THE BRADSHAW LECTURE

ON ANTISEPTICS IN SURGERY.

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

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THE appointment to the Bradshaw Lectureship, which has brought with it my present duty, I estimate as the expression of a confidence which is most grateful, though I am bound to consider it as also flattering, to me. To follow in the steps of eminent masters in the art of didactic expression, not less than in the faculty of thinking, who have preceded me in this function, cannot but be a valid reason for feeling somewhat abashed, as well as for the exertion of my best efforts to justify the choice.

In selecting the subject of my lecture, I have been led to the consideration of the practical methods now in vogue of employing antiseptics in surgical cases, both because I judged it to be a subject well within the range of the objects of the founder of the lectureship, and because it was one in which for many years past I (in common with surgeons generally) have taken much interest; and have by this time acquired a very considerable experience. It has also the advantage of being a subject of ever-growing importance and improvement.

The tests of time and experiment have been applied to a sufficient extent to confirm or to disprove the value of many methods, at first highly approved and much lauded. Can we yet discern the difference between the good wheat which stays and nourishes, and the chaff which flies away and vanishes with the searching winds?

In endeavouring to answer this question with such exactitude as the present state of knowledge will permit, I propose to confine my remarks chiefly to the external application of antiseptics, to the exclusion of theories of causes and origin which belong rather to science than to the art of surgery, and which time will not allow me to discuss in this lecture.

Let us first consider the agencies which more or less accelerate or retard the healing of wounds. In doing so, we must bear in mind that every method of treatment has some basis of fact or theory which enables it to resist immediate extinction, and to maintain its ground for a certain time. Each of them has some sort of title to theoretical consideration which contributes to form an argument for its support. If the theory be disproved, the practice at once fades away into the limbo of exploded schemes, which has swallowed up a multitude of medical and surgical notions.

The foundation and support upon which all alike rest, and which give to all a large proportion of such success as they may meet with, is the reserve fund of recuperative vitality which lies in what was called by Cullen the *vis medicatrix naturæ*. This I shall accordingly place first in order and in importance.

The vigour and intensity of vital force pervading all the tissues, from the highest nerve-structure to the humblest forms of protoplasm, together with the exact balance of compensating functions which are found in perfect health, endow the individual possessing them with the means of resistance to disintegrating influences, and to overcome the tendency to dissolution. They enable him to pass through the dangers of infection, and often to set at naught unhealthy surroundings. Such persons walk through the fiery furnace of contagion unscathed as the three Jewish children, without even the smell of fire coming upon them. But a great degree of this power is sometimes found in those who are by no means examples of perfect health. A scrofulous subject will frequently undergo severe operations, long suppuration, and tubercular infection, without showing symptoms of either pyæmia, erysipelas, or other forms of blood-poisoning, to which others, stronger than they, succumb. Wherein does the resisting power reside in these? Are they protected by hereditary or acquired peculiarities, which, like vaccination, render them not susceptible to these particular kinds of tendency to dissolution? If we argue, from the bacterian theory, that they do not furnish the suitable nidus or nourishment for the cultivation of one particular form of microbe, we only push the question one step backward, and

again inquire, What are those suitable conditions? and why does one possess them, and not another? The bacteria, which are said by Beale to lie latent in all the tissues even of the healthiest animals, seem to cause no mischief. But even the more active microbes seem in many cases to be rendered powerless by the vitality and conserving force of the tissues or secretions which they inhabit. Klein considers that such a theory of general vital inhibitory force is not tenable, and proposes the explanation that the inhibitory force is due to the presence of a chemical substance produced by the living tissues.

This looks like a recurrence to the old chemical, as distinguished from a particulate, agency. Is it not possible that this chemical agent may be the oxygen formed in the vital processes? In the form of ozone, it is a powerful antiseptic. Can it be said to inhibit putrefactive forces out of the living body?

Dr. Burdon Sanderson has advocated the theory that the really poisonous property of the bacteria resides in the zoogloæ, which is the result of their propagation, a theory which rests upon the experiment of the injection of filtered bacteria into the flesh of living animals without poisonous effects. The formation of this zoogloæ, following the general analogies of such procreation, takes place most readily in tissues most easily decomposed. From this point of view, these may be the cause, rather than the consequence, of the invasion of bacteria.

But other lowering causes, such as bad hygienic atmosphere, may so depress the patient, that his tissues are no longer able to resist the decomposing forces. Accumulating doses of particulate animal poisons, absorbed by the vessels of an abraded surface from external sources, may at length overcome the internal inhibitory resistance; and pyæmia, hospital gangrene, or erysipelas, may then result, corresponding to the external irritation or stimulus. And such irritation may possibly be produced by microbes, otherwise harmless, which have gathered infective properties from other animal bodies, as flies are known to carry infection from one patient to another.

Another question arises, Do microbes cause suppuration without the previous production of putrefaction? We are in some danger of forgetting that abscesses commonly form, and necroses occur, in deeply placed tissues, and in bones, without any communication whatever with the external atmosphere; and that, when first opened, the pus in these abscesses is usually sweet, and without the least trace of putrefaction.

If microbes be the cause of this suppuration, how do they reach the spot on which they exercise their injurious influence? Are they the resident microbes developed to the power of active propagation, or foreigners introduced from without? Again, there must be, in some cases, inhibitory influences preventing the full and complete result of their pernicious development, even when introduced from without. Bone-caries, with open sinuses, may continue its slowly destructive course for years, without setting up blood-poisoning.

I have lately seen a scrofulous female, aged 60, who had had carious disease affecting the bones of the foot, and slowly destroying them one after the other, with constant discharge of pus, without producing constitutional symptoms, for twenty years. And yet, in other cases, an apparently closed abscess may be putrid when opened, and contain multitudes of bacteria. It is supposed, however, that these have, at some time, had communication with the external air, since they are usually found near mucous channels, the rectum, urethra, mouth, and throat, closely exposed to foul and putrefying agencies. All these problems still await solution.

The protective and inhibitory power of the system is clearly indefinite in its strength and quantity, variable and indeterminate in its efficiency. It may be expressed by the algebraic sign x as a factor in the vital processes, whose value is unknown in any given case with which the surgeon has to deal. It may be improved, fortified, and conditioned, to some extent, by previous treatment, by feeding, tonics, and healthy hygienic circumstances; but these are often necessarily wanting in various emergencies and accidents. It may be probed and fathomed, to some extent, by a careful medical examination of all the functions and organs of the body; but it is by no means capable of anything approaching to exact measurement, or of any closer estimate than the shrewd guesses of the practised surgeon. It may be said to form a limited liability bank, upon which all methods of treatment draw for successful results. It is well not to overdraw the account.

That which I shall place as next in importance for the satisfactory progress and healing of wounds, is a healthy atmosphere surrounding the patient, both before and during the period of healing. It is in very great measure owing to the remarkable advance in this particular that so much improvement has taken place, in longevity, in the rate of mortality, in the shorter duration of surgical complaints,

and in the less fatal results of surgical operations during the last twenty years.

The successful results of segregation of patients, and of the open air and under canvas treatment of surgical pneumonia and hospital gangrene (brought about by the enlightened views and energetic advocacy of the army medical officers, and their influence upon the officers in command in the choice of sites for encampments and hospitals), show what has been done towards the prevention and cure of these diseases on purely hygienic lines.

I have long thought and taught that success in surgical operations depends, in great measure, upon the previous treatment of the patient, and his emplacement within the range and under the influence of good hygienic surroundings, in all cases which admit of some delay before operating. There are, of course, cases of accident and disease which do not admit of such delay, and others in which such influences are impossible or uncontrollable; but it is too often the case that change of air and place come after, instead of before, the operation, when convalescence might be best promoted by the latter course.

As a striking instance of the effects of a pure and well-oxygenated air, I may here allude to a fact, stated by Mr. Stavely Hill, in his interesting volume *From Home to Home*. Speaking of Montana and Manitoba, in North-West America, through which he journeyed, he says: "The way in which in this climate a gunshot-wound, or other flesh-injury, heals, is truly astonishing. Of course, a good deal is owing to the abstemious and healthy life which the people live, but something is due also to the excellence of the air, and the dryness of the atmosphere. Even in hot weather, meat will keep for almost any length of time. I have carried beef with me in the wagon for three weeks, as good at the end of that time as at the beginning. So long as it is kept from the flies, no change seems to take place in its quality." As a consequence, the people, even of both sexes, regard little the infliction of pistol-shots upon each other.

An interesting illustration of a purely natural and simple antiseptic came under my notice last year, while enjoying my holiday among the hills of Cumberland. I was about leaving Wastdale Head in the evening, after a pleasant ramble about Scaw-fell, when a messenger brought the news that a dreadful accident had befallen a tourist, while climbing the rocks at the side of that mountain. After some delay, caused by the difficulties of bringing down the insensible patient, I found that he had fallen a distance of about one hundred feet, while turning the corner of a perpendicular rock-face. The fall was broken at a distance of seventy feet by a rough rock slope, over which the unfortunate man slid and rolled with great velocity; and then over another precipice of thirty feet; finally, alighting on soft turf. Along the rock-slope, the integuments of the head and face were scraped and ground fearfully. They were damaged to an extent exceeding anything of the kind I have ever before witnessed. The scalp and integuments of the forehead and face were hanging in tatters over the ears and eyes. The nasal and superior maxillary bones were denuded of covering, indented, and bruised. The lips and chin were in rags; the eyelids torn and livid, and all the soft parts covered with a sandy grit imbedded into their substance. He was in a state of semi-coma from shock and hæmorrhage, with two ribs fractured and a deep laceration on the buttocks; but, fortunately, there was no fracture of the skull. I had no appliances but pure cold water, and no instruments but a common sewing-needle and some silk. After carefully picking, scraping, and wiping the parts with a clean rag, dipped in the mountain stream, I stitched the different parts of the skin together with numerous and close sutures, pressed up into shape the indented nasal bones, and bound up the head and face with a wet bandage. There was no other treatment but cold water and simple diet. The wound healed throughout by primary union, and, as I recently learned from the patient himself (an Edinburgh medical graduate, who lately called to thank me), with no suppuration whatever, and leaving extremely little disfigurement. Even with the advantages of a good constitution, which the patient possessed, and recent mountain training, I doubt whether the results would have been so perfect in a large town.

The open method of treatment, without any dressing at all, and allowing the wound to scab over, has been practised by some surgeons, in the hope of good results such as these. Closely allied to this plan is the dry method, with simple lint or absorbent cotton or wood wool applications. Both methods express the surgeon's reliance upon the unaided recuperative power of the tissues and the innocuousness of the atmospheric envelope, providing only that the means employed were effectual in carrying away the decomposing discharges. But the dangers of unrestricted primary and superficial adhesion are obviously those of pent-up matter, forming subsequently deep secondary abscesses. There are also the risks of contagious affections, such as erysipelas and hospital-gangrene, reaching the wound.

Chief among the measures of surgical hygiene, I would place the more intimate agent, strict and absolute personal cleanliness; and in this term I include not only clean linen, towels, and sponges, and cleanliness of the patient's person, but pure hands in the dressers and nurses, as well as in the surgeon himself, pure instruments, and last, but not least, pure water. I have seen jugs of water professedly clean, after exposure in a ward for a few hours, covered with a film of dust, the composition of which largely included dried particles of living protoplasm which had floated in the air. The origin of this, no doubt, was from the shaking of bed-clothes, dusting of furniture, and from ledges and crevices in the walls and flooring. It must have contained, sometimes, particles of infective secretions. With the water, this witch-broth is often conveyed to the surface and sinuses of an absorbing wound, with the usual disastrous results. The same effect would result from the use of impure lint, wool, and vessels used for the dressings. To insure against this, some surgeons have used the spray-distributor, with simple water as the agent of purity. But this water, itself supposed to be pure, may carry the infective matter. The same remarks may be applied to the use of cotton or other wool, exposed for a time to the air of the ward before using. When this is freely applied and kept on (in the belief that it will absorb the discharges) for several days, the mischief is manifestly intensified.

The care and foresight required to obviate these lurking dangers are so great, and the precautions required to prevent them are so minute, that the use of other antiseptic applications are, in my opinion, imperative, to defend effectually every unguarded avenue to the citadel of life, whose unaided garrison may not be a sufficient defence against the enemy.

A well known provincial surgeon, who is said to use no antiseptic measures beyond extreme cleanliness, scalds all the sponges he uses with boiling water, using fresh sponges for every case. Other ovariotomists, remarkable for their success, simply soak the new sponges well, in 1 in 20 solution of carbolic acid, and wash their hands and instruments in the same. Dressings of antiseptic carbolic gauze are sometimes used instead of sponges, and burnt directly after using.

These precautions of extreme cleanliness have, among the London surgeons, been supplemented by the use of carbolic acid and other antiseptics, ever since Pasteur wrote (in 1860) on germs in the air, and Lemaire (in 1863) on the use of phenic acid. In all this it is manifest that the training and intelligence of surgeons, dressers, and nurses, have almost as much influence on the progress of the case as those of the operator himself, and a great deal of the vastly increased success of cases in late years must, in fairness, be attributed to these sources. But it is not always that the operator can command this able assistance. Then he must do as best he can, with imperfect help, and often with imperfect appliances. And it is in these cases that a simple and yet effective mode of proceeding becomes highly valuable, and passes into general use for all cases.

The proper application of drainage has, in my experience, prevented many of the disastrous results, such as tension, abscesses, and burrowing of matter, which formerly were common in hospital wards. Chassaignac's rubber tubes seem to me to supply all that is needed for this purpose. Less perfect substitutes are found in rolls of oiled silk, gauze, or bundles of horse-hair, and softened fowl's bones. The drainage openings left by the operation should be placed as far as possible at the most dependent point, in the position in which the patient is placed after operation, and it is best to have two or three of these arranged for alternating or changing positions. They should also be placed as far as possible remote from contaminating matters, and from the mucous outlets of the body. The packing of gauze or wool should be accumulated more thickly at and around the drainage openings. If old sinuses be included, they should be well scraped with a sharp spoon, and cleansed thoroughly with a strong solution of chloride of zinc, or sulphate of copper lotion. I have been accustomed so to arrange the incisions as to include such sinuses, and open them freely up, without regard to the lines of incision usually made for the operation. Absolute cleanliness is, of course, more imperative in cases in which antiseptics are not used, and frequent dressing and careful syringing are required in all cases in which excretory orifices are concerned in the operation. In small and superficial wounds, these precautions are less imperative, and frequently drainage is disregarded successfully, even in cases where scrous cavities are implicated. In such operations, however, more constant watchfulness for possible tension and retention of discharges is required.

In default of pure air, careful hygiene, and absolute cleanliness, can we assist Nature in resisting suppuration, putrefaction, and their concomitant dangers, by the use of antiseptics, or prevent these accidents from occurring, in the way of prophylaxis, or remove them if already present?

To prevent misconception, I should state that I employ the term *antiseptic* to mean the local use of applications calculated to prevent suppuration and putrefaction, and to promote quick healing. By the term *aseptic* I mean a condition of wound and dressings absolutely free from these changes, whether or not micrococci be found in the outer portion of the dressings, for these can be rendered innocuous by the application of antiseptics superficially. I believe that I am right in asserting that the opinion of a great majority of surgeons at the present time is, that the safeguards against blood-poisoning may be much increased by the local use of antiseptics, and that the question of the hour is what is the best, most powerful, least irritating, and most convenient and economical antiseptic for general use? A great number have been tried, and many have been found wanting in one or other of these requirements. In many, there is little positive certainty that they aid the vital inhibitory force, or diminish the antagonistic agencies, which vary in almost every case.

After the publication of Lemaire's work on the use of phenic acid, in 1863, this substance was employed by many surgeons (the late Mr. Callender among them) in the form of carbolised oil, and by Sir Joseph Lister as carbolised putty, in cases of compound fracture. Although this substance fulfilled the requirements of cheapness and general usefulness, its absolute microbicide and antiseptic power is comparatively small, namely, 1 in 31 (Miquet). It was soon found to be irritating to the tissues, and apt to produce carbolic poisoning. Although the limits of dilution and efficiency had been sketched out by Lister (1 in 20 to 1 in 40), patients vary so very much in susceptibility, that both they and their surgeons often experienced the penalty of exceeding the limits. Its volatility, while rendering it more efficient in the deeper recesses and sinuses of a wound, caused it to lose a good deal of its efficacy superficially, by its want of persistence and staying power. This was partly, but not entirely, overcome by Lister's gauze, which, again, was expensive and uncertain.

Chloride of zinc, in the form of Burnett's fluid, had been used long before this at the Middlesex Hospital by the late Mr. De Morgan, to destroy cancer-germs in wounds; and it was found, when applied strong, in a saturated solution, to be a good antiseptic. Its microbicide power, however, is not so great as many other substances, namely, 1 in 52. In combination with solution of carbolic acid, 1, with many others, found, and still find it a valuable application to sweeten, and to keep sweet, wounds.

The sulphates of copper, iron, and zinc had been long used for what was called their detergent properties, which, I take it, meant nearly the same thing as antiseptic. The former two of these salts have an effective microbicide power of 1 in 110; that is to say, they destroy microbes when diluted to that extent, which is twice the dilution of carbolic acid nearly.

Iodine has a still greater antiseptic power (as high as 1 in 400), and has been used by Messrs. Savory and Bryant in solution as a wash to recent wounds with good effect, in the proportion of 1 in 1,000. To stop the putrefactive process when once formed, Mr. Savory uses it in the proportion of a drachm of the tincture to half a pint of distilled water. As a sedative as well as antiseptic dry dressing, its compound, iodoform, has been found very useful.

Condy's fluid, or permanganate of potash, with an antiseptic power less than, though nearly approaching to, that of carbolic acid, is inconvenient, from the discoloration which it causes. Like alum, boracic acid, and salicylic acid and its salts, the antiseptic power is not sufficient to make it a reliable application where sepsis is already present. Nearly all these substances, when more or less strong solutions are used, have the drawback of blunting and corroding the instruments used in operating and dressing, except boracic and salicylic acids.

In the choice of an antiseptic agent, it must be borne in mind that a much weaker solution suffices to prevent putrefaction than to destroy it when it has once commenced, and that the potentiality of antiseptics may be modified by any sort of dilution to any extent; so that, the greater the power of a given antiseptic, the more generally useful, and the more economical it is, within the limits of its market price and its supply.

Solubility, a degree of volatility, no irritative property when applied to the living tissues, and no effect upon the system by absorption, seem to be the criteria of a good antiseptic. Some antiseptic applications combine the advantages of absorbent dry dressings. This gives to the treatment by salicylic wool, sanitas, wood-wool, etc., a preference with many surgeons. These substances possess also the advantage of close and comfortable packing; so that, although not highly antiseptic, they exclude the air, absorb the discharges, and so prevent the beginnings of putrefaction, and keep the wound aseptic for a greater or less time, according to the amount of discharge.

Salicylic wool is a very convenient dressing, and is at present much used. Encalyptol, at first much lauded, has not fulfilled the expectations of practical surgeons, and is now dropping out of use. In default of more powerful remedies, the compound tincture of benzoin (Friars' balsam) is a good primary application to slight wounds, excluding the air, and antiseptic to a considerable degree. A good deal of the power of these and other aromatic substances of the like kind has been lost by partial and imperfect modes of application.

The introduction by Sir Joseph Lister of the carbolic spray, by means of Siegel's spray producer, and its combination with the carbolic gauze and the judicious use of Chassaignac's drainage-tubes, improved the results of antiseptic surgery, especially in the treatment of compound fractures, and large spinal and other abscesses. The good effect of this combination, and the greater attention to the cleansing and surgical purification to which it led in the continental hospitals, was plainly shown in the vastly decreased mortality in the practice of Volkmann and Nussbaum in Germany. It led, also, to greater care in all the details of hygiene; and in this way, in no small degree, effected this beneficial change.

In large towns, and in crowded, poverty-stricken districts, the free use of antiseptics is rendered more imperative by the lowered vitality and dirty habits of the patients, as well as by the depressing effects of impure air. Accidents happen, and operations must continue to be needed, even in these unhealthy circumstances. And here I think the carbolised spray is useful to purify the air, and clothing, etc., which it does to a considerable degree; and the experience recorded by Mr. T. Holmes, at Wimbledon, shows that even pure air, great cleanliness, and favourable surroundings, do not entirely prevent erysipelas and pyæmia from being carried by infection.

(To be continued.)

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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I AM here this evening to fulfil the promise I made to you last spring, that, if I were spared until the coming of another session, I would resume the subject I was then unable to complete, and would continue the story of the advances made in abdominal surgery in recent years; and that I would endeavour to show you in how entirely different a light we are able to regard the subject now, from that in which we saw it, even in so recent times as those in which, forty years ago, I took my seat upon the benches of the Leeds School of Medicine.

I have already told you that, in that day, intraperitoneal surgery, except under the direst necessity, was unrecognised; and that, save only for the relief of hernia, or some other necessarily fatal accident, the abdomen was a region yielded almost entirely to the physician.

If you will refer to the text-books and surgical works of fifty years ago, you will see the verification of this statement; and you will note that not only were the great operations I have already brought to your notice unknown, but that of those, concerning which I am now about to speak, no inkling had taken possession of the surgical mind. Indeed, had things which are now done every day been so much as even hinted at then, the hints would have been considered to be simply the thoughts of the enthusiast, and any attempt to carry them into effect would have been regarded as insane!

Thus, all the operations on the pelvic organs are the triumphs of men of comparatively recent days; and it is only the encouragement afforded by their unexpected success that has led on to others of equal, or almost equal, brilliancy.

I have already said all that I desire to say concerning the surgery of the uterine and pelvic organs; and I was engaged, when last we met, in the discussion of the surgery of the alimentary canal.

I had spoken of gastrotomy, as an useful and justifiable proceeding for the relief of those terrible forms of starvation arising from strictures of the pharynx, œsophagus, and cardiac orifice of the stomach; and had expressed an opinion that, in this operation simply