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CLINICAL LECTURE

ON

The General Principles Involved in Amputation,

With a Consideration of Some Points in the Technique.

BY

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CLINICAL LECTURE

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THE GENERAL PRINCIPLES INVOLVED IN AMPUTATION,

With a Consideration of Some Points in the Technique.

Gentlemen:—The late Sir Wm. Fergusson used to speak of amputation as "one of the meanest, and yet one of the greatest operations in surgery; mean when resorted to if better may be done—great as the only step to give comfort and prolong life." Other surgeons have termed amputation the last resource of surgery, the opprobrium of surgery, the disgrace of our art, the tacit confession of failure; but these expressions are only true when operations are performed unnecessarily by reckless, unskilled and unprincipled operators. Surgery has made gigantic strides during the past decade; but the time will never come when amputations will cease to be a necessity, for who among us can restore a mangled limb crushed by the heavy car-wheel, or can prevent the onset of gangrene with the main arterial supply destroyed, or cure a malignant disease of the bone except by amputation. Surely no one; and as long as these terrible alternatives confront the surgeon, amputations must be resorted to in order to save human life. In studying the conditions under which amputations have been resorted to during the

past half century, it is astonishing to see how limited in number those conditions are at the present day. Without doubt the next few years will be marked by still greater limitations; yet the fact is true that the time will never come when some condition will not exist which calls for amputation. Szymanowski, a celebrated Russian surgeon, once said that "we must reach such a state of perfection in amputation as to consider every amputatation a plastic operation;" and with a view to the accomplishment of such an object I desire to direct attention to this subject in the lecture to-day.

The word amputation derives its origin from two Latin words, the preposition *ambi*, meaning around, and the verb *puto*, to prune, or to trim; but we should bear in mind Szymanowski's definition of an amputation, and not confine ourselves to a strict literal meaning as the derivation of the word implies. For practical purposes amputation means the removal of any part of the body by the cutting operation. The expression is used with especial reference to a removal of an extremity; but the word is occasionally employed in reference to removal of the female breast, the scrotum, the penis, and the tongue.

There are four periods at which an amputation can be performed: *1. Immediate*—before reaction from shock; *2. Primary*—after reaction but before inflammation; *3. Intermediate*—after inflammation but before suppuration; *4. Secondary*—after suppuration is established. For all practical purposes these four periods can be reduced to the primary and secondary. As a rule, to which there is scarcely an exception, the immediate amputation should not be performed, as the patient is likely to die from shock during the operation. The double shock of the operation and of the injury is apt to kill the patient; and the shock of the injury of the limb may be complicated with shock from injury of some important internal organ from which the patient could never rally, and

hence the impropriety of the amputation, and the needless addition of suffering to the patient on account of the operation, and the just opprobrium brought against the surgeon for his unjustifiable interference.

It is sometimes necessary to amputate as soon as consistent with safety. Now, what is to guide the surgeon in his decision of so important a question? In cases of compound comminuted fracture, with injury to the main artery of the limb and with great loss and destruction of tissue in the soft parts, the hæmorrhage is often alarming, and amputation is called for imperatively as the only salvation for the patient. What is the earliest moment a surgeon should operate? Never during profound shock; and the rule which must govern a surgeon is, to employ all known means to control hæmorrhage and to bring about reaction from shock, and wait. If the patient has pallor and coldness of skin, weak and feeble pulse, sighing respiration, non-reacting pupils, traumatic delirium—internal injuries, no amputation is indicated. The earliest possible time an amputation can be performed, under great necessity from hæmorrhage, is when reaction is beginning; but unless the patient is likely to become exsanguined by delay the beginning of reaction is an unfavorable period for operation, and it is wise to defer it until reaction is fully established. Amputation should not be performed with a sub-normal temperature, a cold skin, a feeble rapid pulse, or during traumatic delirium—especially in children. The condition, then, of the temperature, the skin, the character of the pulse and the mental state, are all important factors in the solution of this problem. Delay in performing an amputation was formerly fraught with very great danger from septic infection; but with the modern methods of preventing sepsis in a recent wound, this obstacle is removed; and with antiseptic compresses applied tightly over the bleeding wound, and not above the

wound upon sound tissue, hæmorrhage can be controlled and the wound kept from rapid sepsis a sufficient time to give the patient opportunity to react. I have seen an Esmarch elastic bandage applied above a lacerated wound, over sound tissue, and when the flaps were made a certain amount of sloughing followed from the compression. The wound itself is the proper place to apply firm compression, never above the seat of the wound. This point is one of practical importance, because the elastic bandage as a means of controlling hæmorrhage has been misused; instead of applying the compression over the bleeding part, it has been carried above the bleeding part and over sound tissue. As a result of this, gangrene in the flaps may occur, with its accompanying septicæmia.

The mortality of amputations depends upon a variety of conditions; even the state of the weather has been shown to have a causative effect on the death-rate. Hewson has shown that with a rising barometer the average duration of life in the fatal cases was only 7 days, while with a falling barometer the average duration was 13 days; and that 75 per cent. of the fatal cases died when the barometer was rising. The conclusion is that, while the state of the weather may or may not turn the tide for or against any given patient after amputation, barometric changes materially influence the condition of patients suffering from the effects of severe surgical operations, and have a slight influence upon the death-rate.

Age is also a factor in estimating the mortality after amputations. Holmes has proved "that the risk of amputations is constantly rising throughout life, and that at any given period after 30 years of age the risk is more than twice as great as it was at the same period after birth." Thus if, for example, it may be stated that 5 per cent. is the mortality after amputation in a child at 10 years of age, the mortality at 40 years would be 10 per cent.

The *seat* of the amputation is also an important factor. Amputations of the lower are more fatal than those of the upper extremities. In any given limb the death-rate increases in reference to the proximity of the amputation to the trunk. Thus if, for example, amputation of the thigh be represented by 50 per cent., the leg would be 40 per cent., the arm 25 per cent., the forearm 13 per cent. These figures are far too high since the introduction of antiseptics, but are quoted to show the relative figures in the different amputations.

The *part of the bone* sawn through affects the mortality. The mortality is greater where the shaft is divided so as to expose the medullary canal than where the cancellated tissue of the bone is sawn through; for in the former case, the risks of pyæmia and osteo myelitis are greater than in the latter case.

The primary amputation is much more fatal than the secondary. Sir James Paget states that the mortality is 12 times greater in the former case. This rate is perhaps too high; but the fact that the primary amputation is attended with a greater death-rate is due to the severe character of the injury. It has been stated that the amputation of expediency, performed for the relief of deformity, is attended with a greater mortality than either primary or secondary amputations.

The *general health* of the patient has an important influence upon the success of an amputation. The condition of the kidneys, lungs, heart, and vascular system, liver, brain, and other important organs, materially affects the results after amputations.

The *previous habits* of the patient is another important factor. A man of dissipated habits has his chances of recovery lessened by his profligate life, while the temperate man has his chances of recovery greatly increased. Pneumonia often causes death after amputations in those cases where the patients have been hard drinkers for many years.

The *hygienic conditions* are most important in affecting the mortality. Patients in the country do better than those in the city, and the latter do better in private practice than in hospitals. Always secure for a patient abundance of fresh air and plenty of sunlight. Too much stress cannot be placed upon his hygienic surroundings. While the weather, age of patient, seat of amputation, the part of the bone sawn through, whether for injury or for disease or for deformity—above all and beyond all the hygienic condition stands out foremost; and if we exclude serious organic disease, nothing is so important as the sanitary arrangements. Sir James Y. Simpson showed that five times as many deaths occurred after amputations in large city hospitals as in private and country practice. To-day the mortality in amputations is very much less than in his day, and a large majority of the causes of death following amputations may be said to have been forever eliminated by the application of the principles of scientific surgery. We will now discuss the indications for an amputation. I have been in the habit of arranging all the indications for amputation in the form of an acrostic, employing the word amputation itself to fill up the acrostic. These indications for amputations are:

Aneurism.
Malignant disease.
Perforating ulcer of foot.
Uncontrollable hæmorrhage (primary or secondary).
The operation of expediency in deformity, in tumors and tetanus.
A disease of the joint.
The moist and dry variety of gangrene.
In certain compound fractures and dislocations.
Old sloughing and varicose ulcers.
Necrosis of bone.

These ten indications for amputations have thus been arranged in an acrostic, which will always enable the student or surgeon to have at his command the information.

REQUISITES OF A GOOD STUMP.

1. The bone must be amply covered.
2. The flaps must not be adherent to the bone nor exert pressure or traction upon the cicatrix.
3. The nerves must not be adherent to bone or to cicatrix.
4. The nerves must be cut high enough so as not to be affecte l by pressure or by atmospheric changes.
5. The bone must be smooth and capable of bearing firm pressure upon it.

CHARACTERISTICS OF A BAD STUMP.

1. Necrosis at end of bone.	Sequestrum from injury to bone in sawing, by rough use of saw, by suppuration in bone by injury to periosteum, by sawing without irrigation to prevent the saw from acting as an actual cautery.
2. Conical-shaped stump.	Insufficient covering, spasmodic retraction of muscles, growth of bone.
3. Neuralgia of stump.	External pressure, local and constitutional causes, bulbous enlargement, adhesion to cicatrix.

Before entering upon a consideration of the different methods of performing amputations, it is well to make a short digression to review the history of this operation from the earliest recorded dates.

Amputations were performed four hundred years before the Christian era, by Hippocrates. In these early times amputations were resorted to only in cases where gangrene was present, and the mortified extremity was simply chopped off with a chisel and mallet, such as you see here in my hand. A pair of powerful shears has also been used instead of the chisel. This was the crude way of performing amputations in early times, and great care was exercised not to wound any living part in chiseling through mortified tissue.

Celsus, who lived during the reign of Cæsar, or about the time of the beginning of the Christian era, devised and carried into execution the circular method of amputation. This method followed the bar-

barous method of Hippocrates. The circular method of Celsus consisted in severing the entire limb, skin, muscle and bone upon the same level, with no attempt to form flaps to cover the stump. The chiseling method of Hippocrates through mortified tissue was displaced by the circular method of Celsus, in which all tissue was cut upon the same level, and some seventeen hundred years later an attempt was made to perform amputations by the formation of a flap to cover the stump, and this brings us to the subject of flaps in chronological order. The names of Lowdham, of Alanson, of Hey, and of Benjamin Bell are associated with this great reform in operative surgery with reference to amputations. It was not, however, until during the first half of the present century that amputation by the flap method was recognized universally, and was perfected in all its details. Great credit for this further advance in operative technique is due to such men as Langenbeck, Liston, Teale, and others, through whose writings and by whose personal experience we are indebted for the present excellent methods of flap amputations.

Having now considered some subjects in reference to amputations in general, such as the derivation of the word, the periods at which amputations may be performed, the mortality of the operation, the indications for its performance, the requisites of a good, and the characteristics of a bad, stump; and finally, a brief outline of the history of amputations from the earliest recorded facts down to the present, we may now direct attention to a careful study of the technique of the operation in its present perfected state. For the purposes of description of an amputation in general the following points are to be considered in an amputation of the leg:

First—Preparation of patient.

Second—Provision against hæmorrhage before operation.

Third—Formation of a suitable flap.

Fourth—Section of the bone.

Fifth—Provision against hæmorrhage during operation.

Sixth—Treatment of wound.

The preparation of the patient consists in a careful study of the patient's history, and also the special preparation of the member to be removed. Before the operation the heart and lungs should be examined, the urine analyzed, the general habits of the patient inquired into with reference to intemperance, to the opium habit, or to previous disease, and to other points of interest which influence the treatment after operation, as well as the mortality. In other words, the surgeon should study thoroughly the individual upon whom he is to operate, and make himself complete master of the situation. The local attention to the part consists in thorough ablution, shaving, and free irrigation with carbolic acid or bichloride of mercury solution.

Provision against hæmorrhage before the operation. —The limb should be elevated and held for a few minutes, and at the same time rubbed towards the trunk. The tourniquet should be now placed over the femoral just beneath Poupart's ligament, so as to press against the bone. It should be screwed down quickly upon a bandage placed under the bone and over the artery; if it is slowly turned a large amount of blood will pass into the limb, and the compression is soon sufficient to keep the venous return in the limb, but not enough to prevent arterial blood from entering the limb. Esmarch's bandage is often used instead of Petit's tourniquet, but the amount of oozing following its use is so great that I prefer digital pressure or the tourniquet, when properly applied. If the Esmarch bandage is used and the main vessels are ligated, the irrigation by hot water, as suggested by Dr. Varick, of Jersey City, will control the oozing better than any other means. If the hot water is employed for this purpose I should recommend that

a weak solution of carbolic acid be prepared in anticipation, or else a mild solution of corrosive sublimate (say 1–4000). These solutions have the additional advantage of making doubly sure the aseptic condition of the flaps.

Third stage, formation of suitable flaps.—Circumstances often influence the surgeon as to the kind and shape of flaps in any given case, but if he can operate at a point of election instead of a point of necessity, either the circular skin flap, modified, if necessary, by two lateral sections, which converts the amputation into one of an antero-posterior skin-flap of equal length, or Teale's long anterior and short posterior flaps or the bilateral flaps, will be found best in all amputations. Whatever shape may be decided npon, all flaps should consist of skin and connective tissue only, and not muscle. At all points of the body where pressure is made against bone, skin alone covers the part; the os calcis and the olecranon, the tuberosities of the ischium, are good examples of this. If muscle be included in the flap on the supposition that it will form a soft cushion over the divided end of the bone, the fact that the muscle soon completely atrophies takes away the supposed advantage. If the muscle is included there is considerable bleeding from the cut surfaces and there is a much larger wound for healing.

The surgeon having decided on the kind of flap desired, everything is now ready for the operation. One assistant gives ether, another hands the instruments, a third holds the limb to be removed, a fourth is responsible for the application of the tourniquet or the elastic bandage, and a fifth sponges and helps tie the vessels. Each assistant must understand his respective duties and he must not interfere with the duties of the others; thus the operation from beginning to end will be executed in perfect order, and with the least possible delay or suffering. The nurse should wash and wring out the sponges used during the

operation; and what has been said of antiseptic preparation of the assistants must include the nurse.

The surgeon stands upon the right side of the limb to be removed, so that he can hold back the flaps with his left hand, and in doing so he must remember to cut with his scalpel directed so that the cutting edge is slightly turned towards the part of the limb to be removed, and never towards the flap. In this way he cannot button-hole the flap, and the edge of the circular flap being cut at right angles to the long axis of the limb, will not slough, as it will do if the edge is cut obliquely. The flap should consist of skin and connective tissue and deep fascia down to the muscle; but it is not to include the muscle. The blood-vessels nourishing the flap run between the skin and the deep fascia, and if the edges of the flap be cut at right angles and not obliquely, the extreme edge of the flap is bountifully supplied with vessels. In dissecting up the flaps they should be held by the surgeon's fingers, and never by forceps, which contuse the flaps. The surgeon having dissected up the flaps to a convenient distance and holding the flaps back with his left hand, he is now prepared to make a circular section of the muscles down to the bones.

Before cutting the muscles an interosseous flap can be cut, as suggested by Linhart, of Würtzburg. The object of the interosseous membrane flap is to prevent the retraction of the tissues which carry the vessels up out of reach. A small catlin is thrust in close to the tibia and then carried down for about two inches parallel with the bone. The catlin should now cut across until it comes in contact with the edge of the fibula, and then upwards along the edge of the fibula to a point opposite to where the first incision was made. This will cut out a tongue-shaped piece of tissue composed of the interosseous membrane upon which and attached to which the anterior tibial artery is found. This interosseous flap retracts

more readily than muscles, and consequently, being cut two inches longer than the muscles, the flap with the artery will be found directly upon the face of the stump.

With a large amputating knife the muscles should be severed at a point just below the point where the base of the flap is attached. It is best to allow for a certain amount of contraction of the muscle after it is cut, and if the circular division is made as described, the cut surface of the muscle extends down so as to be upon a plane corresponding with the bone or bones. A double-tail retractor, or a triple-tail retractor if two bones exist in the extremity, is placed in front of the face of the stump so as to keep the muscle from being injured during the sawing of the bones.

Fourth stage, section of the bone.—The leg must be firmly held during the sawing, and the assistant supporting the part to be removed must avoid any pressure downwards, this movement being likely to cause fracture of the bone, or any movement upwards, which is likely to bind the saw and prevent its free movement. When the femur is to be sawn the saw should go through the linea aspera before completely severing the bone, and this will avoid splintering the edge of the linea aspera. When two bones are involved, as the tibia and fibula, they should be sawn upon the same level, remembering to saw through the smaller of the two bones first, so as not to disarticulate the fibula at its upper end. Volkmann has found that rapid sawing causes so much friction that great heat is generated, which produces circular necrosis at the end of the bone. The saw should be used gently and drawn lightly from heel to toe, and the sawing should be performed under continuous irrigation, so as to prevent the development of too much heat from friction. The surgeon should now pass his finger over the surfaces which have been sawn, and remove by Liston's bone-forceps any slight pro-

jection or splinter, and then bevel the edge of the tibia so that its sharp crest will not perforate the skin when the flap is drawn down over the face of the stump. If desirable, a small piece of periosteum can be pushed up from the bone before the saw is applied, and then the periosteal flap can be stitched over the front of the bone by a catgut suture. This procedure was formerly in vogue to prevent osteo-myelitis, as the periosteal flap united by primary union, so that no suppurative discharge could be absorbed by the medulla.

Fifth stage, provision against hæmorrhage during the operation.—The surgeon should secure and tie the main artery first; then the other arteries in turn according to their sizes. Do not tie veins unless it is necessary. The artery forceps should embrace only the divided end and open mouth of the artery, and the ligature should involve the vessel only, and none of the surrounding tissues. Catgut is preferable for ligatures, as it possesses the especial advantage of allowing the stump to be closed. If torsion is employed, the advantages are still greater; but this method is only safe in the hands of surgeons who understand its use thoroughly and are skilled in its practice. After all the vessels are tied or twisted some oozing may occur. This is controlled by hot irrigation, or by packing into the stump a number of antiseptic sponges wrung out in hot bichloride of mercury.

After hæmorrhage is completely arrested and the wound-surface perfectly dry, the last and sixth stage is entered upon, and this leads us to a discussion of a most important subject, viz.: *the treatment of the wound.* The different methods which have been devised are numerous, and many of them complicated. No better idea of the progress which surgery has made can be given than to compare the methods formerly in vogue with those methods which are now employed. Formerly no surgeon would amputate

except he employed red-hot knives, and then he would only cut through gangrenous tissue. In those days of crude and unscientific surgery the stump was often cressed with incense, and aloes, and the white of an egg. Again, some surgeons suggested the application of mushrooms and puff balls, and others recommended burnt agric and Fowler's powder. Still other surgeons treated their amputation stumps by thrusting them into the bowels of a cock opened alive, and even employed hog excrement as a dressing. In marked contrast to all of these dressings is the simple way in which these wounds are treated at the present day.

I pass by the Guérin pneumatic occlusion method and the Maisonneuve pneumatic aspiration method as too difficult and complicated for the use of the general practitioner. The cold water dressings as suggested by Liston, and the continuous bath recommended by Langenbeck, are methods to be employed in exceptional cases. Dressings of stumps, for practical purposes, may be reduced to one of two methods: either the closed or the open method. The great majority of cases should be dressed by closing the wound. In treating an amputation wound by the first method, it is assumed that all the details of antiseptic surgery have been carefully carried out; otherwise failure to obtain primary union is certain.[1]

In dressing a stump with a view to obtaining primary union, it is often advantageous to defer permanently closing the stump for several hours. This is especially indicated where there is much oozing from the surface of the wound. By deferring the final dressing for a few hours the wound is not closed until it is perfectly dry, and until a delicate film of

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[1] These details of wound treatment have already been discussed in a previous lecture, a report of which may be found in THE JOURNAL of August 21, 1886, and it is unnecessary to repeat what has been said in regard to the technique of an aseptic surgical operation.

coagulated blood glazes the surfaces.[2] Whenever the final dressing has been deferred I have irrigated the wound thoroughly with a hot solution of bichloride of mercury, and then packed with a large number of small sponges which have been taken immediately out of a glass vessel containing a solution of hot bichloride of mercury. The sponges should be wrung out as dry as possible and introduced into the wound, and the flaps brought over the sponges, and then a heavy bandage of antiseptic gauze placed over the stump with but moderate compression. In five or six hours, the patient in the meantime having reacted from the shock, is now perfectly conscious, and will permit the completion of the dressing, and without any pain.

The bandage should be carefully removed from the stump and one by one the sponges removed from the wound; and all oozing having ceased, a thin film of iodoform can be dusted or sprinkled over the flaps and upon the face of the stump. A drainage tube of *red* rubber—because it contains no sulphur—should be placed in contact with the face of the stump, brought out at each angle of the wound, and fastened by a safety pin and cut off flush with the surface of the skin. The flaps should now be approximated and the sutures tied. Catgut should be employed; but three or four silver sutures should also be used, because the catgut is often absorbed too quickly and the flaps are not held firmly. The silver relaxation sutures can be removed as soon as they show evidence of the slightest irritation. A button or silk suture or horse-hair can be used instead of the silver wire if the surgeon prefers.

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[2] Some surgeons have objected to deferring the permanent dressing several hours because the patient has come out of the influence of the anæsthetic, and the final dressing must be done while the patient is conscious. The objection is overruled if the sutures are introduced through the flaps but left hanging loosely. There is no pain in the mere approximation of the flaps.

If the edges have been accurately approximated a thin film of iodoform can be sprinkled over the line of incision, and then the protective and then the hospital gauze lightly placed over the stump. The gauze next to the wound should be wet, having previously stood in a hot solution of bichloride of mercury or carbolic acid. The gauze should be wet, because dry carbolic gauze is not antiseptic unless it is warm. The absorbent cotton can be now placed over the entire stump and held in place by an antiseptic bandage. Over this dressing layers of antiseptic gauze can be placed with the Mackintosh; the latter can be dispensed with as a rule. The superficial dressing of hospital gauze should be dry and quite firmly bandaged to the stump, which should be placed upon a splint and bandaged to it.

In three days, if everything has gone on well, the dressing should be changed under irrigation so as to remove the drainage tubes, and a new dressing applied in the manner already described. This second dressing can remain unchanged for a week, and then a new and final dressing can be applied. It is thus evident that by this method all the great principles of wound treatment have been observed.

In exceptional cases, however, it is not best to close the wound because primary intention can not be obtained on account of the peculiar conditions of the wound. In cases of compound fracture, attended with great crushing of bone and soft parts, there is occasionally some contusion over a small area of the wound, which might prevent primary union, but is not sufficient to prevent a satisfactory healing by secondary intention, and thus securing a longer stump. Another circumstance where closing the wound is not best, is in an amputation of emergency, at a place where antiseptic dressings can not be secured immediately. I believe that under such circumstances no attempt should be made to secure primary union, because all the essential conditions

are absent, and a failure under these circumstances would expose the patient to serious risks from septic infection. Half-way antiseptic surgery is more dangerous than full exposure of the wound to the air. I believe that leaving the wound fully exposed to the air is not only safe, but is in reality the best method where all the conditions of rigid asepsis cannot be controlled. During the past session I have treated two stumps by the open method, and both of them did just as well as regards constitutional disturbance as the others. The open method has one disadvantage; the wound does not heal so quickly; but it heals satisfactorily in the end. In the open method the highest type of antiseptic surgery is found. The frequent use of carbolic acid renders the soil unsuitable for the growth of germs, the causes of putrefaction. The unobstructed flow of the discharge prevents the secretion becoming putrid. The exposure of the wound permits evaporation, which renders the discharge too highly concentrated for the favorable growth of these germs; and, finally, as Pasteur has shown, this same free exposure, by the supply of oxygen to the microörganisms, prevents their disorganizing and breaking up the albuminous compounds in their struggle for one of the essentials of their being. The preservation of the albuminous compounds diminishes, and even prevents, the processes of putrefaction. The exposure of the wound lessens the chances of decomposition by causing it to become dry.

There is no real inconsistency between antiseptic surgery, as now understood, and treating a wound openly. A careful study of the principles of antiseptic surgery shows that both methods are in accord with its precepts, only that in the open method the wound heals by secondary union, and still the wound is aseptic In the open method the stump is irrigated every few hours with carbolic acid solution. Balsam of Peru is used to stimulate the granulations,

and in ten days the granulating surfaces upon the flaps are approximated, and healing takes place between these two granulating, instead of between two fresh, surfaces. In epidemics of diphtheria I have found the open method preferable, because a healthy granulation surface is a barrier to the entrance of septic poison.

In conclusion, gentlemen, endeavor to obtain primary union in all amputations by using every detail requisite to success. When the conditions are unfavorable, aim at secondary union by the open method; but remember that even if the open method is best suited to certain cases, it is still antiseptic surgery in its highest and broadest sense, and that good judgment and a due regard for the best interests of the patient has persuaded you to adopt the method which is less brilliant in its technique, but more brilliant under such circumstances in its ultimate results.