

Little (Jas. L.)

Compliments of  
Dr. J. L. Little.

TWO LECTURES  
ON  
Lister's Antiseptic Method  
OF  
TREATING SURGICAL INJURIES,  
Delivered at the College of Physicians and  
Surgeons, New York,  
BY  
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Etc., Etc.

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## TWO LECTURES ON LISTER'S ANTISEPTIC METHOD OF TREATING SURGICAL INJURIES.

Delivered at the College of Physicians and Surgeons, New York.

BY

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[Reported for THE HOSPITAL GAZETTE.]

### LECTURE I.

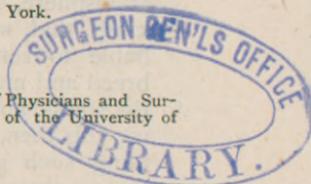
GENTLEMEN:—We will turn our attention this morning to the subject of "Antiseptic Surgery" a topic, at present, of universal interest, and one with which, even should you never practice it, scientific medicine demands that you should be familiar.

Acknowledging its importance, then, we will at once pass to a consideration of the subject. Up to a comparatively recent date all the putrefactive changes taking place in organic substances were supposed to be produced by the oxygen of the atmosphere; the belief being based upon the fact that when the atmosphere was thoroughly excluded from the substance or substances in question, no putrefactive change occurred; and that such changes did take place soon after air was admitted or when it was not excluded.

Microscopic examinations, however, soon determined the fact that other substances were present in the broken down material, besides the products of decomposition. Minute living bodies, among which bacteria stand most prominent, were found to exist there in immense numbers. Whether the substance was solid or fluid these little bodies were found swarming through it, living and multiplying, and the question very naturally arose, how and where did they originate?

Bastian, on the one hand, advocated the theory of spontaneous generation, while others, including Tyndall, showed by various experiments that germs must have already existed in, or been introduced into the fluid or solid before the bacteria and their kindred could be produced; they springing from these germs when once the conditions for their production were favorable. To-day some of the greatest minds in Europe are engaged upon the subject; the scientific journals are filled with articles relating to it; and although the question is still unsettled, the practical application of some of the results of research and experiment has been successfully made in our department of medicine; viz.. Surgery.

Professor Lister, accepting the germ theory, has applied to the treatment of open wounds an entirely new method, which has so far yielded the most wonderful results. To-day, I wish to give you some details concerning it, and before doing so I should like to impress it



thoroughly upon your minds, that in order to obtain results such as Lister's, it is absolutely necessary that nothing, however little, should be slurred over, and that the fullest and most careful attention should be paid to all details, both during and after the operation.

Accepting the "germ theory," then, we must believe that the atmosphere, everywhere about us, is filled with germs of various kinds, that, when the air is allowed free access to a wound, are very liable to settle upon and cling to it, and the resulting organisms to breed and multiply, almost *ad infinitum*, filling the fluids, pervading the solids, and producing changes that result in putrefaction. Knowing this then, it is very easy to understand that when the air containing such germs is thoroughly excluded from a wound, or when these germs are destroyed before reaching it, no such changes will take place. That degree of inflammation and suppuration which has hitherto been considered as the necessary result of such wounds will be entirely prevented, absorption of the products of decomposition not taking place traumatic fever does not show itself, nor indeed is there any rise in temperature.

Let us turn our attention for a few moments to the manner in which wounds heal.

There are two principal methods by which healing takes place. First, that which is called healing by adhesive inflammation. In these cases slight redness takes place around the wound; plastic lymph is poured out between the cut surfaces; there is a slight rise in temperature, and a small cicatrix is left after the wound is healed. This method surgeons generally call healing by "first intention." Second, healing by granulation or "second intention." By this, we mean those cases where, either from the edges being kept apart, or from some loss of tissue, primary union cannot take place. What results? Inflammation is set up around the wound, there is redness more or less marked, and a rise in temperature,—the so-called inflammatory or traumatic fever. The wound soon becomes covered with a thin pellicle of exudation, which rapidly goes on to the formation of pus. The pus once formed, the redness diminishes or disappears, the pain subsides, the temperature falls, and the discharge continues until the granulations rise up to a level with the edges of the wound, and cicatrization takes place.

I have purposely left out some of the methods of healing; the two that I have given you sufficing to illustrate what I have to say.

A wound, of whatever nature, treated strictly in accordance with the rules laid down by Mr. Lister, will heal without the appearance of any of the phenomena characteristic of union by the second intention, and under this treatment we no longer look for the "healthy, cream colored, laudable pus" of olden times. Indeed, that which we once considered normal, we now consider abnormal. I have performed a number of successful operations by this method. Recently I amputated the thigh of an old woman on account of malignant disease of the lower extremity. After the amputation the patient's temperature was accurately taken morning and night, and never, at any time during convalescence, did it rise higher than  $99^{\circ}$ , nor was

there the slightest suppuration. The same result followed, recently, in an amputation at the knee joint. I have also had, lately, four successive cases of removal of the breast heal without the slightest redness around the wound, the formation of pus, or elevation of temperature. To be sure, breasts dressed in the old way would occasionally heal without suppuration, but, gentlemen, this was a rare occurrence in my experience,—partial union being the rule, with more or less suppuration. Lacerated wounds, compound fractures, have all done well under this treatment.

Lister's method, properly followed out, prevents inflammation and suppuration, and this is something entirely new. I think, gentlemen, that if these successes continue under Lister's method of treatment, that some of us will be obliged to restudy our surgical pathology.

With these preliminary remarks, I will now describe in detail the materials used in applying Lister's method. Of all substances used as germ destroyers, carbolic acid has, thus far, proved to be the most effectual. Other antiseptics have been tried, but the results do not equal those obtained with carbolic acid. Lister's method is essentially this: In treating an open wound, let neither the air, the instruments you use, your hands, nor the dressings that are to be applied, nor in fact anything, come in contact with the wound unless it has been thoroughly saturated or wet with a solution of carbolic acid, and, at the same time, keep the wound thoroughly drained.

Carbolic acid comes in crystals, but the addition of a little water dissolves them; and gives you a solution. This sample, which I show you, is known as Calvert's carbolic acid. When here in 1876, Mr. Lister said that he used the absolute phenol, which he thought had less odor, and was more soluble than carbolic acid, which, however, is less expensive, and answers equally well. You should procure two bottles; one that will hold a quart, and one that will hold two quarts; and a two ounce graduate. The quart bottle of course contains thirty-two ounces, and by pouring out two ounces of water, you have thirty left. To this quantity of water you add an ounce and a half of carbolic acid, and you have a solution of the strength of 1 part of carbolic acid to 20 of water. By filling the two quart bottle with water, pouring off four ounces, and adding the same amount of carbolic acid ( $\frac{2}{3}$  iss) you have a solution of the strength of 1 part of carbolic acid to 40 of water. If, however, you wish to keep but one solution on hand, let it be the 1 to 20, and by pouring a cupful of this into a basin and adding a cupful of clear water, you have the 1 to 40 solution, whenever you may wish to use it. I think it is better to keep both on hand. Now, you are ready for work, in so far as the solutions are concerned.

As to the *spray*, Mr. Lister insists that the immediate atmosphere must, during the operation, be thoroughly carbolized, and the germs that it contains thus destroyed. For this purpose you will use the 1 to 20 solution. The proper use of the 1-20 and 1-40 solutions is a matter of importance, and it may be well to dwell a little upon it. The 1-20 solution is used for puri-

fying the parts upon which you are about to operate. They must be thoroughly washed off with soap and water, and afterwards cleansed with the solution. The hands of the surgeon and his assistants should be thoroughly cleansed, the finger nails being well cleaned by the use of a nail brush, and afterwards the hand should be washed in the solution. The instruments and sponges to be used should be placed in this fluid, even as long as half an hour before the operation. Again, the 1 to 20 solution should be used in compound fractures and recent wounds, when the wound has been exposed to the air. Before the dressings are put on, the wound should be thoroughly washed out with this solution in order that any germs that may have found lodgment in it may be destroyed.

This 1-20 solution is too strong to use for any length of time, as it benumbs your hands so that it is very difficult to operate, and is, therefore, only used at the beginning of the operation to cleanse the surgeons hands and the parts to be operated on; the 1-40 solution then being substituted and continued, it being strong enough. The 1-40 solution is used for the instruments and sponges during the operation.

I dwell on this point, as there is some difference of opinion as to the use of these two solutions. In order to settle this, I wrote to Mr. Lister and received the following reply.

12 PARK CRESCENT, PORTLAND PLACE, 11th Dec., 1877.

MY DEAR SIR:—In reply to your inquiry in your letter of Nov. 26th, received yesterday, I write to say that I use the 1 to 20 carbolic acid lotion for purifying the skin of a part about to be operated on, and also my own hands before I begin to operate, and for cleansing instruments and sponges, and also for the spray, when a steam spray producer is employed. The 1 to 40 lotion is our ordinary lotion used for the sponges during the course of an operation, (the sponges having been purified before the commencement of the operation with 1 to 20) and for washing the wound when requisite, and for the lotion in changing dressings. The 1 to 20, I should add, is used for washing (in order to purify them) wounds inflicted accidentally, such as compound fractures.

Thanking you for your kind report of the progress which antiseptic surgery is making in America.

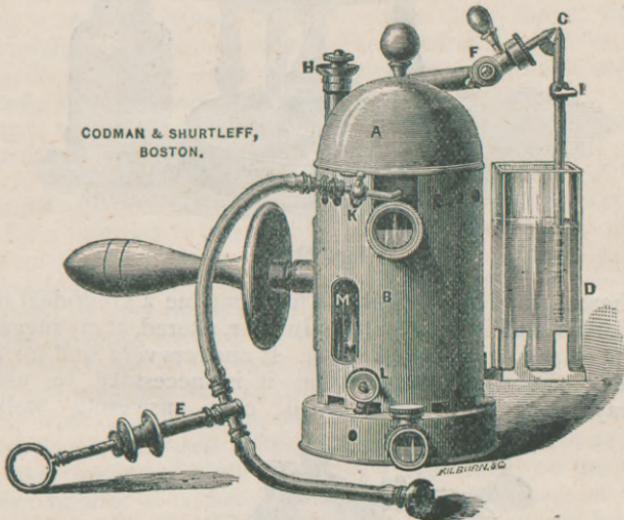
I remain, yours very truly,

JOSEPH LISTER.

A good spray producer should break up the fluid into a fine cloud, the finer the better, as coarse spray soon wets the operator's clothing and condenses rapidly upon the bed, and the hands and clothes of the surgeon. The apparatus should be large enough to work for from one and a half to two hours at a time. This little one (Fig. 3) I have here will run for an hour and a quarter. They should be so arranged that they can be placed and maintained at any level that may be desired, and should also have a contrivance by which you can regulate the amount of heat by raising or lowering the flame.

All the spray producers which I here exhibit to you, have one

fault—the flame not being protected by a piece of wire gauze, to make the light perfectly safe when using in proximity to ether; for in using these unprotected flames some serious accident will yet occur. Only a few days ago, while operating under spray, the flame of the lamp being a little below the level of the patient's head, the ether caught fire, and an explosion resulted which might have proved very serious. Fortunately, the patient was but slightly burned. Some of the lamps used are a little better protected than others, but they should all be surrounded with wire gauze after the manner of Sir Humphrey Davy's lamp, and thus made absolutely safe.



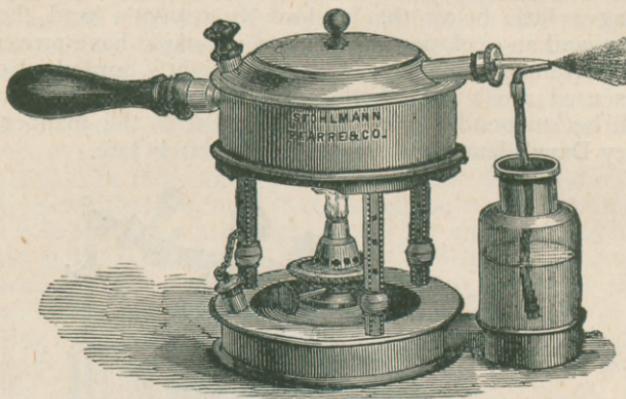
**Fig. 1.**

\* The pump E is no longer used for the purpose of filling the boiler.

The best spray apparatus is, undoubtedly, that made by Codman & Shurtleff, of Boston, Fig. 1. By means of a window in the boiler, you are enabled to determine when the water is getting low, and by a similar arrangement in the lamp, the amount of alcohol present. It has an apparatus by which the flame is raised and lowered, so that you are able to regulate the force with which your spray is projected. The one which I here show you has a very fine tube, which produces a very minute breaking up of the fluid, giving us a light cloud of spray. It also has a stand, which makes it very convenient for hospital or clinic work, being so arranged that you can raise or lower it as you wish.

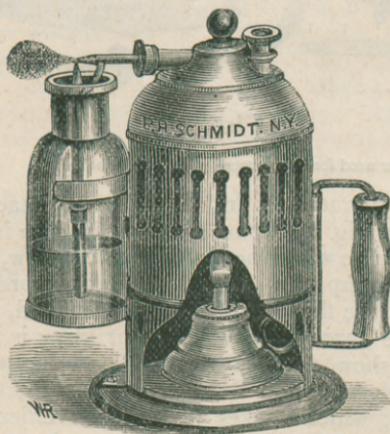
The next best instrument for this purpose is that of Dr. Weir, Fig. 2, which has the advantage of being cheaper than the one of which I have spoken. For hospital work it answers very well. It gives a good spray; this one, however, gives a much coarser spray than that of the Boston apparatus. This can be easily remedied.

Its great disadvantage is that the spray-tube is fixed and the apparatus must be lowered or raised while operating, by the assistant. Moreover, the lamp-flame should be thoroughly protected with wire-gauze.



**Fig. 2.**

I have here a small instrument that has done me a great deal of service, Fig. 3. This is a Tiemann's Steam Inhaler, altered, at my suggestion, by Schmidt, so as to give a good spray. It answers very well for dressing wounds. For large operations, it is necessary to use the large spray apparatus, this small one answering well for



**Fig. 3.**

subsequent dressings. Mr. Lister uses a still smaller one for this purpose, which he carries in his pocket. This small one which I have, will work for over an hour. The best instrument is the one which makes the finest spray, it wetting and numbing the hands but

little, and causing the fluid to last longer, while producing as good an effect upon the tissues. The spray-tube, in order to accomplish this, should be of small calibre. Dr. Weir states that if he wishes the solution to come up in smaller quantity he compresses the rubber tube. I think it is better, however, to have a finer tube, the same end being reached with much less trouble. Always be careful to see that the safety valve is right before you use it.

We will now turn our attention to the "antiseptic gauze." It is made of very coarse muslin, a sort of *cheese-cloth*, which is prepared in the following manner: Seven parts of common resin and five parts of paraffine are to be melted together over a water-bath, and one part of carbolic acid added. The latter should be slowly and carefully stirred in. Into this mixture the cloth should be dipped until thoroughly saturated, heated up to a certain degree of temperature, again thoroughly immersed in the mixture, folded and pressed sufficiently to squeeze out any excess of the compound.

There is one great objection to the use of this gauze if you get it in the stores—it is expensive, costing from ten to fifteen cents per yard. If you make it yourself in large quantities, it will cost but from four to five cents per yard. The imported gauze costs in single pieces from fourteen to fifteen cents per yard, while in quantity it can be had for from eleven to twelve cents. As considerable is used in each dressing, the cost is something to be considered.

It should be kept rolled up in a thick piece of brown paper. The resin and paraffine are used for the purpose of holding the acid firmly fixed in the meshes of the cloth and preventing its evaporation, which would certainly occur without them. This prepared gauze is used for covering wounds and making bandages for dressings.

Another material used is the Mackintosh cloth. It is an imported article and consists of cloth on one side and rubber on the other. It has a strong odor of carbolic acid, and is used to protect the parts from the atmosphere. Before using it, hold it up to the light and determine whether or not it contains any holes, for even a small pin-hole through it is liable to cause an unpleasant failure of the whole plan. A piece of rubber cloth, or rubber tissue, in fact anything of the kind will answer equally well. This, however, is supplied a little cheaper than the rubber tissue, and is, on that account, generally used.

There is another article used, known as Mr. Lister's "protective oil-silk." Both sides of it should be coated with a thin layer of copal varnish, and then covered over with a mixture consisting of one part dextrine, two parts starch, and sixteen parts of the 1—20 solution of carbolic acid. This is allowed to dry on the oil-silk. What is it for? It is called protective oil silk and is used to protect the wound from the action of the carbolic acid, for while this acid is all powerful in destroying germs, it will, if left in contact with the parts too long, prevent union or healing. Carbolic acid is only meant to come in direct contact with surface during the operation or while dressing it afterwards. A small piece of this silk laid over the wound protects it from the action of the gauze, which is laid above it. The rea-

son that dextrine &c., are used is to enable it to become uniformly moistened when dipped in a watery solution.

In addition to the Mackintosh cloth and oil-silk, we must have some other appliances. Foremost amongst these in Mr. Lister's treatment, is rubber tubing. It is kept in open wounds for the purpose of drainage.

There are three sizes of this tubing, and it is used in this way: A piece of the tubing with a number of holes cut in its side is placed in the wound with one end just protruding from between the lips. To keep the tube from slipping either in or out it is a good plan to pass a thread and needle, previously carbolized, through the tube and skin, thus stitching it in for the first few days. This can be easily done while the patient is still under the influence of the anæsthetic, or a better way is to pass a thread through the end of the tube and fasten the thread to the patient's body, at some distance from the wound, by a piece of adhesive plaster. Unless you resort to some such expedient you will have trouble in keeping the tube in place.

These tubes, as I have already told you, are for the purpose of maintaining free drainage of the wound. If there is much discharge the parts should be daily cleansed with the 1-40 solution. If, however, the wound is doing nicely there is no need of this, it being simply necessary to cut off the tubing, piece by piece, as it is pushed from the wound by granulations until the last portion is reached, when you will remove it.

In introducing a drainage tube, it is always best to make a counter opening, if you can, so that you may have two openings through which to pass it. Mr. Lister has, lately, been using-cat gut ligatures and pieces of horse hair, instead of a drainage tube. These were first thoroughly saturated with carbolic acid and then drawn through the wound, a little bundle of horse-hair is easily retained, and, after a little time separates so that it can be easily removed one or two hairs at a time.

Another thing very necessary to the accomplishment of a perfect result, is to be able to do away with ligatures; for if there is any foreign body in the wound, and a ligature is unquestionable such, it will excite inflammation generally, and produce irritation always. Therefore in all wounds where we try to get union by the first intention, we do away, as much as possible, with ligatures. Acupressure was the first step in this direction, torsion the second, and last and best of all, the cat-gut ligature.

They are thoroughly saturated with a mixture of carbolic acid, (one part dissolved in one tenth part it's weight of water) and five parts of olive oil. They should be left in soak for two or three months. It is best, I think, to buy them already prepared, and save yourself this trouble. They come in two or three different sizes. Their great advantage lies in the fact that after you tie them you can cut both ends off short and leave the knot in the wound, for the animal substance soon shrinks and dissolves, producing no irritation whatever. In cases where you do not care to apply antiseptic measures, the plain cat-gut ligature behaves in the same manner.

In the operation for simultaneous ligation of the common carotid and sub-clavian arteries, which I performed about a year ago, I tied both vessels with this material. This procedure was very strongly objected to by some of the surgeons who were present. I tied them both very carefully and was particular to tie the square and not the surgeons knot, in order that the ligature might hold well. I then cut off both ends and left the knots in the wound. They caused no trouble whatever, and were never heard of again. I have never had a case of secondary hæmorrhage following the use of this material.

Sometimes it is necessary to use silk for sutures. They should be passed through a compound consisting of one part of carbolic acid to ten parts of melted wax, and dried with a towel, by which means any superfluous material is removed. For sutures they are much better than cat-gut, as the latter soon melts and allows the wound to gap.

Mr. Lister also uses what he calls the "safety pins," which are so made that their ends will not penetrate the Mackintosh cloth, and allow germs to reach the wound. This shows how carefully he acts upon the idea that the air is deadly poison to the wound, and that it must, consequently, be thoroughly excluded from the parts. So strongly is he impressed with this idea that he says "a single pin-hole made in the Mackintosh cloth, might destroy the patient's life."

So much, then, Gentlemen, for the materials used in applying Mr. Lister's method to the treatment of open wounds.

At the next lecture I will describe in detail the manner in which these materials are used.

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## LECTURE II.

GENTLEMEN:—In order to successfully practice Mr. Lister's Antiseptic Method, it is necessary that we should believe, or act as if we believed, the atmosphere to be loaded with germs that are poisonous to open wounds, and, moreover, that the vitality of such germs may be destroyed by a proper use of antiseptics. By keeping these facts in mind, and endeavoring to follow Lister's directions to the letter, we will accomplish results hitherto unparalleled in the annals of surgery.

I am, as you can see, a firm believer in Mr. Lister's method of treatment, and was so persuaded by seeing results from it that I had never seen before. For the last twelve years Mr. Lister has been working out his plans to perfection. The first attempt he made was to use carbolic acid in the dressing of an abscess. Having applied it to the surface on a piece of lint, he raised the edge of the latter, opened the sac and let the pus drain out thoroughly.

After this he began to use the spray, then dressings on tin-foil, and finally reached the point that seems to be as near perfection as possible, i. e., his present method. Mr. Lister was recently called to fill the chair of Surgery in London in place of Sir William Fergusson, who lately died. At the time when he came to London there were but few Surgeons who either believed or practised his method, and as

a consequence, his first operation in this way, was attended by many men eminent in the profession, who were anxious to witness, and ready to condemn it. A patient with simple fracture of the patella was brought into the amphitheatre, and etherized. Prof. Lister laid open the joint, cleaned it out, wired the bony fragments together, made an opening for the drainage tube, inserted it, and closed the wound. All procedures were of course carried out after his method. The patient fully recovered, the temperature not having at any time gone above  $99^{\circ}$ .

As you well know, an opening into the knee-joint, was, up to a very late date, an exceedingly dangerous matter. Even a small pen-knife puncture in this situation has often brought about a fatal result, and we had come to consider such openings as serious as wounds of the abdomen. Nevertheless, in this case, Prof. Lister not only cut down and exposed the parts, but having wired the fragments, left a drainage tube in the joint and the patient recovered with no rise in temperature and an excellent joint. Gentlemen, such results are simply unparalleled.

I wish, for a few moments to call your attention to all the materials used in performing an operation according to Prof. Lister's method. We must have.

- 1st. A steam spray producer.
- 2nd. A solution of carbolic acid, 1—20
- 3rd. A solution of carbolic acid, 1—40
- 4th. Antiseptic gauze.
- 5th. A piece of Mackintosh cloth or rubber tissue.
- 6th. Draining tubes. If you fail to have these, soft catheters will do. If you have neither, a few shreds of horse hair will answer the purpose.
- 7th. Bandages made of antiseptic gauze.
- 8th. Cat-gut ligatures.
- 9th. Carbolized waxed ligatures. 10th Protective oil-silk.

These are the paraphernalia necessary to perform an operation after the Lister method. In addition all surgical instruments commonly used in other operations, are here employed. Looking over the list of additions to an ordinary operation you may think that they must of a surety interfere with the rapid and proper performance of the operation. This, however, is not the case after you are once thoroughly familiar with their uses, the operation becoming as simple and easy as when performed without them.

The following is the method carried out by Mr. Lister in performing any important operation. First, have on hand all the articles that I have named, being especially sure that your spray apparatus is in good working order. It is better to have two, in case one gives out. You next send your assistant to the house, have the table prepared, and the sponges and instruments placed in the 1—20 carbolic acid solution. The patient being anæsthetised your assistants and yourself prepare for the operation. Your hands should be first washed with soap and water, taking care to cleanse the nails thoroughly with a brush. They should then be dipped in the 1—20

solution, and the patient's wound or the parts upon which you are about to operate, sponged off with the same, after being also washed with soap and water.

Afterwards your 1—40 solution comes into play, one or two basins of it should be on hand. Into this your sponges and instruments are to be dipped during the operation. For the sponges and instruments soup-plates or the old fashioned delf pie-plates will be found very convenient.

When the operator is ready the spray should be started. The apparatus should be in the hands of a careful assistant whose duty it is to keep the cloud of spray constantly falling on the wound, never for a moment directing it elsewhere. As the surgeon changes his position, so should the assistant, so that he may not be interfered with. If the operation is to last long some support will be needed for the spray producer, if not, it is best for the assistant to hold it himself.

During the operation, the instruments that have been used should be carefully wiped and replaced in the carbolic solution. Some of you may think that all these precautions are quite unnecessary, but let me tell you, Gentlemen, that it is only by carrying out fully and carefully these details, that the best results are obtained. These spray producers are very unpleasant to use, for they throw the spray in all directions; it gets in your face and mouth, and benumbs your hands. Still this does not justify us in dispensing with the spray altogether, as some surgeons have done. Moreover, the surgeons who have neglected to use it, have failed to get such results as I have described to you; results that are quite easy of attainment, if Mr. Lister's most excellent rules are followed out in detail.

During the operation a cat-gut ligature may be needed, one or two should be taken from the bottle where they are kept and placed in the Carbolic Solution (1—20) and left there until wanted. They should be about a foot in length. When needed, one should be handed the gentleman who is to tie the artery. He ties it, snips off both ends of the ligature and lets the knot remain in the wound.

Another thing—during the operation the solution in which your sponges have been cleansed will soon become very turbid. It is not necessary to throw this out and add fresh fluid, for a thorough squeezing out of the sponges is all that is necessary, before you use them again. "It is *surgically pure*" says Mr. Lister, "as long as it contains a sufficient quantity of carbolic acid."

The operation being completed, the drainage tube should be inserted if necessary and the parts brought together with either cat-gut or carbolized silk sutures. The former should never be used where there is, or is liable to be much tension, for they are apt to melt away in a short time. If there has been much oozing during the operation, a carbolized sponge should be placed in the wound as a compress, and left there until the next day. The rest of the dressings I will describe in a few moments.

Let me call your attention now, gentlemen, to the manner in which a wound should be treated when it has been exposed for a longer or

shorter period to the atmosphere, and the germs it contains. Suppose you have a compound fracture. Air has certainly found access to the tissues, and with implicit faith in the germ theory, we at once proceed to disinfect the parts, or, in other words, to put them in an antiseptic condition.

The usual treatment of such a condition is a strong argument in favor of Mr. Lister's method. You have been taught that if a person suffers from a simple fracture anywhere, be it single or multiple, if there is no external opening, nothing need be feared, so far as suppuration is concerned. Though the swelling be great, it will soon go down, the serum be absorbed, and union of the fragments and healing of lacerated tissues take place without the formation of pus. But if, with the fracture, you also have an external wound, (viz. a compound fracture) the prognosis is very different, unless you succeed by immediately closing the wound, in converting it into a simple fracture, free suppuration will take place, and the pus may burrow about in every direction, erysipelas or pyaemia may result, and death end the story. All this simply because air was admitted to the lacerated tissues.

The prognosis between a simple and compound fracture, is, as I have already said, very different; the former very good, the latter very grave indeed. If, therefore, we can by any treatment whatsoever give to the compound fracture the same prognosis as to the simple, we are undoubtedly doing a great work. This is the very thing Mr. Lister aims to accomplish, and succeeds in doing with his method of treatment.

To do this the wound should be first thoroughly washed out with the 1-20 solution of carbolic acid. A common Davidson's syringe will answer all practical purposes, and if unable with any of its nozzles to reach every part, a flexible catheter, previously thoroughly steeped in carbolic acid solution may be passed in, and the wound be carefully and fully injected, so that all parts are washed with the solution. In this manner the wound has been put in an antiseptic condition. All this, if possible, should be done under the spray, so that while the dressings are being applied, no germs may enter.

It is in just this way, gentlemen, that the most surprising results have been produced. For the past ten years, probably, certainly for the past eight, we have been applying this principle in our hospitals, to the treatment of such injuries, only it has been done less thoroughly. The wound was washed out with a carbolic acid solution, not always fully, however, and then protected from the atmosphere with some simple dressing, such as lint soaked in carbolized oil. Lacerated wounds are brought into an antiseptic condition by washing them thoroughly with the 1-20 solution.

Now, gentlemen, I will describe the manner of applying the dressings after an operation, antiseptically performed, or after a compound fracture or lacerated wound has been brought into an antiseptic condition, by washing out with the 1-20 solution. You should always do your dressings under the spray. This is very important. After the wound has been brought together, and the hæmorrhage checked, and, if necessary, a drainage tube inserted; you must take a single piece

of protective oil silk, previously immersed in the 1-40 solution, and simply lay it over the wound. It should be large enough to cover the wound; over this should be laid one or two thicknesses of the prepared gauze, thoroughly saturated with the 1-40 solution. This is to destroy any germs that may have lodged upon the surface of the subsequent dressings. The part is now covered with from six to eight layers of the gauze, previously prepared with a piece of the Mackintosh cloth an inch less in diameter all round, placed underneath the upper layer. The smooth surface of the Mackintosh cloth should be turned toward the wound. These should be retained in position by a roller bandage made of the same antiseptic gauze. The eight layers of gauze, together with the Mackintosh cloth, should be large enough to extend a good distance beyond the wound in all directions. For instance, as I show you on this mannikin, if the wound to be dressed is just below the elbow, the dressing should be long enough to extend some distance above the elbow joint; and down, covering in the hand; and sufficiently wide to envelop the limb. The last dressing can be secured with the "safety pins," taking care that they do not pierce the Mackintosh cloth.

The reason we use so much dressing is for full protection, and so that we need not dress the wound often; not oftener than once in three, four or five days; the rule being to keep the dressing on until the discharge finds its way to the outside. As soon as this occurs, the dressing should be changed. In our hospitals, the moment this takes place, even if at night, the house surgeon is called up to redress it. Sometimes the number of dressings are so few that the surgeons task is comparatively light,

During the first twenty-four hours there is usually a very extensive discharge of serum from the surface of the wound; so great, indeed, that it may even in this time saturate all the dressings. This being the case, it is of course necessary to again dress it. As I have already said, if the wound is large, it is best to put on a very thick dressing. *You should not disturb a dressing unless there is pain, an oozing through at some point, or a rise in temperature.*

The fact that there are cavities in the wound, in some cases, which will fill with serum, shows how necessary a drainage tube is. The use of the drainage tube may, however, be carried to excess. In several amputations of the breast I did not consider this necessary. I simply brought the cut surfaces accurately together by means of compresses and applied Lister's dressings. They healed very nicely. Where this can be done there is no need of a drainage tube. If this cannot be done, by all means, use a drainage tube, cutting a hole in the oil-silk through which it may pass.

This matter of the drainage tube is of such importance, that Mr. Lister claims great results from its use; the wound being thoroughly drained by it. Where there are accumulations of pus and serum there is an elevation of temperature, and the surrounding parts soon become inflamed.

Sometimes you can leave on the dressings a week, ten days, or even two weeks at a time, and often when you think it necessary to renew

the applications, you are agreeably surprised to find the wound healed. I have already told you how you can know when the wound needs redressing.

In making your after-dressings you should have everything ready ; gauze, another piece of Mackintosh cloth, bandages, and the carbolic solution (1-40). The spray apparatus should be in perfect order, and so held as to throw the spray into every little pouch and crevice of the wound ; in fact, so that it shall reach *every* part of it. The dressing should be gradually removed until you come to the last layer. If everything looks well and there is no discharge, simply put on fresh layers of gauze and a piece of Mackintosh cloth. If, however, there is pain and an elevation of temperature, it is necessary to remove all the dressings under spray, examine the parts closely, and put on fresh dressing throughout.

You will find a tendency for the drainage tube to slip into the wound. How to prevent this I told you in my last lecture. The drainage tube should be allowed to remain in until the second or third dressing, if there is any discharge. If not, take it out. If so, it is well to wash the wound thoroughly with carbolic solution and re-introduce the tube. Mr. Lister has said, however, that unless there is some evidence of putrefaction going on in the cavity there is no need of washing it out. How can we determine that such changes are taking place? The piece of oil-silk lying next the wound is the "tell-tale," the danger signal, for if decomposition has taken place, and sulphuretted hydrogen or any bad gases are there generated, this oil-silk becomes discolored, and tells us plainly that the antiseptic method has failed. This being the case, you must at once inject the wound with the strong carbolic solution thus trying to get it back to its original condition, and renew the dressing.

If, during an operation or dressing, the spray gives out, it is best to have a piece of gauze on hand which you dip in the carbolic solution, and immediately throw over the wound, until your apparatus is in working order again, or another has been procured. Thus you protect the parts from the atmosphere.

A word now about wounds that have existed for some length of time. Suppose we have an old ulcer of the leg to deal with. Mr. Lister does not consider the carbolic acid dressing alone sufficient in these cases. He uses a solution of the chloride of zinc 1 to 12, which he paints over the ulcer with a brush. The pain is very intense, but does not last long. After the wound is thoroughly cauterized in this way, Mr. Lister applies his usual dressing for wounds, under-spray.

In operating for necrosis or caries, after exposing the sinuses, you should thoroughly cauterize them by injecting the zinc solution into them. You may then proceed to dress the wound in the usual antiseptic manner. I cannot urge upon you too strongly the necessity for carrying out fully all these little details. I might state in conclusion, gentlemen, that Prof. Volkmann of Halle, has used in his clinic for some months past, thymol solution, in place of carbolic acid. This solution is made of the strength of one part thymol to

1000 parts of water. The formula as given by Dr. W. T. Bull of this city, is as follows :

			Grammes.
Thymol,	grs. xvss		1.0
Alcohol,	℥ iij	or	10.00
Glycerine,	℥ ss	or	20.00
Aq.,	℥ xxxiv	or	1000.0

It is claimed that this solution does not irritate the surface of the wound, and consequently the "protective oil-silk" may be dispensed with. The gauze is made in the same way as with carbolic acid, except that spermaceti is used in place of paraffine. The proportions are 1000 parts of gauze, 500 spermaceti, 50 of resin and 16 of thymol.

The disagreeable odor of carbolic acid is entirely avoided by this dressing. This substance is now being tried in the New York Hospital. I have have not yet had an opportunity of using it.





