probably recur again, and the risk of this is greater than that of opening the wound.   Moreover, the presence in the wound of a large mass of blood-clot will very materially delay healing, and is much better removed.

In cases where the bleeding is venous instead of arterial, pressure should be carefully applied over the bleeding point, and the limb or part well raised on pillows, etc.   Care should be taken to see that there are no bandages or straps of splints, etc., constricting the parts above the wound, as this is the commonest cause of such venous bleeding, all that is required in many cases being the removal of the constricting bands and the elevation of the part.

Recurrent Hæmorrhage from the Wound as the Result of some Constitutional Condition of the Patient.

The treatment of recurrent hæmorrhage by opening the wound and securing the bleeding vessel previously mentioned, though the best procedure in most cases, is not always applicable.   There are some cases where a

general oozing of blood occurs from the wound. This oozing may continue uninterruptedly, or it may stop, and after an interval of hours or days start afresh. The bleeding is usually not copious, but the quantity lost is often considerable, and the patient soon gets into a most dangerous condition.

In some cases of this nature the bleeding does not come on for some days after the operation. The cause is probably always constitutional, and is due to some blood change which interferes with the proper clotting of the blood. What the exact nature of these blood changes is has not yet been determined. One of the best explanations seems to be that it is due to an absence or deficiency of the calcium salts. The constitutional conditions in which this type of hæmorrhage is most commonly met with are hæmophilia, jaundice, and leucocythemia. There are, however, cases which do not apparently come under the head of any of these three diseases, in which bleeding of this nature occurs, and it seems probable that there are other conditions, as yet unrecognised, in which similar blood changes take place.

JAUNDICE.—When patients are suffering from jaundice at the time of the operation, as is often the case in operations for occlusion of the common bile-duct, they are very liable to bleed in this way. The bleeding takes place from all parts of the wound and even from the stitch-holes. Pressure alone is seldom of much use in stopping the hæmorrhage. Styptics may be tried, preferably supra-renal extract or Ruspini's styptic. These styptics are best applied by soaking narrow pieces of lint in them, and then packing the lint into the wound and applying pressure over it. Mr. Mayo-Robson has recently drawn attention to the value of calcium chloride in large doses in the treatment of these cases; he advises the drug to

be given by the rectum in 60-grain doses three times a day, until all signs of oozing from the wound have ceased.

HÆMOPHILIA.—These are most serious cases, and often, in spite of all treatment, result fatally. Ruspini's styptic or suprarenal extract should be applied locally and aided by pressure. These drugs can be given internally at the same time. Ruspini's styptic can be given in doses of 10 minims hourly in about 1 ounce of water; suprarenal extract is best given in tabloid form in 5 or 10 grain doses (it is advisable to crush the tabloids and dissolve them in water). Calcium chloride in large doses, given internally, is also sometimes efficacious, and should be tried if the other styptics fail. Wiel on the Continent has used a 5 per cent. solution of gelatin as a local styptic in these cases with successful results.

LEUCOCYTHEMIA.—This is another disease in which bleeding of this nature often occurs. The treatment is the same as in the previous cases.

Secondary Hæmorrhage.

By this term is usually meant hæmorrhage starting at any time from one day to three weeks after the operation. The cause is usually ulceration into a bloodvessel, and consequently it does not occur in aseptic wounds. Other and rarer causes are the imperfect application of a ligature, with subsequent slipping from movement of the part, and the too rapid absorption of an absorbent ligature. The treatment is the same as in the case of recurrent hæmorrhage; that is to say, opening up the wound and securing the artery, except that it is even more important to do this immediately any signs of bleeding show themselves. The bleeding is usually slight at first, but later may be

furious, and it is therefore particularly important to deal with it in the early stage before this has occurred. Pressure should be applied over the main vessel on the proximal side of the bleeding point, if this is possible, and then an attempt made to secure the bleeding vessel. In cases where the wound is in a sloughy condition this is often a very difficult matter, and the vessel cannot be secured by a ligature. Under these circumstances a good plan is to underpin it (acupressure). This may be done by passing a stitch deeply through the tissues so as to include the vessel, and then tying the stitch; or another way is to pass a hare-lip pin beneath the vessel, and compress the artery by figure-of-eight turns made with silk round the ends of the pin and over the artery, or a clip can be put on to the bleeding point and left *in situ*. These methods failing, recourse may be had to the actual cautery. One of the great objections to the latter is the liability to fresh hæmorrhage when the sloughs separate.

Internal Hæmorrhage.

The evidence of this will usually be the onset of symptoms of syncope and shock, which are otherwise difficult to account for, accompanied by signs indicating the presence of free fluid in the abdomen or chest. It is of interest to notice that a high temperature may accompany internal hæmorrhage. This temperature is probably due to the absorption of some of the constituents of the blood. It is advisable to bear this in mind, as otherwise the symptoms may be ascribed to sepsis, and the true nature of the case not detected till too late.

The proper treatment is to at once open up the wound, expose the bleeding point, and secure it. This in the

case of hæmorrhage into the abdominal cavity often means an operation of equal or even greater gravity than the original one. The proper treatment of internal hæmorrhage under such circumstances, therefore, may be a matter of the greatest difficulty, or even impossible. The facilities for operating may not be at hand, or the condition of the patient may be such that reopening the abdomen is out of the question. When the source of the hæmorrhage cannot be dealt with directly, the patient should be kept as quiet as possible, ice should be applied over the probable source of bleeding, and morphia should be administered subcutaneously to reduce the blood-pressure. Stimulants are best avoided, as, by raising the blood-pressure, they tend to increase the hæmorrhage.

The Treatment of Hæmorrhage after Special Operations.

HÆMORRHAGE AFTER THE REMOVAL OF TONSILS OR ADENOIDS.—The following causes of severe hæmorrhage after the removal of tonsils or adenoids are given by Cordes :*

1. Hæmophilia.
2. Cardiac disease or arterio-sclerosis (in adults).
3. Anomalies in the course of the internal carotid.
4. A preparatory application of cocaine.
5. Small shreds of vegetations remaining partly attached to the pharynx ; the hæmorrhage ceases when they are removed.
6. Occasionally severe hæmorrhage results in females if the operation be performed at the time of the menstrual period.

Hæmorrhage after Removal of Tonsils.—The patient

* W. Milligan, *Med. Ann.*, 1901.

should be made to sit up and breathe with the mouth well open, preferably in a draught of cold air, as, for instance, in front of an open window. The upright position tends to empty the vessels and the cold to make them contract. Ice or iced water may be given to drink, or iced water applied to the side of the face. This is all that is necessary in slight cases of hæmorrhage, and serious hæmorrhage is very uncommon.

If, however, the bleeding is severe, and will not yield to such simple measures, the following may be tried: When the bleeding is from the tonsil, a piece of lint or a small Turkey sponge previously soaked in turpentine or some other styptic (perchloride of iron should not be used) is twisted round the end of a clip or pair of tongue forceps and pressed against the bleeding surface, counter pressure being at the same time made over the position of the tonsil outside. Pressure should be maintained for some minutes until all bleeding has ceased. If no styptic is available, the lint or sponge must be wrung out of hot water (any heat under a temperature of 100° F. will tend to increase the bleeding rather than to stop it).

If an artery is spurting, or the bleeding refuses to stop with the above measures, a gag should be placed in the mouth, and an attempt made in a good light to clip the bleeding point. If this is successful, the clip may be left on for a few minutes or the vessel twisted.

Hæmorrhage from the Naso-pharynx after the Removal of Adenoids.—The bleeding, though often severe at first, stops, as a rule, after a minute or so. If it should not stop, pressure should be applied to the bleeding surface by passing a small Turkey sponge up behind the soft palate and pressing it against the posterior pharyngeal wall with the finger ; or the sponge can be wrung out of spirits of turpentine, or any other suitable styptic, and

applied in the same manner. The sponge can be held in place either by the finger or a clip. Another plan is to wrap a strip of lint round the end of a Gottstein's ring-knife (which will be at hand), and press on the bleeding point with it. When it is not possible to control the bleeding by any of the above measures, and it seems probable that the bleeding is due to the accidental wounding of an abnormally-situated internal carotid or other vessel, it may sometimes be necessary to ligature the common carotid artery. This is, however, a very doubtful expedient, as, if the blood is coming from the internal carotid, it is unlikely that the hæmorrhage will cease even after ligature of that vessel, owing to the free communication from the opposite side. It should certainly not be ligatured unless it is found that compressing the vessel in the neck controls the bleeding.

BLEEDING FROM THE NOSE AFTER OPERATIONS FOR THE REMOVAL OF POLYPI OR ONE OF THE TURBINATE BONES. —Syringing the nose out with iced or hot water will usually suffice, or a strip of lint soaked in turpentine or some other styptic may be placed in the nose for a few minutes. In cases of severe hæmorrhage, the following plan, which is advised by Mr. Shield,* may be tried : A small, soft Turkey sponge of suitable size is wrung out of spirits of turpentine, and passed up behind the soft palate ; it is then seized by forceps passed through the nose from in front, and the latter are pulled upon so as to draw the sponge against the posterior nares. This will stop any bleeding from the back of the nares, and in the case of bleeding further forward, strips of lint can be pushed into the nostril from which the blood is coming while the sponge is in position, the sponge preventing the lint from going into the naso-pharynx. When the hæmor-

* 'Lectures on Nasal Obstruction.'

rhage has in this way been controlled, the forceps and sponge can be cautiously removed, leaving the plug in place. Other methods are to plug the nose in the ordinary way for epistaxis, or to insert an inflatable indiarubber tampon (Fig. 14). If a plug is inserted, it should be removed in twenty-four hours.
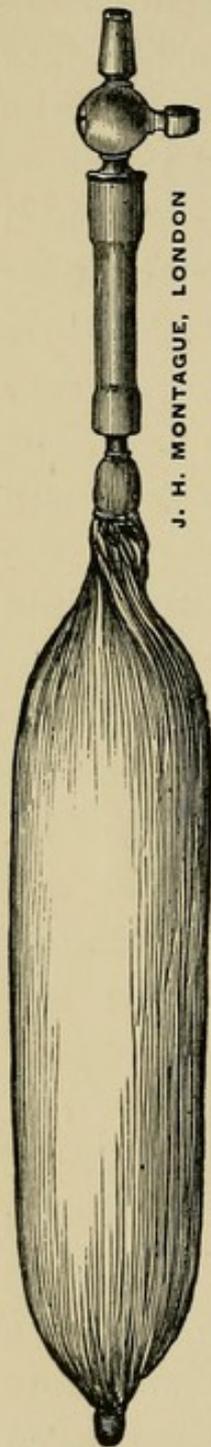
HÆMORRHAGE AFTER TOOTH-EXTRACTION.—This is seldom of any consequence, and when it is usually results from hæmophilia, or some other constitutional condition in the patient. The tooth-socket should be plugged with cotton-wool from the bottom, the wool having been first soaked in some suitable styptic; then a pad of folded lint should be placed on the top of the plug. This pad should be of sufficient thickness to prevent the teeth meeting, so that when the jaw is closed and tied up tight with a jaw-bandage, pressure is maintained upon the plug.

A good plan in some cases is to put a stitch through the gum on each side of the socket and tie it tightly, so as to close the cavity. This plan is a very useful one, especially when there is not a tooth on each side of the empty socket. The most troublesome cases of hæmorrhage after dental operations are those resulting from a wound of the posterior palatine artery. This accident may happen from the forceps slipping, or from the improper use of an elevator on an upper molar.

J. H. MONTAGUE, LONDON

FIG. 14.*

* The tampon is smeared with vaseline, passed into the nose, and inflated.

Pressure may be tried, or an attempt made to clip the vessel. This is, however, seldom successful, as the vessel usually lies in a groove in the hard palate. The bleeding can be stopped by pushing a small wooden plug up the posterior palatine canal. The position of the posterior palatine canal is about a quarter of an inch to the inner side of the last molar tooth. An incision must be made in this situation through the mucous membrane and the plug inserted. It should be removed at the end of twenty-four hours.

HÆMORRHAGE AFTER REMOVAL OF THE TONGUE.—If the wound has been kept aseptic after the operation, this but rarely occurs. When hæmorrhage does occur, however, it is usually very dangerous. If the whole tongue has been removed, it is best to leave a silk thread through the stump, and to secure this outside the mouth with a piece of strapping. In case of bleeding taking place, the stump can then be easily pulled forward and the bleeding point clipped. If no such thread has been placed through the stump, the latter must be caught hold of with a clip or vulsellum forceps and pulled well forwards, so as to expose the bleeding point. Two or three clips should be kept handy in cases where there is any possibility of hæmorrhage. If secondary hæmorrhage does occur, it will probably take place from a week to ten days after the operation.

BLEEDING FROM THE INTERCOSTAL ARTERY AFTER OPERATION FOR EMPYEMA, ETC.—The bleeding point should be picked up, if possible, with a clip, and ligatured, the wound, if necessary, being enlarged to expose the vessel. Or the centre of a square piece of lint may be pushed into the wound, and the cavity so formed packed with cotton-wool ; then, by pulling on the lint, the bleeding can be controlled.

BLEEDING FROM THE FRÆNAL ARTERY AFTER CIR-
CUMCISION, ETC.—The artery should be picked up with
a clip, if possible, and ligatured. If this is difficult,
a stitch may be inserted beneath the vessel and tied
over it. Or a pin can be passed through beneath the
vessel and a figure of eight made over it with silk. A
strip of lint soaked in lotio plumbi will often stop the
slight hæmorrhage that is sometimes seen after circum-
cision, and makes an excellent dressing.

BLEEDING FROM THE PERINEUM AFTER LITHOTOMY,
ETC.—Any bleeding points that can be seen must be
picked up and ligatured, or the clip left on. This failing,
a tube with a petticoat tied round it should be inserted
into the wound, and gauze or wool packed round the
tube. Two strings are then attached to the end of the
tube, and fastened to a band round the patient's waist.
If there is no necessity for draining the bladder through
the wound, the latter may be simply plugged in the
ordinary way, and pressure made on the perineum by a
perineal bandage. This bandage is an excellent method
of applying pressure to the perineum. It is put on as
follows: A piece of 4-inch bandage is tied round the
waist, and the ends cut off. The roll of bandage is then
passed under this behind, and carried forwards across
the perineum, beneath the waist-bandage in front, and
back again. The two free ends of the bandage are then
pulled upon, and tied together in the centre of the
perineum. In this way considerable pressure can be
exerted on any desired point.

HÆMORRHAGE AFTER OPERATIONS ON THE BLADDER.—
This is very seldom met with, but may occur after opera-
tions for the relief of enlarged prostate or for the removal
of growths, especially papillomata (villous tumour). It
may also follow lithotrity, but should not do so if the

operation has been properly performed. Again, it may result from the too rapid evacuation of an overdistended bladder, especially in old men. The great difficulty in dealing with the bleeding in these cases depends upon the fact that the bladder is usually filled with blood-clot, and nothing can be done until this has all been removed. As large a catheter as possible should be passed, and a stream of warm water forcibly injected with a large bore syringe. At first only a very small quantity of fluid should be injected, and then allowed to flow back again; as the clot comes away more and more fluid may be injected each time. This must be persisted with until all the clot has been washed out of the bladder, as evidenced by the absence of clots in the water coming back from it. Some styptic solution should then be injected into the bladder: for this purpose a strong solution of hazeline or Ruspini's styptic is recommended; but other styptics, such as suprarenal extract, turpentine, etc., may be used instead. Styptics having a caustic action, such as liq. ferri perchlor., etc., must not be used, as they set up cystitis.

Of course, if there is an opening into the bladder, either through the perineum or above the pubes, the clot can be washed out much more easily through it. And when there is such an opening, if the hæmorrhage will not yield to styptics and hot lotion, the bladder may be packed with strips of lint after passing a tube or tubes down to the openings of the ureters. The lint should be in long strips, and the ends left outside the wound. In cases of severe hæmorrhage from the prostate or trigone the bleeding can be temporarily controlled by passing one finger into the rectum and compressing the prostrate and trigone against the back of the pubes, or by compressing the bladder bimanually by one hand above the pubes and a finger in the rectum.

HÆMORRHAGE FROM THE RECTUM.—This is, fortunately, a rare occurrence with the present improved methods of operating; it still, however, occasionally follows operations for piles, etc.   It is a very troublesome complication, not only on account of the difficulty of stopping it, but because a large amount of blood may be lost into the bowel before there is any external evidence of its presence.   The hæmorrhage usually takes place after the bowels have acted for the first time following the operation, and is, as a rule, due to the slipping or premature separation of a ligature.   The bleeding is free, and is accompanied by a considerable amount of shock.

It is well to remember that the amount of blood lost externally is no indication of the total hæmorrhage, as the rectum and sigmoid may be filled with clot.   An anæsthetic should be administered and the sphincter dilated, then, after emptying the bowel of clot with the finger and by syringing with hot water, an attempt may be made to clip the bleeding-point and re-ligature it.   To facilitate this manœuvre the wall of the rectum above the bleeding-point should be caught with a pair of pile forceps or an ordinary clip, and drawn
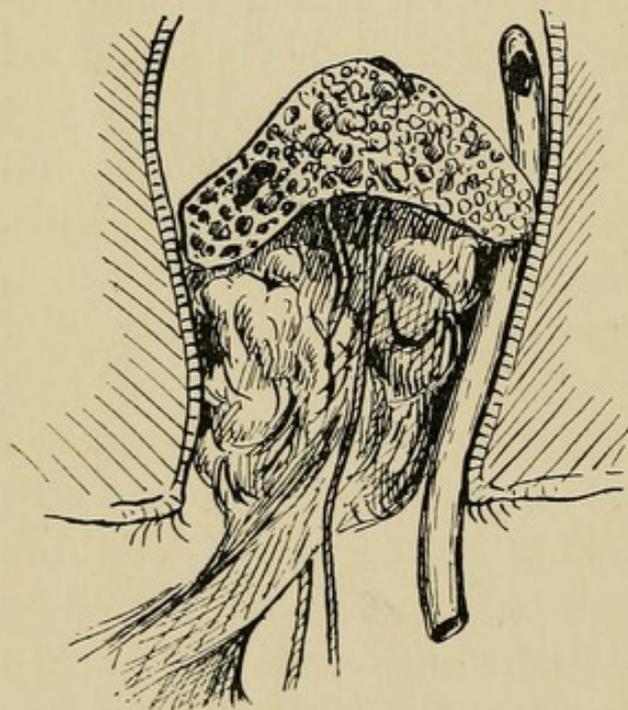
FIG. 15.

down so as to give good access to the bleeding spot. Even then it is often by no means an easy matter to control the hæmorrhage, as the rectum tends to lie in folds, and the bleeding often comes from a surface rather than a point.

If, as is not infrequently the case, it is found to be impossible to control the hæmorrhage in this way, the rectum must be plugged.

The following method of plugging the rectum is that advised by Mr. Herbert Allingham (Fig. 15). A No. 12 catheter is first passed into the bowel for about 6 inches, to allow of the passage of flatus after the plug is in position. A strong silk thread or tape is fixed through the apex of a bell-shaped turkey sponge, of suitable size, in such a way that the two ends of the thread will hang down on the hollow side of the sponge. This sponge is then damped and pushed up the rectum with its apex pointing up the bowel, and the two threads hanging out of the anus, until it is well above the bleeding-point. The whole of the space below the sponge is then packed with wool or gauze. The two ends of the thread attached to the sponge are then pulled upon, so as to compress the packing against the sides of the rectum. A large pad of lint, or lint and wool, is then placed over the anus, the threads brought one on each side of it and tied tightly over the pad. The plug can be left in for a week or longer. Plugging, if properly carried out in this way, will never fail to control the hæmorrhage.

In cases of secondary hæmorrhage—*i.e.*, when bleeding occurs a week or more after the operation, and is due to sloughing—no attempt should be made to catch the bleeding-point with clips, but plugging should be resorted to at once. In women, hæmorrhage from the rectum can be temporarily controlled by passing a finger into the vagina and compressing the rectal wall against the sacrum.

BLEEDING AFTER INCISION INTO INFLAMED TISSUES.—It is not at all uncommon for rather free hæmorrhage to occur after incisions have been made into inflamed

tissues, such as for the relief of tension in cellulitis, etc. The ends of any small vessels that may have been divided do not contract, but are held open, and, in consequence, bleeding from them continues for some time. A certain amount of bleeding in these cases is advantageous, as it relieves the local congestion. If it continues for long, however, something may have to be done to stop it. It is generally useless to attempt to pick up the bleeding-points, as the tissues are often so rotten that they give way at once. Elevation of the part and the application of a really hot fomentation and pressure will almost always suffice to stop the bleeding. Should it not do so, the incisions must be packed with strips of gauze or lint, and firm pressure applied with cotton-wool and bandages.

When severe hæmorrhage occurs from a wounded vessel situated in rotten or gangrenous tissues, and the vessel cannot be picked up with a clip owing to the tissues tearing away, the best way to secure the vessel is to pass a hare-lip pin or needle through the tissues beneath it, and then compress the vessel by a figure of eight made with silk round the ends of the pin—*i.e.*, secure the vessel by acupressure. This is also the best way of arresting hæmorrhage from an artery in the base of an ulcer or ulcerating surface. The tissues should be under-pinned on the proximal side of the bleeding-point.

HÆMORRHAGE FROM THE STUMP AFTER AMPUTATIONS. —Recurrent hæmorrhage after an amputation will usually stop if firm pressure is applied and the part elevated. Should it not do so, the wound must be reopened, and any bleeding-points clipped and ligatured.

Secondary hæmorrhage after an amputation is, fortu-nately, a very rare occurrence now, though it used to be common. Ligature of the main vessel above has been

advised, but most authorities agree that it is better to re-amputate higher up.

Constitutional Treatment of Patients suffering from Hæmorrhage.

IMMEDIATE TREATMENT.—This is mainly the treatment of shock, which is gone into in the next chapter.

The patient should be freely stimulated if all the bleeding-points have been properly secured. Liquoris Strychninæ may be given hypodermically in doses of from 5 to 20 minims. Brandy or whisky may be given ; this is best done by giving repeated doses of from ½ to 1 ounce by the rectum—or mouth if there is no danger of vomiting—or alcohol can be given hypodermically in small doses (10 to 20 minims).

REMOTE TREATMENT.—Patients who have suffered from severe hæmorrhage are usually very anæmic, and in old or weakly patients this condition may persist for some time. In children and young adults the blood-forming capacity is good, and they soon make up any deficiency. In order to assist the tissues in forming new blood, iron in some form or another should be given until all signs of anæmia have disappeared. Port wine is an excellent remedy in these cases, and 3 to 6 ounces should be given per diem unless otherwise contra-indicated. Patients who are suffering from anæmia due to loss of blood must not be allowed to get up and about too soon ; especially they must be got up very gradually at first, as there is great danger of thrombosis if they are allowed to get up too quickly. Massage to the lower limbs, if carried out for a day or so previous to their getting up, will do much to prevent this danger.

HAPTER IV

SHOCK AND COLLAPSE

SHOCK and collapse are terms which have been applied to conditions very similar, if not identical; and although several authorities have attempted to differentiate them, it seems wiser in the present state of our knowledge not to do so, but to speak of one condition only, which I prefer to call shock.

This condition of shock is a most important one, and it may now be said to be the chief danger of severe operations. The two great dangers of any severe operation are sepsis and shock, and, thanks to modern aseptic methods, sepsis has now been practically driven out of the field, and can be eliminated as a source of danger. But we are still left with shock, and our aim should be to eliminate that also as effectually and thoroughly as has been done with sepsis. Much has already been done by improvement in the methods of administering anæsthetics, by improved methods of operating, by the judicious use of strychnine and other stimulants, by transfusion and other allied methods. But much still remains to be done before shock can be said to have ceased to be a danger in the more severe surgical procedures, especially when these involve interference with the abdomen or its contents.

Before attempting to treat shock, it is first of all necessary to understand the physiology of the condition and to get a clear idea of the causes at work. I think, therefore, it will not be out of place if a brief review of the more important facts in the physiology of shock is given before proceeding to the discussion of the treatment.

The Physiology of Shock.

A great deal of experimental work has been done recently on this subject, and although it cannot yet be said that the physiology of the condition is quite clear, the main factors in the causation of shock seem to be sufficiently clear to allow of their being taken as a foundation for methods of rational treatment. The main factor in the production of the condition we know as shock is a fall in general blood-pressure, and it is the explanation of this fall that requires consideration.

Of the experimental data available, some of the most important are the experiments of Crile on animals. His experiments may be conveniently divided into three classes.

1. Shock produced by Injury to important Afferent Nerve Paths.—He showed that injury to the spermatic cord or testis was followed by shock, and was accompanied by a very marked fall in general blood-pressure ; also that while the general blood-pressure was falling the portal blood-pressure was proportionally rising. This shows that the fall in general blood-pressure was due to the dilatation of the vessels of the splanchnic area, and the consequent loss of blood from the general circulation into that area.

That the fall in blood-pressure was not cardiac in origin he proved by repeating the experiments after

eliminating the action of the cardio-inhibitory apparatus by the injection of atropine or preliminary section of the vagi.

2. SHOCK PRODUCED BY EXPOSURE OR INJURY OF THE ABDOMINAL VISCERA.—If in an animal the abdomen was opened and the intestines freely exposed, this procedure was soon followed by a marked fall in general blood-pressure and vascular dilatation of the whole of the splanchnic area. This did not always occur immediately, but was sooner or later manifest, and was steadily progressive, injury or manipulation of the intestines increasing the effect to a marked degree. *Further, if the arteries supplying the splanchnic area were clamped before opening the abdomen, no amount of exposure or manipulation of the intestines gave rise to a fall in the blood-pressure, and no shock resulted.*

This seems to show that one of the most important factors in the production of shock is the condition of the splanchnic vessels. Curiously enough, the omentum seems to be different from the rest of the peritoneum in this respect. Crile found that the changes occurring in its vessels after exposure or manipulation were the reverse of those obtaining in the rest of the peritoneal cavity. It would seem, therefore, that its function is to act as a protection to the rest of the peritoneum.

It was found in these experiments that the last factor in the circulation to fail as the result of shock was the heart (anæsthesia by chloroform being excepted). Crile was further able to show that the rapid action of the heart, which occurs in severe shock, is not due to commencing failure and exhaustion of that organ, but is due to its having an insufficient quantity of blood to work upon. If when the heart was in this condition saline solution was injected into the veins, the heart at once began to work more slowly and forcibly. A sphygmographic

tracing taken at the same time showed a long and rapid rise and fall in the pulse-wave, the wave not being sustained on account of the lack of resistance on the arterial side of the circulation. As the vaso-motor tone began to be established, the pressure on the arterial side rose, and the pulse-wave slowly returned to the normal, while at the same time the heart-beats became faster and less forcible, so as to adapt the heart to the more normal conditions of the circulation, until eventually the heart and pulse became once more normal in force and rhythm.

3. THE RELATION BETWEEN THE REGION OPERATED UPON AND THE SHOCK PRODUCED.—It appears that operations upon the abdominal contents and visceral peritoneum, and operations upon the male generative organs, produce the most profound shock as a general rule. In the abdomen the severity of the shock produced is in proportion to the distance of the part operated upon from the pelvis, the shock being most severe after operations in the neighbourhood of the stomach, pylorus, and duodenum.

In the extremities the amount of shock caused by operation is in direct proportion to the nerve-supply of the part—that is, to the area of skin and muscle injured and the relative number of nerve-endings in them. Thus, a crush of the paw of a dog will cause more pronounced shock than amputation of the limb high up. Crile states that in animals subjected to extensive removal of integument, shock was induced with a rapidity proportional to the area exposed, and its depth corresponded to the duration of the exposure.

There is another factor in the causation of shock after exposure of the peritoneum which has to be considered.

It has been shown by experiments on dogs that if the abdominal cavity is opened and the intestines disturbed,

after the shock which results from this procedure has persisted for some time, the specific gravity of the blood increases considerably. This increase in the specific gravity of the blood tends to take place earlier, but is prevented by absorption of fluid from the tissues, and it is not until this source has been exhausted that the increase shows itself. In one of Professor Sherrington's experiments the specific gravity of the blood rose from 1,054 to 1,062 in fifteen minutes after exposure of the intestine in a young healthy dog. This increase in the specific gravity was found to last in some cases for several days after the operation, and then to gradually pass off.

This increased specific gravity of the blood is an important factor in shock, as it must greatly interfere with the already impaired circulation. It is of considerable importance from the aspect of treatment, as it has been supposed that the transfusion of saline solution so lowered the specific gravity of the blood that it was prevented from being beneficial in the treatment of shock except when employed in small quantities. This is, however, not the case, as a very large quantity of saline solution would have to be injected before the specific gravity of the blood would even reach the normal. And, indeed, it was found in the experiments that although the specific gravity could be reduced to the normal by transfusion, it rapidly increased again if the exposure of the peritoneum was continued.

Dr. Grunbaum has tested the specific gravity of the blood of patients during operations, and has demonstrated that the specific gravity rises several degrees during the course of an ordinary abdominal section ; in some cases the rise was as much as 5 or even 7 degrees.

The great fall in arterial blood-pressure which occurs in shock is due to vaso-motor breakdown and the collection

of blood in the great splanchnic veins. That this collection of the blood in the splanchnic area is mainly due to the engorgement of the splanchnic veins is shown by the fact that if the abdomen of an animal is opened and shock produced by exposing the intestines, clamping the aorta or cœliac axis does not cause nearly so great a rise in the general blood-pressure as compression of the intestines themselves.

The course of events in a case of surgical shock from whatever cause would seem to be as follows : A fall in general blood-pressure takes place or tends to take place. This is immediately compensated for by the vaso-motor mechanism,* and the pressure rises again or is maintained. This compensation will sooner or later become inefficient in maintaining the blood-pressure by itself, and the aid of the heart will be called in by means of the cardio-accelerator centre, and for a time, by increased action, the heart will help in maintaining the mean pressure.

As the exhaustion of the vaso-motor centre continues, however, a time will be reached when, in spite of the increased action of the heart, it is no longer possible for the pressure to be sustained at the normal level, and a fall in general blood-pressure will then occur. Directly this drop in blood-pressure takes place, the circulation will become partially inefficient, and not only will the circulation of the different centres be impaired, but the blood itself will not be properly oxygenated, owing to the pressure not being maintained in the lungs.

One of the first important centres to feel this will be the vaso-motor centre, and it will become exhausted still more rapidly, and a still greater fall in blood-pressure occur. As the vaso-motor mechanism breaks down, the

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* In cases of shock due to primary breakdown of the vasomotor centre this stage of compensation will, of course, be absent.

blood will tend to collect in the large venous trunks, and this will interfere with the intake of the heart. As the output of the heart is directly proportional to its intake, and the latter is diminished owing to the stagnation of the blood in the great venous trunks, the output of the heart will be diminished, and in consequence there will be a further drop in the arterial blood-pressure. It has been experimentally proved that the output of the heart does not depend upon the aortic blood-pressure, but upon the pressure in the vena cava. The heart will act more and more rapidly to try and make up for the small amount of blood that it has to act upon, but sooner or later the cardiac muscle will become exhausted from the diminished quantity and quality of its blood-supply, and death will result.

Surgical shock is the result of exhaustion of the vaso-motor centre, and the other centres, such as the cardio-inhibitory centre and the respiratory centre, are only affected secondarily.

No doubt other centres besides the vaso-motor centre are affected in the early stages of shock, and we have evidence of this in the irregularity of the pulse that is sometimes seen, especially when the cause of the shock is some violent nerve stimulus, as in injury to the testicle, and also in the fact that Cheyne Stokes' respiration is occasionally observed. But there can be little doubt that the main factor and the most important one is the fall in blood-pressure. Inhibition of the heart does occur as the result of severe injury to important nerve-endings, but is rare as a cause of shock. Crile found that shock was established in dogs just as readily after the cardiac branches of the stellate ganglion had been divided, thus showing that the cardio-inhibitory apparatus can be of comparatively little importance in the causation of shock.

To briefly summarize conclusions:

1. The chief factor in the production of shock is exhaustion and breakdown of the vaso-motor centre, resulting in the blood collecting in the splanchnic area, and a fall in general blood-pressure.

2. When the shock has been caused by extensive denudation of tissue, as is the case in many abdominal operations and in burns and scalds, the increase in the specific gravity of the blood becomes an important factor.

3. The heart is only secondarily affected by the fall in venous blood-pressure interfering with its intake.

The Treatment of Shock.

This requires much care and careful judgment. It is very easy to do too much, and so to increase, instead of diminishing the shock, and, on the other hand, it is a condition which calls for prompt and often energetic treatment. The different methods of treatment will be considered in detail for the sake of clearness, though in practice, of course, several would be used at the same time. The cause of the shock, whether it be the result of a severe injury, a prolonged operation, or loss of blood, is of very little importance in dealing with individual cases. The cases which react best to treatment are those of hæmorrhage, and the worst are those which are the result of a prolonged operation associated with injury to important organs.

WARMTH.—The patient should be kept warm with blankets and hot bottles, but care must be taken not to overdo this; the patient should never be kept in a condition of profuse perspiration, as this will tend to greatly increase the shock. Although it is important to maintain

the body temperature, at the same time much heat will cause dilation of the superficial vessels, and when this occurs it means a still greater loss of blood to the essential circulation.

POSITION.—The position of the patient is of great importance in treating shock. The best position to place the patient in, is with the foot of the bed so raised that the abdomen is on a higher level than the thorax and head. This tends to prevent the blood from accumulating in the abdomen and lower limbs, and helps the blood to flow from the great veins into the heart. The foot of the bed should be raised on blocks a foot or more in height, and the patient should not have a pillow under the head.

Bandaging the abdomen, rapidly and effectually raises the general blood-pressure, and may be tried if there is no serious contra-indication to its use; since it tends to embarrass the respiration, care should be taken to see that the thorax is free to move, and is not pressed upon by heavy bedclothes, etc. Bandaging the extremities is also effectual in raising the blood-pressure, and is a useful way of treating shock in suitable cases. The limbs should be firmly bandaged all the way up with some elastic bandage, such as flannel or domet. The bandages must be put on carefully so that there are no creases, and must not be left on for long, or they will do harm by cutting off the blood-supply to the limbs.

STIMULANTS.—The value of stimulants in the treatment of shock is often much overestimated. Many cases of shock can easily be rendered much more serious by overstimulation. It must be remembered that the cause of the condition is exhaustion of the great nerve centres, and that stimulation increases this exhaustion and does not give the centres time to recover. Again, if the heart be stimulated while the blood-pressure is still so low that

the great venous trunks passing to the right auricle con-
tain only a small amount of blood with which to supply
it, the heart will only exhaust itself by beating more
forcibly without being able to raise the blood-pressure or
improve the circulation, except momentarily. And to
stimulate the heart to increased action when it has
nothing to work on will only have the effect of hastening
the time when it must fail. It is true that an injection of
strychnine will improve the pulse for a time, but it does
so by forcing the already exhausted nerve centres into
action, and this will be followed by further exhaustion of
these centres as soon as the effect of the strychnine has
passed off. Again, it has been repeatedly proved by experi-
ment, and is a well-observed clinical fact, that stimulants
administered while the patient is in a condition of shock
are often not eliminated, but remain in the system, so
that when the shock passes off the combined effect of all
the stimulants administered will be produced with per-
haps a fatal result. This is particularly the case with
strychnine. It will be seen, therefore, that stimulants
have a very limited field of action in the treatment of
shock, and must be used with caution.

If strychnine is used, it should be given hypodermically
in doses of $\frac{1}{30}$ grain at one hour intervals. Digitalin
is also a useful drug, and a good plan is to combine these
two drugs, a hypodermic injection of strychnine ($\frac{1}{30}$ grain)
and digitalin ($\frac{1}{100}$ grain) being given every hour for three
or four doses.

Stimulants, if used, are best given in small repeated
doses, and should be combined with some other form of
treatment, such as transfusion, which will raise the
blood-pressure. Alcohol is not of very much use, as it
causes vaso-dilatation, and is very transient in its effect; it
is best administered by mixing it with the saline solution

used for transfusion or given as a rectal injection, or it can be given hypodermically in 20-minim doses.   Ether is practically of no use except to tide over a sudden syncope, as its effects are quite momentary; it must never be injected. into a vein, as it causes intravascular clotting.

Dr. Kelly advises the use of a rectal nutrient enema containing 40 grains of ammonium carbonate after operations which have caused shock, and speaks well of the results of this treatment.

SUPRARENAL EXTRACT.—It has been found in experiments on animals that suprarenal extract or its derivative, adrenalin, will raise the blood-pressure in every stage of shock; as, however, it is rapidly oxidized, its effect does not last long, and to be of much use it must be administered continuously.   It may be administered either by adding it to the transfusion fluid or by hypodermic injection.

TRANSFUSION AND SALINE ENEMATA. — Transfusion is one of the most valuable remedies we have in the treatment of shock.   The results of experiments show that the intravenous injection of water causes an immediate rise in the blood-pressure.   If only a small quantity is injected the pressure rises, but is not sustained, and falls again to the old level in a short time.   If the injection is continued, a point is reached when the pressure is sustained, except in the worst cases.   No amount of fluid transfused will raise the blood-pressure above the normal, owing to the rapid escape of the fluid from the bloodvessels into the tissues.   The objection often raised against the use of transfusion in large quantities, that it so lowers the specific gravity of the blood as to embarrass the circulation, is not true, as has already been shown.   Crile, who has done a great many
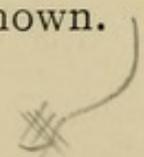
experiments to determine the value of transfusion, comes to the following conclusions with regard to it :

1. If the peripheral resistance is lost—*i.e.*, if the shock is due to complete vaso-motor breakdown, no amount of transfusion can more than temporarily restore the blood-pressure, and death is certain.

2. If the shock is much increased by regional accumulation of blood in the splanchnic area, as is the case in the shock following abdominal section, transfusion is often effective, peripheral resistance still being present.

3. If the shock results from hæmorrhage, and the vaso-motor mechanism is intact, transfusion is effectual.

In treating severe shock the patient should be transfused early, and it must not be expected that the single injection of 1 or 2 pints of saline solution will do permanent good in improving the circulation. Transfusion should either be repeated at frequent intervals until the blood-pressure is sustained and the circulation is once more efficient, or it should be carried on continuously until this end is attained. Very large quantities of saline may be allowed to flow into the circulation with safety. The fluid should not be allowed to flow in too quickly, and it should be kept warm (at blood temperature). There is generally a very marked improvement in the pulse and general condition as soon as tranfusion is started ; this must, however, not be taken as an indication that the transfusion can be stopped, but the fluid should be allowed to flow in slowly until about 2 or 3 pints have been injected, and then the patient should be watched for a time to see if the blood-pressure is sustained. If after fifteen or twenty minutes it drops again, more fluid should be allowed to flow in until the pressure is sustained.

Method of Performing Transfusion.—The best apparatus

for the purpose is about 2 feet of rubber tubing, to one end of which a glass funnel is attached, and to the other a glass cannula ; the cannula should taper to a narrow point, and should have a slight bend in it.   The cannula must be tied into the end of the tubing before commencing the operation.   A very good cannula can be made by using the needle of an exploring syringe; it has the advantage that it can be very rapidly introduced into a vein without even a preliminary incision being made in the skin, and, in addition, it can be introduced into a much smaller vein than the glass cannula ; and this is of importance, as in some patients the veins, even such veins as the median basilic, are so small that it is almost impossible to get an ordinary glass cannula into them.

Introducing the Cannula.—A bandage should first be tied round the upper arm to make the veins prominent; then, any large vein being chosen (this will usually be the median basilic), an incision is made over it and the vein exposed.   A double loop of silk or catgut is then passed beneath the vein with an aneurism needle, and the thread is divided so that there is a double ligature round the vein. The lower of these ligatures is then tied up so as to shut off the vein below ; the other is held up by the surgeon so that the vein is steadied in the loop.   Next, a longitudinal incision is made into the vein with the point of the knife, the cannula is slipped into it, and the upper ligature tied over the point so as to fix it in the vein. Before introducing the cannula, the surgeon should see that the whole of the rubber tubing and cannula are full of fluid, and that there are no air-bubbles in the apparatus.

If the needle of an exploring syringe is used instead of the glass cannula, it can simply be stabbed through the skin into the vein in a direction towards the heart.

The best solution to use for transfusion is normal

saline solution, which can be made by adding a teaspoonful of common salt to 1 pint of water; the solution should be boiled to sterilize it, and then cooled down to about 110° F. The right temperature may be roughly estimated in cases of emergency by the surgeon putting his fingers into the solution; he should be able to just bear his fingers in it with comfort. In an emergency also, when it is necessary to waste as little time as possible, the fluid need not be sterilized, but common tap-water may be used, to which sufficient boiling water from the kettle has been added to raise it to the desired temperature. In carrying out the transfusion, the fluid should be allowed to flow in slowly, and if there are any signs of dyspnœa at any time after the fluid has been running in, the transfusion must be stopped until this has passed off, when it can again be allowed to flow in. Some time should be occupied in introducing the fluid, and thirty minutes for the introduction of 3 pints is about the average time necessary: 2 or 3 pints of fluid should be allowed to flow in, and then the cannula may be removed and the wound sewn up; or the cannula may be left in, and after clipping the rubber tube, it can be wrapped round the arm so that it is all ready for use again. All that is then necessary in order to retransfuse is to unwrap the tube, refix the glass funnel, and remove the clip. It might be supposed that there is a danger of the blood clotting in the cannula and vein, and this clot being swept into the circulation by the next lot of fluid used for tranfusion. This is, however, not the case, as the cannula and vein remain full of water. Brandy or whisky in suitable quantities may be added to the transfusion fluid if desirable.

It will be as well to mention here that rigors sometimes occur after transfusion of normal salt solution or

even of water. They usually come on about twenty minutes or half an hour after the transfusion; they are not accompanied by any rise of temperature, and soon pass off without doing any harm. What the cause of them is it is very difficult to say; that they are not due to the accidental introduction of septic matter or other poison into the circulation is certain, as beyond the rigor no other bad effects follow, and they occur however carefully the solution and instruments are sterilized.

Rigors more commonly follow transfusion in men than in women, and do not occur except in a comparatively small number of cases. Dyspnœa is said to follow transfusion occasionally; this occurs when the fluid is injected too quickly into the circulation, and is due to sudden dilution of the blood in the lungs. It does not take place if the fluid is injected slowly so that it is able to mix with the blood before passing into the lungs. If it should occur, the injection must be stopped until it has passed off, and then continued more slowly.

Rectal enemata of saline solution may be made use of instead of transfusion, but are not so effectual. In cases of very severe shock where the circulation has almost failed, the fluid is not absorbed fast enough to be of use, as there is not enough circulation to carry it into the great vessels. It is, however, a very useful method when the degree of shock is not very severe, and we want to prevent it from increasing.

The water used for the injection should be at a temperature of about 110° F. As much water as possible should be allowed to flow into the bowel—as a rule not more than 1 pint at a time can be retained; but this depends to a large extent on the care with which it is injected. By allowing it to flow in quite slowly while the buttocks are well raised on a bolster it is often possible to get a couple

of pints retained without any discomfort ; at least twenty minutes should be occupied in introducing this quantity. The best apparatus for injecting the water is a No. 8 soft rubber catheter, with a glass funnel attached to the free end ; the eye end of the catheter should be passed well up into the bowel, and then the fluid should be poured slowly into the funnel. The injection must be repeated as often as the circulation seems to demand it, as evidenced by failure of the pulse ; and whether the circulation shows signs of failure or not, it is often advisable to repeat the injection every half hour or so until all signs of shock have passed off.

It is sometimes a very good plan to add brandy to the water used for injection ; about 1 ounce of brandy to 1 pint of water should be used.

Another method of treating shock, which is very popular on the Continent, is by the subcutaneous injection of normal salt solution. The injection is usually made into the subcutaneous cellular tissue of the breast. This method has, however, no advantages over the intravenous or rectal methods, and, on the other hand, it has many disadvantages. Enough fluid to be of any practical utility can seldom be introduced, and unless the circulation is fairly efficient, it will not be absorbed at all, and will not find its way into the circulation ; moreover, the injections are often extremely painful.

ARTIFICIAL RESPIRATION.—This has often a remarkable effect on patients suffering from shock. It does good by drawing blood into the chest to supply the heart, and by increasing the oxygenation of the blood. It may be done gently in severe cases of shock, and may with advantage be combined with the administration of oxygen.

THE RELIEF OF PAIN.—It is rather doubtful whether the pain following an operation increases the shock or not.

If the pain is severe, it probably does, and morphia should be given. Unfortunately, morphia tends to prolong the shock, and therefore as little as possible must be used ; for this reason also it is well to combine it with atropine.

Morphine ($\frac{1}{4}$ grain) and atropine ($\frac{1}{100}$ grain) may be given hypodermically. When the patient remains in a condition of shock for many hours, it becomes most important to administer nourishment in some form, as the condition is one that gives rise to a great deal of tissue change, and the patient has probably been without food for some time previous to the operation. Some easily digested form of food must therefore be administered in the hope that some of it may be assimilated and help to keep up the vitality of the patient. Nutrient enemata of albumin or peptonized milk should be given every one or two hours, or appropriate food may be given by the mouth if the patient can swallow.

In conclusion, it must be borne in mind that the condition called shock which follows severe operations and injuries is, in a large measure, a mechanical one, in which the circulation is the main factor at fault, and that therefore it is a condition which it is possible to treat successfully in many cases, since by appropriate means the mechanical disadvantages under which the circulation is labouring can be overcome. One of the chief factors in maintaining shock is the exhaustion of the nerve centres in the cord and medulla, and although we cannot directly influence these, in most cases their recovery is only a matter of time, if meanwhile we can succeed in maintaining the circulation. Our efforts, therefore, must be exerted in maintaining the circulation in as efficient a condition as possible until such time as the exhaustion of the nerve centres has passed off.

We must not expect this to take place suddenly or quickly in bad cases, and considerable patience and perseverance will be called for. The most difficult cases to deal with successfully are those where a profound condition of sepsis or toxæmia is present in addition to the shock; it is often extremely difficult or impossible to distinguish the one condition from the other, and patients under such circumstances often react extremely badly, or not at all, to treatment, and when they do react, relapse again almost at once.

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CHAPTER V

POST-ANÆSTHETIC COMPLICATIONS

OWING to the great improvements in the methods of administering anæsthetics which have taken place recently, the after-effects are now less important than formerly, and we do not so often find the results of the anæsthetic complicating the after-treatment of an operation case. It is especially in the old and weakly subjects that these after-effects are most likely to cause trouble. The after-effects are much diminished if the patient has been properly prepared for the anæsthetic beforehand. In some cases, however, and especially in emergency operations, time will not permit of the patient being properly prepared for an anæsthetic, and it is in these cases that we most often see post-anæsthetic complications. Most of the after-effects result more in discomfort to the patient than in any actual danger; occasionally, however, the results of the anæsthetic, either alone or by complicating some condition caused by the operation, may give rise to symptoms of the gravest import. The nature of the anæsthetic used and the method of administration are of considerable importance. Ether is undoubtedly more liable to cause unpleasant after-results than chloroform, but its other advantages sufficiently outweigh these to render it a preferable anæsthetic in the

majority of cases. The liability to, and the severity of, post-anæsthetic complications are proportionate, to a large extent, to the length of the administration.

Vomiting.

A certain amount of vomiting may be said to be the rule after ether ; the vomited material is usually little else than mucus, and vomiting generally passes off before the patient regains consciousness. Occasionally, however, it is more severe, and may continue for many hours or even days. When this is the case it is very distressing to the patient, and may be dangerous, by lowering his strength and preventing the proper assimilation of nourishment.

Vomiting is more liable to occur if the patient is jolted or moved carelessly soon after the anæsthetic ; care should therefore be exercised in moving the patient back to bed, both to avoid jolting and to keep him as flat as possible. The cause of the vomiting has been attributed to the presence of ether in the stomach. Hess of New York, who has investigated this subject, comes to the conclusion that the drug is excreted by the gastric mucous membrane, and as it is usual for the stomach to be empty during an operation, it remains there in a concentrated form mixed with mucus ; no doubt also a considerable quantity of ether finds its way into the stomach with the saliva which is swallowed. Hess considers that the bad cases of post-anæsthetic vomiting are due to a gastritis set up by the ether present in the stomach, and suggests that the best way of preventing this is by diluting the stomach contents. He advises that the patient should be given a draught of water before the commencement of the anæsthetic, so that any ether

that may find its way into the stomach will be rapidly diluted.   Whether the vomiting is due to any local condition of the stomach or is of central nervous origin is still somewhat doubtful ; that, at any rate, the vomiting is not entirely due to local causes seems probable, as vomiting follows the anæsthesia produced by rectal etherization. And, again, some of the worst cases of vomiting occur after chloroform.   That ether does get into the stomach during an anæsthetic there can be no doubt, and draughts of water after the administration, whether retained or not, will assist in either diluting or washing it away.

Although vomiting is more common after ether than after chloroform, the worst cases of vomiting are seen after the latter drug.   The presence of blood in the stomach (which has been swallowed during the anæsthetic) is a common cause of subsequent vomiting.   In children vomiting after ether is very much less common than with adults, in spite of the fact that, as a rule, children are sick from very slight causes ; and it seems that old people are also less liable to post-anæsthetic vomiting.

The position of the patient after an anæsthetic is of some importance in preventing sickness.   The patient should be turned on to the right side if possible, so as to allow any fluid in the stomach to find its way easily into the duodenum.   In cases of very intractable vomiting, propping the patient up into a sitting or half-sitting position will often be efficacious in stopping the sickness. When the vomiting consists in simple regurgitation of fluids directly they are swallowed, this is all that is usually necessary to stop it and enable the patient to retain nourishment.

Another point of great importance with regard to the posture after an anæsthetic may be referred to here—that

is, that after the patient has been put back to bed, and before he has regained consciousness, the head must be kept well to one side, as if he be allowed to lie on the back with his head in the midline, should any sickness occur there is a great danger of the vomited material becoming sucked into the air-passages and obstructing respiration. This may occur even though a nurse is watching the patient, and several deaths have been recorded from this cause after the administration of ether.

When from the nature of the operation it is particularly advisable that the patient should not vomit after the operation is finished, or when it is known that the particular patient is liable to exceptionally severe vomiting after anæsthesia, an excellent plan is to wash out the stomach with warm water before sending the patient back to bed ; this is often effectual in completely preventing vomiting.

As soon as the patient is conscious after the anæsthetic, if vomiting does not cease he may be given some quite hot water to drink (about ½ pint may be allowed) ; this will sometimes have the effect of making the patient sick, but will do no harm, as it washes out the stomach and gets rid of the ether.

Another plan is to give 15 to 20 grains of bicarbonate of potash in ½ pint of hot water ; or 3 minims of tincture of iodine dissolved in ½ pint of cold water is sometimes very effectual. Strong hot coffee may be tried, or champagne is sometimes useful.

There are several drugs which enjoy a reputation for preventing vomiting after anæsthesia ; thus hydrocyanic acid in small repeated doses is said to be of value. Morphia is certainly sometimes of use, and may be given either hypodermically or by the mouth. Dr. Hewitt says that when there is a neurotic element in the vomiting,

bromide of potassium may be given as an enema (20 grains in 2 ounces of water) with good results.

Counter-irritants to the region of the stomach are sometimes effectual. The best of these is a flannel rung out of boiling water and applied to the epigastrium; it must be applied as hot as possible and changed as soon as it has become cool. Blisters have also been used with success.

Strong essence of peppermint is sometimes very effectual; it is best given as five or ten drops on a lump of sugar, the latter being sucked slowly, or it may be given with a little water: it probably acts in the same way as a counter-irritant. In cases of very severe and intractable sickness the stomach should be washed out with warm water by means of a soft rubber tube, until the water comes back quite clean; this removes any de-composing or irritating material that may be present, and it is the most effectual method we possess of stopping vomiting; it should always be tried in bad cases. Patients who have suffered from severe vomiting often complain of pain round the lower part of the chest, especially on deep inspiration, for a day or two after-wards; this is due to the muscles having been strained during the violent retching. This pain often gives rise to a great deal of discomfort, and should be relieved by rubbing the skin over the painful muscles with lina-mentum saponis.

Lung Complications.

The liability to lung complications after anæsthetics is probably greater than is usually supposed. These com-plications are most commonly seen after ether, and but rarely after chloroform. The most common of these

complications is bronchitis, which may go on to broncho-pneumonia in bad cases. The so-called ether pneumonia, which is of the lobar type, seems to be much more rare than its name would imply.

Crouch and Corner, who investigated this subject recently at St. Thomas's Hospital, found in 2,400 administrations of ether, ten cases of subsequent lung complications which were directly attributable to the anæsthetic. Of these ten cases, three were broncho-pneumonia (one of whom died), one developed pleurisy, and the remainder bronchitis of varying degrees of severity. It may be mentioned that in this series of cases the anæsthetics were given, for the most part, by inexperienced anæsthetists. The liability to these complications appears to be greater after prolonged anæsthesia, and especially when the patient is subjected to changes of temperature or draughts soon after the administration, as is the case when they have to be conveyed along passages, etc., on the way from the operating-table to the bed. It is, therefore, commoner in hospital than in private practice. To prevent these complications great care should be taken not to let the patient be subjected to any draught or sudden change of temperature after an anæsthetic, and if it is necessary to move a patient some distance from the operating-room, the head and mouth should be covered over with a thin blanket. The treatment is, of course, that which is appropriate for the lung condition present.

Other Complications.

Among other complications that may be seen are the following :

RENAL TROUBLES.—Some observers state that albu-

minuria for a day or two is very common, and is more often seen after chloroform than after ether.

JAUNDICE has been recorded as occurring after chloroform.

INSANITY.—Several cases of this have been recorded. It is specially liable to occur in patients the subject of recurring attacks of insanity, the anæsthetic acting as the exciting cause in bringing on another attack.

DIABETIC COMA has been known to be brought on by the administration of an anæsthetic. Of course, this is best prevented by carefully dieting the patient before the operation.

PARALYSIS.—Dr. Blumfeld[*] mentions three varieties of paralysis that may follow anæsthesia: (1) Those of peripheral origin. These are due to the patient, while his volition is in abeyance, being allowed to remain for some time in a strained position, which has resulted in some nerve or nerves being pressed upon. Deltoid and ulna paralysis are examples. (2) Those of central origin. These are really apoplectic fits, resulting from the congestion due to the anæsthetic. (3) Indeterminate.

PERSISTENT HICCOUGH.—This may occur and prove very difficult to stop. Tongue traction has sometimes been successful.

HÆMATEMESIS.—This complication is very rare, but is sometimes seen after operations, and it is doubtful how much of it is due to the anæsthetic and how much to the operation itself. It seems to be commoner after operations on the intestinal tract than after operations on other parts of the body. A case is reported in the *Lancet*, August 22, 1902, where hæmatemesis occurred four days after the operation, and Mr. Mayo Robson cites several cases of this complication, some of which were fatal.

* 'Vomiting after Anæsthetics,' *Clinical Journal*, August, 1901.

HæMOPTYSIS.—This also is a rare complication, but is occasionally seen. Of course, as a rule it is seen in tubercular patients who have cavities in the lungs, and the congestion resulting from the anæsthetic acts as the exciting cause. Sometimes, however, no history of any previous lung trouble is obtainable, and on examination of the chest it is not possible to discover any signs of mischief. It is, as one would naturally suppose, most commonly seen after ether.

Diet.

As a rule, no food should be given by the mouth for from four to six hours after the anæsthetic, as it will probably only cause vomiting. The first food that is given should be something that is easily assimilated, but need not necessarily be fluid. Solids or semi-solids are often more readily retained, and are more satisfying to the patient. A cup of tea with some soft bread-and-butter and a lightly-boiled egg may be given. Anything in the way of a large meal should not be allowed, as it will almost certainly cause sickness. When the adminis-tration has been a long one, of course the interval that must be allowed to elapse before food is given should be longer. On the day following the operation the patient may be allowed to go back to his ordinary diet if there is no sickness and it is not otherwise contra-indicated by the nature of the operation.

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CHAPTER VI

THROMBOSIS FOLLOWING OPERATIONS

THIS is, fortunately, a rare complication. It may result from two conditions: (1) After a prolonged or severe operation upon an anæmic subject; (2) as the result of sepsis in the wound. The thrombosis differs considerably, according to which of these conditions has caused it, both as to its type and its liability to give rise to infarction. In the first case, the thrombus is due to stagnation of the blood and infarction; if it occurs it will do so during the period of formation of the clot, and there is very little tendency for it to do so later. In the second case, the thrombus is a septic one, and the chief period of danger is during the softening of the clot; moreover, in this case, if infarction occurs abscess will probably form at the site of the infarct, and a condition similar to pyæmia will be set up. It is well to bear these facts in mind, as it is of the utmost importance that the patient should be kept absolutely quiet during the dangerous period. There seems to be an exceptional liability to bed-sore in some of these cases, and if the cause is a septic one necessitating prolonged immobility, it is best to turn the patient on to his face, lifting him on a sheet so as to disturb him as little as possible. The liability to the formation of bed-sore is much less in this position, as has already been pointed out.

Thrombosis most commonly occurs about a week or ten days after the operation, though it may take place very much earlier than this, and, as in the second of the appended cases, it may occur as late as three weeks afterwards. In a résumé of forty-eight cases of crural thrombosis following surgical operations collected by Shenck, and reported in the *New York Medical Journal*, September 6, 1902, it was found that out of a total of 7,130 gynæcological operations there were forty-eight cases of thrombosis of the veins of the lower extremity.

He also points out that this complication is much more common after operations on the pelvis than after operations on any other part of the body, and that injury to the large venous trunks by the two forcible use of retractors is a possible cause in some cases. Ligature of a vein close to the point at which it enters the main venous trunk may cause thrombosis in that trunk by extension of the clot, and this was thought to be the cause in some of Shenck's cases. The most common date for the onset of this complication was found in this series of cases to be between the twelfth and sixteenth days after the operation. It was found that the anæmia and cachexia accompanying malignant disease was a factor in many of the cases where thrombosis followed operation for the relief of this condition. An infective origin for the thrombosis was also traceable in many of the cases.

In an investigation carried out by Wright and Knapp recently into the cause of post-typhoid thrombosis, it was shown that there was a decrease in the coagulation time of the blood of typhoid patients during the later stages of that disease (*i.e.*, that the blood coagulates more rapidly than normal), and that this increased coagulability is

accompanied by an increase in the amount of calcium salts present in the blood.   This increase in the calcium salts is attributed to the fact that typhoid patients are fed almost exclusively on a milk diet, which contains a high percentage of these salts.   If this view is correct, and it seems a reasonable one, and is well backed by experimental evidence, the thrombosis following typhoid is in part due to a milk diet.   And it is possible that some of the cases of thrombosis that follow operations are due to the same cause.   Wright and Knapp suggest the use of citric acid to precipitate the calcium salts as a prophylactic agent.

It would seem that operations in the neighbourhood of the pelvis are those most liable to be followed by thrombosis, and that this is attributable to direct injury or infection of the main venous channels or the ligature of their immediate branches.   Anæmic or cachetic conditions undoubtedly predispose to the condition.

The onset of thrombosis is usually accompanied by pain in the part or by itching.   This pain is generally of a dull, aching character.   On examining the part there is found to be tenderness over the site of the vein, or the thrombosed vein, if superficial, may sometimes be felt like a lead pencil beneath the skin.   The greatest care must, however, be taken in examining a patient in whom thrombosis is suspected, as otherwise there is great danger of dislodging the clot.   The treatment should consist of wrapping the affected parts in cotton-wool and elevating the limb.   Absolute rest in bed for at least five weeks is usually necessary, and this time may have to be considerably extended.   Splints should not be used, but the limb, if necessary, may be steadied by sand-bags.

Great care must be exercised in the nursing, especially during the period when the clot is extending, and the

patient must be moved as little as possible and very carefully, otherwise there is great danger of a portion of the clot becoming detached and giving rise to an infarct in the lung; the patient should also be warned as to the danger of moving. For the same reason anything in the nature of a purge must not be given, and if there is any difficulty in getting the patient's bowels to act, enemas should be used.

Roughly speaking, it may be said that in the non-septic cases most of the danger of infarction is over in a fortnight from the commencement of the thrombosis. In the septic cases the time is longer, being roughly five or six weeks. When there is marked anæmia, it is most important to treat this condition by careful attention to diet and the administration of iron in some form or another.

When infarction does occur and is not immediately fatal, the patient should be sat up and oxygen administered to relieve the dyspnœa, which is very distressing; some stimulant is usually necessary, such as strychnine or brandy. As soon as the dyspnœa has to some extent passed off, which in most cases is in about five or ten minutes, the patient should be propped up with pillows and kept as quiet as possible. Alkalies, and especially ammonium carbonate, seem to be of some value in preventing further extension of the clot, and may be given in large doses by the mouth. In thrombosis of septic origin, if the position of the clot will permit of it, the vein on the proximal side of the clot may be cut down and ligatured. When sudden death has occurred from infarction and the medical attendant is at hand, it is always worth while to try and restore the patient by artificial respiration, etc., as the cause of death in most cases is quite momentary.

Infarction is usually accompanied by a rise of temperature to 101° or 102° F. ; the temperature falls again in twenty-four hours, as a rule, though it may remain slightly elevated for some days.   In the septic cases there is, of course, the ordinary septic temperature.   A careful examination of the chest on the day after infarction has taken place will sometimes reveal a patch of consolidated lung corresponding to the area cut off by the infarct.

Illustrative Cases of Thrombosis and Infarction following Operations.

CASE 1 (Fig. 16). THROMBOSIS FOLLOWING OPERATION FOR APPENDICITIS.—A rather anæmic-looking girl was admitted with symptoms of acute appendicitis.   At the operation, which was performed on January 16, a large abscess containing much foul pus was opened and drained.   The case progressed favourably for the next few days, and there was free discharge of pus from the wound.   On the 22nd (six days after the operation) the patient complained in the morning of some pain in the right leg, and it was discovered on examination that the right femoral vein and most of the veins of the calf were thrombosed.   At 3 p.m. the same day the patient had a sudden attack of dyspnœa, faintness, and cyanosis.   She was very bad for some few minutes, but was relieved by the inhalation of oxygen and an injection of strychnine.   She had to sit up.   The respirations were 50.

On the 23rd the patient was still dyspnœic.   Respirations 40.

This condition remained practically unchanged till the 26th. Nothing at this time was found in the lungs.   The condition now improved, but on the night of the 28th there was another attack of dyspnœa (i.e., another infarct).   There was at this time some œdema of both legs, and both the femoral veins were thrombosed.   The legs were dressed with lead and opium lotion, and 20 grains of ammonium carbonate was given three times daily by the mouth. The wound was now almost healed, and the tubes had been removed.   On February 6 the patient complained of pain and stiffness of the right shoulder, and it was noticed that the superficial veins of the right side of the chest and all down the arm were

dilated. All the veins of this region that could be seen or felt were found to be thrombosed, and it appeared certain that the right innominate vein was thrombosed.

On the 11th an eczematous rash appeared over the legs, chin, and right hand. There were no further infarcts, and the patient rapidly improved. The thromboses all cleared up in the course of about ten days or a fortnight after this, and the patient left the hospital quite well on March 6.

At first the patient was fed with albumin water, but after the appearance of the thrombosis a more nourishing fluid diet was
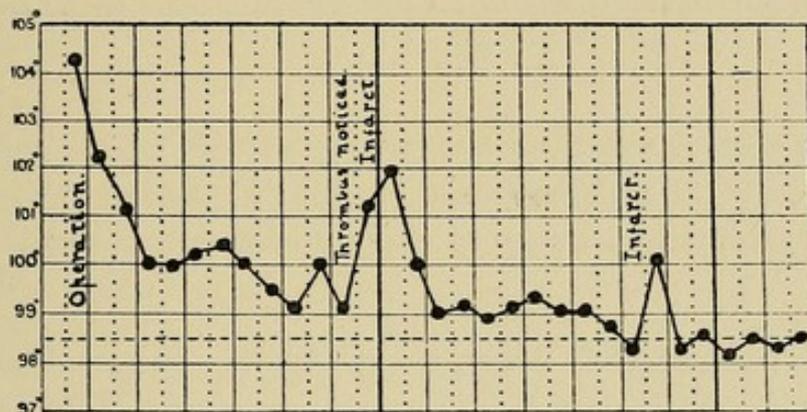

FIG. 16.

allowed, and iron in the form of cachets of pil. ferri (5 grains) were given three times a day ; $\frac{1}{2}$ a pint of stout was also given daily and port wine. For the pain and distress when the infarction took place a hypodermic injection of morphia was administered. Large doses of alkalies, sodium bicarbonate, and ammonium carbonate were given throughout.

In what way alkalies act in the treatment of these cases is very doubtful, but they seem to have a very beneficial effect.

CASE 2 (Fig. 17). THROMBOSIS FOLLOWING AN OPERATION FOR APPENDICITIS.—This was the case of a man, aged forty-five, who was operated on for acute appendicitis, and had a large abscess in the neighbourhood of the appendix drained. About twelve days after the operation the patient had what was described as an acute cardiac attack, accompanied by very severe dyspnœa. (This seems to have undoubtedly been an infarct in the lung.) There was at the same

time œdema of the right leg, and the femoral vein was found to be thrombosed. A week later there was another attack of a similar nature to the first one. After this attack some friction was noticed
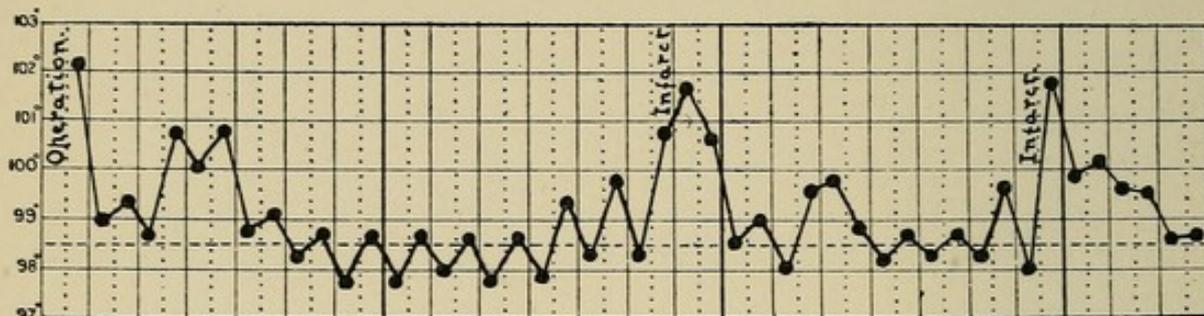

FIG. 17.

on listening with the stethoscope over the lower part of the left side of the chest. The thrombosis gradually cleared up, and the patient was able to go away to the country two months after the operation.

The temperature charts of both these cases are appended, and it will be noticed that there is a rise of temperature coincident with the infarction of the lung.

CASE 3 (Fig. 18). THROMBOSIS FOLLOWING AN OPERATION FOR HERNIA.—A woman, aged forty-nine, was operated upon for the radical cure of a hernia on the right side, on November 22.

On the third day after the operation there was a slight rise in the temperature. This, however, dropped again, and remained normal till the 28th, when it again rose, and continued high. On December 2, as sepsis was suspected, the wound was dressed, though the patient complained of no pain in the wound. The wound was found to be quite healthy, and almost healed. On this day pain was complained of in the calf of the left leg, and on examination it was found that the iliac, femoral, and saphena veins were all thrombosed. There was some cystitis present, for which she was treated by washing out the bladder.

The same afternoon, while being moved in bed, she had an infarct in the lung. There was sudden, very severe dyspnœa; the pulse became irregular and uncountable, and she was in great distress. Oxygen and stimulants were administered, and she gradually rallied. On December 6 she had another pulmonary infarct, which

almost proved fatal.   On December 27 she had another pulmonary infarct of a severe nature, and another less severe attack on the 28th.   At this time the patient was very ill indeed, and vomited everything.   There was much dyspnœa, and she was very cyanosed.
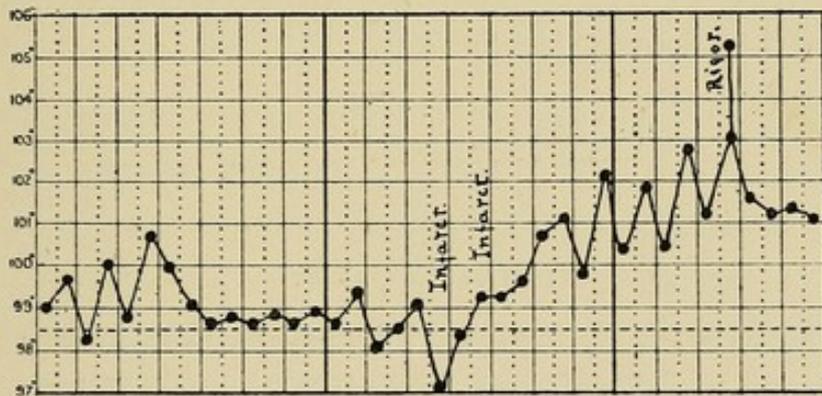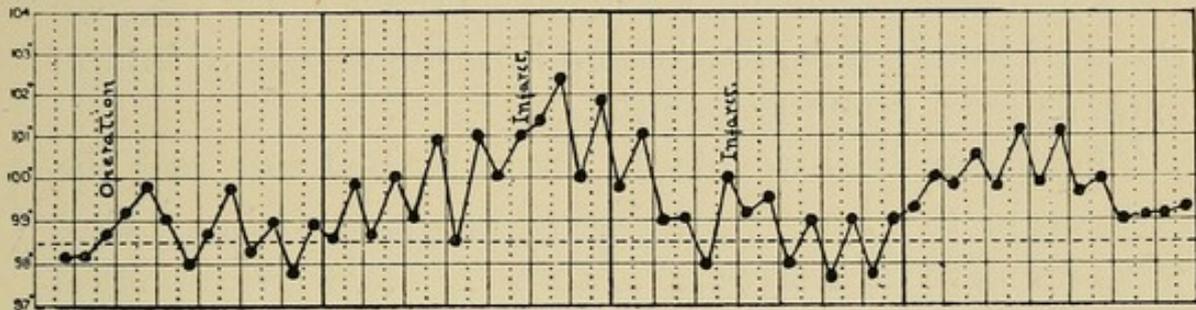
'FIG. 18.]

The breathing gradually improved in the course of the next few days.

On January 8 a large sloughing bed-sore formed over the sacrum, and she was accordingly turned on to her face and subsequently nursed in this position.   The bed-sore was very septic, and contained much gangrenous tissue.   From time to time there were rigors, and her temperature remained high.

On February 3 her temperature went up very high, and she became extremely ill.

On February 12 she had several rigors, and developed a bad cough, though no signs could be discovered in the chest.

On February 28 she coughed up a quantity of pus on two occasions.

After this the temperature gradually came back to the normal, and by April 10 the cough had disappeared, and she soon afterwards left the hospital for the seaside.

This case was one of septic thrombosis, though the cause of infection is somewhat doubtful. It may have been from the wound (which, however, did not break down), or from the cystitis which was present. It shows very well how much more dangerous these cases are than those of simple thrombosis, and how the danger of infarct extends for a much longer time.

There can be little doubt that the bed-sore and the abscess in the lung were due to septic emboli. There were no signs of the lung abscess for over two months from the time of the formation of the thrombus; this shows the great importance of complete rest in bed for a long time in these septic cases.

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CHAPTER VII

POST-OPERATIVE RASHES AND DRUG-POISONING

Septic Rashes.

FOR a long time great confusion has existed in the diagnosis of rashes following operations, and hitherto many of them have been called scarlet fever. Some text-books describe a form of scarlet fever called 'surgical scarlatina,' which occurs in patients with open wounds ; it seems most probable that this is really a septic condition. Though undoubtedly there are from time to time cases where a genuine attack of scarlet fever follows an operation, careful investigation seems to show that these cases are rare, and that most of the cases described as scarlet fever following injury or operation are in reality septic in origin.

A septic rash generally makes its appearance at the time that other septic manifestations usually appear— that is to say, from one to four days after the operation —though the time after the operation at which the rash appears is often slightly shorter than in the case of ordinary sepsis in the wound, as the nature of the infection is more acute. The appearance of the rash is generally accompanied by a marked rise in temperature to 102° or 103° F., and is followed by other constitutional

symptoms, such as malaise, rapid pulse, restlessness, etc.
The rash itself is usually a scarlet erythema, which much
resembles the rash of scarlet fever. It usually appears
quite suddenly in the course of a few hours. Often the
rash is an almost uniform injection of the skin, at other
times it may be more punctate or blotchy in appearance.
Occasionally it is papular. The rash often fades on
pressure, but this depends to some extent upon the
intensity of the injection. The exact appearance of the
rash is by no means constant. Its distribution also
varies a good deal; the most common type is a uniform
scarlet rash, which appears simultaneously all over the
body. In some cases, however, the rash is more limited
in its distribution, and may be confined to the buttocks
and flexor aspects of the thighs, or to the skin over the
joints of the extremities, around the ankles, knees, and
wrists. Most commonly the rash only lasts for a few
days, and then fades away; occasionally it may persist
for a week or even longer. Desquamation often occurs,
and especially if the rash has been at all severe. Slight
albuminuria is sometimes present for a few days in the
more severe cases.

In the worst cases all the symptoms of septicæmia
develop, and the patient soon sinks into a typhoid state
and dies. In the milder cases the rash lasts for a few
days, accompanied by an elevated temperature, but often
by very few other constitutional symptoms, and then
clears up, and the patient makes a good recovery.
Almost any degree may be seen between these two types
of case. Septic rashes are much more often seen in
children than in adults. In children a very mild degree
of sepsis is often followed by a rash, and frequently the
rash is almost the only symptom present. It is quite
common to see a child, as the result of some septic

infection, such as the opening of an abscess or the presence of an infected wound, develop a scarlatiniform rash and perhaps a temperature of 103° F., and in twenty-four hours or forty-eight hours to see the whole of the rash disappear and the temperature come down to normal.

As regards the condition of the wound : there are often no signs of sepsis in it at the time when the rash first appears ; it may be a little puffy round the edges, but often there is little more than this, and sometimes there is nothing to be seen at all. Later on the wound usually gets into a sloughy condition, or breaks down and suppurates.

The argument often used against the diagnosis of the rash as septic, that the wound does not show signs of sepsis, or only shows them slightly, is quite fallacious. It must be remembered that the appearance of a septic rash after an operation is evidence of a general septic infection in contradistinction to a local infection, and that therefore the wound itself, which is the site of infection, does not always break down or show signs of sepsis.

General septic infection only occurs in the cases where the local resistance to septic organisms is absent or insufficient ; and since sepsis in the wound is the result of local resistance, one would not expect to see the wound break down to any marked extent in these cases. And, in fact, it may be stated as a rule that in those cases where, after an operation, general infection of the blood occurs as manifested by the appearance of a rash or other constitutional symptoms, the wound shows little or no evidence of sepsis. And the more severe the general infection, and the more rapid its onset, the less likely is the wound to show marked signs of sepsis. There is,

however, another class of case in which the wound first breaks down and suppurates, and then later on, the local resistance to the action of the septic organisms proving insufficient to protect the body from general infection, general infection takes place and a rash develops; in this class of case the rash will, of course, not appear for some time after the operation.

The diagnosis is often a matter of very considerable difficulty. The conditions under which the rash appears —that is to say, within a few days after an operation—should make one suspicious of sepsis, and cases should not be called scarlatina and removed to a fever ward without strong evidence in favour of scarlet fever and a history of possible infection. If there is much doubt as to whether the case is one of scarlet fever or sepsis, the patient should be isolated as far as possible for a few days, when the diagnosis will probably be cleared up. The so-called strawberry appearance of the tongue which is seen in scarlet fever is not seen in cases of sepsis, though the tongue is furred.

The following are some of the points which may help in distinguishing a septic from a scarlet fever rash :

1. The premonitory febrile symptoms are usually absent, the rash being the first thing noticed in most cases.

2. The distribution of the rash is irregular; it appears often simultaneously all over the body, and not, as in scarlet fever, on the neck and face first.

3. There are no throat symptoms, except in those cases where the wound is in the throat.

4. The pyrexia is high and of the septic type, with often marked intermissions.

Subsequent peeling is no proof of scarlet fever, as it not infrequently occurs in the cases of undoubtedly septic rash.

The following are good illustrative cases of septic rash following operations:

A child was operated upon for curved tibiæ; the right tibia was divided on November 15, and the left on the 22nd. On the 27th the child developed a scarlet rash all over the body, The wound in the right leg was found to be swollen, and it subsequently broke down and suppurated. On December 1 the rash had cleared up, and the patient was peeling freely all over the trunk and right leg. This child was in a ward with twelve other children, none of whom developed scarlet fever, so that there could be no doubt as to the rash being septic.

A boy of sixteen had the tendons at the back of the ankle divided for talipes. Two hours after the operation he had a shivering fit. The next morning he was hot and flushed, and had a temperature of 101° F. The chest and limbs were covered with a mottled, rose-coloured rash, which disappeared on pressure. Forty-eight hours after the operation the rash had commenced to fade away. The temperature was 101° F. and the pulse 126. On the following day, three days after the operation, the rash had disappeared. The temperature was 100° F. On examining the wound, it was found that the skin round it was red, swollen, and very tender, and the foot and ankle were œdematous. On the seventh day after the operation all the symptoms had cleared up, and the patient made a good recovery.

The following is a good example of a doubtful case, in which the diagnosis was difficult:

A boy, aged six, had an exostosis removed from the lower end of the femur. Thirty-six hours after the operation his temperature went up to 101·2° F. Forty-eight hours after the operation the temperature had risen to 104° F., and he was in a state of high fever, with a flushed face, rapid pulse (156), and quick, shallow respiration. The whole of the body and limbs were covered with a bright, scarlet, punctiform rash, fading on pressure, and not elevated or perceptible to the touch. The tongue was furred and the pharynx was congested. The wound at this time was swollen round the edges, but otherwise showed no signs of suppuration. On the fourth day a bright erythematous patch was noticed on the back of the left wrist-joint. On the fifth day the rash was the same as

before, but there was in addition extreme hyperasthesia over the whole body, and the patient complained of pain in the wound. On the sixth day a trace of albumin was found for the first time in the urine. On the eighth day both elbow-joints were painful and swollen, and the patient complained of pain in the knees. At this time the wound was very foul and sloughy, and contained some very fœtid pus. On the tenth day the rash had faded slightly, and there was commencing desquamation on the chest and face. The inguinal glands were enlarged, and there were pyæmic abscesses in several places. The patient died in the afternoon.

At the post-mortem the elbow-joints and knees were found to contain pus, and there were other signs of pyæmia.

SCARLET FEVER FOLLOWING OPERATIONS.—There have been a considerable number of cases reported from time to time of scarlet fever following an operation. Many of these cases are certainly not scarlet fever, but cases of sepsis which have been mistaken for scarlet fever. It is sometimes extremely difficult or even impossible to distinguish between a genuine attack of scarlet fever following an operation and a septic rash. In some of the cases, however, other persons who have been in attendance on, or in contact with, the patient have subsequently developed scarlet fever, and thus the infective nature of the rash has been conclusively proved.

Operations upon the nose and throat—such as for the removal of adenoids, tonsils, etc., and operations for cleft palate—seem to be those most commonly followed by an attack of scarlet fever. Quite a large number of cases seem to have followed the operation for adenoids. The source of infection has not always been clear. In some cases it has afterwards been found that the room or house was infected, or that the patient had come into contact with infected persons just prior to the operation, or even that the operator was the source of infection, as in a case quoted by Sir James Paget.

The late Dr. Washbourne, in an article on this subject, in which he quoted several cases, stated that he thought the organism or infective virus of scarlet fever remained dormant in the mouth, and that the traumatism caused by the operation allowed of its entry and development. This is a similar view to that of the late Sir James Paget, who said that the operation, by lowering the patient's resisting power, allowed of the development of an otherwise dormant virus.

Another view which would seem a very probable one in many cases is that the virus of scarlet fever finds an entrance by the wound at the time of the operation in the same way that septic infection occurs. This view will account for the very short incubation period in these cases of post-operative scarlatina, owing to the more direct method of entry of the virus into the system. That this view is the correct one—in some cases, at any rate—is supported by the fact that occasionally the rash starts in the neighbourhood of the wound, and then spreads over the rest of the body.

The type of scarlet fever which follows operations seems to vary somewhat from that seen under ordinary circumstances, the characters of the attack being apparently modified by the conditions under which it occurs. Thus the incubation period is often very short. In a series of sixty-three cases collected by Edward C. Stirling the commonest time for the appearance of the rash was two days after the operation. The value of this series of cases is, however, very doubtful, as there are a great many cases included in the series, if not the majority, that are really septic cases. An analysis of the undoubtedly scarlatina cases, however, shows that the time at which the rash appears is often very short—two or three days in many cases, and as short as twenty-four

hours in a few. Most of the other variations that have been described seem to be the result of the inclusion of septic cases among those of genuine scarlet fever, and therefore but little value can be attached to them.

RASHES DUE TO ENEMATA.—These are not at all un-common, and it is most important that they should be recognised, as otherwise they may be confused with septic or scarlatinal rashes, and cause considerable confusion. The practice of giving an enema just before an opera-tion is now so usual that it is not uncommon to see a rash follow an operation, and be mistaken for the onset of septicæmia or scarlet fever, when it is really due to the enema that was given before the operation. The rash generally makes its appearance very shortly after the injection, usually in from three to twenty-four hours. The most common time seems to be about twelve hours. The rash lasts from two to four days, and then gradually fades away.

The distribution of the rash is very variable; it may be evenly distributed over almost the whole body, or it may be confined to certain parts. The buttocks and thighs—especially about the inner aspects—and over the sacrum are perhaps the most common places for the rash to appear, and it is here that it is usually best marked and thickest. The rash often appears on the face, and sometimes on the arms and upper part of the chest.

The type of the eruption also varies a good deal. Dr. Monro describes three types of rash from enemata: (1) The scarlatiniform; (2) the measly; and (3) the urti-carious. More than one of these types may, however, be present at once, or the rash may start as one type and subsequently change to another.

There is usually no itching in the first two types, but

the urticarious form is, as a rule, accompanied by very severe itching. Very rarely desquamation follows the rash. The rash most commonly seen is a bright erythema, which fades on pressure. It is usually patchy, and often much more distinct in some places than others. The spots are sometimes raised, and the similarity to measles may be close. As a rule, the rash is not accompanied by any pyrexia, but occasionally the temperature is raised for a time. In some of the recorded cases the onset of the rash has been accompanied by sickness and vomiting. The diagnosis is often very difficult when the rash first makes its appearance. The cause may, however, be suspected when a rash appears within twenty-four hours of the administration of an enema, and is not accompanied by pyrexia and other constitutional symptoms.

The cause of enema rashes is somewhat doubtful. It appears to occur only after large injections, and is not seen after the use of suppositories or small enemata. Soap enemata, and especially enemata made from hard soap, seem to be the most common cause of the rash. Soft soap, when used to make enemata, seems to be much less liable to give rise to a rash. Turpentine enemata also occasionally cause a rash. It has been supposed that the cause of the rash is the absorption of fæcal matter by the intestinal wall as the result of solution by the enema. It appears more probable, however, that the material composing the enema is the responsible agent. No treatment is, as a rule, called for. Subsequent enemata may cause a reappearance of the rash, or they may be quite unaccompanied by any further trouble. When there is severe itching, as is often the case in the urticarious form of the rash, a weak lotion of carbolic acid should be used to bathe the skin. This will generally relieve the itching.

Illustrative Cases.—E. G., a woman, aged thirty, was operated on for the removal of a lipoma on January 15. She had been given an enema of hard soap and water (16 ounces) five hours before the operation. Three hours after the operation she was seen to be very flushed, and on examination it was found that she had a bright erythematous rash on the face and limbs and a large part of the trunk. There was no itching, and there were no symptoms except the rash. The temperature was normal. The rash lasted for two days and then faded away, having entirely disappeared by the 19th.

Miss M. was given an enema consisting of 2 pints of soap and water at 9 a.m. on November 23. At 12.30 chloroform was administered, but no operation was performed. At 7 p.m. the same evening she complained of headache, and had a shivering fit. The temperature was normal. During the evening she developed a red rash on the neck and greater part of the trunk, which was accompanied by itching. During the night the patient vomited. On the following day there was a profuse red eruption all over the body. The temperature in the morning was 99·4° F., and in the evening it rose to 99·8° F. The pulse was also rapid (102). On the 25th the temperature was normal, and did not again rise, and the patient felt quite well. The rash was still present, though fading. On the 26th the patient was quite well, and the rash had almost gone.

SALICYLIC RASH.—There is a peculiar rash sometimes seen when salicylic wool has been used as a dressing. This rash only occurs on those parts of the skin with which the wool has come into direct contact, and its distribution, therefore, corresponds to the area of the dressing, and thus renders its nature immediately apparent. The rash usually consists of numbers of small clear vesicles, which may have an inflamed base. The rash is not accompanied by itching. It soon disappears if the salicylic wool is changed for sal alembroth or plain wool.

HERPES FOLLOWING OPERATIONS.—Several cases have been recorded where an attack of herpes, accompanied by a high temperature, has followed an operation or even the passage of instruments into the bladder. In most of the cases the herpes made its appearance in crops of vesicles

on the neck and face, and around the mouth. In many of the cases there appears to have been some septic infection.

Drug-Poisoning.

Cases of poisoning from the excessive use of antiseptics have been recorded from time to time, and the possibility of such an occurrence should be borne in mind. These cases often give rise to a great deal of difficulty in diagnosis, as the symptoms are often put down at first to some complication of the operation, and poisoning is not suspected. Many of the cases follow the use of dressings saturated with strong antiseptics and kept damp by placing oil-silk or jaconet over them, such, for instance, as may be used for preparing the skin previous to operation. Of course, the larger the area of skin so covered, and the longer the time that the skin is subjected to the action of the antiseptic, the more pronounced will be the result.

Poisonous symptoms may follow the packing of large cavities with antiseptic gauze or washing out large cavities with strong antiseptic solutions, especially if care is not taken to remove the antiseptic afterwards. Poisonous symptoms are much more liable to follow the use of antiseptics in children than in adults, and patients whose kidneys are not working properly are more prone to develop symptoms from comparatively small quantities of antiseptics than those whose renal organs are sound. Again, some individuals seem much more susceptible to certain drugs than others.

IODOFORM-POISONING.—This may follow the packing of a large cavity with iodoform gauze or the use of iodoform emulsion in the treatment of tubercular joint affections. The chief symptoms in the acute cases are a very high

temperature (104° to 107° F.), accompanied by cerebral disturbance, either in the form of delirium, mania, or coma. The pulse is rapid, and in the fatal cases the patient soon passes into a condition of collapse, followed by coma and death. In addition, the pupils are generally contracted, and there may be hæmorrhage from the rectum. The symptoms usually come on within twenty-four hours. In the chronic cases there is disturbance of digestion, loss of appetite, insomnia, vertigo, with a rapid pulse and a raised temperature.

As soon as the symptoms show themselves, any iodoform-gauze packing, if present, should be removed and the cavity washed out with a solution of bicarbonate of potash, which is said to act as an antidote. The same drug may also be given by the mouth.

Illustrative Case.—F. W., aged fifty-two, was operated upon for a large hydronephrosis of the right kidney. The kidney, or what was left of it, was shelled out of its capsule as the intestines and other viscera were firmly adherent to the latter. The walls of the cavity were stitched to the edges of the abdominal wound, and the cavity itself was packed with iodoform gauze. A very large quantity of the gauze had to be used. The operation was a very severe one, but the patient rallied as well as could be expected, after being transfused with normal saline and having an injection of strychnine. Next day she was comfortable, and her condition was good. Her urine was normal, containing no albumin, and being normal in quantity as far as could be estimated.

At 11.30 p.m. her pupils were noticed to be contracted. Up to this time she had had no morphia. Later in the evening an injection of $\frac{1}{8}$ grain of morphia was given to secure sleep and allay the restlessness which was present. She slept all night, but at 5 a.m. her temperature was found to be 105° F., and she was drowsy and could not be aroused. The pulse was very rapid, and there was some twitching of the muscles of the face. The pupils were still more contracted than on the previous evening. At 7 a.m. the temperature was 107° F. This was reduced by sponging to 102° F. She was very hot and perspiring freely. The pulse was

almost imperceptible, and very fast. There was marked twitching of the fingers and facial muscles. She had some hæmorrhage from the rectum. The case was thought to be one of iodoform poisoning, and the gauze was all removed from the wound and the cavity washed out with a solution of potassium bicarbonate (20 grains to the ounce). She also had 20 grains by the mouth. The temperature again went up to 104°, and remained up till death, which took place a few hours later from heart failure.

CARBOLIC-ACID-POISONING.—The symptoms usually come on within a few hours of the application of the dressing or compress; the initial symptoms are commonly drowsiness and pallor. The respirations are markedly affected as a rule, there may be dyspnœa, or the breathing may be laboured or stertorous—the chief symptoms seem to be due to the action of the drug on the central nervous system—sooner or later there is complete coma with muscular relaxation, the pupils may be contracted or normal. The urine is turned a dark olive-green colour, and its specific gravity is increased. It is said that a premonitory sign of poisoning is the disappearance of sulphates from the urine, the absence of all sulphates being a sign of danger. The prognosis is favourable, the symptoms usually passing off, after the cause has been removed, in the course of a day or two.

Illustrative Case.—The patient was a child, aged four years. An operation was going to be performed to get rid of the deformity of genu valgum, and to prepare for this the skin of both legs was thoroughly cleaned up and a compress of 1 in 40 carbolic acid applied to most of the skin of the lower extremities. Six hours later it was noticed that the child was rather sleepy, but nothing was thought of it. Soon after this it was found that the child was in a comatose condition. She could not be aroused, and the muscles were relaxed. There was, however, slight response to stimulation. The skin was cold and very pale. Respiration was rather rapid—about 36. The pulse was 180. The knee-jerks were absent. The pupils were normal in size, and reacted to light. Some

urine which was drawn off was found to be of a greenish colour and of a specific gravity of 1,022.

Carbolic acid poisoning was diagnosed, and the compresses removed. Saline purgatives were administered and stimulants given. Recovery took place slowly in the course of about two days, but the urine remained green and the pulse rapid for a day or so.

PERCHLORIDE AND BINIODIDE OF MERCURY POISONING.—The symptoms are the ordinary ones of ptyalism. There is generally marked gastro-intestinal disturbance, especially diarrhœa; vomiting may also be present. Salivation is often a marked symptom. Suppression of urine sometimes occurs, and is a very dangerous complication. The pulse is feeble and quick. The symptoms often vary very considerably in different cases, but if the condition is thought of, there is seldom any great difficulty in arriving at a correct diagnosis. The treatment should be directed to washing the drug out of the system by the use of saline purgatives and large draughts of fluids.

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CHAPTER VIII

OPERATIONS ON THE MOUTH, NOSE, AND PHARYNX

Removal of Adenoids.

COMPLICATIONS.—(1) Severe sepsis, followed occasionally by septic pneumonia; (2) severe septic throat due to diphtheria or scarlet fever ; (3) acute otitis media.

Complications after an operation for the removal of adenoids are but rarely seen, but when they occur they are often grave ; this is all the more unfortunate, as the operation is usually considered to be a very simple one. In order to avoid these complications as far as possible, it is particularly desirable that the patient should not be operated upon unless the throat is in good condition at the time, and the patient has not recently been exposed to the bad effects of unhealthy surroundings, or is likely to be exposed to them afterwards. With this object in view it is an excellent plan to have any bad and especially septic teeth removed before the operation, and to let the patient have the throat sprayed with some suitable antiseptic for a day or two previous to the operation. The greatest care should always be taken to see that the patient has not recently been subjected to any risk of catching scarlet fever, diphtheria, or any other fever. After the operation is over the patient should be kept in

bed for twenty-four hours, and provided with plenty of clean pocket-handkerchiefs on which to blow his nose. It is advisable in private cases to warn the parents that the child may vomit some blood occasionally for the first twenty-four hours, as otherwise this may give rise to the idea that the child is bleeding, and cause considerable alarm. Care must be taken to see that the patient is not put in a draught ; a stuffy room is, however, to be particularly avoided. Some light food may be given in about two hours after the operation. No particular diet is necessary, but, as a rule, semi-solids, such as custard, bread-and-milk (boiled), thick soups, etc., are more easily swallowed than fluids. On the day following the operation the throat should be sprayed with some suitable antiseptic, such as one of the following :

℞ Sodæ sulph. - - ℥i.ss.
Hydr. iodidi rubri - grs. ii.
Sodæ iodidi - .- grs. ii.
Aquam destill. - - ad Oi.

℞ Sodæ sulph. - ℥ii.
Sodæ bicarb. - grs. x.
Glycerine of carbolic acid - ♏xl.
Aquam destill. - ad Oi.

℞ Sodæ sulph. - - ℥i.
Sanitas - - - ℥iii.
Aquam destill. - - ad Oi.

℞ Listerine - - ℥iii.
Aquam destill. - ad Oss.

or, if the patient is old enough, he should be made to use the same solution as a gargle ; this helps to get rid of any accumulated blood or mucus at the back of the throat, and at the same time tends to keep the latter free from infective material. The throat should be sprayed or gargled before and after each meal for the first week after the operation. Anything in the way of syringing or spraying the naso-pharynx is generally better avoided, as it increases the danger of middle-ear trouble.

If it *is* thought advisable to syringe the naso-pharynx,

care must be taken that the fluid is not injected forcibly, and that a free exit is allowed for its escape. Mr. Sheild advises that a syringe of about 5-ounce capacity should be used, with a piece of rubber tubing of small diameter attached to its end. The tubing should be passed along the floor of the nose, and should fit the nares quite loosely. He also recommends allowing the patient to inhale the vapour of creosote, iodine, or carbolic acid from one of the usual forms of apparatus, two or three times a day, after an operation on the nose or throat.

A saline purge should be administered on the day following the operation, and repeated, if necessary. The patient may be allowed to get up on the day after the operation in uncomplicated cases, but should be confined to one room, if possible, for two or three days. For the first day or so, and sometimes for a week after the operation, the symptoms of nasal obstruction often persist, owing to the swelling of the mucous membrane which takes place. At the end of this time, however, it is of great importance to make the child do regular respiratory exercises, so that he may get accustomed to breathing properly through the nose. The child should be made to close the mouth and breathe entirely through the nose for five or ten minutes at a time; this should be done two or three times a day, and the child encouraged to breathe as much as possible through the nose at all times.

In cases where it is difficult to get the patient to do this properly, owing to lack of intelligence, etc., a good plan is to fix a piece of oil-silk over the mouth by tapes round the head, for an hour or so daily, so as to oblige the child to breathe through the nose. These exercises must be continued until the child has got into the way of carrying out normal respiration with the mouth shut. If previous to the operation the child has got into the habit

of pronouncing words in a nasal manner, as is almost always the case when there is pronounced obstruction, he must be carefully taught to pronounce these words properly, repeating them over and over again until the proper sound is obtained. The importance of these exercises of breathing and speaking must not be underestimated; children who have suffered from adenoids for any length of time have contracted the habit of breathing through the mouth and speaking in an incorrect manner, and it is not to be expected that the mere removal of the growths will remedy all this unless care and patience are exercised in breaking the child of the habit. And, moreover, it is only by carefully teaching the child nasal breathing and stopping habitual mouth breathing that any guarantee against a recurrence of the adenoids can be secured.

If the naso-pharynx becomes septic, accompanied by foul-smelling breath, and perhaps a high temperature, the naso-pharynx should be irrigated with a nasal douche two or three times a day, warm water, or water to which a little bicarbonate of soda has been added, being used for the purpose; the fluid must not be allowed to flow in under pressure, but should flow gently in at one nostril and out at the other, the patient being instructed to breathe through the mouth meanwhile. A purge should, of course, be administered at once, and small doses of quinine and iron are sometimes useful.

If symptoms of otitis media develop after the operation, a blister or leeches should be at once applied behind the affected ear, or hot fomentations repeatedly applied to that side of the head. The naso-pharynx must also be irrigated. If suppuration occurs in the ear, the case must be treated as an ordinary case of otitis media.

Children who have just undergone the operation for

adenoids seem especially liable to catch diphtheria or scarlet fever if they are subjected to any infection, and when they contract one of these diseases under such circumstances it is a very serious matter. Care must, therefore, be exercised to prevent as far as possible any chance of the child contracting them. An attack of influenza may supervene upon an operation for adenoids, and when this occurs there may be considerable difficulty in correctly diagnosing the symptoms, which may be very alarming at first.

On the fourth or fifth day after the operation the Eustachian tube should be inflated by means of Politzer's bag, and this should be repeated daily for three or four days, and for longer in cases where there is any marked deafness associated with the adenoids. Or, if the child is old and intelligent enough to understand, he may be shown how to inflate the Eustachian tubes for himself by holding his nose and forcing the air into his pharynx. Of course, if there is any sepsis after the operation, the use of the Politzer's bag must be deferred. In all bad cases of adenoids it is a good thing to insist on the child doing daily respiratory exercises, with deep breathing, for some months after the operation.

Removal of Tonsils.

The complications are practically the same as in the case of adenoids, except that otitis media does not occur. The after-treatment is also the same. As in the case of adenoids, the throat should be sprayed for the first few days after the operation at frequent intervals. Gargling is usually impossible, as the throat is too sore. On this account also swallowing is more painful, and while this is the case the patient should be given such things as

jellies, custard, bread-and-milk, etc., as these are often swallowed more easily than fluids. A condition very closely resembling ordinary follicular tonsillitis sometimes occurs on the raw surface after the removal of the tonsils. It should be treated as for that affection by chlorate of potash, gargles, etc. Chlorate of potash internally is often very useful in these cases :

℞ Pot. chlor. - - - - - gr. v.
    Aquam menth. pip. - - - - ad ℥i.
          Sig. : Three times a day.

or the following mouth-wash may be used, and some of it swallowed :

℞ Pot. chlor. - - - - - gr. vii.
    Tinct. ferri perchlor. - - - - ℳx.
    Glycerini - - - - - ʒi.
    Aquam menth. pip. - - - - ad ℥i.

There is one point of considerable importance in the after-treatment of both adenoids and tonsils which must be kept in mind : the patients are often in weak health, and the enlargement of their tonsils, etc., is largely the result of their constitutional condition, and therefore care must be taken after the operation to improve their general health. If possible they should be sent away for a change of air, preferably to the seaside, as soon as they have recovered from the operation—*i.e.*, in about a week or ten days' time.

Tooth-Extraction, etc.

It is not usually considered necessary to pay any attention to the wound after the extraction of teeth, except in the event of hæmorrhage proving troublesome. This carelessness is not, however, justified; sepsis not infrequently occurs, and there are many recorded cases

where the most serious results have followed from this cause. Lately, considerable attention has been paid to oral sepsis and its results, and it seems probable that it is answerable for many more diseases than had previously been supposed. Some attempt, therefore, should be made to keep the mouth clean for the first two or three days after teeth have been extracted by the constant use of mouth-washes, etc. One of the best preparations for this purpose is phenate of soda (about 1 drachm to the pint). This has the double advantage of keeping the mouth clean and relieving the pain after extraction. A solution of tincture of arnica, which is very popular, can also be used, but is not so efficacious as phenate of soda. A very excellent mouth-wash in all septic conditions of the mouth, and one which can be used after extraction, is the following :

℞ Alcohol - - - - - 100 parts
   Tinct. rhatany - - - - 40 ,,
   Acid. benzoic. - - - - 8 ,,
   Saccharine - - - - 4 ,,
   Olei. menth. pip. - - - - ½ part
   Olei. cinammomi. - - - - ½ ,,
     Sig.: Fifty drops to half a pint of water.

Operations on the Tongue, etc.

COMPLICATIONS.—(1) Sloughing and hæmorrhage; (2) septic pneumonia; (3) œdema of the glottis; (4) cellulitis, etc.

A certain amount of sepsis often accompanies these operations, and is quite unavoidable; but much may be done to reduce it. It is very important that before the operation any decayed or septic teeth should be removed, and the mouth and throat well washed out with some suitable mouth-wash for several days prior to the

operation. The most effectual way of keeping the mouth clean after operations upon the tongue is to make the patient lie right over on his side, so that the fluid cannot get into his throat, and then to gently irrigate the oral cavity with warm boracic, or other suitable solution. (Mr. Jacobson advises 1 in 60 or 80 carbolic to be used.) If this is done with care, the mouth and stump of the tongue can be very effectually cleansed without any discomfort to the patient, and without causing coughing. The irrigator should be provided with a glass nozzle, and very little pressure should be used. A syringe may be used instead, if desired. The mouth should be frequently irrigated out in this way during the first few days after the operation. After this the patient may rinse the mouth out for himself in the ordinary way. The alcoholic mouth-wash already mentioned (under ' Extraction ') is a very good one in these cases. Mr. Jacobson advises painting the stump over every two or three hours with a solution of formalin. The patient should be nursed in a sitting position, well propped up with pillows. This position tends to prevent congestion of the lungs, and also prevents the stump of the tongue falling back and obstructing the air-passage, which, if it has been freely cut away from the floor of the mouth, it is apt to do in the prone position.

The patient should be fed after the operation by means of a feeder with about 3 or 4 inches of india-rubber tube attached to the nozzle. The end of the tube is passed to the back of the throat, and the feeder gently tilted up. For the first day or so the diet has to be fluid only, but after that semi-solids can usually be taken. A calomel or saline purge should usually be given on the day following the operation. For hæmorrhage after operations on the tongue,

Operations on the Nose.

All that has been said in connection with adenoids also applies here. The treatment of hæmorrhage after operations on the nose has already been described in the chapter on hæmorrhage. A piece of gauze kept over the nose, and damped occasionally with some volatile antiseptic, is of assistance in preventing sepsis in some cases, especially after removal of the turbinates. Persistent sneezing is a curious complication that sometimes occurs after operations on the nose. This may prove extremely troublesome. If it continues for any length of time, the best way of treating it is to paint the nasal cavity with a solution of cocaine, or cocaine and suprarenal extract. It may also often be stopped by simply syringing out the nose with warm water.

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CHAPTER IX

OPERATIONS ON THE HEAD

Operations on the Brain : Trephining, etc.

COMPLICATIONS.—(1) Hernia cerebri; (2) œdema of the brain.

Hernia cerebri is caused by unrelieved tension in the brain, and is generally the result of sepsis; the cause of the tension should therefore be investigated, and, if possible, removed, when the hernia will probably disappear. Not infrequently pus will be found in the interior of the hernia, or a superficial abscess will be found beneath it. The hernia itself consists mainly of granulation tissue, and contains very little brain substance, so that there need be no hesitation in scraping it away and applying pure carbolic acid to the stump. This requires no anæsthetic, as the protrusion is insensitive. The hernia may be treated by applying pressure over a piece of sterilized tin-foil.

After any operation on the brain, the patient must be kept as quiet as possible, preferably in a darkened room, and anything that may tend to excite the patient, such as visits from friends, etc., prevented. The bowels should be kept acting freely by the administration of calomel. The use of alcohol in any form must be avoided. In cases of trephining for hæmorrhage on to the dura mater,

the patient need not be subjected to so much restraint, and, as a rule, he may be allowed to sit up soon after the operation; in these cases it may be assumed that the patient is well as soon as the wound has healed. Inflammation, if it occurs after these operations, will usually show itself by a high temperature and symptoms of increased intercranial tension on about the third day after the operation.

After any operation on the brain-tissue, it is most important to insist on the patient abstaining from any form of mental strain for some months after the operation. At first reading should be forbidden, and later only allowed in moderation. A complete change and rest for some months is very important in most of these cases.

Hare-lip Operations.

COMPLICATIONS. — (1) Bronchitis and pneumonia; (2) diarrhœa; (3) sepsis; (4) dyspnœa and asphyxia.

A low form of sepsis sometimes occurs after these operations, especially when it has been necessary to interfere with the bone in any way. Care must be taken to keep up the strength of the patient under these circumstances, and to keep the mouth as clean as possible. In very young infants who have had a large cleft closed by operation there is danger of sudden death from asphyxia soon after the operation, and it should be borne in mind. The nasal passage in young infants is often too small to be used efficiently for respiration, and it easily becomes blocked up with secretion; the sudden great diminution in the size of the oral cavity may result in sudden dyspnœa some hours after the operation. Mr. Jacobson cites three cases in which fatal dyspnœa occurred from this cause. The nurse should be instructed to watch for

any difficulty in the breathing, and to depress the lower lip of the infant from time to time so as to allow of a free entry of air, or the lower lip may be held down by applying a piece of plaster until the child has had time to become accustomed to the new conditions.

If hare-lip pins have been made use of, they should be removed on the second day after the operation ; if fish-gut or silver wire has been used for the supporting sutures,
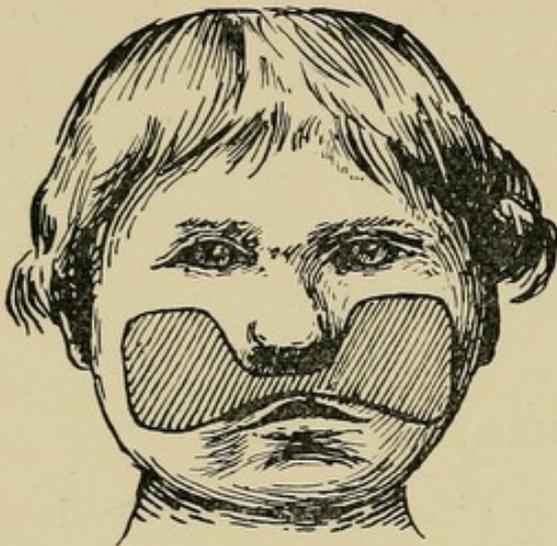

Fig. 19.

one of them should be removed on the third day and the other left for a day or so longer. The fine sutures used for approximating the edges of the wound should not be removed for a week, unless they are causing stitch abscess, when they must be removed at once. While examining or removing stitches, the cheeks must be held together so as to prevent the wound being subjected to any tension. After the stitches or pins are removed, a piece of adhesive plaster, cut with a narrow bridge to go over the upper lip, and expanded ends to fit on to the cheeks, must be put on firmly so as to bring the cheeks together and prevent any tension coming on the wound (Fig. 19).

Cleft Palate

COMPLICATIONS.—(1) Whooping-cough ; (2) exanthematous fevers ; (3) diarrhœa.

Great care must be exercised to prevent any of these complications, as, with the exception of the third, any of

them will almost inevitably result in failure of the operation. After the operation the child's hands should be secured either by applying splints or by wristlets attached to a broad piece of webbing fixed across the bed; if the child can be constantly watched by a competent attendant, it is better to dispense with this restraint, as it tends to make the child restless, and may lead to crying. Nothing should be given by the mouth for three or four hours after the operation, and for the first forty-eight hours only barley-water and albumin-water or milk allowed; rectal feeding may be added if necessary after this, and for the first week the diet should be confined to soups, broth, egg and milk, etc., and then jellies, light puddings, and food which does not need mastication for a week more. If the child is old enough to understand and do what it is told, the mouth should be syringed out or sprayed with some mild antiseptic lotion several times a day. If this procedure leads to any struggling, or the child is too young to keep quiet during the process, it must be discontinued. Everything possible in the way of careful nursing must be done to prevent the child from crying or being sick. If old enough to talk, the child must be prevented from doing so. In three or four days after the operation if the weather is fine, the patient should be got out into the open air for an hour or two every day. It is best not to inspect the stitches at all till the time arrives for their removal. As a rule, some of the stitches may be removed at the end of a week or ten days, and the remainder at the end of a fortnight; but unless the stitches are causing sloughing or ulceration, it is well to leave them as long as possible. It is usually about three weeks after the operation before the wound is firmly united.

If the operation has been successful and the gap in the

palate has been closed, the next thing that calls for attention, and which is of the greatest importance, is to teach the child to pronounce its words properly, and this is of still greater importance if the child has already learnt to talk and has got into the habit of pronouncing words wrongly. A great deal of care and patience is often necessary; the patient should be made to sit on a chair facing the teacher and pronounce words, and especially those words which he has got into the habit of pronouncing badly, after him, and at the same time watch the way in which the teacher moves his lips and tongue. The teacher should exaggerate these movements, so as to make them more obvious. Words with sibilants and labials in them should especially be taught with great care, as these words are the ones most likely to be pronounced badly as the result of the cleft-palate. Nasal breathing exercises should also be carried out daily to get the child used to breathing properly through the nose when the mouth is shut (see under Adenoids). After the Davies-Colley operation at least three weeks and often more should be allowed to elapse before the stitches in the mouth are removed ; those in the deep flap must be left to come out in the best way they can. Sloughing of the large flap need not be apprehended in this operation.

CHAPTER X

OPERATIONS ON THE NECK

Tracheotomy and Laryngotomy.

COMPLICATIONS.—(1) Surgical emphysema ; (2) ulceration of the trachea ; (3) sloughing of the wound.

Surgical emphysema is either the result of a faulty operation, or is due to the tube not being in the trachea. If the tube is properly in the trachea and the air-way free, emphysema cannot occur. When it occurs, the tube must be removed and carefully reinserted, or a better fitting one substituted. Ulceration of the trachea is due either to the tube not fitting or to its being worn for too long a time. A metal tube should not be left in for more than a week without being changed; at the end of that time, if the tube cannot be dispensed with, a rubber one, such as Morant Baker's, should be substituted. Many tubes are made with too great a curve on them, and the lower end in consequence presses on the anterior wall of the trachea and causes ulceration. The necks of different individuals differ very considerably, and it may be necessary to try several different tubes before one can be found to fit well. In young children especially it is most necessary to get a properly fitting tube, as their tissues will not stand pressure in the same way as adults, and ulceration is very liable to occur from a badly-fitting tube.

Sloughing of the wound may be diphtheritic or may result from the tube pressing too tightly against the wound. The tapes should be relaxed, and the wound dressed frequently with ointment or gauze, a collar of which should be kept beneath the tube. If the sloughing tends to spread, the wound should be well painted with carbolic acid or nitrate of silver.

After the operation the patient must be put back to bed, and made as warm as possible. Most surgeons have a steam-tent put round the bed, so as to keep the atmosphere warm and moist. The value of this is, however, somewhat doubtful, as the steam seldom gets anywhere near the tube, and usually expends itself in damping the tent. Fresh air is of the utmost importance, and if the temperature of the air round the cot can be kept up to about 60° F. and the child kept free from draughts without the use of the tent, it is much better not to use one. Whether a steam-tent is used or not, the temperature of the room must be kept up to 60° or 65° F., and all draughts avoided; a double fold of gauze should be placed over the mouth of the tube, and it is a good plan to drop a few drops of eucalyptus oil on to the gauze from time to time. If, however, this causes coughing, it must be discontinued. The child should be encouraged to go to sleep after the operation. After the difficulty of breathing has been relieved by the operation many children naturally fall asleep for a few hours, and on no account should they be awakened, as it is the best thing possible for them. This is of the greatest importance, as in most cases the child is very exhausted from the previous difficulty of respiration. The inner tube must at first be removed every two hours, or oftener if necessary, but the child should not be awakened for this purpose. The inner tube must be cleaned in weak

carbolic solution (1 in 200) and replaced. Any mucus or membrane that is coughed up should be wiped away at once with a clean piece of turkey-sponge dipped in the carbolic solution. If the tube becomes blocked with any mucus that will not come out, a soft feather may be used to remove it. The feather should, if possible, have been sterilized by immersion in some strong carbolic solution for an hour or more, and then the carbolic washed away with sterile water, or the feathers may be sterilized by boiling. Several of these feathers should be kept at hand immersed in a weak carbolic solution. The feather should be gently inserted into the tube, and then turned round before being removed, so as to catch the mucus, etc. If the breathing becomes harsh and whistling, and there seems to be difficulty in bringing up the secretion, the opening of the tube must be sprayed with a solution of bicarbonate of soda (20 grains to the ounce) for five or ten minutes at a time. This will loosen the secretion or membrane, and allow of its being easily coughed up, or, if desired, the solution can be applied to the trachea with one of the feathers. Careful nursing is of the utmost importance in these cases; it must not, however, be meddlesome. Especially, the child must not be prevented from sleeping.

The old adage of 'leaving well alone' is very applicable to these cases, and the too free use of the feather is particularly to be avoided. If the breathing at any time becomes very difficult owing to the accumulation of mucus, etc., in the trachea and tube, this can be quickly relieved by sitting the patient up, and propping him in that position with pillows. Feeding the patient is usually a difficult matter, and must be undertaken with care. If possible, the patient should be propped up in a sitting position for this purpose, and fed by means of a feeder

with a piece of rubber tube attached to its spout, the end of which is passed to the back of the throat. The feeding must be at frequent intervals, and if there is much difficulty in getting the patient to swallow, nasal feeding must be resorted to at once.

At the end of the first twenty-four or thirty-six hours the outer tube must be removed and cleaned, or a new one introduced. This is usually an easy matter, but it is well to have a director or tracheal dilator at hand in case of any difficulty arising in reintroducing the tube. If the original tube has not got a hole at the bend so as to allow a free air-way by the mouth, one of these tubes should be introduced at this stage if obtainable, or a bivalve tube may be used. If the inner tube of a bivalve tube is removed, the patient can breathe through the mouth if there is no obstruction. On the second day after the operation the mouth of the tube should be blocked up either with a wooden plug or with a piece of wet lint for ten or fifteen minutes at a time, so as to get the patient accustomed to breathing through the mouth again. (For this purpose it is, of course, necessary to have a tube with an upper opening.) Unless the cause of the obstruction is a permanent one, an attempt should be made to remove the tube altogether on the third or fourth day.

Removal of the Tube.—As stated, this should be done at the earliest possible date. A great deal of trouble will be saved if the patient has been gradually accustomed to breathe through the mouth by plugging up the opening of the tube from time to time. When the tube is removed, a pair of tracheal dilators should be at hand, so that should any difficulty with the breathing occur, the wound can be quickly opened. If on removing the tube spasm occurs, the tube must be reinserted ; an attempt should

then be made to remove the tube while the patient is sitting up; this will sometimes be successful. The surgeon should not leave the patient after the tube has been removed until he is satisfied that the patient is able to breathe comfortably through the mouth.

If the tube has to be retained for more than a week, an indiarubber tube should be substituted for the metal one; this may be one of Morant Baker's tubes, or a very good tube can be constructed out of a piece of drainage-tube (see Fig. 20). In infants especially a metal tube should never be retained for more than a week. The author once saw a case in an infant under two years of age where a metal tube had been worn for a fortnight, and in which the end of the tube ulcerated into the innominate artery, and the child bled to death in three minutes. In most cases where there is any difficulty in the removal of the tube, this is chiefly due to nervousness or habit on the part of the child, and is not due to any actual obstruction in the larynx; care and patience, therefore, is all that is called for. Occasionally, however, there is some actual obstruction in the larynx from ad-

FIG. 20.—DRAWING TO SHOW THE METHOD OF MAKING A TRACHEOTOMY-TUBE OUT OF A PIECE OF DRAINAGE-TUBE.

hesion or granulations, and it becomes necessary to dilate the trachea above the tube; this is, however, very rarely the case. A plan which is sometimes useful when there is considerable difficulty in getting the patient to breathe through the mouth is to intube the larynx, and then remove the tracheotomy-tube, the laryngeal-tube being removed at the end of twenty-four or forty-eight hours.
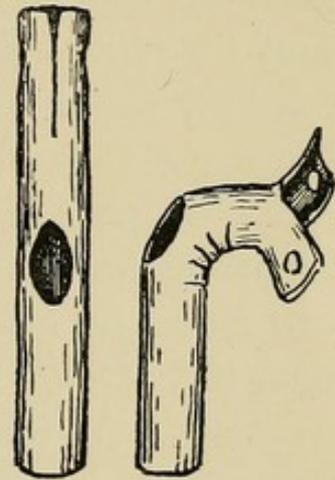
Dilating the Larynx.—A little chloroform is administered, and after dilating the wound a soft catheter is passed up from it, and the end drawn through the mouth with a clip; several catheters of increasing sizes may be in this way passed through the larynx until it is sufficiently dilated, or by means of the catheter a silk thread can be passed through from the wound to the mouth, and a small piece of fine Turkey sponge tied on to the end of the thread and drawn up through the larynx so as to clear it or break down any adhesions; or a Macewen's tube can be made use of.

Œsophagotomy.

The chief difficulty in these cases is the feeding; if possible, this should be done by nutrient enemata for the first three or four days, and the patient not allowed to swallow anything by the mouth during this time. If, however, this cannot be managed, a soft rubber tube must be passed down the œsophagus either from the mouth or nose, and the patient fed through it. This tube can either be inserted each time the patient is fed, or, if possible, it should be retained, at any rate during the daytime. At the end of the first week or earlier, if the wound is healing well, the patient may be allowed to swallow liquids in small quantities at a time. These wounds are practically always septic, owing to organisms getting into them from the wound, and it is necessary to see that there is free drainage at the most dependent part of the wound.

Operations on the Thyroid Gland.

COMPLICATIONS. — (1) Aphonia; (2) cellulitis of the neck; (3) thyroidism.

Aphonia results from wounding the recurrent laryngeal nerve, or from its becoming involved in the cicatrix. In the first case, the aphonia will come on immediately after the operation, and in the second, some time afterwards.

Cellulitis of the neck is a very serious complication, and should, of course, not occur; if it does, the wound must at once be freely opened up and drainage provided for. The possibility of thyroidism occurring after operations on the gland must be borne in mind. The symptoms are similar to those of exophthalmic goitre (without the exophthalmus), but are acute. They come on, as a rule, at the end of the first twenty-four or forty-eight hours after the operation; the temperature goes up, often to a great height (103° to 105° F.), and remains
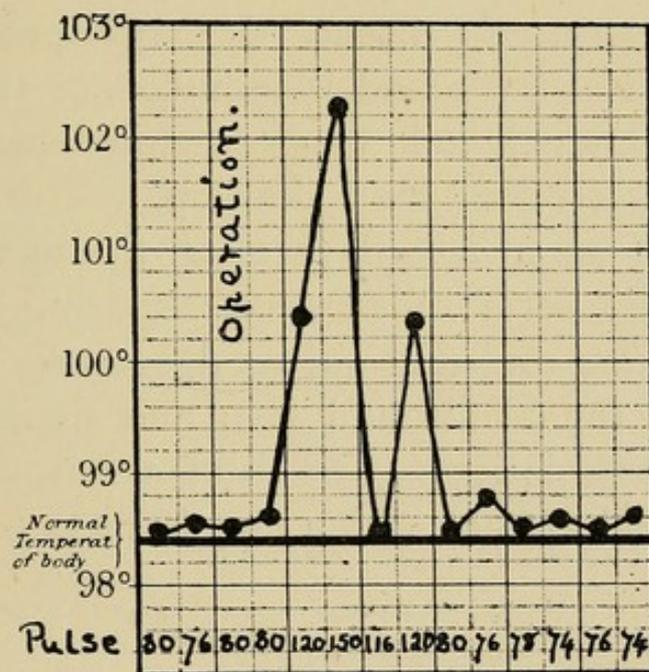
FIG. 21.—CHART OF A CASE OF THYROIDISM.

intermittent (Fig. 21); the patient becomes very flushed and uncomfortable; the pulse is quick and bounding, and there is often marked tachicardia; the symptoms are very alarming, and may easily be mistaken for the onset of acute sepsis. The pulse and tachicardia are, however, characteristic, and this mistake should not be made. The symptoms, as a rule, subside in the course of a day or two, and no harm results. Should they, however, be serious, as is sometimes the case, the wound must be

opened and washed out thoroughly with sterilized water, and then drained or packed with gauze to prevent the secretion of the gland getting into the tissues of the wound and being absorbed by the lymphatics. In very bad cases transfusion may be tried. This condition of thyroidism is rarely serious, but one or two cases of a fatal issue have been recorded. In the earlier days of the operation, when it was the practice to remove as much as possible of the gland, symptoms like those of myxœdema not infrequently occurred. In these days, however, as a rule, only one lobe is removed, and this danger is consequently absent. It may happen, however, that too much of the gland is removed, or that the part left is not functional, and then symptoms due to absence of thyroid secretion may develop. The symptoms usually come on a few days after the operation, and often take the form of muscular spasm. Laryngeal spasm may occur and cause acute dyspnœa. There may be tetany of the hands and feet, and there is usually progressive emaciation. The best treatment is large doses of thyroid extract, which may have to be continued indefinitely.

CHAPTER XI

OPERATIONS ON THE THORAX

Amputation of the Breast.

COMPLICATIONS.—(1) Lung affections; (2) sloughing of the skin; (3) sepsis.

If no drainage-tube has been used, the patient should be made to lie as much as possible on the sound side for the first twenty-four hours to prevent blood, etc., from accumulating in the loose cellular tissue at the axillary end of the wound. Of course, if a drainage-tube has been brought out through the skin in this situation, there will not be the same necessity for this position. If there is much pain after the operation, a hypodermic injection of morphia should be given ($\frac{1}{4}$ grain). A good deal of pain is not uncommon at first from the tension of the sutures, especially if much skin has been removed.

There is frequently a little oozing of blood through the dressings during the first twenty-four hours; this should be looked for by the nurse from time to time, and when noticed, more wool must be packed on over the part of the dressings where it is taking place. It is better not to redress the wound unless the oozing is considerable. It is a very good plan for the first two or three days to keep large pads of clean wool under the affected side between the dressings and the bandages. On the day

following the operation the patient should be propped up into the half-sitting position with a bed-rest and pillows in order to prevent any tendency to lung complications.

Lung complications are very liable to occur after removal of the breast, especially in elderly patients, and as carcinoma is a disease which is most common towards the later period of life, many of the patients are elderly. This tendency to lung complications is to be accounted for by the limitation of the thoracic movements, which must of necessity result from the presence of a large wound on the chest. Any deep respiration causes pain, and, as a result, the respirations are shallow and almost entirely diaphragmatic; respiration is also impeded by the chest being tightly bound up with bandages, etc. It is well to bear this in mind, as otherwise what would have been a successful operation may result in the death of the patient from an intercurrent bronchitis.

After the operation the arm should be fixed to the side, and the hand supported by a clove-hitch made in a bandage passing round the neck. If a sling is used to support the arm, it must not be made tight enough to raise the clavicle or shoulder, as this will increase the tension on the stitches, and may result in some of them cutting through. If a tube has been used for drainage, it should be removed on the second day after the operation and the wound dressed; the skin at the axillary end of the wound should be carefully cleaned at the same time.

After the first three or four days the arm should be gently moved and abducted each day to prevent the formation of adhesions between the skin and deeper structures. These movements must be very slight for the first fortnight, but after this they may be increased in range daily, and the patient encouraged to move the arm freely herself. A certain amount of limitation of

movement in the shoulder on the affected side not infre-
quently results after this operation owing to the extensive
removal of skin, which is often necessary ; but much can
be done by early movements to overcome this tendency.
Some of the stitches may be removed at the end of the
first week, and the remainder at the end of a fortnight.
After the wound has healed it is a good plan to have the
skin gently moved on the deeper tissues each day to pre-
vent the scar from becoming adherent.   It is hardly
necessary to mention that the patient should be kept
under close observation for several years after the opera-
tion, so that should recurrence take place, it may be
detected and dealt with at the earliest possible date.

When an extensive area of skin has been removed with
the breast, and a considerable amount of tension has in
consequence been necessary to bring the edges together,
sloughing of parts of the skin-edges may result.   When
this is seen to be imminent, the tension must be at once
relieved by dividing the sutures. If in consequence of
sloughing a large granulating area remains, this area
should be covered in by Thiersch's skin-grafting, so as
to prevent the contraction that will otherwise result.

Sepsis after removal of the breast is a very serious
complication, owing to the large wound and the extensive
lymphatic area opened up.   Septicæmia is very liable to
follow, and may prove fatal.   Pleural effusion on the
same side as the wound may also result, and become
purulent.

Operations for Empyema.

COMPLICATIONS. — (1) Non - expansion of the lung ;
(2) persistent sinus ; (3) empyema occurring in the oppo-
site side of the chest ; (4) cerebral abscess ; (5) curvature
of the spine.

After the operation there is not infrequently—and especially is this the case with children—a good deal of respiratory embarrassment from the altered conditions of respiration ; slight blueness of the lips may often be noticed, and is evidence of insufficient aeration of the blood in the lungs.   This is best met by oxygen inhalation.   The patient should be allowed to breathe oxygen from an indiarubber-tube attached to an oxygen cylinder whenever the breathing seems difficult or there is cyanosis ; this helps to tide over the period until the circulation becomes accustomed to the new respiratory conditions.   The dressings must be changed frequently if there is much discharge, and the same care should be taken as in dealing with a sterile wound, as it is most important that fresh infection should not be engrafted on to that already present.   After the first few days it is usually sufficient to change the dressings once daily.   It is most important that the wound in the chest should be kept sufficiently open to allow of free drainage.   If after the fluid has drained away the ribs come together and narrow the opening, there should be no hesitation in enlarging the wound, and, if necessary, taking away more rib.   The drainage-tube should be removed each day and cleaned before being reinserted, otherwise it is very liable to become blocked by pieces of pyogenic membrane, etc.

As the discharge diminishes in amount the tube may be shortened from time to time ; in children the tube or tubes may be shortened much earlier than is the case in adults.   It is best to keep the patient in bed for the first week or ten days, and then if his condition is satisfactory he may be allowed to get up for some part of the day, and allowed to get out of doors for a short time if the weather is favourable.   There is no fixed time for which

the tube should be retained, but, as a general rule, it may be said that the tube should be removed as soon as the discharge has diminished to a drachm or two of clear fluid.   After the tube has been left out, the sinus should be packed with gauze daily so as to insure it healing from the bottom.   In children it is often possible to remove the tube in two or three days after the operation. When the dressing is changed, the patient should be turned well over on to the bad side so as to allow any pus to run out, and the patient should be instructed to cough.   This will often help to get rid of any pyogenic membrane or pus that is not able to drain away.   Occasionally, after an empyema has been opened, there are still symptoms of retained pus, such as high temperatures, fever, etc., even though free drainage has apparently been established.   This is generally due to the empyema being loculated, and pus still remaining encysted in some cavity other than that opened.   This pus must be sought for and evacuated.   The best way of doing this is to push a large catheter in different directions until the pus is found, or the finger may be used if the external opening will admit of it.

Non-expansion of the lung after operations for empyema is a very serious complication, as it usually leads to deformity of the chest with secondary lateral curvature of the spine, and results in a persistent discharging sinus, which is a continuous source of trouble and inconvenience to the patient.   A great deal can be done to assist the lung to expand by suitable respiratory exercises.   The exercises that are suitable for hastening and facilitating expansion of the lung after empyema may, with advantage, be divided into two classes :

(1) Those suitable while there is still an opening into the pleural cavity.

(2) Those suitable after this opening has closed. (By an opening is meant one which establishes a condition of pneumothorax, and not a sinus shut off by adhesions from the pleural cavity.)

In (1) we have to deal with a condition of pneumothorax, and, consequently, since expansion of the chest will no longer give rise to negative pressure in the pleural cavity on that side, we cannot avail ourselves of the ordinary breathing exercises, and we must make use of the positive pressure produced by the sound lung during expiration to expand the affected one. The patient should be made to expire forcibly against resistance. The simplest way of doing this is to make the patient blow forcibly through a small tube held in the mouth, such as a piece of glass tubing. A good plan in a child is to give it a whistle or trumpet which will not make a noise unless blown hard. The exercise may be modified by telling the patient to make a forcible expiratory effort with the glottis closed, and then to let the air escape slowly through the partly-closed lips. These exercises are done with the object of causing positive pressure in the affected lung, and so expanding it. They should be carried out regularly from the first day, and gradually increased from day to day.

In (2) our object is to obtain expansion of the lung by negative pressure in the pleural cavity as in normal respiration. This can only be done when the pleura as a cavity is closed by the healing of the wound or by the formation of adhesions between the visceral and parietal layers of the pleura. As adhesions are almost always present to some extent, these exercises can usually be commenced before the wound has healed. The following exercises are taken from Dr. H. Campbell's book on respiratory exercises :

'BREATHING EXERCISES FOR ONE OR BOTH LUNGS.

'1. Exercise for one lung only, in this case to be applied to the affected lung.

'One hand is placed in the axilla of the sound side of the chest, and pressed firmly against the chest wall, so as to check its movements as far as possible. The opposite arm is then raised from the side until the wrist rests on the head. While the movement of this arm is in progress, an attempt is made to expand to the utmost the corresponding side of the thorax at the same time that the body and head are inclined to the opposite side.

'2. Take the fullest possible thoracic inspiration, followed by an ordinary expiration.

'3. Expire to the utmost, bending the body somewhat forward; then take an ordinary inspiration, resuming the vertical position.

'4. Take the fullest possible thoracic inspiration, then expire to the utmost, bending the body forward.

'5. The patient stands erect, and then blows quickly through a small opening produced by pursing the lips. At the same time he bends the head and then the dorsal portion of the spine, whilst with the outspread fingers he compresses the sides of the thorax. Having done this, the fingers are enlaced behind the neck, the mouth is closed, and a very slow and prolonged inspiration taken through the nostrils, whilst at the same time the spine is slowly extended.

'*Breathing Exercises combined with Active Exercises.*—6. The arms, held stiff, are swung round as far as possible in the sagittal direction. Inspiration accompanies the upward movement, expiration the downward.

'7. The arms, held stiff, are moved from the side of the body outwards in a lateral plane to the vertical, and then returned to the original position. Inspiration accompanies the upward movement, expiration the downward.

'8. The arms, held horizontally in front of the body in the sagittal plane, are swung backwards in the horizontal plane as far as they will go, and then returned to the original position. Inspiration accompanies the former movement, expiration the latter.

'9. The arms are made to swing in the lateral plane and in the same direction, so as to reach the highest possible point on either side, and are then returned to the original position. Inspiration is taken with the ascending movement.

'*Passive Respiratory Exercises.*—10. The operator stands behind the patient's head, which should project slightly beyond the couch. The upper arms are then grasped by the assistant, his thumbs looking upwards. The arms are then brought above the head, so as to form a **Y** with the body, and strong traction made upon them, the patient meanwhile taking a deep inspiration. They are then brought towards the thorax, and firmly pressed against it, while the patient takes a deep expiration.

'11. The operator stands at the side of the patient, and grasps the arms as they rest at each side of the body just above the elbows, his thumbs being uppermost and looking towards the patient. He then moves the limbs in a horizontal plane until the hands meet behind the head of the patient, who meanwhile takes a deep inspiration. This is followed by a deep expiration while the limbs are moved back to the original position, the elbows being firmly pressed against the sides.

'12. The patient lies on the sound side of the chest, with the arms above the head, and the operator, standing behind, places the palm of each hand over the uppermost part of the thorax, so that the roots of the fingers correspond with the axillary line. The side of the thorax is thus grasped between the fingers and thumbs. With every expiration the operator makes firm pressure on the thorax, and endeavours to make the fingers and thumbs meet.'

Persistent sinus may be due to several different causes, one of which will, of course, be non-expansion of the lung. If the lung has expanded properly, and yet there is persistent septic discharge from the wound, the presence of dead bone must be suspected and looked for by exploring the sinus with a probe. A portion of the rib is often found to be necrosed, the necrosis being most commonly along the lower border of the rib above the sinus. When this is the case, all the necrosed portions of rib must be removed before the sinus will close. The drainage from the chest not being free enough is a not infrequent cause of persistent sinus, and when the discharge is intermittent from the sinus—that is to say, when the wound keeps healing up and breaking down

again—this cause must especially be suspected; the wound under these circumstances should be freely opened, and if a large cavity is found inside the chest, it must be freely drained until it has almost closed up, and then made to heal from the bottom by plugging.   Other and rarer causes of persistent sinus are tubercular disease of the pleura; caries of the spine, to which the empyema was secondary; and the development of calcareous plates in the pleura.

When empyema occurs on the opposite side, it is probably safer to be content with aspirating the chest for a few days to allow time for the formation of adhesions, so that complete collapse of the lung does not take place when the chest is opened.

With regard to washing out the pleural cavity after making an opening into the chest, this procedure has been proved to be dangerous, however carefully practised. In many cases no harm results, but in a few dangerous collapse symptoms and even sudden death have followed after the most careful washing out of the cavity.   It is therefore safer to be content, as a rule, with simple drainage.   Should it, however, be thought desirable to irrigate the cavity, as is sometimes the case in very foul or purulent empyemata that resist treatment by drainage alone, the patient should be placed in the recumbent position while this is being done, and a free exit must be allowed for the fluid so that there is no possibility of the irrigating fluid causing tension in the pleural cavity while the irrigation is in progress.

The constitutional treatment of these patients is of the utmost importance; fresh air and an early change to the seaside are of the greatest benefit in restoring the patient to health.   Breathing exercises should be carried out from the first to help the expansion of the lung, and

later on proper gymnastic muscular exercises should be enforced to prevent the tendency to contraction of the chest and curvature of the spine. This is particularly important in children who are liable, as the result of empyema, to develop marked deformity of the chest and lateral curvature of the spine. In some cases curvature of the spine after empyema may be looked upon as a beneficial condition ; that is to say, when the lung has not expanded the lateral curvature of the spine allows the chest on the affected side to fall in and close the gap. When the deformity is very marked, however, an attempt should always be made to get rid of it by suitable exercises, as the condition is apt to be progressive.

CHAPTER XII

OPERATIONS ON THE ABDOMEN : GENERAL TREAT-MENT AND COMPLICATIONS

The After-Treatment of Laparotomy.

A GREAT deal depends in these cases on the way in which the after-treatment is managed—more so, indeed, than after almost any other class of case. The treatment, however, must be carried out with intelligence, and must be based upon careful observation of the individual case, as these cases vary very much, and hardly two of them are quite alike. Anything in the way of routine management is to be particularly avoided, and the line of treatment adopted should, so far as possible, be based upon physiological facts, the medical attendant trying to form a mental picture of the condition of the abdomen, and treating the case accordingly. It should be his object to prevent complications as far as possible, as it is much easier to prevent the complications that are liable to arise than to treat them after they have once become well established. Meddlesome interference must, however, be avoided, and especially the too free use of drugs. When complications do arise the treatment must be vigorous, as, once well established, there may be great difficulty in combating them.

After the operation the patient should be carried carefully back to bed, and jolting must be avoided, as it is very liable to increase the vomiting. The flannel gown which the patient has worn during the operation should be changed for a clean one, which has been warmed, and hot-water bottles should be applied to the feet and elsewhere if necessary. This should not be overdone, as it is not desirable to make the patient break into a profuse perspiration, which is often the case if the use of hot-water bottles, etc., is carried to excess. Care must be taken also in the use of hot bottles not to burn the patient. Persons who are under the influence of an anæsthetic burn extremely easily, and it is not at all uncommon to see quite extensive burns from this cause in hospital practice.

A warm nutrient enema should be administered soon after the patient has been got back to bed, and it is a very good plan, if there is any sign of shock, to administer an enema of warm water 1 pint and brandy 1 ounce. This may either be combined with a nutrient enema, or given separately. Mr. Watson Cheyne advises an enema containing hot coffee (2 ounces), brandy (1 ounce), beef-tea (1 ounce), and liquor strychninæ (10 minims).

If there is vomiting, and it does not stop in a short time, hot flannels may be applied to the epigastric region, and the patient can be allowed to drink some hot water with some bicarbonate of soda dissolved in it (see under Post-Anæsthetic Complications).

In cases where there is constant regurgitation of fluid from the mouth rather than actual vomiting, as is not uncommonly seen in cases of intestinal obstruction and peritonitis, this can often be stopped by just propping the patient up a little so as to allow gravity to act.

This is not advisable, however, when there is shock present. If there is much pain after the patient regains consciousness, it may sometimes be relieved by flexing the patient's knees over a pillow, so as to relax the abdominal muscles. If very severe, an injection of morphia must be given, but it is as well to avoid the use of opium if possible, as it increases the liability to meteorism. If there is much restlessness, morphia is indicated. It should be given in a dose of from $\frac{1}{8}$ to $\frac{1}{3}$ grain hypodermically, according to circumstances. With regard to position, the patient should, as a rule, be allowed to lie in the most comfortable position, and this will usually be found to be upon the side (see Introductory Chapter). In order to prevent the possibility of meteorism, an excellent plan is to pass a small tube, such as the ivory nozzle of an ordinary Higginson's syringe, through the sphincters twice in the twenty-four hours, and leave it in for one hour at a time. It does not cause the least discomfort, and allows of the escape of flatus. On the third day after the operation, and earlier if the patient's bowels have not been well opened previous to the operation, a soap-and-water enema should be administered, and repeated in an hour if there is no action of the bowels. If this fails to act, an oil enema may be given, or a dose of castor oil (1 ounce) given by the mouth, or calomel (2 grains) every three hours until the bowels act, may be used instead of the oil, or salts in repeated doses every two hours are preferred by some surgeons. This question of aperients is a very important one, and surgeons differ very much as to the exact procedure; but it may be stated as a general principle that the sooner a proper evacuation of the bowels has been obtained, the sooner is the patient out of danger. Our

object must be to get, if possible, a natural action, unaccompanied by violent peristalsis. The best way of doing this is by the use of enemata, which are probably the least irritating form of aperient and at the same time give rise to their effect with the least amount of peristalsis. With regard to the use of aperient drugs, salts especially, in small repeated doses, are probably the least irritating to the intestine, and produce their effect without giving rise to much muscular action of the intestinal wall ; but, unfortunately, they are very liable in some cases to cause vomiting, which it is often particularly desirable to avoid. One of the best ways of administering salts for the evacuation of the bowels in these cases, is in small doses dissolved in a large quantity of water, as, for instance

$\mathbb{R}$ Mag. sulph. -   -   -   - ℨss.-i.
    Sodæ sulph. -   -   -   - ℨss.-i.
    Aquam   -   -   -   - ad ℥vi.
        Sig. : Every hour till the bowels act.

The value of saline purgation in the treatment of incipient peritonitis has been repeatedly proved, and there can be no doubt of its usefulness in appropriate cases. The late Mr. Lawson Tait was one of the first surgeons to revive the practice, and he used to speak very highly of the value of saline purgation in the after-treatment of ovariotomy cases.

Castor oil is certainly one of the most reliable and most valuable aperient drugs that we possess, and, when it can be taken, is in many cases preferable to the use of salts. An ounce of the oil may be given on the morning of the third day after the operation. Calomel, especially in small repeated doses, is very useful in some cases, and should be made use of in preference to salts or oil in cases where there is peri-

tonitis present or suspected ; but as calomel acts largely by virtue of its irritating qualities, causing peristalsis, it must be used with caution. Great judgment and care is necessary in the employment of aperients after laparotomy, and careful observation of cases combined with a knowledge of the physiology of the intestine will be of more service in the treatment of cases than any amount of reading.

If all goes well, the wound should not be dressed for ten days, and then the majority of the stitches should be removed. It is often advisable, when the wound has been sewn up by a single series of sutures, to leave two or three of the deep ones—that is to say, those holding together the whole thickness of the abdominal wall—for a day or so longer, so as to insure that there is no pocketing of the peritoneal side of the wound, which would be liable to result in a ventral hernia ater on. When a large number of sutures have been inserted, the superficial ones may be with advantage removed at the end of the first week, and the deeper ones left for ten days or a fortnight. When the abdominal wall has been sewn up in layers, the superficial stitches should be removed in a week or ten days, the deep ones, of course, being left. After the stitches have been removed, the wound should be supported with broad pieces of strapping so as to prevent any strain being thrown upon the newly-united wound edges, and a firm flannel binder should be worn over this.

The patient must not be allowed to get up for at least three weeks after the operation, and in the case of elderly patients or those with flabby abdominal walls five weeks is not too long for them to be kept in bed. The patient should be kept on a couch, and not allowed to walk about for another week or ten days, and it is often advisable to

extend this time. No active exercise or any exertion, such as lifting heavy weights, should be indulged in for at least two months after the operation. Before the patient is allowed to get up, a properly-fitting abdominal belt should be put on, and the patient told not to get out of bed without it. This belt should be worn for six months. In the case of women, specially made corsets can be obtained which support the lower part of the abdomen.

DIET.—This is one of the most important parts of the after-treatment of abdominal cases, and we must be guided largely by the nature of the case in the selection of a suitable diet. When there is a lesion in any portion of the alimentary tract, our object must be to avoid the use of any diet which will need digestion or necessitate peristalsis by that portion of the intestine. Thus, in stomach cases we should avoid the use of foods which are normally digested by that organ, and in the case of lesions of the small intestine we should make use of foods which can, to a large extent, be digested by the stomach, and so on. One thing must especially be avoided—that is, the use of any diet which, in the process of digestion or otherwise, is liable to cause the formation of gas, and so flatulence and distension.

It must be remembered that the alimentary tract under these circumstances is not in a normal condition, that digestion is often not complete, and fermentation and other abnormal processes are very liable to take place. Milk, which is a very commonly used diet in these cases, is particularly unfortunate in this respect, as it is very liable not to be properly digested and to undergo fermentation, and give rise to the formation of gas, etc. It is probably one of the worst forms of dietary in many of these cases; and although peptonizing it does away to some extent with this disadvantage, it does not do so

altogether, as it is even then liable to undergo fermentation in the stomach and intestines, and, in addition, the peptones used to peptonize it are irritating. One of the safest and most reliable diets is albumin-water. This is made by beating up the white of three or four eggs in a pint of water, lemon and sugar or other flavouring materials being added according to taste. This is very easily digested, is unirritating, and at the same time is not liable to give rise to the formation of gas during the process of digestion; 2 pints of albumin-water given during the twenty-four hours represents a fair amount of nutritive material, and, as a rule, is all that is necessary during the first two or three days. About 2 ounces should be given by the mouth every two or three hours while the patient is awake. If desired, the albumin-water may be combined with peptonized milk, but it is better to avoid the use of milk altogether till after the bowels have acted. Another preparation which may be used, and which is very similar to the albumin-water, is plasmon.

Plasmon is a pure albumin prepared from the caseinogen of milk. It is a fine white granular powder, which is readily soluble and free from taste or smell. It can be added to almost any form of diet, and, as it contains a very high percentage of albumin, forms a very useful method of administering proteid. It has the advantage of being the cheapest form of pure albumin obtainable, as it is prepared from butter-milk, a by-product in the preparation of butter. It is a very easily assimilated form of albumin, and, owing to its method of manufacture, is free from chemicals. In abdominal cases it is best given either as a beverage or as jelly :

Plasmon - - - -	3 teaspoonfuls.
Tepid water - - -	½ pint.

A little water should be added to the plasmon, and then stirred into a thick paste; the remainder of the water should then be added, and the whole boiled for two minutes. This will give $\frac{1}{2}$ pint of the liquid. About 2 ounces of this should be given to the patient every two or three hours, with more water and some suitable flavouring added according to taste. As a change the plasmon may be given as jelly or cocoa, and later, when solid foods are begun, it is a very good plan to combine a certain amount of plasmon each day with the diet. The amount of plasmon which it is advisable to give in the twenty-four hours must, of course, vary a good deal with circumstances, but roughly it should be from three to six teaspoonfuls of the powder.

A very useful diet for many of these cases, which was first drawn attention to by Mr. H. Gilford (*British Medical Journal*, November 16, 1901), is grape-sugar. To quote his own words:

' In my opinion one of the best of these foods is grape-sugar. Grape-sugar by itself is too nauseous, but combined with a flavour, such as that of raisins, it is nearly always palatable. I find, in fact, that it is, as a rule, preferred to nearly all other forms of liquid diet, and patients will often by preference continue taking their " raisin-tea " long after they have become tired of milk and slops. It is made by pouring boiling water on to half its bulk of chopped raisins. This is stewed for about two hours and then filtered. The filtrate may be given either with water or without, and either hot or cold, according to the wishes of the patient. Though it doubtless contains other substances than grape-sugar, these are apparently present in such small quantities that they may be neglected. Given at first in small doses and afterwards more freely, it is undoubtedly of value. When

one remembers the important place which sugar takes among the foods, it seems strange that it should not be more utilized as an article of sick diet. This applies with peculiar force to grape-sugar, seeing that it requires no digestion.'

A combination of egg-albumin or plasmon with grape-sugar in the form of 'raisin-tea' is a most excellent diet for these cases during the first few days. It combines a maximum of nutrition in an easily assimilated form with a minimum of bulk and residue; it contains both proteid and carbohydrate—the former in an easily digested form, and the latter in a form which requires no digestion at all.

Beef-tea, which is still so popular as a form of invalids' diet, is practically useless except as a stimulant, and there are many better stimulants than beef-tea. A recent chemical analysis made of the beef-tea in one of the big hospitals revealed the fact that the best beef-tea only contained 3·4 per cent. of proteid, so that beef-tea and the numerous other beef extracts are quite useless as a diet. A recent writer on the subject says: 'All the bloodshed caused by the warlike ambition of Napoleon is as nothing compared to the myriads of persons who have sunk into their graves from a misplaced confidence in the food-value of beef-tea.'

When stimulants are necessary or advisable, brandy or whisky are the best, and it is better to give them in small repeated doses either separately or combined with the fluid diet than to give them in large doses. Champagne is sometimes valuable, but, as a rule, it is better to avoid the use of gaseous drinks, as they often cause flatulence.

For the first four or five hours after the operation it is advisable not to give anything by the mouth except

water.   If the patient is thirsty, some lemon-juice may
be added to the water with advantage, or peppermint-
water is sometimes very comforting.   About a tea-cupful
of fluid should be allowed at a time.   There is no advan-
tage in only giving the fluid in small sips ; such small
quantities of water are just as liable as larger quantities
to cause vomiting, and the latter will have the advantage
of laving the stomach if it is vomited.   It is correct in
these cases to assume that thirst is the physiological call
of the body for more fluid, and therefore it ought to be
satisfied as far as possible.   Large quantities of fluid at
a time are, however, not advisable, as they are liable to
cause vomiting by distending the stomach ; but giving
water only in teaspoonfuls is neither reasonable nor does
it answer any real purpose.   A cup of tea with a little
sugar but no milk is often very much appreciated when
the vomiting has passed off.   It should be made weak,
and must not be allowed to stand before being drunk.
If there is no contra-indication, feeding by the mouth
with albumin-water or whatever is considered most suit-
able may be commenced as soon as all vomiting has
ceased—that is, in most cases, about six hours after the
operation.

For the first three or four days—that is to say, until
the bowels are open—the diet should be entirely confined
to fluids ; after that, in uncomplicated cases and in cases
where there is no intestinal lesion, lightly-boiled eggs,
thin custard, jellies, and milk preparations, such as
koumiss, etc., can usually be allowed.   At the end of ten
days, and, in some cases, earlier, more solid diet can be
given, but should consist at first of easily-digested foods,
and should be eaten slowly, as such patients are very
liable to get attacks of indigestion from very slight
causes when first allowed more or less ordinary diet.

Such things as toast and dry biscuits, which may leave hard, undigested portions in the intestines, are best avoided. The time at which ordinary diet can be allowed must of necessity vary so greatly with the nature of the case that it is quite impossible to lay down any rules, and each case must be treated on its own merits, the appetite of the patient being often a very fair guide as to the amount and quality of the diet to be used. If there is any tendency to distension of the abdomen from wind, etc., the fluid or semi-fluid diet should be continued until it has disappeared. In many cases of laparotomy rectal feeding is necessary for the first few days, though it is but rarely that small quantities of albumin-water by the mouth need be altogether dispensed with. A combination of rectal feeding and small quantities of fluid by the mouth is often the best treatment. (For rectal feeding, see Appendix.)

COMPLICATIONS OF LAPAROTOMY.—(1) Shock ; (2) vomiting ; (3) meteorism ; (4) peritonitis ; (5) stitch suppuration ; (6) fæcal fistula ; (7) parotitis ; (8) weak scar ; (9) intestinal obstruction.

1. *Shock.*—This condition has already been treated of in a separate chapter, and will not be further considered here.

2. *Vomiting.*—This has also been considered, but it may be mentioned here that in very bad cases of persistent vomiting, which will not yield to the ordinary treatment, washing out the stomach with warm water should be tried and repeated at intervals of two or three hours. If necessary, propping the patient up into a semi-sitting position is also sometimes of use. It should be our object to remove the cause of vomiting rather than to check it.

3. *Meteorism.*—This is the most dangerous complication that is commonly met with after laparotomy. A good

deal has lately been written on this subject under the
name of ' pseudo-ileus,' a new name which seems to have
little to recommend it.   Tympanitis is also another name
which has been used to describe this condition.   What-
ever the exact physiological cause of the condition may
be, whether it is due to paralysis of the intestinal muscu-
lature or to some other cause, it is a condition which is
not uncommonly seen, and which, when once well estab-
lished, is often extremely difficult to treat.   It usually
first shows itself about twenty-four to forty-eight hours
after the operation by distension of the abdomen accom-
panied by some discomfort.   The patient's breath is often
foul.   In the fatal cases this distension steadily increases,
and is accompanied by constipation, which may become
absolute, the patient dying either from a kind of toxæmia,
due, no doubt, to the absorption of poisons from the
intestine, or, in some cases, from a variety of peritonitis.
A certain amount of flatulence after laparotomy is quite
common, especially when the operation has been under-
taken for the relief of some septic condition, as, for
instance, in the case of appendicitis.

  Our object must be to prevent the onset of this trouble-
some complication by appropriate means.   The method of
passing a tube through the sphincters and leaving it
there, is certainly one of the best means of securing this
end.   Mr. Allingham has pointed out that it is necessary,
for the expulsion of flatus, that the abdominal muscles
should contract, and that after a wound has been made
in the abdominal wall the patient is unable, or unwilling,
to contract these muscles, on account of the pain which
it causes him, and in consequence flatus tends to
accumulate in the intestines.   When the tube is in
position, however, there is a free way through the
sphincters, and wind is able to pass unaided.

As soon as distension has made its appearance, steps must at once be taken for its relief. An enema should be administered, and probably one of the best enemas for the purpose is a turpentine one, such as that in the old British Pharmacopœia:

> ℞ Turpentine -   -   ·   -   · ℥i.
> Gruel -   -   -   -   -   · ℥xvi.

or a rue enema may be used, as:

> Confectionis rutæ   -   -   - ℥iii.
> Infusum anthemidis -   -   - ad ℥xvi.*

After the enema has been given, the rectal tube should be passed through the sphincters and left there for an hour, so as to allow of the escape of wind. It is a good plan to let the tube be kept in for one hour out of every six when there is any distension. If these measures do not prove effectual in relieving the distension, large oil enemata should be used, or castor oil, calomel, or salts given in repeated doses by the mouth until the bowels are open. The administration of small hypodermic injections of strychnine in repeated doses is often of value in these cases. The passage of a galvanic current through the abdomen has been recommended, with a view of overcoming the paralysis of the intestines.

As a rule, the condition will yield to the above treatment if it is commenced early and carried out vigorously. In very bad cases powerful enemata, containing large doses of glycerine, or glycerine and magnesium sulphate, are sometimes successful:

> ℞ Glycerini   -   -   -   - ℥i-iss.
> Mag. sulph. -   -   -   - ℥ss.
> Aquam   -   -   -   - ℥vi.

and when all other measures have failed, the advisability

* St. George's Hospital Pharmacopœia.

of reopening the abdomen and incising the bowel may be considered.

4. *Peritonitis.*—The question of reopening the abdomen will have to be considered. If this is not done, our only hope is in getting the bowels to act. Calomel in repeated doses is probably the best way of securing this in these cases.

5. *Stitch Suppuration.*—This is not infrequently seen, and is sometimes the result of too much tension on a stitch. When this is the case, the offending stitch should be divided, so as to relieve the tension. The stitch should not be removed, for fear of carrying septic material into the deeper parts of the wound. When the abdominal wall has been sewn up in layers, suppuration of the deep stitches is a very troublesome complication. This is the great objection to all buried sutures. That it is not always the result of the suture material being septic is certain, as occasionally a sinus will form, leading down to the deep sutures, months after the wound has healed up. When this is the case, the old wound must be opened and all the stitches removed.

Any persistent sinus which refuses to heal should be carefully investigated for the presence of a foreign body, such as a stitch, piece of drainage-tube, etc., as this is by far the most common cause of such sinuses.

6. *Fæcal Fistula.*—Fæcal fistula is most commonly seen after operations for appendicitis, and is then due to an opening either in the remains of the appendix or in the cæcum. The first thing to do is to make sure that there is free drainage from the sinus, and that there is no danger of pocketing. For this purpose a drainage-tube should be kept in, and the fistula kept as clean as possible. The majority of these fæcal sinuses close spontaneously in the course of a month or six weeks,

and often in much less time than this. If there is any tendency to the formation of a bottled-shaped cavity, the external opening should be carefully dilated or enlarged by cutting, and the wound drained from the bottom. The diet should be regulated so that it may be easily digested, and the patient should be kept in bed, and, if possible, in such a position that the intestinal contents do not tend to flow into the fistula, but rather to pass by the natural channel. When, in spite of these measures, the fistula will not close, it generally means that there is some obstruction to the flow of fæces from the part of the intestine above the fistula into that below it ; and this should be investigated, and, if found to be the case, an operation will have to be performed to clear the obstruction, or to anastomose the intestine above and below the fistula, or whatever else may seem most suitable.

As these fistulæ, however, often close of themselves after existing for several months, it is as well to wait for six months or so before trying to close them by operation, unless there is obvious obstruction and all the fæcal material is passing by the wound. In cases of fæcal fistula not connected with the appendix or operations for its removal, the same remarks apply, but the cause of the persistence of the fistula may then be the formation of a spur, and steps must be taken for its removal.

7. *Parotitis.*—This curious complication may occur after any operation, but it is most commonly seen after laparotomy and operations on the pelvic organs. It seems to occur more often in women than in men. Excluding operations on the pelvic organs, it is most commonly seen after operations on the stomach, such as for the treatment of perforated gastric ulcer, etc. Out

of 100 cases collected by Mr. Stephen Paget,* the following primary causes were noted : Injury or disease of the alimentary canal, injury or disease of the urinary tract, ditto of the abdominal wall, peritoneum, or pelvic cellular tissue, a blow on the testicle, the introduction of a pessary, menstruation, and parturition. In 93 per cent. of the cases it occurred as an isolated lesion, no other complication being present. There was evidence of a primary septic focus in only fifteen cases. The period at which it comes on after the operation seems to vary very considerably. The commonest time seems to be from a week to ten days after the operation. In some cases the submaxillary glands are affected as well as the parotids. The condition comes on with great swelling of the parotid glands, accompanied by the usual signs of inflammation. It closely resembles mumps. There is often pain, and there may be a high temperature. The temperature, however, does not as a rule exceed 100° F. or 101° F., except in the septic cases.

The condition often suggests that an abscess is forming ; as a rule, however, the inflammation subsides in the course of a day or so. Suppuration, however, may take place, and the best evidence of this will be the temperature chart. The pus tends to burrow into the external auditory meatus or the pharynx. The cause of the condition is very doubtful. That there is some curious association between the parotid gland and the genital organs is certain, but what this depends upon we do not yet know. The best way of treating the parotitis is by hot fomentations or lead lotions, and a smart purge should be administered. If suppuration takes place, incisions must at once be made into the gland, care

* 'Parotitis following Injury or Disease' : Stephen Paget, *British Medical Journal*, 1887, vol. i., p. 613.

being taken not to wound the branches of the facial nerve.

The following curious case of this complication is reported by Fiske Jones (*Boston Medical and Surgical Journal*,' November 20, 1902):

A girl, aged nineteen, had a first attack of appendicitis in 1897. An abscess developed, spreading into the pelvis, which was opened and drained on the tenth day. Forty-eight hours after the operation the right parotid gland began to ache and swell. Two days later the left became similarly affected. Within a week the pain and swelling began to subside. One year afterwards a second attack of appendicitis occurred. An abscess was opened and drained forty-eight hours after the onset of the symptoms, and two days later the right parotid became inflamed, the opposite gland being involved forty-eight hours after its fellow. In November, 1899, two years and a half subsequent to the first seizure, a third attack occurred ; the appendix was removed, and the pelvis drained. Once more the right and then the left parotid became inflamed. There was no rigor, and the symptoms were comparatively mild.

8. *Weak Scar.*—Stretching of the scar, and the formation of a weak spot in the abdominal wall, is most commonly seen when the wound is in the area below the umbilicus, as it is more subject to pressure in this situation. A weak scar is most often seen after operations for the drainage of a septic cavity, and especially after operations for tubercular peritonitis or tubercular lesions of the appendix. It must be treated by strapping the sides of the scar firmly together with adhesive plaster, and making the patient wear a properly-fitting abdominal belt. There must on no account be a pad on the belt to press on the scar, as such pressure is liable to cause atrophy of the tissues, and will tend to still further weaken the scar. In some cases, especially in children, it is better to keep the patients in bed for a time until the scar has to some extent consolidated, and

then to let them get up with a belt, which should be worn for six months or more.

9. *Intestinal Obstruction.*—Intestinal obstruction is an accident that may follow any abdominal operation, but it is most common after operations on the pelvic organs. It is also not infrequently seen after operations upon the appendix. The symptoms generally commence with colicky pains in the abdomen, accompanied by distension and sickness. There is also increasing difficulty in getting the bowels to act. The patient may have been going on quite satisfactorily for the first three or four days after the operation, and the bowels have been opened on the third day by means of enemata, and then something appears to go wrong. There is constipation, accompanied by colicky pains, and great difficulty is experienced in getting the bowels to act. This difficulty increases, until in a very short time there is absolute obstruction, and the ordinary symptoms of acute intestinal obstruction are developed. The condition is most commonly seen about five or six days after the operation. Although the symptoms develop slowly, the condition is usually that of an acute obstruction when once established. The pathology of the obstruction in these cases is probably, that a coil of intestine becomes adherent to some portion of the field of operation, and kinking takes place in consequence. At first only slight narrowing of the intestinal lumen results, but as the intestine above gets more and more distended, the obstruction increases, until often it becomes absolute.

As soon as ever the symptoms show themselves, and this condition is suspected, prompt measures must be taken for its relief. At first an attempt should be made to stretch or detach the adhesions by causing peristalsis of the intestine. Large doses of salines may be adminis-

tered by the mouth, and turpentine enemata administered by the rectum. Mr. Watson Cheyne* draws attention to the value of position in the treatment of this condition. He advises that the patient should be placed in such a position that a certain amount of dragging is produced upon the adherent coil of intestine. Thus, the buttocks should be raised, and, in fact, the patient placed in a modified Trendelenburg position. Should these measures not prove effectual in getting rid of the obstruction, time must not be wasted, but the abdomen should be at once reopened, and the adherent coil detached from the part to which it has become adherent.

* 'Surgical Treatment': Cheyne and Burghard, vol. vi.

CHAPTER XIII

OPERATIONS ON THE ABDOMEN (*continued*)

Operations on the Stomach.

SPECIAL COMPLICATIONS.—(1) Pneumonia; (2) regurgitant vomiting; (3) hæmatemesis.

1. *Pneumonia.*—One of the commonest causes of death after operations on the stomach, and more especially operations undertaken for the relief of pyloric stenosis, is pneumonia. The reason for this is that the patients are often old and enfeebled subjects, and that the free movement of the upper abdominal muscles is interfered with owing to the incision. The respirations in consequence are shallow, as the patient is afraid of the pain caused by a deep inspiration. Coughing is for the same reason prevented, and, as a result, mucus collects in the most dependent parts of the lungs and sets up hypostatic pneumonia. The best way of preventing this is to nurse the patient as far as possible in a sitting position; the knees should be flexed over a cushion or bolster, and the back and head supported with a bed-rest and pillows.

2. *Regurgitant Vomiting.*—This sometimes follows the operation of gastro-enterostomy. When it comes on about two or three days after the operation and there are no signs of peritonitis, it is usually due to the formation of the so-called ' vicious circle '—that is to say, a kink

has formed in the intestinal loop, and the contents of the stomach, instead of passing into the distal portion of the intestine, are passing into the proximal or duodenal portion, and so back into the stomach. This should be especially suspected if there is much bile present in the vomit. It used to be supposed that the presence of bile in the stomach was the cause of the vomiting, but it has now been shown that this is not the case. The vomiting is probably always due to some blockage in the new anastomotic opening, which may be of either a temporary or permanent nature. The vomiting may be but slight, occurring only a few times and then ceasing altogether, or it may be so serious as to quickly cause a fatal issue. When regurgitant vomiting occurs, the stomach should be washed out, and all feeding by the mouth stopped for a time. Changing the patient's position is sometimes effectual in freeing the bowel. Thus, if the patient has been propped up he should be made to lie down flat on his back so as to prevent the drag on the loop of intestine. Giving the patient large draughts of water to drink has occasionally stopped the vomiting. The bowels should also be got to act well. If these measures fail to stop the vomiting, another operation should at once be performed to make a free exit for the stomach contents into the bowel. Probably the best operation to perform under these circumstances is to anastomose the loop between the pylorus and stomach to the distal portion of the intestine lower down. When persistent vomiting follows other operations on the stomach than gastro-enterostomy, it is probably due to acute gastritis or peritonitis, and must be treated accordingly.

3. *Hæmatemesis.*—Vomiting of blood after operations on the stomach is not at all uncommon for the first twenty-four or forty-eight hours. It is generally, how-

ever, only the blood which has got into the stomach at the time of the operation, and need not cause alarm. When, however, the blood is bright in colour, and there is reason to suppose that it is the result of oozing from the stomach wound, a little hot water may be given to drink with a view to stopping it, or the stomach may be gently irrigated with warm boracic lotion by means of a soft tube. It is seldom that the bleeding is of any consequence.

POSITION AFTER OPERATIONS ON THE STOMACH.—The best position in most cases is the half-sitting position already mentioned, but the exact position must depend upon the nature of the lesion and its site in the stomach. Thus, in many cases our object should be to keep the patient in that position which will allow of fluids, etc., most easily finding an exit from the stomach into the intestines. Since the pylorus is to the right side, the right lateral position is, in many cases, advisable, and is always to be preferred to the left lateral or supine positions. The power of the stomach to expel its contents is usually very feeble after any operation upon its walls, and we must try to assist it, as far as possible, by means of gravity.

It is an excellent plan when patients are being nursed in the sitting position to allow them to sleep at night in the right lateral recumbent position. They not only sleep better in this position, but it prevents the accumulation of fluids in the stomach, and insures free drainage from that organ into the intestine during the night. Moving the patient's position from time to time also tends to prevent the formation of bed-sores, which are otherwise very liable to form in the case of old and emaciated subjects.

Again, in the case of ulcers which have been treated

surgically, we must try to keep the patient in such a position that the wound will not be in a dependent part of the stomach, and so will not be constantly in contact with the contents, be it food or mucus.

As in these cases it is particularly desirable that there should not be any vomiting after the operation, owing to the strain which it might throw upon the stitches in the wall of the stomach, it is best not to give anything by the mouth for the first twenty-four or forty-eight hours, and rectal feeding should be adopted. Patients often complain of great thirst; this must be appeased by giving warm water enemata, and sometimes a thin slice of lemon to suck will make the patient more comfortable. When the patient is old or much enfeebled as the result of his condition previous to the operation, it is often not wise to depend entirely on rectal feeding even for the first two days, and he should be given small quantities of fluid diet, such as albumin-water every two or three hours, as soon as the results of the anæsthetic have passed off. The diet should be entirely fluid for the first five days or a week after the operation. The sugar diet already mentioned is a very suitable one in stomach cases, and may be combined with albumin-water. The wound in the stomach wall is probably healed at the end of a week or ten days. Mr. Barker[*] recommends that when the patient after an operation on the stomach complains of a feeling of weight and distension in the region of the stomach, a soft tube should be passed and the fluids contained in the stomach siphoned off. He says that very marked relief from pain and discomfort often follows this procedure; it may be employed during the first twenty-four hours, and repeated if necessary.

[*] *Lancet*, August 22, 1902.

Operations on the Gall-Bladder and Biliary Ducts.

SPECIAL COMPLICATIONS. — (1) Hæmorrhage ; (2) biliary fistula ; (3) broncho-pneumonia and pleurisy ; (4) acute dilatation of the stomach.

1. *Hæmorrhage.*—Many of these operations have of necessity to be performed upon patients who are suffering from jaundice, and the coagulability of the blood under these conditions seems to be altered in much the same way as is the case in patients the subject of hæmophilia. Oozing from all parts of the wound takes place, and if not stopped often proves fatal. This oozing may not come on for two or three days after the operation. Mr. Mayo Robson has recently pointed out the value of large doses of calcium chloride in the treatment of this condition (see page 40). He also recommends the use of suprarenal extract and local pressure.

2. *Biliary Fistula.*—This is an extremely troublesome affection, which occasionally follows operations on the gall-bladder. As a rule, these fistulæ close spontaneously in the course of a month or two. When, however, this is not the case, it is generally due to there being a block in the common duct, either from an impacted stone, malignant disease of the head of the pancreas, or as the result of adhesions, and, if possible, a further operation should be performed for its relief.

When the biliary fistula is accompanied by absence of bile in the stools, as shown by clay-coloured fæces, it is practically certain that the cause of the fistula is a block lower down in the biliary passages, and a second operation must be performed. When, however, there is a certain amount of bile in the fæces, it is better to wait

for some time, to see whether the fistula will close spontaneously.

3. *Broncho-pneumonia and Pleurisy.* — These complications often result from the interference with the movements of the diaphragm caused by the operation. They are best guarded against by nursing the patient in a semi-recumbent position.

4. *Acute Dilatation of the Stomach.*—This is said to have followed the operation of choledochotomy in some cases. It is best treated by gastric lavage and rectal feeding.

Operations for Appendicitis.

The treatment of the wound is the same as for any other abscess, but it is very important that the drainage-tube should not be left out until all the deeper parts of the wound have healed, as otherwise the opening in the skin is very liable to contract and allow the pus to pocket. Sometimes a week or ten days after the operation, when the patient is apparently almost well again, there is a rise in temperature and pain at the site of the wound—in fact, a recurrence of the original symptoms. This usually means that another abscess has formed in the deeper parts of the wound cavity; in other words, some pus has pocketed, and got shut off from the rest of the wound. Under these circumstances the wound should be carefully dilated and explored with the finger or a director until the pus is found, and given a free exit. Great caution must, however, be exercised in doing this, or there will be danger of opening the general peritoneal cavity and setting up peritonitis.

A certain amount of trouble may be experienced in getting the bowels to act for the first few weeks after the operation, owing to the formation of adhesions

between the coils of intestine.   This is particularly liable to occur if the abscess has tracted down into the pelvis.   It can, however, be overcome by the proper use of salts, and the adhesions will soon stretch and disappear.

If the wound has been packed with gauze, this should, as a rule, be removed in thirty-six or forty-eight hours. As the removal of the gauze is usually very painful, it is as well to give an anæsthetic.   Gas or gas and oxygen is generally sufficient for this purpose.   When there is much difficulty in removing the gauze, it should be left in for a time.   It generally becomes loosened in a day or so, and is then quite easy to remove.   After the removal of the gauze the wound should be lightly repacked, or a tube put in.   The rectal-tube should always be used after the operation as a precautionary measure against distension.   It is particularly in these cases that distension and meteorism are liable to occur.   The patient should have the tube placed through the sphincters, and left in for one hour in six hours, commencing soon after the operation (see page 147).

It is most important, after all operations for appendicitis, to get the bowels to act as soon as possible.   An enema should be administered on the day after the operation, and, if it fails to act, should be followed by a dose of salts or castor oil.

Most of the complications and means of dealing with them have already been mentioned under Laparotomy.

Ventral hernia sometimes follows the operation for removal of the appendix, and it is a peculiar fact about these herniæ that they are often very painful.   When this is the case, a further operation should be performed for the cure of the hernia.

Radical Cure of Hernia.

SPECIAL COMPLICATIONS.—(1) Epididymo - orchitis; (2) retention of urine; (3) separation of the deep sutures; (4) persistent vomiting; (5) recurrence.

In order to keep the dressings dry it is advisable, in the male, to place a piece of jaconet with a hole in it over the dressings, the penis being made to emerge through the hole. In young children it is so difficult to keep the dressings dry that it is advisable to apply a collodion dressing to the wound in the first instance, and to place a large pad of wool over this, which can be changed constantly. The best way of nursing quite young children after operations for the radical cure of hernia is to sling their legs up to a cross-bar over the bed, in the same way as is done in Bryant's method of treating fracture of the femur. This not only enables the small patient to be kept much cleaner than would otherwise be the case, but the flexed position of the thigh acts as a protection to the inguinal rings, and prevents undue pressure being exerted on them, during the period of healing of the wound, from crying, etc.

The usual time during which the patient should be kept in bed after these operations is from three weeks to a month. Three weeks is, however, all that is usually necessary. When the patient is first allowed to get up after the operation, a pad of wool held on by a firm spica bandage should be applied over the inguinal canal. This should be worn for the first week. After that all support to the canal can usually be dispensed with. The use of a truss after the radical cure of hernia is inadvisable, as the continuous pressure exerted by a truss tends to weaken the scar and surrounding tissues, and therefore tends towards the recurrence of

the affection. Of course, when the operation has been undertaken for the purpose of enabling the patient to wear a truss—that is to say, when, owing to the nature of the case, a real radical cure of the condition was not to be expected, and the operation was undertaken with the object of so improving the local conditions as to allow of a truss keeping up the hernia—the case is different : a light truss, therefore, should be ordered in these cases. The patient after the operation for hernia should be warned against the danger of lifting heavy weights, or exerting himself in any way, for the first two months or so afterwards, as the parts are not thoroughly consolidated for that time, and any violent exertion is liable to cause the hernia to come down again.

1. *Epididymo-orchitis.*—It is not at all uncommon after operations for hernia to find a few days after the operation that there is some swelling and tenderness of the epididymis and testicle on the same side. This is most probably due to the interference with the veins of the cord at the time of the operation, or to the cord being constricted by the ring having been sewn up a little too tightly. The swelling is often considerable, but it is of no consequence, and all subsides in the course of a day or two. If there is much pain or discomfort, the testicle should be supported by a small cushion or slung up well on to the abdomen by means of a bandage, and evaporating lotions applied to relieve the pain. Occasionally this swelling and enlargement of the testis, etc., persists for a week or two, but invariably subsides without any harm resulting.

2. *Retention of Urine.*—This is not uncommon for the first twenty-four hours after the operation. Loosening the bandages is sometimes all that is necessary to enable the patient to pass his water. If simple means fail, a

catheter should be passed and the urine drawn off, the usual precautions being, of course, taken to prevent the introduction of organisms into the bladder.

3. *Separation of the Deep Sutures.*—This has already been referred to under the head of 'Laparotomy.' It is a particularly annoying complication in these cases, as it often renders the operation more or less ineffectual.

4. *Persistent Vomiting.*—Leaving out of account the vomiting due to the anæsthetic, peritonitis, or meteorism, which have already been referred to, this complication is usually seen after operations for the cure of large scrotal hernia when portions of the omentum have been ligatured and cut away. The vomiting generally comes on about a week or ten days after the operation, and is accompanied by some tenderness of the abdomen and symptoms which at first are easily mistaken for those of peritonitis. The condition is either due to some sloughing of the omental stump or to the formation of adhesions between it and the surrounding coils of intestine. The condition is not common, but is seen occasionally; the symptoms generally pass off in the course of a few days, and no harm results to the patient. The patient should be put on a fluid diet again if solids have been allowed, and the bowels should be well opened with saline aperients. The symptoms usually subside after the bowels have been well opened. Pain often accompanies the symptoms, and is best treated by hot fomentations, and, if necessary, by the use of morphia.

5. *Recurrence.*—The question of recurrence hardly comes within the scope of this work. Fortunately, with the present improved methods of operating it is not very often seen now, but even after the best operations cases will occasionally occur. In the case of hospital patients,

many of whom are navvies, whose work entails the lifting of heavy weights, often with the knees bent, and who can seldom afford to keep away from their work for a sufficient time after the operation to insure the best results from it, it is not surprising that recurrence is sometimes seen ; indeed, it is a matter of surprise that the results under these circumstances are as good as they are.

After-Treatment of Hysterectomy.

This differs very little from that of any other abdominal section.

Retention of urine is common after any operation on the uterus or pelvis, and the greatest care must be exercised in relieving it by the catheter, as cystitis is readily set up and seriously complicates the after-treatment. The catheter should be passed frequently—every five or six hours—to prevent the bladder from becoming distended, as this will result in much discomfort to the patient. An attempt should be made to get the patient to pass her water while lying on the side. As already stated, many women are unable to pass their urine while in the dorsal recumbent position, and in consequence there is apt to be a collection of residual urine in the bladder even when the catheter is in use.

The vagina must be kept as clean and aseptic as possible after the operation. This is best done by daily gentle irrigation with some mild antiseptic solution. A pad of cyanide gauze well dusted over with some antiseptic powder should be kept over the vulva and changed twice a day.

Operations on the Kidney.

SPECIAL COMPLICATIONS.—(1) Uræmia; (2) severe pain; (3) vomiting; (4) high temperature; (5) pulmonary embolism.

The after-treatment of these cases is practically the same as for laparotomy. When a drain has been placed in the loin, frequent changing of the dressings will be necessary to keep the patient dry, and if there is a tendency for the skin round the wound to become sore from the constant irritation of the discharge, a little ointment should be smeared over the skin to prevent this. After nephrectomy everything that is possible should be done to diminish the work of the remaining kidney until it has become accustomed to the new conditions. The diet should be bland, and all highly nitrogenous diets are best avoided, as they will give the kidney more work to do in excreting urea than would less nitrogenous diets. Morphia or opium in any form is best avoided, as it tends to diminish urinary secretion. The skin and bowels should be kept acting, so as to relieve the work of the remaining kidney. The amount of urine passed per diem should be measured and charted, so that any diminution in the quantity may be noticed at once.

1. *Uræmia.*—When the excretion of urine diminishes and uræmia threatens, the case should be treated in the same way as for an ordinary case of uræmia—that is to say, the skin must be made to act by the use of hot-air baths or pilocarpine, and the bowels must be kept acting freely. The application of hot fomentations over the healthy kidney is often useful.

2. *Pain* does not always occur, but may be very severe. It is generally of a shooting character, running down into the groin and inner side of the thigh on the same

side. Sir William Bennett has pointed out that when this pain is present in a marked degree after the kidney has been stitched into the loin (nephrorrhaphy), a nerve has probably been included in the suture. On one occasion, when the pain was especially severe, he found this to be the case. The advisability in such a case of opening the wound and dividing the suture will have to be considered.

Slight renal colic may occur after some operations on the kidney, especially nephrotomy, and is due to the passage of blood-clots down the ureter. This is best treated by hot fomentations, etc. Morphia must not be given if there is any uncertainty as to the condition of the other kidney. If, however, it is known that the other kidney is healthy, and there has been no diminution in the amount of urine excreted since the operation, it may be given with safety.

3. *Persistent Vomiting* after operations on the kidney, and especially after nephrorrhaphy, sometimes occurs, and may accompany the high temperature mentioned below. It is probably due to the same cause. The patient often vomits on and off for some days; the condition is not, as a rule, serious. It is as well to remember the possibility of this complication occurring after operations on the kidney, as otherwise the symptoms may give rise to serious fears of peritonitis.

4. *High Temperature.*—A high temperature is not at all uncommon after the kidney has been much interfered with. After nephrorrhaphy a high temperature may persist for a week or longer, the temperature often varying from 100° to 103° F. This is probably due to interference with the sympathetic nerves. It need not give rise to alarm, and it is not accompanied by any inflammatory condition. The temperature rises directly

after the operation, and remains up.   Should the tempera-
ture, however, be normal or subnormal for the first few
days and then rise, it will not be due to this cause, and
sepsis must be suspected and the wound examined,
and, if necessary, opened.   The patient may, while the
temperature persists, feel flushed and uncomfortable.

5. *Pulmonary Embolism.* — This is, fortunately, a rare
complication.   For treatment, see Chapter VI.

CHAPTER XIV

OPERATIONS ON THE GENITO-URINARY TRACT

ONE of the most important things to be attended to in the after-treatment of operations on the genito-urinary tract is to keep the patient dry. There is a great tendency for the dressings to become soaked with urine, and if such dressings remain long in contact with the skin, especially of old men, it is very liable to get raw and inflamed. To prevent this the dressings should be frequently changed, and mackintosh sheets should be arranged round the ends of the tubes, etc., to prevent, as far as possible, the urine getting on to the dressings. It is well to keep the skin round the wound powdered with starch or boracic powder, and to keep large pads of absorbent wool tucked in between the loins and the bed on each side.

The best way to alleviate pain after these operations is by means of suppositories of morphia and belladonna, though the use of opium in any form is best avoided in cases where the kidneys have been interfered with or where they are thought to be diseased. The bowels should always be kept acting loosely for some time after the operation. One of the most important things to assure success in these operations is to keep the urine sweet and to prevent acidity. For this purpose some

drug should be given which is excreted in the urine as an antiseptic. Of these there are several. Boracic acid or salol, given in 10-grain doses three times daily, may be used, or urotropine, in 5 to 10 grain doses in an ounce of water, three times daily. Where the urine, in spite of these precautions, remains foul, and cystitis is present, the bladder should be washed out twice a day with some mild antiseptic, as boracic, hazeline, etc.

The use of stronger antiseptics than this is not advisable, as they often give rise to a considerable amount of pain, and are liable to make the cystitis worse. Where the cystitis will not improve with this treatment, nitrate of silver may be used with advantage. Very dilute solutions should be used to commence with (1 in 4,000, increasing up to 1 in 800). In washing out the bladder, only 2 or 3 ounces of fluid must be injected at a time and allowed to run out again, this being repeated until the solution comes back quite clear. The solution should be at a temperature of about 100° F. The best apparatus for washing out the bladder is a soft rubber catheter on the end of a glass funnel.

When the urine is very alkaline, benzoate of ammonium can be combined with the boric acid in 10-grain doses three times a day by the mouth, or urotropine may be used. When the urine is very acid, bicarbonate of soda, in 10 or 20 grain doses, should be given by the mouth, either alone or combined with one of the other drugs mentioned above until the urine is rendered neutral.

CATHETER FEVER. — After any operation on the urethral tract, or after the passage of instruments, etc., the so-called condition of catheter or urethral fever is liable to occur. It usually comes on during the first thirty-six hours, though it sometimes occurs after the removal of an instrument that has been tied in at the

operation, and it is well to be on the look-out for this. It often follows the first act of micturition after the operation. The patient shivers, and has a rigor, followed by a hot stage and profuse sweating; this condition soon passes off in the majority of cases, and is not dangerous unless followed by suppression of urine, which is very rarely seen, and practically only occurs when the kidneys are diseased—10 grains of Dover's powder, administered before the operation, will usually prevent the occurrence of these unpleasant symptoms. If a large catheter has been tied in after the operation, the same powder, given that night, will often facilitate its removal next day, and add to the comfort of the patient; or an excellent plan is to remove the instrument while the patient is sitting in a hot bath. This is a good plan whenever large instruments have to be passed or withdrawn from irritable urethras. In order to prevent the occurrence of this complication after operations on the urethral tract, Mr. Freyer* recommends that a draught containing quinine (5 grains) and liquor opii sedativus (15 minims) should be administered on recovery from the anæsthetic, and quinine (10 grains) given daily for two or three days afterwards.

Occasionally a much more severe condition of this fever is seen. There are repeated attacks of fever, accompanied by high temperature and rigors, or the fever is more or less sustained, and the patient gradually sinks into a low state, with feeble pulse, etc. This is more common in old patients and those who have had a cystitis previous to the operation, or some other septic focus in or near the field of operation. The condition is probably a septic one, and must be treated on those

* 'Operations on the Urethra and Prostate.'

lines. The great danger is suppression of urine and uræmia. When this occurs, it must be treated by purgation and sweating, and, of course, opium in any form must be absolutely avoided.

The best way of treating this severe type of urinary fever is by preventing its occurrence, and it ought to be very rare if proper care is taken. Unfortunately, the whole genito-urinary tract is in a septic condition in some of these cases, especially when dealing with old and neglected prostatic trouble, and it is in such cases that it is most commonly seen.

DIET.—The main object in dieting is to keep the urine neutral and prevent acidity ; therefore it is well to avoid nitrogenous foods as far as possible, and starchy foods should be given. For the first few days after the operation the diet should be a light one, and plenty of fluids may be allowed with advantage, as this helps to wash out the genito-urinary tract. In old and debilitated subjects it is so important to keep up their strength that a low diet is not advisable, and it should be sustaining from the first, and combined with stimulants of a suitable nature.

Suprapubic Cystotomy.

COMPLICATIONS.—(1) Pelvic cellulitis ; (2) suppression of urine ; (3) epididymitis.

Suppression of urine has been already mentioned under catheter fever. It is a condition calling for prompt treatment. The main indications are to relieve as far as possible the congestion of the renal tissues by leeches to the loin, and purgation, and at the same time to encourage the excretion of the urea, etc., by the skin and bowel, so as to tide the patient over the dangerous period while the kidneys are not acting.

Hot antiseptic baths of boracic or very weak perchloride are a good way of dealing with complications occurring after operations on the urinary tract when the patients are strong enough to stand them; but they are sometimes dangerous in old people, and in any case a competent attendant must be present. It is most important to keep the patient as dry as possible, and this often necessitates very frequent dressings. When this soaking of the dressings and skin by the urine gives rise to much trouble, it is a good plan to arrange a catheter bent into the shape of a siphon with the end inside the drainage-tube, and a long piece of rubber tube attached to the other end and passing into a receptacle containing some antiseptic at the side of the bed. A special siphon drainage-tube for this purpose is shown in Fig. 22.
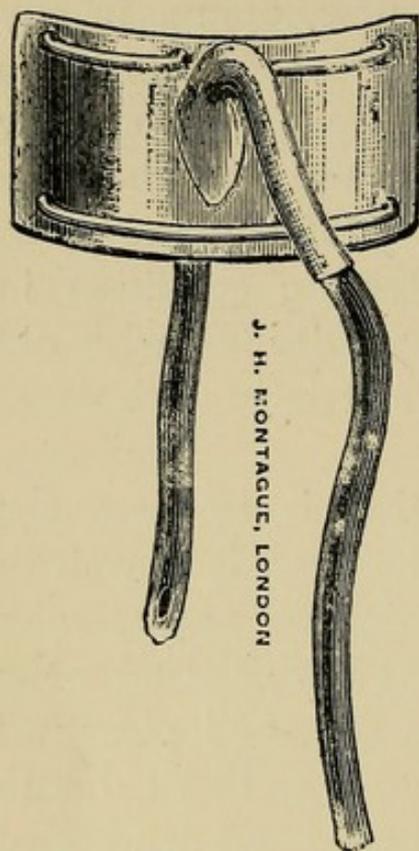
Fig. 22.

J. H. MONTAGUE, LONDON

Unless the operation has been done to establish a permanent drain above the pubes, the drainage-tube should be removed at the end of the first twenty-four or forty-eight hours, and a smaller one substituted which only passes down to, and not into, the bladder. This must be shortened every day, to allow of the wound healing from the bottom.

Lithotrity.

COMPLICATIONS.—These are the same as for cystotomy, but there is a greater liability to urinary fever and epididymitis. The patient should be kept in bed for the

first few days, and it is often advisable to keep him in bed for a week or ten days. He should be instructed to turn on to the side to pass water. Hot fomentations to the abdomen are very comforting to the patient during the first twenty-four hours, and morphia or some opium preparation may be administered if there is pain. The patient should be allowed to sit in a hot hip-bath for fifteen or twenty minutes two or three times a day, and instructed to try and pass his water while in the bath. It is sometimes necessary to draw off the urine by means of a catheter for the first few days. Quinine or salicylate of soda may be administered by the mouth, and will do much to prevent the occurrence of fever. Morphia suppositories are very useful in relieving pain after the operation.   The diet for the first few days should consist of milk, barley-water, and be combined with stimulants, if necessary.   Mr. Jacobson says :* ' It is advisable to once more thoroughly wash out the bladder with the evacuator a week after the operation, as a safeguard against recurrence from small fragments left behind at the operation.'

Internal Urethrotomy.

COMPLICATIONS.—(1) Hæmorrhage ; (2) urinary fever ; (3) epididimytis.

Hæmorrhage is more likely to occur after the operation has been done with Maissoneuve's instrument than with Sir H. Thompson's, as the former cuts the roof of the urethra. If bleeding does occur, it is best treated by tying in a catheter ; if this proves insufficient a perineal bandage should be applied with a suitable pad so as to compress the bulb of the penis against the catheter.

* ' The Operations of Surgery,' 1903 edit., vol. ii.

Many surgeons tie in a large catheter after the operation, and leave it in for twenty-four hours; if this has been done it should be removed in a hot bath, and a large instrument, preferably a steel sound, passed every two days at first, and at the end of ten days or a fortnight the patient may be taught to pass it for himself, and told to do so once a week at first, and later at more distant intervals for some months to prevent recontraction of the scar in the urethra.   Some surgeons, on the other hand, prefer not to pass any instrument till after the wound has healed, which will be in about ten days or a fortnight, and then to pass steel dilators (Mr. Freyer recommends Nos. 13 to 15, English gauge) so as to insure the urethra being well dilated, and then to let the patient pass the instrument for himself at intervals for some months afterwards.

Circumcision.

The dressing is usually a matter of some difficulty in these cases, as it is difficult to get it to keep on, and it easily becomes soiled.   Dry gauze and collodion makes an excellent dressing if the wound heals aseptically, but is extremely troublesome to remove, and sometimes causes pain; it is also very painful if erections occur.   A very good way of dressing these cases is to wrap a narrow piece of dry cyanide gauze round the penis at the site of the wound, and then to put a larger strip over the top of this and overlapping it.   A pad of absorbent wool about 2 inches thick and large enough to cover the whole perineum and come well up into the abdomen is next taken, and a hole is made in it with scissors just large enough to admit the penis; the penis is placed in this hole, and then the pad of wool fixed on by taking two or three turns of bandage round the body and thighs.

This protects the penis, and adds very materially to the patient's comfort.

In hospital practice a very good dressing is made with strips of lint soaked in lotio plumbi (diluted one half) wrapped round the penis, and secured to the abdomen by a strip of plaster. The mother is given some of the lotion and instructed to keep the lint moist with it, or carbolic oil may be used in the same way. The patient should be kept in bed for the first forty-eight hours, and on the day after the operation he should sit in a warm bath and soak off the dressings, a new dressing being applied afterwards; this should be repeated each day till the wound has healed. If there is much swelling and œdema after the operation, the bath should be used twice daily and weak lead lotion applied.

After operations on adults it is advisable to administer a dose of bromides at night for the first few days to prevent erections. The patient should keep his bed for the first two days, and remain resting on a sofa for a week, and when he first begins to get about should keep a large pad of wool round the penis to prevent its being knocked, etc. If catgut sutures have been used they may be left to come away of themselves, otherwise the stitches should be removed one or two at a time.

Radical Cure of Hydrocele.

The drainage-tube should be removed in twenty-four hours, and the wound sealed up with collodion. Pressure should be maintained by means of wool and bandaging over the wound so as to prevent the collection of blood or serum in the scrotum, and to promote rapid healing by keeping the sides of the wound cavity in contact. Care must be taken to keep the scrotum well up on to the

pubes; this prevents œdema of the scrotum and pain, and assists to keep the dressings clean. For this purpose the best thing is a small cushion placed between the legs so as to support the scrotum, or a suspensory bandage made of gauze and pulled up firmly is an excellent plan. Some of the stitches may be removed on the fourth day, and the remainder a few days later; the patient should remain in bed for ten days or a fortnight, and should wear a suspensory bandage for some months.

Varicocele.

The treatment is the same as for the above, but no drainage being necessary, the wound should not be examined for five or six days, when the stitches may be removed. The patient may be allowed to get up in a week or ten days. A suspensory bandage should be worn for two or three months after the operation.

CHAPTER XV

OPERATIONS ON THE RECTUM AND COLOTOMY

Operations for Fistula.

COMPLICATIONS.—(1) Formation of fresh sinuses; (2) wound not healing properly.

The dressing should be changed on the day after the operation and the parts bathed with carbolic lotion. If a plug of wool or gauze has been placed in the rectum it should be removed at the end of twenty-four hours, otherwise it will cause much discomfort by preventing the escape of flatus. The bowels should be kept confined for about three days after the operation, and then a smart purge should be administered. The diet should consist principally of slops until the bowels are opened, and then ordinary diet may be allowed. The bowels should be kept acting regularly and loosely while the wound is healing by means of salts administered in the morning, or any laxative that the patient is accustomed to. Each time after the bowels have acted, the parts round the wound and the wound itself should be syringed with some antiseptic lotion, such as carbolic acid, Sanitas, etc. A little wool or lint smeared with some mild ointment or vaseline should be placed in the wound daily to prevent the accumulation of discharges and the prema-

ture closure of the wound. On no account must the wound be packed tightly.

When there is much irritation round the wound, Mr. Allingham advises that olive oil should be used as a dressing.

A very excellent plan when it can be carried out is to let the patient sit in a warm bath daily for from twenty minutes to half an hour ; some antiseptic may be added to the bath-water, such as boracic acid or carbolic, if it is thought desirable. The patient should not be allowed to walk about much until the wound has healed ; he need not, however, be kept in bed, but can be got up on a couch after the first few days. Walking or standing before the wound has healed is very apt to considerably prolong the time before healing takes place.

It is necessary to be on the look-out for the formation of fresh sinuses. This may be suspected if the patient some time after the operation complains of fresh pain in the neighbourhood of the wound. Increase in the amount of discharge is also often a sign of burrowing, and the sinus must be searched for and opened up at once. The exact position of a fresh sinus can often be detected by noticing beads of pus oozing up when the wound is pressed upon. When the wound does not seem to be healing kindly and the formation of granulations is deficient, it should be stimulated by suitable ointments or lotions ; Friar's balsam often makes a good dressing under these circumstances.

The Operation for Piles.

After this operation patients not uncommonly complain of a good deal of pain. This is more likely to be the case if the sphincters have not been thoroughly dilated

at the operation. In order to prevent this pain, many surgeons place a ½-grain morphia suppository in the rectum before the patient leaves the table, or a hypodermic injection of morphia may be administered after the patient has been got back to bed.   Hot fomentations or hot bottles applied to the lower part of the sacrum are often valuable in relieving the pain. The diet at first must be light and of such a nature as to leave very little solid residue—tea, bread-and-butter without the crust, soup or broth, jellies, boiled fish, etc. If a plug has been placed in the rectum, it should be removed on the day after the operation and a little ointment smeared over the anus—a piece of wool smeared with the same may be pushed just within the sphincters ; this will prevent the raw surfaces coming in contact, and will make the patient more comfortable. The bowels must be kept confined until the third or fourth day, and then a purge should be administered. For this purpose 1 ounce of castor oil is as good as anything, or, if the patient objects to taking this, the following pill may be given :

    ℞   Pil. hydrarg.   -   -   -   - gr. ii.
        Pil. col. et hyoscyami   -   -   - gr. v.

About five hours after the purge or just before it is expected that the bowels will act, an enema may be given. This may be either a common soap-and-water enema, or one consisting of 3 or 4 ounces of olive oil. It is a very good plan to paint the anus over with a solution of eucaine or cocaine about five minutes before giving the enema.   An enema, if carefully administered in this way, is not painful, and insures the first motion being soft and unirritating. If the bowels do not act properly the bowel should be examined with the finger for the presence of scybala. After the bowels have acted, the

parts should be douched with a 1 in 50 solution of carbolic acid; when there is any pain, a hot fomentation may be applied to the perineum. The bowels should subsequently be kept acting loosely by the administration of salines and enemata until the wounds have healed, and constipation must be particularly avoided. It is safer to insist upon the first few motions being passed in the recumbent position, though when the piles have been treated by ligature there is no objection to allowing the patient to sit up for the purpose of defæcation if he finds it difficult in the recumbent position. For the treatment of hæmorrhage after this operation, see p. 50. If ligatures have been used, they generally separate between the fifth and tenth days, the average being the eighth day. The patient should not be allowed to get up until all the ligatures have come away; he may then be allowed to recline on a couch or easy-chair, but should be more or less restricted to the horizontal position until on examination all the wounds are found to have healed. At this time the anus should be gently dilated with the finger or a rectal bougie daily to prevent any tendency to contraction of the orifice. This is particularly important when a large number of piles have been removed.

Retention of Urine.—This is very common for the first day or so after all operations on the rectum, and more particularly if the anterior wall has been interfered with —as, for instance, by the ligature of a pile in this situation. The patient should be encouraged to try and pass his water naturally if possible, and may be allowed to kneel up in the bed for the purpose. Should he still be quite unable to pass his water, a soft Jaque's catheter may be passed and the urine drawn off. The retention often lasts for several days or a week.

Operations for Fissure, etc.

The after-treatment is practically the same; the recumbent position should be maintained until the wound has healed.

After excision of the rectum the treatment will be very similar, but the period before healing is complete will be longer as a rule, and more frequent dressing will be necessary. Allowing the patient to sit in a warm bath for some time each day is often of great assistance in keeping these wounds clean.

Colotomy.

After the operation the patient should have a small pillow placed under the head and a bolster under the knees. If he complains of being uncomfortable from lying on the back, he may be allowed to turn on the side, providing that he does not turn on to the side on which the colotomy wound is situated. Very little food should be given until the intestine has been opened, though a little fluid diet may be allowed. Old people should be well propped up, almost into a sitting position, as this will prevent any tendency that they may have towards bronchitis, etc.

If the patient is comfortable the wound need not be dressed on the day after the operation. On the second day it should be dressed, and the intestine opened for about 1 inch in a transverse direction with a pair of scissors. After this it is a good thing to open the bowels with a mild purgative, such as $\frac{1}{2}$ an ounce of castor oil. On the tenth day the intestine must be completely divided in a transverse direction, and the clip, or whatever has been used to form the spur, removed. After this a pad

should be applied to the wound, and a firm bandage applied over it to push back the gut and get it to retract back flush with the skin. There is often a little bleeding after the gut is divided. This bleeding generally comes from numerous small points, and if attempts are made to sponge away the clots and clip the vessels, they are often not only unsuccessful, but may result in the bleeding being made worse. The best thing to do is to put on a pad of wool, and exert firm pressure with a bandage over the wound. This is all that is usually necessary. Of course, if there is any vessel spurting, it should be caught in a clip, the clip either being left on or the vessel tied in the usual way. If the incision is made at right angles to the line of the gut, there is seldom any bleeding of moment. When no spur has been formed, it is sometimes not easy to find the gut when it is desired to open it, as it is covered in lymph, and may be unrecognisable. Under these circumstances an incision must be made with a knife into the centre of the wound, until, by the escape of flatus, it is known that the gut is opened, and then the incision may be enlarged with scissors to the required size. The division of the intestine is quite painless. After the gut has been opened, the colon should be well cleared of any accumulated fæces it may contain by suitable purgatives. After this has been done however, it is best not to make use of purgatives at all, unless absolutely necessary, as they are very liable to set up a sort of diarrhœa, and cause soreness of the skin round the wound.

If there are fæces in the lower and now useless portion of the colon, they may be washed out by syringing through from the upper opening, or by enemas. In about a fortnight from the operation the wound will be sufficiently healed to have a colotomy belt fitted. The

best sort of belt is that with a celluloid cup fitting over the opening in the intestine, and kept in place by a belt with an indiarubber interval in it where the cup comes. These belts are much more comfortable than those with a plug fitting into the gut, and are quite as efficient in preventing the escape of fæces. The same remarks apply equally to both lumbar and inguinal colotomy.

REFERENCE.

' Diseases of the Rectum ' : H. W. Allingham.

CHAPTER XVI

OPERATIONS ON THE JOINTS

THERE are some features with regard to operations upon joints that require special notice. There are probably no operations in surgery after which sepsis is more dreaded or more prone to occur, if the most rigorous precautions are not taken, than those upon joints. The most scrupulous care is necessary in the dressing and after-treatment of these cases to prevent the possibility of organisms gaining an entrance and setting up sepsis. Again, it is of the utmost importance that the joint should be functional after the operation—that is to say, should be capable of free and painless movement, and, in the case of the leg, able to support the weight of the body—except, of course, in those cases where the joint is hopelessly disorganized, and the operation has been undertaken with the object of obtaining a stiff joint, as in the case of excision of the knee for tubercle.

After the cavity of a joint has been opened, or the synovial membrane interfered with, there is a great liability to the formation of adhesions, which, if they form, may lead to more or less permanent crippling, and will, in any case, result in much pain to the patient. Although these adhesions can often be got rid of satisfactorily later, it is much better surgery to prevent

their forming at all. It should therefore be our object to prevent the formation of adhesions by moving the joint slightly each day from the earliest possible date.

After such operations as wiring the patella for fracture and the removal of a fractured or loose semilunar cartilage, movement of the joint should be commenced on the second or third day after the operation. In order to move the joint, the bandages and outer dressings must be removed, and the attendant should then pass his hand (we will assume that he is dealing with the knee-joint) under the knee, and gently raise it off the back splint, while with the other hand he holds the dressings in place, and supports the wound by firm pressure, so that no tension is put upon the skin in the neighbourhood of the wound. On the first occasion the joint should only be moved slightly two or three times, the knee being gently raised, and then allowed to assume its original position by its own weight. At the same time the patella should be moved from side to side, so as to prevent the formation of adhesions between it and the anterior surface of the femur.

This must be repeated each day, and at the end of a week the patient should be made to move the joint for himself, the attendant at most only steadying the limb and dressings. The joint at this period should be moved through a much larger angle than at first. The use of the splint can be dispensed with as a general rule by the end of the first week. At the end of ten days, when the wound should have healed, the stitches can be removed, and a dressing of collodion and gauze applied in such a way as to hold together the edges of the wound and so support the scar, and prevent its being stretched during movement of the joint.

The patient should now be encouraged to move the

joint as much as possible, and a very good plan in the case of the knee is to let the patient sit on the edge of the bed with the leg hanging over the edge, and the foot resting on a stool of appropriate height; he must then raise the foot off the stool by extending the knee, and then slowly lower it back again on to the stool; this should be repeated for fifteen minutes twice a day.   At this period massage to the muscles moving the joint (in this case those of the leg and thigh) is very beneficial, both in keeping up the tone and development of the muscles and in getting rid of any adhesions that may have formed.   The scar should be moved from side to side on the deeper tissues each day to prevent it from becoming adherent to the bone, which otherwise is very likely to take place and be the cause of pain later on. After the removal of a loose semilunar cartilage from the knee there is often a tendency for the scar to become adherent to the inner condyle of the tibia, and if this is allowed to take place a considerable amount of pain and disability may result.

After the operation for loose semilunar cartilage or fractured patella, the patient may usually be allowed to walk at the expiration of three weeks or a month.   It is not advisable for the patient to wear any sort of support to the knee after the splint has once been dispensed with, as any support tends to limit movement and prevent the proper development of the muscles supporting the joint, on the integrity of which the subsequent stability or otherwise of the joint mainly depends.

Excision of the Elbow.

After excision of the elbow-joint our object is to form a 'false joint,' and therefore movement must be com-

menced early. The best plan is to fix the arm in a
metal outside splint with a joint opposite the elbow and
with a thumb-screw, so that the splint can be fixed at any
desired angle at will, or by loosening which the splint
can be made to move with the arm. Each day the
thumb-screw can be loosened and the joint moved with-
out removing the splint; the splint must, however, be
removed from time to time, so as to allow of movements
of pronation and supination being carried out. In these
movements, while the wrist is being rotated the surgeon
must fix the ulna, to insure the movements taking place
correctly. At first the joint should be only slightly
moved, commencing about a week or ten days after
the operation, and all movements must be very gentle.
As the wound heals the movements should be extended
until they are free in all normal directions. The hand
should be left free from the first, and the patient en-
couraged to use the fingers and wrist freely.

As soon as ever the parts are sufficiently firm to allow
of it, the splint should be left off and the patient made to
use the limb; the arm can be kept in a sling for part of
the day at first, and a sling should be used as a protection
against injury while out of doors for some months.
Later on, when the parts have thoroughly consolidated,
massage and regular exercises in a gymnasium are very
useful in getting back power and free movement in the
arm.

It will probably be several months before real stability
of the new joint is obtained, but in favourable cases the
patient should at the end of three or four months be able
to use the limb for all ordinary purposes. Special care
must be taken to see that the patient is able to get the
hand up to the back of the head, as this is often difficult
at first, and later on the patient will find it no trifling

inconvenience not to be able to get his hand up to the back of his neck for the purpose of doing up a collar-stud, etc.

Excision of the Shoulder.

After excision of the shoulder movement should be commenced early and carried out in the same way as in the case of the elbow, but it is particularly important to insure the movements taking place between the humerus and the scapula, and not between the scapula and the trunk. The surgeon should fix the scapula by holding the angle firmly with his fingers, and then move the arm or instruct the patient to do so for himself; if this precaution is not taken, the movements, and especially that of abduction, are almost certain to take place between the scapula and the trunk instead of at the shoulder-joint.

The success or otherwise of most operations on the joints depends to such a large extent upon the care with which the movements are carried out during the after-treatment, that too much care and patience cannot be expended upon them ; and in the case of children, who form the largest percentage of the patients, much patience and perseverance is often necessary in order to obtain the desired result. A certain amount of pain is generally caused by the movements at first ; and if this is sufficiently severe to warrant it, an anæsthetic may be given occasionally to insure that free movement is obtained.

Excision of the Knee.

Here, in contradistinction to the case of the arm, our object is to obtain bony ankylosis, and a properly fitting splint which will not allow the bones to get out of position is of the greatest importance. For this purpose

there is probably no better splint than Howe's splint, though any form of well-fitting interrupted splint will do. There is often a considerable amount of pain after all excisions, and, in fact, after all operations involving the cutting of bone. Morphia must be given for its relief, and in the case of young children, to whom it is not advisable to give morphia, a few drops of laudanum, varying according to the age of the patient, should be given in a glass of water. Raising the limb, and especially slinging it well up in a cradle, if the splint will allow of this, often relieves the pain to some extent. It ought not to be necessary to change the dressing for a fortnight after the operation, and then it is often advisable to administer an anæsthetic for the first dressing. This also enables the surgeon to thoroughly examine the wound, and if any recurrent foci are found, to deal with them. At the end of six weeks to two months a well-fitting leather splint, strengthened up the back of the knee with a metal bar, should be substituted for the splint previously used, and the patient can then be got up. In about three months from the operation the patient can usually be allowed to walk, but the splint should be worn for at least a year, and in the case of children for two or three years. In children there is a great tendency for flexion of the knee to take place, and although this can often be prevented by the prolonged use of splints, it cannot always be so prevented, as it is due to the unequal growth of the epiphysis, and in these cases a subsequent partial resection is necessary later on to remedy the deformity.

Excision of the Hip.

After excision of the hip-joint the two most important points that have to be attended to are: (1) To prevent

external rotation of the lower fragment ; (2) to prevent flexion of the hip-joint. In fact, the case has to be treated in very much the same way as for fracture of the neck of the femur.

It is generally advisable to apply an extension by weight and pulley to the foot of the affected limb. The extension strapping should always be carried above the knee, and in children it is better to affix longitudinal pieces of strapping up the sides of the limb and to bandage over these with an ordinary bandage, afterwards applying circular strips of strapping in two or three places so as to prevent its coming undone. The upper ends of the side-pieces should be turned down on themselves, and fixed with strapping so as to prevent their drawing through. This is much less irritating to the delicate skin of a child than applying strapping all the way up the limb. A long Liston or Dessault's splint should be applied from the axilla to the ankle, so as to prevent flexion at the hip. In young children it is better to use a Phelps's box-splint or a double Thomas's splint. If a long splint is applied it must not be put on so tightly as to interfere with the extension. The body should be steadied by passing a sheet across the trunk and holding it in position with sand-bags on each side of the body, the sand-bags being rolled up in the sheet on each side. To prevent rotation of the limb a cross-bar should be attached to the long splint just above the ankle, or a very good plan is to fix a flat piece of wood at right angles across the back of the knee with plaster of Paris bandages. In some cases the limb can be kept from rotating by the use of a sand-bag placed on each side of the thigh.

The limb after excision should be fixed in a position of slight abduction, as this enables the patient later on to

overcome the shortening of the limb, which of necessity follows excision by tilting the pelvis down on the affected side. It is often possible to obtain a more or less movable false joint after excision of the hip by moving the joint two or three times each week after the wound has healed.

At the end of five or six weeks a Thomas's hip-splint, if it has not been used from the first, may be fitted, and the patient can then be got out of bed. No weight, however, should be borne on the limb for several months even with the splint on. If the child is old enough he may be allowed to get about with crutches and a pastern on the boot of the sound leg. In young children it is better to fit a double Thomas's hip-splint with a pelvic band. After the Thomas's splint has been fitted, the patient should be got out of doors for several hours daily if possible. Some surgeons prefer to use a splint of plaster of Paris or leather, which encircles the pelvis and comes down below the knee. The use of removable splints is, however, always preferable to the use of fixed splints; when a Thomas's splint, however, fails to keep the limb in good position, a properly-fitting leather splint may be tried.

Regular massage of the muscles is of the greatest benefit in preventing wasting and in maintaining the proper nutrition of the limb after excision of the hip when the circumstances of the patient will allow of its being carried out. All the muscles of the limb should be massaged regularly two or three times a week throughout the treatment if possible, and when a false joint is desired suitable movements may be combined with it.

The after-treatment of osteotomy undertaken for the relief of deformity, as in the case of coxa vara or genu

valgum, is practically the same as the treatment of a fracture of the bone in this situation.   Special care should be taken to see that the movements of the joint in the vicinity of the operation are maintained during the period of rest necessary for the consolidation of the bone.

CHAPTER XVII

THE AFTER-TREATMENT OF AMPUTATIONS, AND SOME SPECIAL OPERATIONS

After-Treatment of Amputations.

COMPLICATIONS.—(1) Shock ; (2) hæmorrhage ; (3) pain ; (4) adherent cicatrix ; (5) conical stump ; (6) persistent sinus.

After the operation the stump should be elevated as much as possible and steadied with sand-bags, as spasm of the muscles is very apt to take place, and this will tend to displace the dressings ; this spasm of the muscles can be relieved to some extent by applying a very hot rubber water-bottle to the outside of the bandages, and by the use of morphia injections. As a rule, the dressings require changing on the day following the operation, as there is generally a considerable amount of oozing during the first twenty-four hours ; the drainage-tube should be removed as soon as ever the amount of oozing is sufficiently diminished to warrant it. A kind of dark-brown discharge, which probably comes from the end of the bone, not infrequently persists for a considerable time in unhealthy individuals, and in these cases the drainage-tube must be retained longer.

After the wound has almost healed and the stitches have been removed, it is advisable in many cases to apply

some sort of support to the flaps to prevent stretching of the scar, and to hasten healing and consolidation of the end of the stump. This is particularly the case when a large muscle flap has been formed, as in Faraboeuf's amputation of the leg, Teal's amputation, and most amputations through the thigh.

The edges of the flaps should be drawn together by large broad pieces of strapping ; the tissues of the stump being well drawn down over the bone before the free
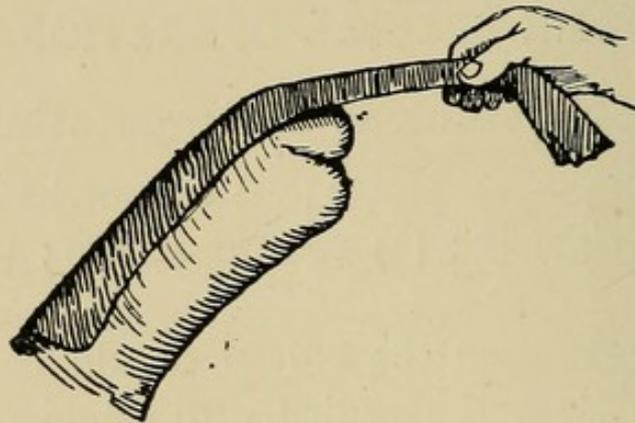
FIG. 23.—METHOD OF APPLYING STRAPPING TO THE STUMP.

end of the piece of strapping is fixed. The stump must next be bandaged from above down—that is, towards the extremity, so as to draw down and support the muscles, and prevent them from pulling the skin and tissues tight over the end of the bone. A linen bag made to fit the stump like a sock should then be placed over all, and fixed by tapes round the waist or joint above the amputation. If no such bag is obtainable an ordinary stump-bandage may be applied. An excellent description of the methods of bandaging stumps after amputation will be found in 'A Manual of Surgical Treatment,' by Cheyne and Burghard.

Pain.—The pain after amputations is usually of a neuralgic type, and is probably due to the contraction of the scar tissue at the ends of the nerves, which have been

cut; these attacks of neuralgic or starting pains often persist for several months after an amputation, and then gradually cease. At first they often cause the patient considerable distress, but this varies very much in different individuals. Hot water-bottles or hot stupes applied over the main nerves above the stump will often relieve the pain; thus in the case of the leg the heat should be applied over the sacral region or upper part of the back of the thigh, and in the arm over the clavicle and scapula.

Adherent Cicatrix.—This is a most troublesome condition, and should be prevented by gently moving the scar on the deep tissues daily after the wound has healed; the patient can easily do this for himself. If the cicatrix is allowed to become adherent, it is often the cause of constant pain and tenderness at the end of the stump, and not infrequently results in chronic and intractable ulceration of the scar later on. Should the cicatrix become adherent, an attempt may be made by gentle massage to loosen it from the bone; and if this is ineffectual, the scar must be loosened by cutting it away from the bone with a tenatome, and then moving it frequently to prevent it again becoming adherent.

Conical stump is generally the result of a faulty operation, but in children is liable to occur, however carefully the amputation has been planned. This is due to the growth of the bone, the latter tending to grow through the end of the stump. It may be to a large extent prevented by massage, the stump being massaged towards the end, and not towards the body, care being taken at the same time to prevent the scar from becoming adherent; or the stump can be bandaged in the way already mentioned to draw down the muscles.

Persistent sinus after amputation is generally due to

some deep stitch or ligature acting as a foreign body, or to a piece of necrosed bone; in either case the cause must be sought for and removed.

As soon as the wound has thoroughly healed, which will usually be about a month after the operation, the patient should be measured for an artificial limb. In the leg (with the exception of Syme's and Stephen Smith's amputations), with but few exceptions, patients are never able to bear any weight on the end of the stump, nor is it advisable that they should do so; the weight is taken on the pelvis from the upper end of the socket, and the end of the stump should not come into contact with the end of the socket, but should be free except for contact with the sides. In a below-knee amputation the weight is taken on the sides of the head of the tibia and on the condyles of the femur.

So that no harm to the stump need be anticipated from fitting an artificial limb at an early date. There is another objection that is commonly brought forward against having an artificial limb fitted at an early date, namely, that so much contraction of the stump takes place after an amputation that the fit of the socket soon becomes loose, necessitating a new limb. This is not the case. It is true that a good deal of contraction does occur and renders the fit loose ; but this will take place however long a period is allowed to elapse before fitting the limb, as a considerable amount of the fat in the stump disappears after the limb has been worn for a short time, and this makes the socket fit loosely. On the other hand, it is most important if the patient wishes to use the artificial limb with success that he should commence to use it before the muscles moving the stump have had time to waste and form adhesions. In order that the patient may obtain the best results

from the use of an artificial limb, the muscles acting upon the stump will have to be trained to their new function; and if they have been allowed to waste to any considerable extent very great difficulty will be experienced in getting these muscles to fulfil their new function. The result will be that many patients will give up the attempt in despair, and remain more or less hopeless cripples for the rest of their lives. This is a most important point, especially in old people, who often have neither the pluck nor the adaptable musculature of youth.

A very considerable time is usually necessary before a patient can become accustomed to the use of an artificial limb, and especially is this the case with the leg, where the weight of the body has to be borne. New centres of equilibrium have to be developed in the brain and spinal cord, muscles have to take on unaccustomed functions, and parts previously free from pressure have to bear very considerable pressure without causing pain or becoming sore. Much pluck and perseverance will be required to attain these ends, and it is of primary importance that such a serious check as wasted muscles should not be added to the other difficulties. Should the stump shrink much after the limb has been worn for some time—as is usually the case—it can easily be remedied by having the inside of the socket built up with cork or other suitable material.

A very close fit is not necessary in an artificial leg, and in the case of an arm a close fit can be secured by means of lacing. When the artificial limb is first worn, all bandages must be dispensed with, and if it is necessary to support the scar, a collodion dressing can be used. A woollen sock or socks should be worn over the stump, to prevent the skin from being chafed by contact with the socket.

After-Treatment of some Special Operations: Varicose Veins.

COMPLICATIONS.—(1) Gaping of the wound after the removal of the stitches; (2) sloughing of some portions of the skin edges ; (3) œdema of the leg.

After the operation the limb should be elevated, either by supporting the splint on cushions, or by slinging it in a suitable cradle.   There is no occasion to change the dressings for ten days or a fortnight after the operation, but it is as well to examine them from time to time to ascertain that they have not slipped, and to see that they are not constricting the limb above.   After the stitches have been removed, the edges of the wound should be drawn together with strips of strapping, and the wound itself powdered with boracic powder, and then the leg should be bandaged, from the foot up, with a Domet or flannel bandage.   As a rule, it is not advisable for the patient to be allowed to walk for quite three weeks after the operation, as the wound after these operations on the veins heals very slowly.   In many cases, when the condition of the veins before the operation was bad, it is best to order an elastic stocking to be worn for six months afterwards.   The elastic stocking must not, however, be brought above the knee. Or an excellent substitute for an elastic stocking, and one which is cleaner if the patient is intelligent enough to apply it properly, is an elastic or Velpeau bandage.

Gaping of the wound when the stitches are removed cannot always be prevented, though it is often due to the edge becoming turned in when the wound is being sewn up.   The edges should be brought together as accurately as possible, and held in position with small pieces of strapping.

Sometimes the edges of the wound are so thin and so badly nourished that sloughing occurs. This considerably delays the healing, and it is best, if possible, to keep the patient in the recumbent position for some time longer, or else to prevent movement of the skin by the application of strapping.

Some œdema of the leg is not uncommon after operations on the veins, and especially when the patient is first allowed to get up. Careful bandaging, from the foot up to the knee, is all that is required to prevent this.

Laminectomy.

COMPLICATIONS.—(1) Chest troubles ; (2) distension of the abdomen ; (3) diarrhœa ; (4) bed-sore.

As most of the patients on whom laminectomy has been performed are paralyzed, the greatest care is necessary in the after-treatment, and the most skilled nursing is a necessity. If the intercostal muscles are paralyzed, and the respirations are being carried out by the diaphragm only, chest trouble, usually in the form of moist bronchitis, is very liable to occur. Coughing is, under these circumstances, impossible, and the patient is in great danger of being unable to breathe, owing to the mucus in the lungs obstructing respiration. When this is the case, an attempt may be made to dry up the secretion by the use of drugs, such as belladonna and morphia, and the patient should be turned on to the side, so as to clear one lung. Expectorants must, of course, on no account be given. When the cause of the paralysis is high up in the cord, distension of the abdomen often proves extremely troublesome. The best way of treating this is by the use of the rectal tube, after clearing the lower bowel with enemata. If, as is often

the case, this does not prove sufficient, direct pressure on the abdomen while the tube is in place may be tried. The pressure can either be applied directly with the hands, or by passing a towel round the abdomen and splitting the ends of the towel, the ends being then passed through each other, and pulled upon from opposite sides in such a way as to compress the abdomen. In any case, the pressure should only be exerted during expiration, as otherwise it may so embarrass the respiration as to prevent the patient from breathing. Even after a successful laminectomy the paralysis seldom passes off for some considerable time, and recovery is usually an extremely slow process. The condition of the muscles should be kept up, as far as possible, by the use of massage and galvanism throughout the after-treatment.

There is, of course, in all these cases of paralysis, a great liability to bed-sore and cystitis. The greatest care and attention are necessary to prevent these complications.

APPENDIX

Rectal Feeding.

THIS may be either by means of rectal suppositories or by enemata. Rectal suppositories have become very popular of late on account of the ease with which they can be administered and retained ; but owing to the comparatively small amount of material contained in them, a very large number would have to be given in order to take the place of feeding by the mouth and maintain the patient's weight. A combination of both methods of rectal feeding is probably the best in most cases. If suppositories are used, alternate ones of meat and milk should be introduced every two hours. A little vaseline is smeared on the suppository, and then it is pushed well up the rectum above the internal sphincter. A soap-and-water enema must be given to clear the rectum once a day.

When enemata are used, the lower bowel must be well cleared with a copious warm-water enema administered half an hour before the nutrient. The patient should lie on the left side near the edge of the bed, and have the buttocks raised slightly ; a No. 10 or 12 soft Jacque's catheter should be passed well up into the rectum, a little vaseline or glycerine being first smeared on it to facilitate introduction ; a glass funnel is then attached to the free end of the catheter, and the nutrient enema allowed to flow in slowly. If it is allowed to flow in too quickly there will be difficulty in getting the patient to retain it. After the enema the patient should lie quiet without moving for about an hour.

The quantity of the enema should be from about 5 to 7 ounces of fluid.   If there is difficulty in getting the enema retained, the addition of a little claret or burgundy will often prove effectual, or 10 minims of tinct. opii can be added to the enema.   All nutrient enemata should be digested before being used either with Benger's liquor pancreaticus or any of the numerous other peptonizing materials.   It has been shown that the addition of common salt to egg-albumin renders it capable of absorption by the rectal wall as readily as peptonizing it would do, and it has not the disadvantage of being irritating, as is the case with most of the fluid peptones. All nutrient enemata should be used at body temperature.

The ease with which the different food-stuffs are absorbed by the rectum varies greatly.   Milk is very extensively used as a medium for enemata, although its proteids are not well absorbed by the rectal wall; egg-albumin is well absorbed if combined with a certain amount of common salt.   Raw-beef juice is probably the best absorbed of any of the proteid-yielding foods.   Sugar is well absorbed, but has the objection that it is very irritating to the rectal mucous membrane, and consequently is not well retained; it should only be used in dilute solutions.   Raw starch is very easily absorbed, and has not the same objection as sugar; fats are very slightly absorbed, and are practically useless for rectal alimentation.

The following enemata are easily absorbed, and can be recommended:

(1) White of three eggs.   (2) Ox serum, 5 ounces.
    Milk, 4 ounces.   Milk, 2 ounces.
    Starch (raw), 1 ounce.   Starch, 6 ounces.
    Salt, ½ ounce.

(3) Grape sugar, 60 grammes.
    Milk, 250 c.c.

One of the above enemas should be administered every six hours.

The following nutrient enema is highly recommended by Ewald: Two tablespoonfuls of wheat-flour are stirred up with 150 c.c. of lukewarm water or milk.   To this one or two eggs and a pinch of salt are added, and the

whole is beaten up with 50 c.c. of a 15 per cent. solution of grape-sugar. A little claret may be added.

If no fluids are being administered by the mouth, a large warm-water enema must be given once or twice daily to supply the proper complement of fluid.

Nasal Feeding.

This is most commonly used in children when forced feeding is necessary, and also after certain operations on the mouth, when it is desirable not to allow mastication or swallowing. It is also sometimes necessary after tracheotomy and certain operations on the larynx to prevent food getting into the air-passages. The child should be placed lying down on its back, and an assistant should be at hand to hold the head. A soft rubber catheter Nos. 4 or 6 (according to the age and size of the child) is then passed along the floor of the nose until it reaches the posterior pharyngeal wall, and then it must be pressed steadily on until the stomach is reached; a funnel is attached to the end of the catheter, and a fluid feed allowed to run in slowly, the amount introduced being, of course, the same as would be given by the mouth.

Subcutaneous Feeding.

This is not a very common method of feeding, but is one that in certain cases may prove useful. As an accessory to rectal feeding, it may prove very useful in cases where a patient is failing rapidly from want of nourishment; and in cases where the patient cannot swallow and the rectum has become irritable and will not retain nutrient enemata it can be used for a few days till the rectum has had time to recover. Patients have been kept alive for many days without losing weight by this method of feeding alone. The food used must be able to be sterilized, and must be of such a nature that it needs no digestion. A 10 per cent. solution of grape-sugar can be used, but is very apt to set up irritation at the site of injection. Sterilized olive oil seems to give the best results: 30 to 40 c.c. of sterilized olive oil should be

injected into the subcutaneous cellular tissue of the groin with a sterilized glass syringe. The oil should be injected slowly, and it is best not to inject it all in one place, but to inject the 30 c.c. in two or three different places. The injection should only be done once a day. No local irritation is caused by the injections.

Diets.

MEAT.—Raw meat is a most useful diet after many operations when the powers of digestion are impaired. The ease with which raw meat is digested, and the small amount of residue which it leaves behind after digestion, makes it a diet of the greatest value in affections of the alimentary tract. The best way of preparing raw meat is to scrape the fibres away from the connective tissue with the back of a knife; the pulp thus obtained can be mixed with a small quantity of ordinary beef-tea, and flavoured with celery salt or other suitable flavouring. As a rule, it is wise not to tell the patient that they are being fed with raw meat, as some people dislike the idea. Of course, it is most important to insure that the meat comes from a reliable source and is quite fresh. Meat extracts, such as beef-tea, etc., are of no value as foods, and but inferior stimulants; moreover, they are very liable to set up diarrhœa. In order that such extracts as beef-tea, bovril, Liebig, etc., may be made use of as foods, they would have to be administered in the concentrated form by the ounce or more many times a day.

MILK.—Milk leaves a larger residue in the intestine than most other liquid foods, and is very liable to undergo fermentation and give rise to the formation of large quantities of gas in the intestinal tract, a most unfortunate circumstance after abdominal operations.

Of all fluid diets milk has probably always been the most popular, though the reason for this is in some ways a little difficult to understand. It must be remembered that milk is not a fluid after it has been swallowed, but that within a quarter of an hour of its having entered the stomach it sets into a tough leathery clot, which may offer very considerable resistance to the digestive action

of the stomach. Milk remains a considerable time in the stomach in a semi-solid state; it would therefore seem to be contra-indicated in all operations on the stomach. There are several ways, however, in which the clotting of milk can be altogether prevented, or can be rendered much less dense and resistant than normally. Thus, simple dilution with water will make the clot less dense and more easily digested. A better way, however, is to dilute the milk with lime-water in the proportion of 1 part of lime-water to 2 of milk; this greatly reduces the density of the clot. The addition of soda-water to the milk, or the simple aeration of it by means of a 'sparklet,' will render the clot much more readily digestible. Boiled milk, though outside the stomach it clots less easily than raw milk, in the stomach clots just as readily and into just as tough a mass as raw milk. With regard to the ease and completeness with which milk is absorbed by the intestine, it has been shown that when milk is given entirely by itself it is absorbed worse than any other animal food. Under the most favourable conditions only about 90 per cent. of the available potential energy ever reaches the blood, the remainder leaving the body as waste. Children, however, seem to be able to absorb milk very much better than adults.

Milk, though rich in proteids and fats, does not contain enough carbohydrates to make it an ideal diet; it is therefore better to combine it with some other diet, such as in bread and milk, and gruel, or to add sufficient sugar to it to raise the proportion of carbohydrates to the proper extent. It is, however, a very valuable diet in many cases after operations. It is easily digested with but little expenditure of energy, and although it leaves a comparatively large residue, it does not cause much peristalsis of the intestine. The large amount of phosphates contained in milk renders it valuable as a diet in cases where there is much bone formation going on, as after excisions, etc.

KOUMISS.—This is a preparation of milk of great value in cases of wasting disease. It is much more readily digested and absorbed than ordinary milk, and thus allows of very large quantities of nourishment being given to

patients whose digestive functions are not working properly, and who would therefore be unable to assimilate such a large amount of nutriment in other forms. Koumiss is prepared from mare's milk by fermentation, and contains about 2 per cent. of alcohol. One of its great advantages as a diet is that the casein is in such a state that it cannot form into clots in the stomach, and is already partly digested. The alcohol and carbonic acid which it contains are of value in assisting its digestion in the intestine.

KEPHIR, which is a similar preparation made from cow's milk, is almost as valuable as koumiss, and is easily obtainable in England.

EGGS.—Eggs are very well absorbed by the intestine, and leave a very small residue. Eggs are much more rapidly digested than milk: 1 pint of milk remains three and a half hours in the stomach; two lightly-boiled eggs remain one and three-quarter hours in the stomach. The food value of one egg equals $\frac{1}{2}$ pint of milk. Twenty eggs would be required to supply all the proteid material required by a healthy individual in twenty-four hours.

To prepare Egg-albumin.—Beat up the white of four fresh eggs in $\frac{1}{2}$ pint of water until the whole is thoroughly mixed, then add lemon and sugar to taste, or, if preferred, salt or celery salt may be added instead.

Plasmon, which is very similar to egg-albumin, and has the advantage of being cheaper, is prepared as follows:

Add three tablespoonfuls of tepid water to three teaspoonfuls of plasmon, stir, and rub into a paste; then add gradually $\frac{1}{2}$ pint of tepid water, place on the fire, bring to the boil, stirring well all the time, and boil for two minutes. This can now be added to milk or other liquid beverage. When cold the dissolved plasmon will form into a jelly, which when whisked will turn into a thick cream. The jelly or cream can be added to food, or by the addition of water can be made into a beverage and flavoured to taste.

All the casein preparations, such as plasmon, protene, nutrose, etc., have the disadvantage, as compared with

pure egg-albumin, that they clot in the stomach in the same way as milk. Plasmon, which appears in many ways to be the best of these preparations, when tested with rennet does not clot into nearly so firm a mass as pure milk, but into a very light friable clot, and, if lime-water is added, does not seem to clot at all. Plasmon and the other casein preparations are of very little value for rectal alimentation, as they seem not to be absorbed. Egg-albumin is a much better form of proteid for this purpose.

GELATIN.—Jellies which are made from gelatin form an excellent diet, and are very readily digested ; 4 ounces of good jelly equals $1\frac{3}{4}$ ounces of solids, of which half is gelatin and the rest sugar.* Gelatin has the advantage of being digested more readily by the stomach than almost any other food. It was estimated by Uffelmann that peptonization is complete within one hour. Gelatin must not, however, be looked upon as a substitute for proteid, but rather as a useful addition to other diets. Its chief value lies in its property of economizing proteid. It is on this account that it has been called a ' proteid-sparer.'

SUGAR.—One of the great advantages of sugar as a diet is the ease with which it can be absorbed. Grape-sugar (dextrose) can pass into the blood without any digestion, and is therefore valuable in conditions where the digestive power is impaired. It has been repeatedly proved that, as a muscle former, sugar is extremely valuable, and therefore it would seem to be indicated as a diet in combating muscle waste. The value of sugar as part of an invalid diet is not sufficiently recognised ; the ease with which it is absorbed, its high nutritive value, and its high potential energy, all help to make it one of the most useful forms of diet in convalescent states.

Unfortunately, all forms of sugar tend to undergo fermentation if long retained in the alimentary tract. Also sugar in a concentrated form is irritating to mucous membranes. It is therefore important when using sugar as a diet not to give it in too large quantities at a time,

* ' Encyclopædia Medica.'

and not to give it in too concentrated a form. When patients object to a sweet diet, milk-sugar, which is almost free from a sweet taste, can be used in place of other forms of sugar.

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Massage.

Massage is of the greatest value after many operations in bringing the muscles back to their normal condition of tone, etc. Massage does not take the place of active exercise, either in developing the muscles or in improving the general circulation, but it gives us a most valuable means of passing from the condition of complete rest to that of ordinary activity without the transition being too sudden. It also acts as a very good substitute for exercise when rest is necessary. In cases of long and exhausting illness following operations, when the patient is obliged to remain in the recumbent position for many weeks or months, general massage is of great value; it promotes absorption and secretion, keeps the skin acting properly, and often enables the patient to sleep naturally, besides very considerably diminishing the period of subsequent convalescence.

Massage must be commenced gently at first; the time occupied and the force used may be increased as the patient becomes accustomed to the treatment. Exhaustion must never be produced. Massage should always be accompanied by passive or, if possible, active movements of the joints and respiratory exercises. Ten minutes a day is probably enough at first, and this time can be increased up to half an hour or an hour. When possible the massage should be carried out by a properly trained masseur; if this is not possible the nurse or some intelligent relation of the patient may be instructed in the treatment. There are several varieties of massage:

Effleurage, or Rubbing.—This consists in stroking and rolling the skin and underlying muscles with the hand, in a direction towards the trunk—*i.e.*, in the direction of the venous circulation. It must be commenced lightly and gradually increased in strength, the hand of the operator being made to grasp the muscles more and more firmly.

Petrissage, or Kneading.—This consists in kneading and squeezing the muscles between the thumb and fingers and the edge of the hand. It has for its object the increase in the flow of blood and lymph through the muscles towards the heart.

Friction.—This is practised by firmly rubbing the skin in a direction towards the heart with the closed fists or finger-tips.

Tapotement.—-This consists of rapid blows delivered at right angles to the surface with the edges of the two hands (the ulna border). This method of massage stimulates the muscle and causes local contractions. It is one of the more vigorous methods of massage, and must not be used when dealing with damaged tissues or weakly subjects.

Exercises.

The use of appropriate exercises after some operations, especially those which affect joints, is of considerable importance. The great point in dealing with injured joints or muscles is to persuade them to move rather than to compel them to do so. Thus the patient, supposing that he is able to move the injured joint within a certain angle, should exercise it by moving it within that angle, and should try each time to increase the range of movement. To assist the patient in this, the best apparatus is a cord running through a pulley, to one end of which a weight is attached, and to the other a suitable handle; the patient should then use the apparatus in such a way that the weight assists the movement instead of hindering it. For instance, in the case of a more or less stiff knee, the cord from the pulley should be attached to the ankle in such a way that the weight will assist flexion.

Artificial Appliances.

FOR THE RELIEF OF CLEFT-PALATE.—An obturator should only be fitted in those cases where no operation is possible, as, for instance, after repeated operations have failed to close the gap, when there is not enough tissue to close it, or when the hard palate has been successfully operated upon but owing to lack of tissue or scar contraction it is not possible to close the gap in the soft palate. In such cases a properly-fitting obturator is necessary. There are two principles of fitting obturators —the Kingsley method, in which an ordinary vulcanite or gold plate is fitted to the hard palate, and to the back of this is attached a soft rubber vellum, which fits into the gap in the soft palate and moves with the palate muscles; and the Seursen method, in which there is a fixed vulcanite obturator taking the place of the hard palate. In the Seursen method the fixed obturator fits in between the pharyngeal muscles, and passes backwards to within $\frac{1}{4}$ inch of the posterior pharyngeal wall; when the patient swallows or phonates, the muscles close round it and shut off the naso-pharynx from the buccal cavity. It is fixed in place by a dental plate fastened by bands round some of the upper teeth. The Seursen method is particularly adapted to cases where the gap in the soft palate is very wide. Very good phonation can be obtained by means of these instruments, but to obtain good results it is of the utmost importance that the patient should be carefully taught to speak after the instrument has been fitted.

AFTER THE REMOVAL OF THE UPPER JAW. — The instrument usually fitted in these cases consists of a gold or vulcanite plate, to the upper surface of which is attached a hollow obturator, made so as to fit into the gap left by the removal of the jaw; the plate takes its purchase from the opposite teeth and the remains of the hard palate. Artificial teeth are fixed to the plate, so as to complete the upper set on the side on which the jaw has been removed. These obturators are made of gold or vulcanite, and should be very smooth, so as not to

cause any irritation; the chief value of them is in preventing the falling-in of the cheek, which is such a distressing after-result in many of these cases. By restoring the roof of the mouth they also help phonation, and prevent food from getting into the nasal cavities. They should be fitted as soon as the wound has healed, and before the parts have had time to contract and cause deformity.

ARTIFICIAL LARYNX.—This is an apparatus designed with the object of enabling a patient after his larynx has been removed to swallow without danger of food getting into the trachea, and at the same time, by means of a reed fitted into the exit-tube, enabling him to speak. There are several varieties of artificial larynx, of which probably Gussenbauer's or Dr. Foulis's modification of it, are the best. They are much too complicated for description here. Some patients can use them with considerable success, but a great many find that they can get on better without; the great difficulty connected with them is that they are very liable to get blocked with mucus.

Artificial Limbs.

ARTIFICIAL HAND OR ARM.—No artificial hand can be fitted unless the amputation is at or above the wrist;
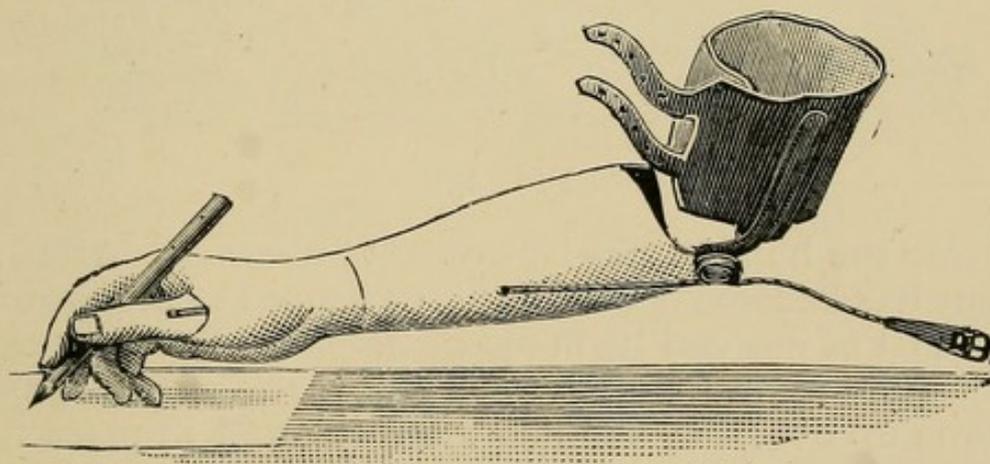
FIG. 24.

however, two or even one finger or stumps of fingers are of more use to the patient than the best artificial hand

that has ever been invented. For an amputation in the middle of the forearm the limb is made with a wooden socket coming up to the elbow, into which the stump fits (Fig. 24); there is a broad leather strap round the lower part of the upper arm, which is attached to the socket by hinges. The grasp of the artificial hand is obtained by means of a cord attached to a belt round the opposite shoulder; a very slight movement of the shoulders is sufficient to open the hand, and by relaxing the pull on
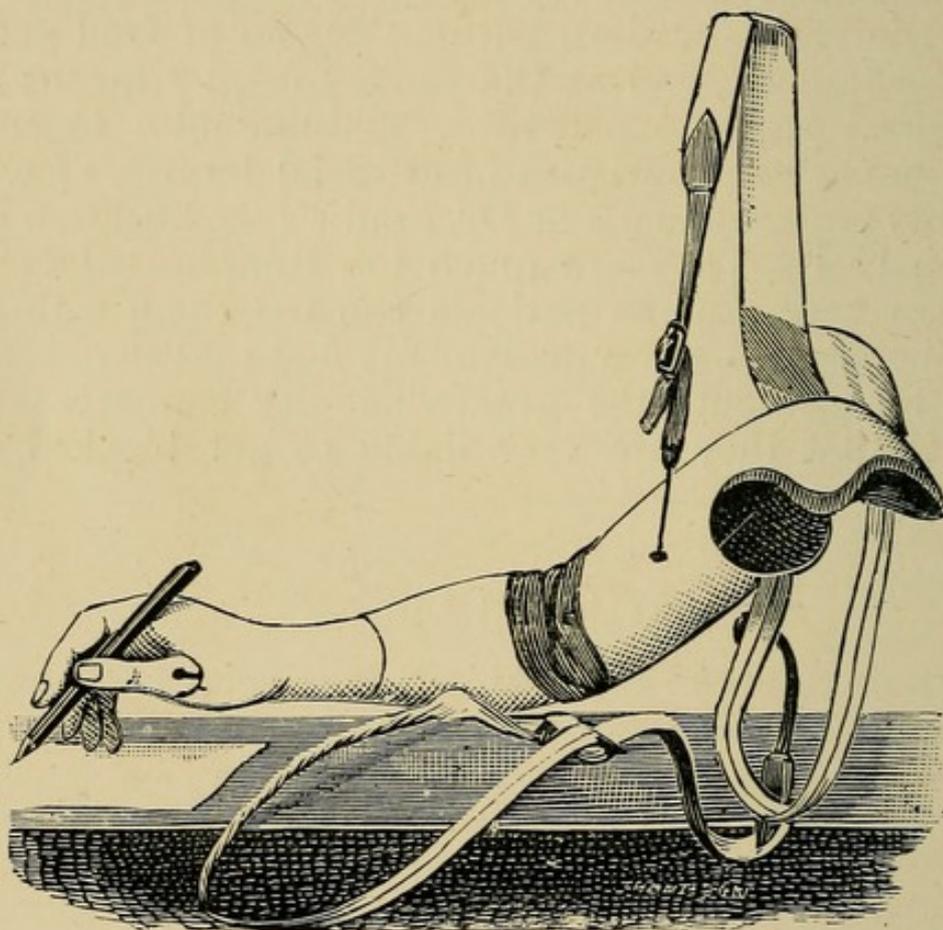
FIG. 25.

the strap the hand closes by means of a spring. After the patient has become accustomed to using the apparatus a great deal of use can be made of it.

For an amputation above the elbow the socket is made to come up over the shoulder, and is fixed in place by a strap round the body (Fig. 25); a cord is used in the same way as in a below-elbow limb for obtaining the hand movement, and another cord passing behind the shoulder is used for obtaining movement at the elbow. Most of the

friction comes upon the sides of the stump, and not upon the end, so that a circular method of amputation is particularly well suited to arm amputations. The important points about an artificial arm are lightness, simplicity, and a good fit.

To measure for an Artificial Arm.—Stump: length from top of shoulder to end, length from point of axilla to end, circumference every 2 inches. Sound arm: length from top of shoulder to base of fingers (the arm being in the extended position), length from point of axilla to elbow, and from elbow to wrist, also circumference every 2 inches. If a below-elbow amputation, measure also from elbow to end of stump. It is much better for the instrument maker to take the measurements himself when possible.

ARTIFICIAL LEGS.—It is practically impossible to fit any appliance that will act satisfactorily to any amputation of the foot short of a Syme's. Such amputations as Chopart's and Lisfranc's make very unsatisfactory stumps as a general rule; this is due to the lever formed by the normal foot being destroyed. No artificial appliance can take its place, as there is very little space to work in, and the tapering shape of the stump makes it impossible to get any purchase for the artificial foot. The best appliance for such stumps is a boot into which a piece of cork has been fitted, to fill up the vacant space left by the removal of part of the foot. After a Syme's amputation a very useful artificial foot

FIG. 26.

can be fitted (Fig. 26); the shortening of the limb resulting from the operation is generally about 2½ inches, which
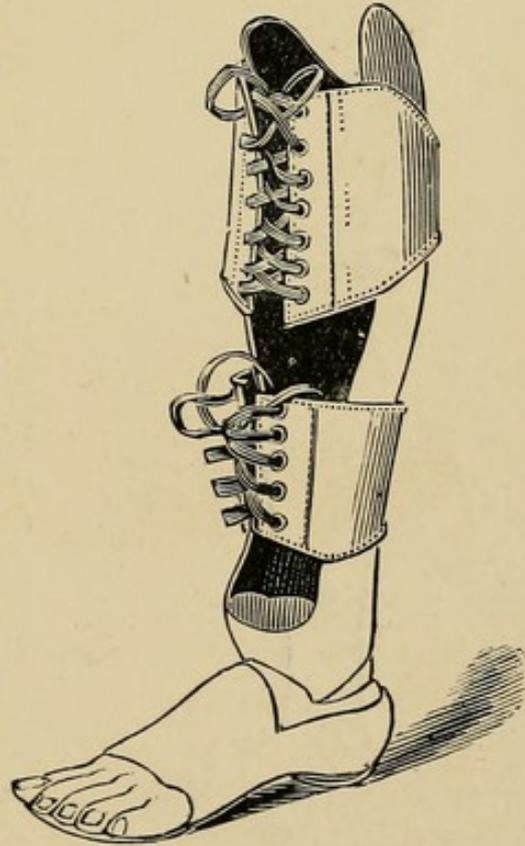
allows room for an artificial ankle-joint to be placed below the end of the stump. A half-socket is made, so as to fit up the calf of the leg and prevent the foot from turning forward; this socket is held in place by cross-straps over the shin; the weight is taken on the end of the stump. A Pirogoff stump is not so satisfactory as a Syme, as the shortening of the limb afterwards is only about 1 to 1½ inches, and this does not allow room for a joint below the end of the stump. The joint has in this case to be fitted outside, and this causes a very unsightly widening of the ankle.

For amputations below the knee a socket is made into which the stump fits. The weight is taken on the sides of the stump and on the head of the tibia; the end of the stump should not take any of the weight (at first, at any rate). The limb is held in place by a short leather socket fitted round the lower part of the thigh and tightened by lacing up the front; this leather socket is attached to the wooden one by side steel hinges (Fig. 27). This form of artificial leg works very well when the stump below the knee is not too short; if the stump is short flexion is very liable to occur, and render the wearing of an artificial leg impossible; also the short stump does not obtain sufficient purchase on the artificial leg to enable the patient to control it. The so-called seat of election probably represents the very worst place that it is possible to remove the leg if it is desired that the patient should subsequently use an artificial limb.
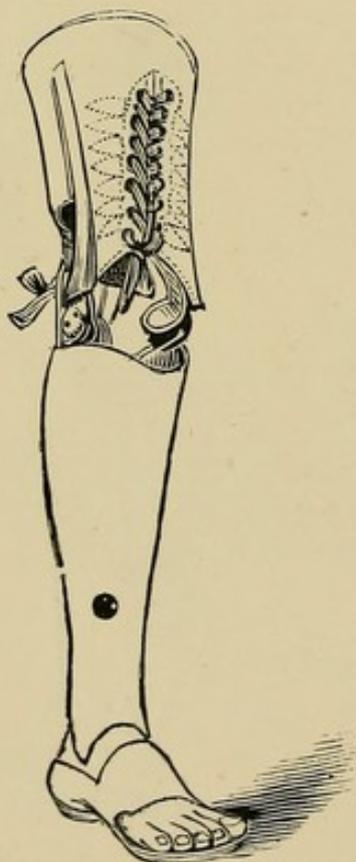
FIG. 27.

After amputation through the knee-joint the weight can be taken on the end of the stump, the limb being fixed in place by a leather

socket fastened round the thigh by lacing. Unfortunately, chafing and soreness of the end of the stump is rather liable to occur, and as almost the whole of the weight must of necessity be taken on the end of the stump, this may prove very troublesome; careful attention to the fit of the limb will do much to get over this difficulty. Special attention should be paid towards the prevention of any lateral play in the socket.

For amputations above the knee, the weight is taken on the pelvis—in fact, the patient may be said to be sitting on the top of the socket; it is therefore very important that the upper end of the socket should fit accurately and should have a *good broad edge behind* (Fig. 28). No weight should, as a rule, be taken on the end of the stump, and the latter should not come down to the end of the socket. The limb can be held in place either by means of a shoulder-strap or by a broad belt round the waist; the belt has a running cord and pulleys, one end of the cord being attached to the back of the limb socket with a flat elastic strap, and the other attached to the front by an adjustable strap. The belt is by far the better method of attaching the limb.

FIG. 28.

In having a suitable instrument fitted to a lower limb stump it is important to see that the artificial leg is strongly made, as the weight that it will have to bear is considerable (in fact, the whole weight of the body), and in many positions of the limb this weight will be acting
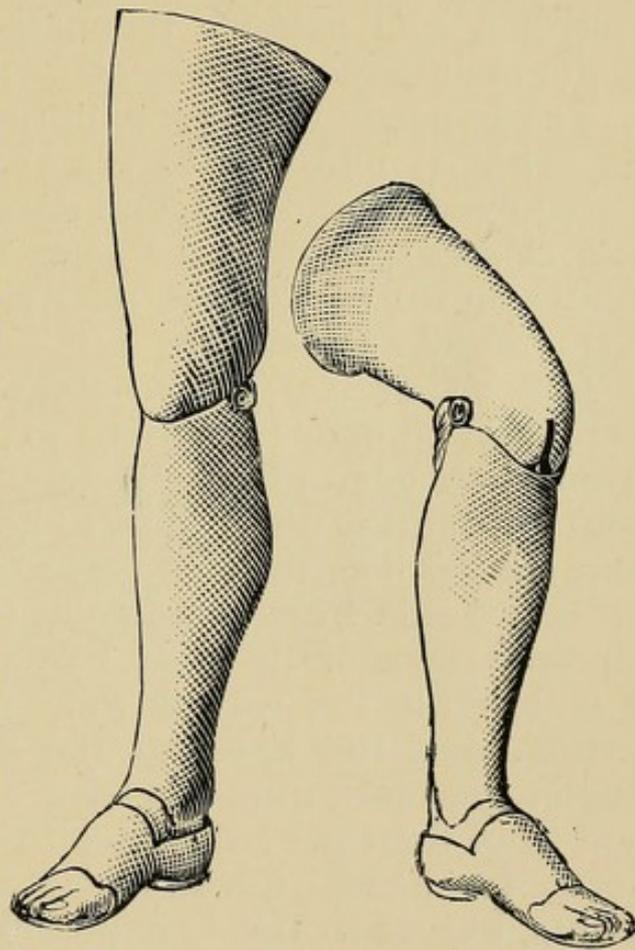
at great mechanical advantage; but, at the same time, if the moving parts, and especially the foot, are too heavy the limb will not move quickly enough for easy progression, and will tend to act like a pendulum. The fixed parts of an artificial limb—that is to say, the socket —can be made heavy without any disadvantage; but it is of the utmost importance that the moving parts should be light, otherwise a most ungainly gait will be the result.

In the better class of artificial limbs sheepskin is shrunk on to the surface of the wood; this prevents it splitting, and enables the limb to be made very light while maintaining considerable textile strength.

The important things to notice in examining the fit of an artificial limb are to see that the pressure is distributed over a large area, and does not come principally on one or two points, and to see that at first no pressure comes on the end of the stump, with the exception of a Syme's and knee-stump.

How to measure for an Artificial Leg.—Length from perineum to floor (when the patient is standing), length from lower edge of patella to end of stump, and on the sound side from same point to floor. If for an above-knee amputation, length from perineum to end of stump, and on sound side from same point to lower edge of patella; circumference of thigh at base on both sides and every 2 inches all the way down. Then, with the patient sitting, and the knee on the sound side bent at right angles, measure from the back of the knee to the ground and from the top of the knee to the ground. It is much better for the instrument maker to make his own measurements, but when this is impossible, the above will generally prove sufficient. Outlines of the stump drawn on paper placed against the limb should also be sent, and the size of boot should be stated or an old boot sent.

Belts.

COLOTOMY BELTS.—These are mainly of two kinds— those with a plug which fits into the opening, and those with a cup which fits over the ends of the gut. The cup

is by far the best form. The chief objection to the plug belt or truss is that the presence of the plug in the intestine gives the patient the feeling of a constant desire to evacuate something from the opening; it also prevents the establishment of any sphincter action at the artificial opening. The cup form does not possess any of these disadvantages. It consists of a celluloid cup with buttons on the outer side, and a belt which fits round the patient's body; the belt is made of indiarubber where it passes over the cup. This holds the cup in place, and insures it being kept well up against the abdominal wall.

ABDOMINAL BELTS FOR USE AFTER LAPAROTOMY.— There are many different kinds of belts, and the exact form is not of much importance. The principal points of a good belt are an accurate fit and a good support to
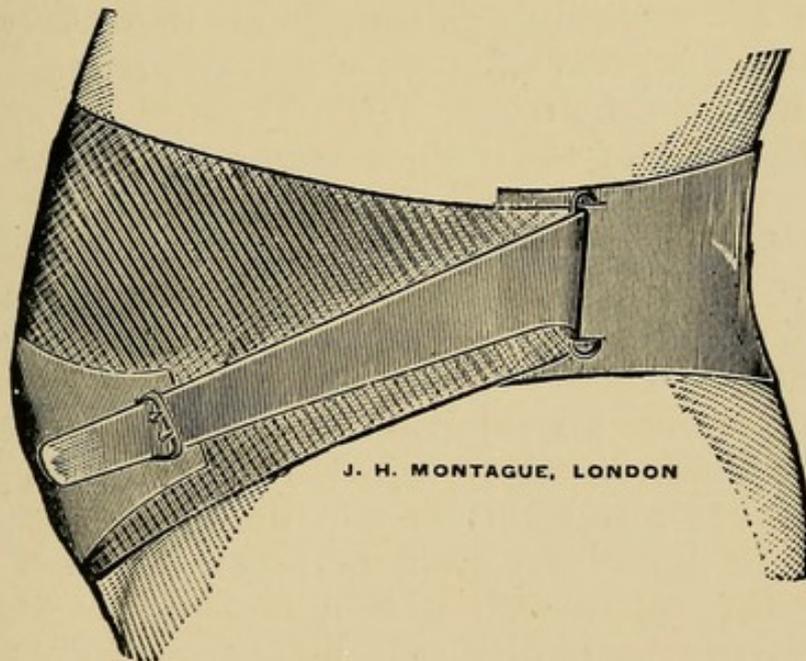
FIG. 29.

the lower part of the abdomen immediately over the pelvic brim. A belt which constricts the abdomen without supporting it is bad, and will do more harm than good. A good form of belt is shown in Fig. 29.

Anti-streptococcic Serum Injections in the Treatment of Acute Sepsis.

The use of this serum in the treatment of acute septic conditions is still somewhat *sub judice*; it is, however, of undoubted value in some cases, and since its use is not attended with any danger, it should be tried in suitable cases. It cannot be expected that it will prove of any use unless the septic condition which it is desired to treat is due to a streptococcic infection; if due to a staphylococcus it can hardly be expected that the serum will prove of any use, and as there are several different kinds of streptococci, more than one of which can cause suppuration, the difficulties of being certain that we are using the right serum are still further increased. Before using the serum a bacteriological examination of the pus should be made, to ascertain what is the nature of the organism or organisms present. If, then, it is found that there are a great number of the streptococci present, the serum should be tried.

The injection of the serum seems to have a marked effect in reducing the temperature, and, as a rule, there is a drop of several degrees within a short period after the injection. It is absolutely necessary that the serum should be quite fresh, and serum that has been prepared for more than two weeks is useless.

The usual site for injection is the loin or abdominal wall. The serum should be injected quite slowly and about 10 c.c. used at a time—the exact dose does not seem to matter; the injection should be repeated every twenty-four hours or oftener, if it is doing good. The serum should always be obtained from some reliable source, such as the 'Institute of Preventitive Medicine,' etc. Mr. Watson-Cheyne has reported favourably on the use of the serum as a prophylactic measure in operations on the mouth in which sepsis is feared.*

* *Practitioner*, April, 1897.

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