THE BRADSHAW LECTURE

ON

ANTISEPTICS IN SURGERY.

Delivered at the Royal College of Surgeons of England, December, 1885.

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INSTANCES of great success in the use of the carbolic spray and gauze method have occurred to most surgeons who have practised it. One instance occurred in my practice, which I will occupy a few minutes in relating.

A youth, aged 16, was sent to me with an enormous abscess, filling the left abdominal and lumbar regions, and extending under Poupart's ligament as far down as the knee. It was associated with a prominent projection of the third lumbar spinous process. The patient was much emaciated, and very weak, while much hectic fever and depression gave evidence of the approach of a fatal termination.

The tumour was aspirated several times, but a semisolid pulpy mass of *débris*, which would not pass the aspirating tube, always remained, and the pus reaccumulated rapidly. I then, with all the precautions possible, and under the spray, made a free incision outside the prominent lumbar spinous process, evacuated, by gentle sponge-pressure, the pulpy and other contents of the abscess, and found and removed a piece of exfoliated bone from the side of the body of the diseased vertebra. Very little discharge of any kind afterwards appeared. The patient was placed on an inclined plane, with the shoulders lower than the pelvis and legs, a bandage was placed on the leg and abdomen, and double extension was applied to the feet. He recovered rapidly, and the thin discharge which followed was aseptic throughout, without even a sour smell. The patient is now walking about well, with the wound quite healed.

This case illustrates forcibly the remarkable power which carbolic acid possesses in preventing the formation of pus-cells. A similar effect is seen in its action upon granulating surfaces. If continued after cicatrisation commences, it retards the progress of healing by destroying (when in a more or less concentrated form) the epidermal nuclei. Then the discontinuance of the carbolic applications accelerates healing. This property seems to be not entirely dependent upon its antiseptic power. Nitrate of silver possesses ten times its antiseptic power, but, as is well known, it promotes the cicatrisation of a sore. The sulphates of copper and iron, with four times its antiseptic power, also promote cicatrisation. Carbolic acid, especially in the form of spray, but also when the solution is simply injected, has, again, the advantage of giving off its vapour at the temperature of the body, so that it enters and fills abscess and empyemic cavities, sinuses, and burrowing tracks, where putrefaction may be lurking, to spread again septic influence.

The more solid non-vapourisable antiseptics, even though more powerful in direct contact, cannot do this. On the other hand, the vaporisable nature of carbolic acid, and of some other antiseptics, makes them more difficult to retain in the dressings. Although, by the use of paraffin and resin, with its jacquardette covering, Sir Joseph Lister succeeded in checking this waste to some extent, these dressings cannot be kept on safely for more than two three or four days, if the amount of discharge be great. In such cases, the advantage of infrequent dressings is to some extent lost. In country practice, and in the army, this loss of efficiency is frequently serious, and putrefaction destroys much of the beneficial effect previously obtained.

There is little doubt that the use of the carbolic spray carries with it a greater certainty that the air of the room, the instruments, the clothing, and the hands of the operator and his assistants, are perfectly pure, and less liable to accidental contamination. The wound is washed, as the operation proceeds, from loose clots and detached portions of tissue. It gives a greater sense of security that the patient has been effectually shielded from septic infection. The carefully packed gauze dressing aids the desired result more or less perfectly. But the discharge is apt to pass *under*, instead of *through*, the packing, along and between the skin and dressing, and to become septic by exposure. The simultaneous use of the absorbable antiseptic ligature is a powerful aid to success, by allowing an entire pri-

mary healing to the deepest parts of the wound. Since I have employed carbolised catgut, and tendon-ligatures cut off short, secondary hæmorrhage has been very rare—I may say, indeed, almost abolished—in my hospital practice; while erysipelas and pyæmia, except in imported cases, are equally seldom seen. Surgeons, I think, agree that the scourge of hospital gangrene has become, since the period of antiseptic practice, quite extinct. Not less virtue do I attribute to the use of free and skilfully applied drainage. With these improvements combined, quick and primary union has been the rule, and there has been very little trouble in the after-treatment.

But these good results of the Listerian combination have not been unattended by drawbacks, some of a serious nature. The picture of the benefits of the carbolic spray and gauze has its reverse side. The most important item on the "per contra" page is the production of carbolic poisoning. I have in many cases had some indications of this injurious effect, evidenced by colicky intestinal pains, nausea and vomiting, olive-coloured, sedimentary, and pellicled urine, and a temperature raised to 101.

A slight degree of these symptoms I do not look upon as at all serious. They can easily be got rid of by diminishing the strength of the materials and solutions employed, and are sometimes coincident with improved symptoms in acute burrowing thecal or other abscesses, or in suppurating cavities. In one case, however, I was strongly led to attribute the fatal result which ensued, to an overdose of carbolic absorption, after the use of the spray and gauze, with injection of carbolic lotion, to purify an old sinus from diseased bone, among the muscles of the forearm. In this case, the vomiting after the operation, beginning on the same night, and accompanied by abdominal pains, was incessant. The operation for the removal of the dead bone was by no means a prolonged or a severe one; there was little or no bleeding, and no symptoms of shock. The patient died the next day from exhaustion. The occurrence of even one such case as this forms a serious objection to the indiscriminate use of the method.

The next item in the array of mischance is the occurrence of carbolic irritation of the wound and skin, in persons with thin cuticle and sensitive integuments. These patients gave few or no previous indications of the peculiarity, and were treated exactly like others, who had no such symptoms, and were dressed in the same manner, with the same gauze and protective. When this has occurred, I have used the eucalyptus gauze, but cannot speak highly of its power as an antiseptic. More satisfactory results were obtained from the salicylic wool, of about 5 to 10 per cent. of strength. When well placed and skilfully packed around the wound, it has proved both efficient and comfortable. Again, if the efficiency of the spray and gauze combination be tested too severely, by being kept on too long, and putrefaction has fairly set in, the stench on removing the dressing sufficiently indicates that the latter end of the case is worse than the beginning. I have witnessed serious symptoms of broncho-pneumonia, with depression of the heart's action and shock, after keeping the patient long exposed to the chilling action of the spray in a prolonged operation, especially in cold weather. This can be provided against, to a great extent, by keeping the patient carefully wrapped in a warm blanket, under a waterproof covering, and his feet covered with warm socks and list slippers. Such an increased necessity for unremitting attention and foresight on the part of the surgeon, who is responsible for the proper treatment of his patient, is an additional, and often a severe call upon his vigour and vigilance.

There are also considerations which become important in the interest of the surgeon himself, as distinguished from that of his patient. It frequently happens, that the spray and carbolic washings and cleansings affect seriously the health of the operator constantly engaged in this work. One well known and remarkably successful ovariologist had his kidneys so seriously affected by carbolic absorption, that he was obliged to give up entirely the use of the spray and gauze method; and it is said that his cases did quite as well as when all the Listerian precautions were carried out. Another eminent ovariologist, after adopting the same precautions for some time, at length reverted to his former reliance (well justified by the excellent results which he had obtained) upon the scrupulous care, cleanliness, and disinfection of his hands and instruments.

A curious question here suggests itself, How it is that, in operations supposed especially to demand the most careful and complete antiseptic arrangements, and a thorough cleansing of the peritoneum, the whole of the strictly Listerian system of precautions have been gradually discarded? The obvious conclusion is, that other antiseptic ways have proved equally effective, and less objectionable in practice, when equally carefully carried out. A minor inconvenience attendant upon the employment of the spray, but one which, I believe, has tended to promote the opposition to, and the neglect of, it in Germany, is its

effect in obscuring the vision in weak and near-sighted operators during the most critical stages of the operations in which they may be engaged, by the condensation of moisture upon spectacles and eyeglasses. Even without these sometimes necessary, but always troublesome appendages, the wavering motion given to the steam and air by the spray-producer tends to perplex and to incommode the operator, until he becomes so much used to it as to be able, in some measure, to disregard it. Again, the ponderous nature of the machinery, the cumbrous materials, and the numerous and minute precautions of the strictly Listerian method, render it difficult to carry them out, and often impossible to continue them, in country practice. Besides the trouble of getting them together in case of a sudden call to operate at a distance from London (which might, by constant practice, be got over), there is the very probable chance that the country practitioner may be so deficient in the management and material of the Listerian methods, that any approach to accuracy or effective completeness is rendered impossible.

The substitution for the spray of a constant dropping of the antiseptic fluid from a sponge or bit of muslin has been quite efficient, when thoroughly carried out by an assistant not more careful of observing others than in attending to his own duty. If the patient be carefully dressed after the operation with a proper amount and thickness of antiseptic padding in the most dependent drainage-tracks, and if there be no great oozing or intermediary hæmorrhage, a period of four to five days may be got over without any septic change, and the wound healed so far as to render any want of precision and effectiveness in dressing less injurious to the patient.

It has also been objected to the spray, from a scientific point of view, that the commotion and whirling vortices produced by the steam-spray in the air, are as likely to carry bacteria into the wound or cavity which may be open, as to destroy them therein, or to render them innocuous in the tissues. Considerations like these, together with the uncertainty which prevails as to the extent of the true microbicide powers of the carbolic acid when diluted with steam, and also as to the extent of the inhibitive influence of the indeterminate vital factor *x*, before alluded to (aided simply by the excessive cleanliness resulting from the spray), have led to the gradual discontinuance by most surgeons of the use of the spray and gauze. The German and French surgeons seem to have discarded its use for some time. One cause of the discredit into which it has fallen in hospital practice is undoubtedly the great costliness of the dressings of gauze, both carbolic and eucalyptic, rendering it impossible to continue its general use in charitable institutions. And, although this cause may not equally operate in private practice, yet the constant practice necessary to manage it with automatic accuracy by the hands of assistants, dressers and nurses, is only to be obtained in hospitals. Sir Joseph Lister, with that courageous adherence to the truth of his convictions which is his characteristic, has at length himself discarded its use, and has, with the steady perseverance which also distinguishes him, turned his attention and experiments towards the adaptation of the well known antiseptic properties of the bichloride of mercury. This substance has been, for a considerable time past, extensively used, both in this country and on the continent. It has the advantage of cheapness, and is easy to procure in any quantity that may be required. Its insolubility in albuminous fluids renders it somewhat intractable. In the form of gauze-dressing, it was difficult of diffusion, and apt to accumulate irregularly at various parts, and to be wanting altogether in other portions. At the more concentrated parts it set up skin-irritation, and endangered noxious absorption. Solution in spirit of wine and glycerine does not entirely remove this objection, while it greatly increases the expense. The desired unirritating solvent for corrosive sublimate is found in the hydrochlorate of ammonia. The solution of the bichloride of mercury of the *British Pharmacopœia* is the form of preparation most simple, as well as most easily available, for antiseptic purposes. It was known to the ancient and mediæval chemists and alchemists by the name of *Sal alambroth*. It affords the desired solubility, and an equable and exact diffusibility. It can be taken up by absorbent cotton-wool, and dried with tolerable certainty as to its strength. It can be used as a wash over the wound, by simply dipping the prepared cotton- or wood-wool in pure water, and squeezing it over the wound. Thus it affords a simple, portable, convenient, and readily applied antiseptic. And it possesses the desirable quality of being cheap, and suitable for hospitals, and for army and navy practice. It is a most powerful microbicide, so dilute a solution as 1 in 1425 being sufficient to destroy putrefactive fermentation, and to render bacteria innocuous. It is employed of the strength of 1 in 1000 and of 1 in 500, the first to prevent and the last to destroy putrefaction.

If, on further experience, it be found that this substance is equally

effective in practice as in theory, and is not, when plentifully and habitually used, injurious either to the wound, the general health of the patient, or to the hands and instruments of the surgeon, it will become a favourite mode of dressing wounds. We are thus again furnishing up for active use the old weapon mercury, with which our forefathers did so much execution upon their patients.

I have lately been trying a dressing less open, perhaps, to the suspicion of noxious effects. It is a solution of the peroxide of hydrogen or oxygenated water, a preparation well known for its chemical efficacy, and manufactured in quantities for the purpose of bleaching hair. It is, I believe, absolutely non-irritating, and is very convenient in its application. A piece of absorbent cotton is dipped into the solution, squeezed over the wound as a wash, and then laid upon it as a dressing. Over this a piece of thin gutta-percha tissue or oil skin is laid, and covered with a layer of absorbent or salicylated cotton-wool, and bandaged lightly. In deep sinuses and irregular wounds, it may be used with a syringe or irrigating apparatus and double tube.

As a microbicide, the peroxide of hydrogen is one of the most powerful agents known. So small a proportion as one part in 2000 is efficacious in preventing the beginnings of putrefactive fermentation, and destroying the activity and propagation of bacteria and micrococci of all kinds. It is absolutely innocuous, and is quite free from any suspicion of local or constitutional irritation. Its active properties are due to oxygen in the form of ozone, an agent which is a normal constituent of the healthy blood, and upon the action of which has been founded a theory of the neutralisation of the bacteria present in the tissues of healthy animals, and the prevention of the propagation-changes which they may undergo, rendering them active agents of septic infection under certain conditions of the system, which a plentiful supply of ozone may remedy. It is, however, an unstable and easily decomposed compound, prone to change by easily giving off its supercharge of nascent oxygen. This property is, in many conditions, certainly advantageous; the gaseous oxygen in the condition of change enters all the intricacies and pouches of a sinus, abscess, or joint-cavity, and thus effectually fulfils its antiseptic mission. It has, I believe, a decided and remarkable effect in diminishing and arresting the formation of pus-cells. For clearing suppurating joints, it may be used with great advantage. I have used it of the strength of 1 in 500, or even stronger, for this purpose, by means of an ordinary irrigation apparatus, provided with a double, or entrance and exit, tube. It can be carried in a concentrated form in a well stoppered blue bottle, kept from the light, and diluted with pure water to the required strength. Its weak point is its instability; the ready escape of its effective gas renders it less applicable as a permanent dressing. If so used, it should be well covered with gutta-percha tissue, or associated with a more permanent nongaseous antiseptic, such as sulphate of copper, or chloride of zinc. It is not very costly, being made in large quantities for bleaching purposes, and may become cheaper in consequence of greater demand and easier supply.

When the condition of the wound is such that the hastening of the cicatrisation process is desirable, and antiseptics, such as carbolic acid, are found to retard this by their action upon cell-growth, I have found a very dilute solution of the nitrate of silver useful, both as an antiseptic, as a detergent agent, and to promote cicatrisation. Its power as a microbicide is also very great, as (according to Miquet) so weak a solution as 1 in 1425 is effective in destroying the noxious qualities of microbes. This agent, again, is rather expensive, but its universal use as a solid application (in every surgeon's case) and the very dilute solution required (1 in 1000, or 1 in 500) somewhat diminishes this objection. It is most useful, again, in the latter stages of a case of ulceration. As substitutes, dilute solutions of the sulphate of copper, zinc, or iron, are cheaper for hospital practice, and also affect the granulations favourably, checking suppuration and promoting cicatrisation. The sulphate of copper has as much relative microbicide power as 1 in 110; while that of the chloride of zinc is 1 in 52, and the boracic acid 1 in 13 only.

It has been said of preventive measures that they are under the disadvantage of never seeming to be less needed than when they have been most successful. This is especially the case with that part of preventive hygiene to which antiseptic remedies may be said to belong. Their good effects can, almost always, be attributed, with more or less of plausibility, to the vital and resisting powers of the constitution of the patient. But, I venture to think that there is at the present time a growing opinion that antiseptics are an intimate kind of hygienic agent, for preventing, and ultimately extinguishing, the causes of blood-poisoning; and, moreover, that there is a possibility that some way of administering them by the mouth, or some other method, may convey them into the circulation of the patient with safe and bene-

ficial effects. And if, in spite of, or because of, an imperfect application of such measures of hygiene, these and similar blood-diseases still occur sporadically, does this mean that active measures of this kind are of no use? Does it not mean rather that hygienic and preventive activity should be redoubled?

The miscarriage of precautions, in some instances, may deter the young surgeon from attempts to improve his treatment by careful experiment, and may tempt him to rest contentedly upon the old ways, and to leave chance and the laws of Nature to settle his patient's matters between them. This fault is natural. It is human. It may almost be said, in some instances, to be humane.

To add more to the already long list of antiseptic applications may, to some, seem superfluous; but we have by no means reached finality. Cases differ, both minutely and widely, and what suits one case may not do equally well for another. The medical practitioner, to be successful, must have a well filled pharmacopœia; and he is obliged, above all things, to be eclectic.

It may happen, on the other hand, that some successful cases have occurred consecutively in his practice. He may form upon them crude conclusions, which come under the category of views; and he may be in haste to publish them, in order to obtain the benefits of priority. This may so influence him that he scarcely takes time or pains to ensure his results, or to know the results of others. Each experimenter may be striving his utmost to avoid the fate which overtakes the hindmost. The dangerous epigram of the French surgeon, "L'audace, toujours l'audace," prompts him, with the immense aid afforded by anæsthetics and antiseptics, to risky achievements. He does not, perhaps, keep before his mind that this audacity has its sober limits, as well as its unlimited tendency to mischief.

It is not difficult to be brave at the expense of one's patients. If, in search of notoriety, Empedocles plunged into the crater of Etna, such a foolish act was at least more to his credit than if he had thrown one of his friends into the vortex of a burning question, to decide a point as to the limits of resistance of the living human body to dissolution by cremation.

Sanguine expectations of good results do not justify the imposition of the great risk, incurred by their failure, to the life of the patient, who must necessarily trust implicitly, and who is ignorant of the real amount of the danger which faces him. But, notwithstanding all these considerations, I am not the less assured that the area of surgical relief to human suffering has been enormously increased by the use of anæsthetics and antiseptics.

And while I equally believe that the patient has a vastly preponderating chance of escaping the dangers of blood-poisoning, under a careful and well planned combination of hygienic and antiseptic precautions, I do not think that these will absolutely, necessarily, and in all cases, prevent its occurrence. Still less do they render desperate operations justifiable. And yet, I have but little sympathy with the state of mind which sees the chief value of a thing in the fact that it has been, and is, and therefore should continue to be!

Progress is good, if it be sound progress. That it should be good and sound, is pre-eminently a desideratum in the art of healing. This deals with the health and the life of a man, and is of infinitely more value to him than politics or trade. Such proceedings as may lead the public to believe that the surgeon experiments upon the living body of his patient, as the physiologist is thought to do upon that of animals, without due respect for the sanctity of life, and without the authority of necessity, must ultimately produce a deplorable reaction from the high respect and reverence which the medical profession bids fair to obtain in the future, above all other professions. And this cannot but be disastrous, both to the welfare of society and to the influence of the profession upon society.

From the foregoing, among many other considerations, it appears to me that the relative efficiency of antiseptics in different hands, and under varying circumstances, is very difficult, if not impossible, to estimate by the statistical method. Cases vary much; scarcely two are exactly alike. The influences which surround, and act, directly or indirectly, upon them, in other ways than by dressings, render the comparison apt to be variously determined by different minds and from different points of view. Each surgeon will do best, I believe, with the means at his disposal, to compile his own statistics for his own guidance, from his own experience, and from his own standpoint. He may be confident that the wisest questioning will bring the wisest and most direct answer; that his results will depend most upon the care bestowed upon his patient, the exactitude of his record, and the accuracy of his judgment, and that his time will be better spent upon these things than by wrangling over his comparative statistical success with his fellow-labourers upon the same lines. The army of workers in science and art may be compared to a compound amœboid creature,

putting forth feelers in all directions into the mass of Nature's pabulum in which it is involved, and working with slow strivings its way to the light. The feelers will be often withdrawn without the desired result, while another trial will meet with more compensation. Let each strive to find the best and shortest way through this perplexing region, thankful to anyone who can guide us to a better way. We may often find ourselves in a *cul-de-sac*; and we may, as we have seen in the foregoing brief review, sometimes have to retrace our steps; but we shall get upon the right road at last, and even then our horizon will be always in advance of us. Many devious labyrinths and apparently hopeless obstructions will delay us in our progress, and we shall not fail to be reminded many a time of the truth of the celebrated Hippocratic aphorism, "Life is short; but art is long, the occasion fleeting, experience fallacious, and judgment difficult."

The President has reminded me of the fact that in the month of December, 1785, John Hunter first tied, at St. George's Hospital, the superficial femoral artery for the cure of popliteal aneurysm. Two preparations, which occupy a prominent place in the museum which bears his name, were made, according to Sir E. Home, from the first and fourth cases in which he performed that operation, to show the collateral circulation, as it was found after the death of the patient some years subsequently. It seemed but a small thing to shift the site of the operation from the popliteal space close to the aneurysm, where it had been done many times before with fatal results, to a few inches further up the thigh; and yet how great the difference in the success of the operation! And what important principles were enunciated with respect to the safer establishment of the channels for the blood-nutrition of the limb, to the more healthy condition of the artery at the selected point, and to the easier performance and bloodless character of the operation! We, who in this College are surrounded on all sides by the proofs of his industry and genius, and who esteem his memory so highly, cannot let pass the first centenary of this important event, which constituted an epoch in the history of surgery, without giving due honour to one of our greatest men. The difficulties of scientific investigation which we have before us were felt by Hunter and his contemporaries even more; and the moral of the observance will best be found and honoured by patiently and stoutly dealing with them, so that haply we may overcome them as successfully as Hunter did, with more imperfect means and appliances, in his day and generation.

A CLINICAL LECTURE ON RECENT ADVANCES IN ABDOMINAL SURGERY.

Delivered before the Pupils of the Medical Department of the Yorkshire College, October 28th, 1885.

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(Concluded from page 1100.)

By an easy transition, we pass from the surgery of the alimentary canal to that of its appendages; and though I have nothing novel to say of the liver or pancreas, I cannot pass over the gall-bladder, concerning which I have a good deal to tell you. Practically, surgical interference with this organ is of very recent date; and I say practically because, though it is only of recent date that its diseases have come systematically under the knife of the surgeon, such operations have not been unknown in former times. So new an operation is cholecystotomy, that I am very anxious to give you thoroughly reliable information concerning it, and concerning the history of its rise and progress. To do this, and to do it very satisfactorily, I have only to refer you to two sources of information; first, to the *American Quarterly Review* for the current year, in which you will find, in very full detail, all the statistical information that could be given concerning the results of the operation to the time of publication; and, secondly, to a very able article on the subject published by Mr. John Taylor, of Birmingham, in the *BRITISH MEDICAL JOURNAL* of January 31st last. In that article, Mr. Taylor says "the operation of cholecystotomy is one of the latest additions to the art of surgery."

Although mentioned as having been formerly performed, and in one instance, successfully, as far back as 1825, in Good's *Study of Medicine*; as being advised, in suitable cases, by Dr. Thudichum in