A LECTURE

ON

THE DRY COTTON-WOOL PERMANENT DRESSING IN AMPUTATIONS.

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GENTLEMEN,—The four amputation-wounds which I propose to make the subject of a few remarks to-day were, as most of you have seen, dressed according to the same method. But from questions which have been put to me here and elsewhere, I am led to think that the distinct principles which I have had in view as underlying this method have not been as clearly understood as is desirable. For this reason, and because you are likely to see the dressing used in other instances, I have thought that it might be well to place before you the *rationale* of the whole proceeding, and then endeavour to see how far it has been consistently met by our practice.

The first thing I must beg of you to observe is this: that I am not here to advocate the adoption of or to defend the cotton-wool or any other dressing, but to indicate to you those points in its employment which require explanation, and which seemed of interest in these cases, and worthy of further study. This I hope we may be able to undertake in a liberal and impartial spirit, trying the whole matter fairly and patiently. I would also ask you to remember that the main principles upon which the method is based are in no way antagonistic to those which underlie what we know as the antiseptic system. I should be sorry that you should carry away any other idea, believing, as I do, that the patient and temperate advocacy of those principles by Mr. Lister has been of incalculable benefit to surgery (whether right in every detail or not), and has produced an effect which will last as long as surgery is a science. If he have done nothing more, he has, at all events, forced upon the attention of the world, in a way that will not be forgotten, the necessity there is of aiming at absolute cleanliness. He has also directed the minds of surgeons, in a more thorough and intelligent manner than had previously been done, to the reason for and need of systematic drainage of discharges. Again, he has given additional force to the older advocacy of rest for wounds, as for all other injuries. These three, then, are the highest aims of the system which goes by Professor Lister's name: to put it briefly, *absolute cleanliness, adequate drainage, and complete rest*. That these principles are of fundamental importance all surgeons are long agreed, and we should be grateful to the man who has been the means to a great extent of forcing them recently into proper prominence, of harmonising and formulating them. But whether the method of dressing which he has designed and brought into common use is to be regarded as the only way of obtaining these ends, is a point upon which there may be considerable and quite consistent divergence of opinion among those who hold fast by the principles. Experiments in other directions, therefore, far from being wondered at or deprecated, should be welcomed and studied patiently and closely.

There had been many and various methods of dressing practised from time to time with one or other of the above-mentioned objects in view, even before the septic effects of the presence of germs had been suspected. One was supposed to secure a free escape of the discharges and their removal; another, greater cleanliness; another, greater rest. And as far as these single aims were concerned, some of them answered their purpose very well; but no really earnest attempt to design a dressing which should combine them all appears to have been made, until Mr. Lister developed his method into more or less of its present form. But that this dressing, though admirable, has its defects, both theoretically and practically, the inventor would probably be the first to admit, though some of his disciples at home and abroad do not appear inclined to do so. These defects it is not our object to dwell on here. Let me just say, however, that they are often magnified by ourselves in our zeal and with the best intentions. For instance, in our anxiety to secure thoroughly efficient drainage, we may place tubes in the wound to more than twice the amount and for more than double the time required; in fact, sufficiently to act very decidedly as irritant foreign bodies, thereby keeping the injured tissues in a state of physiological unrest, and calling forth perhaps a far more abundant secretion on the whole than if they were not present at all. Again, we sometimes mop, scour, and otherwise energetically handle the original wound in our anxiety to prevent any chance of its contamination, in a way that is

almost sure to produce much irritation, and, as a consequence, a copious reactionary outpouring of serum not long after the first dressing has been applied. We thus actually initiate a contest between cleanliness, on the one hand, and true rest on the other; for we speak here of rest physiologically, not as the mere absence of movement of the part; and this contest once begun must be more or less prolonged if the principles of the dressing are to be consistently followed. For if the serum be poured out after a few hours very freely, we are obliged to take down our dressing and reapply it, and thus the unrest is reproduced, and this fresh disturbance of the wound will probably on its part again call forth extra secretion; and so on in a vicious circle. But these faults are our own, more or less, and not necessarily inherent in the method.

Let us now examine the mode of employing the dry cotton-wool dressing, and see how far the requirements of absolute cleanliness, adequate drainage, and complete rest, are met by it in the case of amputation-wounds. But first let us consider what is meant by these terms.

By absolute cleanliness we mean the exclusion from contact with our wounded surface at any time during its treatment, not only of all palpable organic and inorganic impurities, but also of certain almost invisible minute living organisms, which we know are present in the air, and which, it is believed by many, are capable while alive of producing decomposition in the secretions of wounds. To do this, however, it is necessary, in the first place, that they should reach the wound in a living, active condition, and further, find in the latter a fluid of a certain character and density in which they can propagate largely. It has been shown, for instance, by Professor Nägeli that one of the most, if not the most, dangerous of all these organisms is quite unable to exist long or to propagate in a moderately concentrated organic fluid, in which they will develop and swarm if it be a little diluted. Possibly it is for this reason, as has been pointed out, that where an open wound is only secreting enough lymph to glue its surfaces together, we never find fœtor and decomposition; whereas if the same kind of wound were effusing even serum which was retained about it, it would be fetid and swarm with bacteria. Where the latter fell upon viscid organisable lymph, they had not sufficient moisture to support life; while this would be supplied by the serum. This is the explanation of a believer in the germ-theory of decomposition in wounds, and harmonises with some of Mr. Lister's observations. On this reasoning, if we could obtain a perfectly dry dressing and a moderately dry wound whose secretions should remain above a certain density throughout, the presence or absence of noxious germs would be a matter of indifference, for in such a case they would not be able to propagate. But such conditions could only be very exceptionally met with, and hardly ever in amputations, though they are known.

But the next best thing to this would be a dressing which should absorb all secretions from the wound, without contributing from its own meshes the supposed hurtful germs. This is aimed at in Mr. Lister's method; with what results we need not discuss here. We must remember, however, that it has been shown by his adherents that certain species of germs may be present in large numbers in wounds under his dressings, without producing any septic effect. We aim, however, at the exclusion of all germs, good, bad, or indifferent, whatever be their relation to sepsis. They come under the definition of dirt once given, and as such we ought to abhor them. Dirt, namely, has been defined as "nothing but misplaced matter"; and we suppose that the whole "coccus" family are misplaced in wounds, and shall not be in error if we endeavour to exclude them.

Next, what do we mean by adequate drainage? You should be aware that, roundly stated, there are three tolerably distinct species of fluid for which it may be necessary to provide a free escape in amputation-wounds. Shortly after the operation, we may have blood from small vessels, or parenchymatous oozing. Later, when reaction sets in, there may be abundant serous oozing, and, later still, true pus. All these may be perfectly aseptic, and yet produce much fever, etc., by the tension which they cause in the wound. This tension is apparently but one form of physiological unrest, the pent-up fluid causing stretching and pressure on the injured nerve-filaments in the wound, and consequent vaso-motor disturbance, resulting in rise of temperature. But these fluids, on the other hand, may have decomposed, and may then produce septic fever, from absorption, it is supposed, of the noxious matters so generated, into the blood.

Now, to avoid both these sources of danger, we must provide some way or other for the free escape of these fluids, whether by drain-tube, strip of lint, gutta-percha, or other substance interposed between the lips of the wound. But we must beware, in placing a foreign body in the latter for the sake of carrying off its secretions, that this body be not present in such amount, in such a way, or for such a time, as itself to produce undue irritation. For it would thus, as I said before, defeat its

own object and provoke discharge. This is a point we are all constantly liable to forget, and do forget frequently, in the use of the ordinary drain-tube. It is often made unnecessarily large, and left in too long. Again, drainage should not be taken to mean merely conveying the secretions out of the wound, but also as far as possible away from the latter, so as to keep it in as dry a condition as may be for the reasons given. Remember always that dry organic substances are less liable to rapid decomposition than moist under similar conditions.

Turning now to the question of rest, we must bear in mind that the term as applied to wounds should have its fullest physiological significance. It should not be merely regarded as the absence of movement of the limb during and after the operation. A wounded part may probably be kept in a state of unrest quite as much by the continuous contact with it of an irritant fluid, whether applied as a dressing or accumulating in its own tissues, by a clumsy or misplaced drainage-tube, or by an unevenly applied bandage, as by being moved about or roughly handled, and the consequent constitutional disturbance may be equal or even greater. If, during the operation, the wound be wiped over with any particularly stimulating solution, be it of alcohol, carbolic acid, or anything else, a very real irritation of the exposed nerve-filaments and tissues is induced, and we violate one of the first laws of physiological rest. Cleansing solutions, then, should be as weak as possible, compatibly with the preservation of their special properties. But how much greater is the irritation when we sponge and scrub the face of a wound with strong solutions and with unnecessary zeal, as many are often forgetful enough to do, myself amongst the number. Such treatment is usually followed by copious reactionary outpouring of serum. Some wounds, it is true, have to be energetically excited to promote a decided reaction for special purposes, but not those of amputation, where we mostly have fresh clean-cut tissues. In arresting the primary hæmorrhage, then, and in cleansing, stitching, and placing a drainage-tube in the wound, we should usually aim at doing only as much to the raw surface as is absolutely necessary, and no more; and our cleansing solutions should not be too strong or used too long. In applying, also, our first dressing, we should use as much care as if it were going to be left on for weeks. And, if it could be left on for weeks, it would be so much the better. The wound thus at rest would incline to pour out only as much plastic material as would be necessary for union and could be rapidly organised, and would not be excited over and over again at each dressing to give out more fluid material in the shape of serum or pus. And supposing that we regard bacteria as hurtful, a wound comparatively dry from lack of excitement would offer a very unfavourable soil for their propagation, even if they had access to it. Suppose, then, two dressings perfectly pure in the first instance, that one would manifestly be best for the wound which could be left on longest. This, too, we are often liable to forget in our anxiety to see how all is going on about the part operated on. To the patients, also, it is in many cases of almost incalculable importance that they should be spared, not only the pain of disturbing the dressing, but, often far more, the mental distress they go through at such a time. Pain and anxiety are two powerful depressants of vital force; and it may make the difference of life or death to a feeble individual exhausted by disease whether he have an extra twenty-four hours of rest from disturbance of his wound, and the pain and emotional disturbance consequent thereon. How much better, then, is his state when he can be left entirely alone for days or weeks. Unfortunately, this is often impossible or undesirable with the present modes of drainage. Though it is no longer necessary to meddle with wounds in order to pull away ligatures (thanks to Mr. Lister's invaluable invention of the absorbable catgut—a very great step in the direction of rest), still there is the drain-tube in the wound as a foreign body. For this reason, we are obliged to take down any dressing which includes it, in order to shorten or remove it altogether, no matter whether the dressing itself could be left on otherwise or not. Could this be avoided, it would be most desirable. And it appears possible that it may be so in the future. In a recent number of Langenbeck's *Archiv*, there is a very interesting article by a Dr. Neuber, on the use of soluble drainage-tubes. In this, he relates his experience with such tubes in a number of cases. They were made of decalcified bone, which he had found by experiment to be the best material for the purpose. Using these, he was able to leave a Lister's dressing, with some extra packing of salicylated wool, undisturbed for fifteen days, when the tube was found to have been absorbed, and its track healed. Now, if these absorbable drain-pipes can be combined with the catgut ligature and suture, we may perhaps be able hereafter with care to put up an amputation-wound once for all in a pure, dry, absorbent material, and leave it so until it is completely healed before removing the first application. This, if achieved, would go near to realise our ideal dressing, combining cleanliness, adequate drainage, and complete rest.

Let us glance now at the dry cotton-wool permanent dressing as a

method of wound-treatment, and see how much of these three factors it contains. We have all been familiar, no doubt, for many years with the use of this material for injuries of various kinds, and have seen it of benefit. But one of the first to employ it as a permanent dressing to be left on for weeks was M. Alphonse Guérin of Paris. And remember, please, that it is not the material employed, so much as the fact of his venturing to leave it so long undisturbed round a wound, that was the novel feature of his practice which has attracted much attention. I gather from reading, and from a conversation with himself, about a year and a half ago, that, as carried out by him, this method simply consisted in wrapping a very large quantity of ordinary cotton-wool round the wound, which had not been cleaned in any particular way. This was then bandaged tightly around the part, and so formed an elastic, even-pressing, and somewhat absorbent covering, which he left undisturbed for weeks, or until the part was healed, or nearly so. This certainly secured rest, but no particular provision was made for cleanliness at starting, nor, so far as I know, for drainage.

Not long after M. Guérin's visit, Mr. Erichsen suggested to me to give this plan a trial in the hospital. He had, I believe, done so himself in private, and had formed a favourable opinion of it. I did so, as you know, in an amputation of the leg, and had such a satisfactory result that I have employed it since in two amputations of the thigh, and one of the breast. As this is the only systematic test of the method that I know of in a hospital in this country, it appears worth while to take a few notes of the results. These you have been able to watch for yourselves, so I may be brief, and avoid too much detail. But I have essentially modified M. Guérin's method in these cases, feeling bound to do so, and as follows. Knowing what cotton-wool often is in hospital, where it is left about here and there—namely, a trap for dust and dirt—I have had all that employed here baked at a dry heat of 300° to 400° Fahr. This, you know, would render all organic matter in it innocuous, and certainly destroy all germs. Now, pure dry cotton-wool is well known to be a perfect shield against the access of dust and germs to substances covered by it. I need not allude to the familiar experiments which go to prove this, and that air is completely filtered of all decomposition-exciting impurities (whatever they may be) by passing through it. If this be true, a wound perfectly clean in the first instance, carefully enveloped in perfectly clean cotton-wool in sufficient amount to absorb its discharges, ought to remain quite free from contamination from without until the dressing is removed. The wool, so cleansed, was laid out just before the operation on a towel, to the depth of about six inches, and thus ready to be slipped without loss of time under the stump, and lapped over the end and along its upper surface as soon as the sutures were completed. It was broad enough to envelop the limb, and was firmly bound round the latter with a bandage for a long distance up. Now, what measures had we taken that the wound itself should have been put up within the wool in a really clean state? First, the hands of all participating in the operation were well washed in a five per cent. carbolic acid solution, about the properties of which I must assume we are all agreed. The whole limb both above and below the seat of operation was similarly treated, as also all instruments and appliances used during the latter. When this was completed in the usual manner, and the vessels secured with carbolic catgut, the Esmarch's bandage was removed. The wound was then sponged with iced carbolic solution, perhaps, I since think, with unnecessary energy on my part. After this, I wiped it over in the three first cases with five per cent. of carbolic oil before stitching it with antiseptic silk, and inserting an ordinary drain-tube. A strip of lint about as broad as the limb, dipped in the same oil, was then laid along the under surface of the stump, over its end and along its upper surface. Over this, the wool was now quickly folded as described.

These precautions ought to have secured a clean wound. As the spray was not used, the carbolic oil was employed as described. It was thought that it would adhere to the raw surfaces and flaps longer than the watery solution, and so render harmless any dust or invisible dirt which might fall upon them before they were enveloped in the wool. Should the same have fallen on the latter during our manipulations, the oiled lint would meet it, and render it innocuous for the wound. The dressing so applied was left undisturbed as long as possible. By this, I mean until either the thermometer indicated undue fever, whether from possible tension or toxic absorption, or the dressings began to give off an unpleasant odour.

Now, as to the three questions of cleanliness, drainage, and rest, what does our experience seem to teach us here?

Generalising on these four cases, the first point that strikes us is the large amount of complete rest secured to the wound and to the patient; a far larger, I must admit, and more perfect than I have ever attained by any other method. In Case 1, an amputation of the leg for sarcoma of the foot, the patient, a woman, aged 21, enjoyed the most perfect rest

for ten days, until the first change of dressing; then for seven more, when the second dressing was applied, after which she was practically well, the wound having healed almost straight off, except where the drainage-tubes lay. In Case 2, an amputation of the thigh for disease of knee in a man aged 26, we had perfect rest for four days, then for two, when he had the only distress complained of. On the fifteenth day, after a few more dressings, he was up by the fire (the wound being almost healed), and was about on crutches a couple of days later. In Case 3, a patient aged 45 (amputation of breast for cystic disease), we had perfect rest for six days; then change of dressing, and again at intervals of four or five days, until an early cure. In Case 4, a patient aged 55 (an amputation above the condyles of the femur), we had complete ease from the date of operation until the end of the case. The dressings were only removed on the tenth, sixteenth, and twenty-third days. Now, except in Case 2, the patients were, from the beginning to the end, almost absolutely free from pain. And that the wounds were at rest was seen in the absence of almost every trace of reaction and of contraction in the flaps (which was peculiarly striking), and in the small amount of secretion found in the dressings; also by the temperature-chart. We had, then, freedom from pain, except in Case 2, before the second dressing. This pain was in his phthisical chest, however, and not in the wound. We had no tension from lack of drainage, as indicated by this absence of unpleasant sensations in the part and of marked temperature-disturbance. But, quite as important as this, the patients were spared at the most critical time of the case all the dread and worry of having the dressings changed and the wounded part handled. They lay quietly as first placed, with a soft, elastic, warm, and evenly pressing material round the whole limb; remember, for ten days in two cases, and for six and three in the others. The second interval of rest, too, lasted for seven and six days respectively in the first and last cases.

Our experience, then, in these instances would seem to show that, as regards the securing of mental rest for the patient and physiological rest for the wounded part, this mode of dressing has shown itself admirable. To my mind, I must admit that in this respect it goes far beyond the old method of simply laying the stump, covered with oiled lint, on a pillow. For here we have all this, and in addition firm elastic support to the muscles all the way above the wound; a support no less grateful to the patient, as diminishing the tendency to spasm, than important to the flaps as combating their retraction. I cannot but think, too, that the absence of all variations of temperature about the wound must be a matter of considerable importance. This the permanent dressing of dry cotton-wool prevented, by its bad conducting properties. Changes of temperature, particularly in a wound, mean disturbance of the equilibrium of the nerve-forces of the part, and consequent disturbance in its nutrition, the very thing we are doing our utmost to avoid.

In two of these cases, I should have left the first dressings on much longer if it had not been incumbent on us to remove the drainage-tubes and stitches. But these had done their work, and at the end of ten days, or even earlier, were only irritant foreign bodies.

This leads me to speak of drainage. That this was adequate, was indicated by the absence of unpleasant sensations on the part of the patient and of marked rise of temperature. Had there been tension of serum, blood, or pus to any noteworthy degree, both of these factors would have been present. Moreover, the secretions were fairly distributed through the wool around the wound, and had to a large extent dried up; so that, at the end of ten days, we found only a very small quantity, perhaps a couple of ounces of viscid pus, about the line of the wound.

We come now to the question of cleanliness, and how far its requirements were met in these cases. You have seen that, in applying the dressings, we went a long way in this direction. Now, during the ten days which elapsed before their removal in Cases 1 and 4, and six days in Case 3, what evidence had we that all was clean around the wound? First, there was the temperature chart to guide us. You will see by it that in all cases we had a rise towards the second day, and then a fall again. This ascent probably corresponded to reaction after the shock of the operation. It may have been due to the accumulation of a little serum within the flaps. At all events it was slight, and, moreover, transient. In Case 4, this was hardly present at all, but was followed on the fourth day by a rise to 101.4°, for an hour or two, after which the temperature gradually fell to normal, and remained nearly so until the end of the case. In Case 1 it slowly rose until, on the tenth day, we had 102.6°, after which it fell, and remained at nearly normal throughout. In the other two cases, I am not sure that the rise on the sixth and seventh days was not due to other causes than the wound. You must remember that, in Case 2, we had well marked evidences of phthisis, with spitting of blood. But in none of the cases had we a persistently high temperature, or one that called, in my opinion, for

removal of the dressings. Next, we had no unpleasant sensations on the part of the patient to indicate tension, etc., in Cases 1 and 4. In Case 3, we had a slight sense of contraction about the wound, from the description like what would be caused by the drying of the blood on the dressings. This was on the fifth day. Another indication as to the cleanliness of the first dressing during the long interval before its removal, we gain from our sense of smell. Now, in Case 1, there was no odour at all from the wool during the first ten days; in Case 2, a faint sickly odour like dry blood was, I think, perceptible on the eighth day. But you may remember what difficulty some of you had in determining whether there was or not. On this day, when I was not present, Mr. Banks tells me that there was a great difference of opinion on the point among the class going round with Mr. Heath, but that the greater number were inclined to follow Mr. Heath, who was kind enough to test the dressing as to this point at the time, and who took the view that there was no smell. On the tenth day, however, it was plain, but very faint. In Case 3, the dressings had no smell of decomposition from beginning to end. In Case 2, they gave off a very marked odour almost from the beginning to the end. In cases 1 and 4, the second dressings had a slight odour a day or two before their removal, seven and six days after they had been applied.

Now as to the state of the dressings on their first removal, after ten days in 1 and 4, six and three days in the other cases. In Case 3, as has been stated, there was no odour from the start to the end. In all the others there was a pungent smell, like high game, in the small quantity of pus which lay about the wound. There was no question about this smell, it was very bad; but if we are to judge by the appearance of the wound and flaps, and the patient's general condition as to temperature, etc., the decomposition which it indicated was apparently doing no harm.

Now as to the pus present in the dressings: this was found in remarkably small quantity, considering the time it had to form. This was probably due in the first instance to the absence of irritation; in the next, to evaporation of its watery constituents through the wool. What was found was thick and viscid, certainly for the greater part much too concentrated to form a good soil for bacteria. As to the latter, they were present on all occasions in numbers, but apparently not very active. Mr. Silcock, to whom I am indebted for a more careful examination of the pus in regard to this point than I was able to make myself, tells me that there were no rod bacteria, but only micrococci present. Whether this has a bearing on the question of cleanliness, I think we must leave to further study of the whole matter. It is, however, so far interesting. On the removal of subsequent dressings, a similar pus and odour was present.

No one, then, who saw the removal of these dressings, would have said that the highest ideal of cleanliness had been reached, that is, if much stress is to be placed on the smell emitted. We must be careful, however, I think, not to lay too much stress on this smell, undesirable though it be. It is just possible that there may be some odours indicating danger, and others not; just as there are apparently harmless as well as harmful organisms to be found in the pus of wounds. At all events, the pus around and in contact with the wound was in a very desirable condition. Better than all, in conclusion, the patients had an uninterrupted, rapid, and good recovery in all cases.

We have now examined some of the principles upon which we have used this dressing. It has been an interesting experiment, and one from which I myself must say I have learned much; and chiefly the great value of prolonged rest; and that, in our struggle for cleanliness, we may needlessly go too far towards the production of unrest. Also that a wound put up carefully in a very clean condition, may be so left much longer than we usually think.

Further trial may teach us still more. If then we find the dressing wanting on the whole, let us by all means reject it without more ado. In the meantime, let us give some further study to its bad and good points in a fair, liberal, and candid spirit of inquiry.

DORKING RURAL DISTRICT.—There is no striking feature in the death-statistics of this district for 1878, its health, whether measured by the rate of mortality from all causes, or from zymotic diseases, or among young children, being very good. The general death-rate was 14.3 per 1,000 of the estimated population, a decrease of 1.1 on the mean for the last five years. Measles were not very prevalent, but whooping-cough was rather more fatal than usual, and a considerable number of cases of scarlatina occurred. Enteric fever was reported at nine houses in Dorking and in one at Westcott. Such remedial measures as were feasible were adopted in every case. The means for the disposal of the sewage of Dorking seems to require improvement; but there is hope of action in this direction being taken, as the formation of a special drainage district for the place is under consideration.