REMARKS ON THE TREATMENT OF WOUNDS.¹

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SOME years ago, before the days of antiseptics, at a combined meeting of these Branches of the British Medical Association in this place (Bedford), I gave a short history of the treatment of wounds in past times, and added that apposition of surfaces was the thing to be aimed at, and that, speaking generally, nothing further was really required. I said that incised wounds would, with few exceptions, heal well if only the cut surfaces were maintained in good apposition and allowed to be at rest; but that the great difficulty in effecting this was the escape into the wound of serum or blood which separated the surfaces, and, further, caused trouble and suppuration by itself undergoing decomposition. I based this statement much upon the observation of wounds of the lips and cheek, which scarcely ever fail to heal at once when the skin edges are united by sutures, the reason being that any escaping serum or blood does not rest in the wound but passes into the mouth. The same occurs commonly in the scalp where the pressure upon the resisting cranium prevents the lodgment of products in the wound. To prevent this escape and accumulation at other parts, as after the removal of fatty tumours, I recommended careful securing of vessels; and, secondly, the spending some time before the final closure of the wound in expressing the blood and serum, and then applying moderately firm and equal pressure over the divided parts. I felt at that time, and still feel, that the union or healing of wounds is the natural and inevitable process, unless interfered with, and that, therefore, our business is to prevent interferences in the way of accumulations in the wound, disturbances by movement and so forth; in short, in this, as in so many things, to let Nature have her perfect way. I also at that time practised and advocated the plan of leaving the wound in many cases entirely uncovered and exposed to the air, thus avoiding all dressing and the pain and evils of redressing. I found this answered well, and it certainly was a great relief to the patient, and a great saving of trouble to the surgeon. Since that time the great and rapid improvements in the treatment of wounds have thrown much of previous views and plans into the shade, and have raised that which was formerly an opprobrium into that which is now the greatest glory of practical surgery, and one of the great advances of our marvellously advancing age. These improvements are, first, the use of clips or pressure forceps, which arrest hæmorrhage during operations, and so close up the orifices of the smaller vessels as to prevent leakage from them. Secondly, the use of animal materials for ligatures which undergo absorption and can be cut short, and, therefore, offer no impediment to the healing of the wound. Thirdly, the employment of drainage when necessary. Fourthly, the most important improvement of all has resulted from the recognition and practical application of the antiseptic, or anti-organism, principle, which will ever be gratefully associated with the name of Lister.

For the acceptance of this we were prepared by the observation of the differences in the course of a compound fracture from those of a simple fracture. We knew that in the former case the evil results were due to the admission of air causing decomposition or other changes in the blood and serum effused into the fracture, but we did not know to what quality in the air these effects were due. We knew also that various other substances, animal and vegetable, can long be preserved without change by the exclusion of air; but the knowledge that air pure and simple is devoid of offence, and

that its deleterious qualities are due to the presence in it, the admixture with it, of micro-organisms, and can be prevented by the removal or destruction of these organisms, may be regarded as the great medico-chirurgical discovery of our time. This discovery is remodelling the whole science of pathology, and is carrying our thought a stage further along the line of causation into the region of the prevention, and we hope also the cure, of disease. In no instance has this discovery been attended with so good results as in the treatment of wounds; at any rate, in none do we obtain such obvious practical evidence of the good result. We have learned from it that if organisms be excluded, or admitted only in such small quantity as to be combated and destroyed by the living energies of the part, the serum or blood that may be in the wound is innocuous and may be absorbed, and the apposed surfaces of the wound, coming into contact, will unite; but if, on the contrary, they be in sufficient force to overcome or to pervert Nature's guard of leucocytes, they give rise to decomposition of effused products, to suppuration, and the further evils with which, happily, we are less familiar than of old. This is the one great, simple, fundamental piece of knowledge—and great additions to practical knowledge are commonly simple—upon which we base our present treatment of wounds, and by the careful application of which such good results are obtained.

The question which naturally arises in our minds is, Whence do these organisms come—these accompaniments and apparent instigators of suppuration, of decomposition, and of other evils; these streptococci, and staphylococci and other micrococci, as well as bacilli, to which we have lately been introduced, and the varieties of which are daily growing in our knowledge? Whence come they and whither go they? It is a question of profound interest, and it is likely long to remain so, for these organisms seem, like the wind, to blow where they list, and no one can tell whence they come and whither they go; and with regard to these and so many other points in the deep mysterious recesses of the natural as well as of the spiritual world we are still—

Children crying in the darkness,
Children crying for the light
And with no language but a cry.

There are, however, points connected with the subject at which we may hope to arrive at a clearer understanding, such as the occurrence of acute suppuration in the knee-joint of an otherwise healthy vigorous young woman, lately in Addenbrooke's Hospital, in whom no trace could be found of any discharge or sore upon the surface. Whence did the organisms of suppuration spring, and how did they find their way into the knee-joint? The same remark applies to acute suppurative periostitis, where they have long been known to be present in great abundance and in great virulence. It may be, it not improbably is, the case that in certain persons the bacilli exist in greater or less quantity in a more or less innocuous or inactive and non-toxin-producing state, and that when the vitality of any part is lowered by a blow or strain or an inflammatory attack they take their opportunity, cluster in it, and germinate, and acquire increased virulence or toxin-producing quality, and do mischief, causing suppuration and other troubles. This may account for their presence in such cases as I have mentioned, and the general prevalence in animal bodies of these organisms would account also for some of the other phenomena associated with them. It may truly be said of them that they are of the earth earthy, and the higher we ascend into the regions of the atmosphere the less numerous and the less potent do they become, the less able to hold their own. Though air is their habitat and means of conveyance, yet air simple—air pure and fresh, which seems to be synonymous with air in motion—appears to be their antidote. The closely shut up stuffy apartments, of which the bedchambers in our houses, and especially in our cottages, present so many examples, are their favourite breeding places. If we could build our hospitals, instead of our castles, in the air, high up, we should have little need of antiseptic appliances.

I need scarcely say that it is in dealing with internal cavities that the greatest exploits of modern surgery have been achieved—exploits surpassing everything that was formerly conceived. The peritoneum, which used to be the dread, is now entered fearlessly as if it were the playground of surgery.

¹ Intended for the combined meeting of the South Midland and Cambridgeshire and Huntingdonshire Branches of the British Medical Association at Bedford, but read at the meeting of the Cambridge Medical Society.

Let it be understood that the organisms take their effect first and chiefly in the fluids—blood and serum—which lie in the wound. These, detached, as it were, from the body and its vital influence, have little resisting power and easily fall victim to deleterious influences. In these the organs live and multiply, and cause the decomposing and suppurative products which soak into and react upon the adjacent tissues. The tissues left to themselves are commonly able to defend themselves against their insidious foes. In them an influx of active organism-devouring leucocytes, summoned to the rescue, suffices usually for the purpose and routs the invading force; but these defenders are liable to succumb if the hostile foes are allowed to accumulate, and still more if they are allowed to exercise their noxious influence in the extravasated fluids.

In the treatment of a wound, therefore, there are two main points to be attended to: first, to endeavour to reduce to a minimum the media upon which the organisms act; and secondly, to reduce to a minimum the organisms themselves. Either of these would suffice, if effectually carried out; but, as we cannot be certain of fully accomplishing either, we resort to both. By careful securing of vessels and careful pressure upon the region of the wound we endeavour to prevent oozing and accumulation in the wound, and by the antiseptic agencies we endeavour to prevent the accession of micro-organisms. By a successful employment of these means the apposed surfaces are kept in contact, and, there being nothing to interfere with the natural process of union or healing, this takes place almost invariably. We have, indeed, thus at length attained to the desideratum which I spoke of in this place many years ago, and do now succeed in preventing the interferences which for ages barred the successful treatment of wounds.

Among the advantages which may be mentioned as resulting from this better treatment of wounds are:

1. The diminution of the risks of secondary hæmorrhage, which was often the result of ulceration of the tied vessels consequent on the septic hemp ligatures we formerly used. This was one of my trials—and a great one it was—through many years of practice. Now, however, for a long time I have not seen an instance of the kind. I am not aware that secondary hæmorrhage has occurred in our hospital since the use of the catgut ligatures, which are cut short and disappear under the absorbing influence of the unimpaired leucocytes, and the vessel walls are allowed quietly to unite.

2. The infrequency of the various indications of general blood poisoning and erysipelas, which is undoubtedly the greatest benefit which the antiseptic treatment has given.

3. I would mention the less frequent occurrence of tetanus. This terrible malady may manifest itself at any period during the healing of any wound. The quicker, therefore, the wounds heal the less time and opportunity is there for the formation and introduction into the system of that peculiar poison, probably of organismal character, which concentrates its evil influence on the neuromotor system. Previously to the last ten years I not infrequently saw instances of tetanus coming on during the healing of wounds. In these last ten years I have seen only one or two cases, and I should be glad to know whether the experience of those present is in this respect in accordance with my own.

I have on several occasions called attention to the quick and good healing of wounds in aged persons, and cases illustrating the same have not infrequently appeared in our journals. This result, I apprehend, may be attributed, in part, to the little susceptibility which the aged body shows to many septic influences. As the old person is less liable than the young to the contagion of measles, small-pox, diphtheria, and other similar maladies, so it may be assumed that his wounds are less liable to be disturbed by the presence of the organisms which interfere with healing. I do not think, however, that this is the sole cause, for we find that ulcers in old people heal quickly as well as wounds. Indeed, when treating ulcers on the legs of young women I often observe that they would heal in half the time if the patients were 80 years old instead of 18; and it will have been remarked that the healing processes in stumps left by the separation of parts which are the seat of gangræna senilis often show no lack of vigour. This is the more striking because they are carried on in a region contiguous to the parts

which have been unable to maintain their vitality at all. This healing quality encourages to the performance of amputation in gangræna senilis under certain conditions; and, provided there be sufficient power to withstand the shock, the loss of blood, and other attendant evils of the operation, and the immediate effects of the incision upon the wound, the healing will commonly go on well. There seems, in short, to be what may be described as a healing energy in old people in addition to the comparative insusceptibility to organismal contagion.

Rarely, it may be said, is there absolute purity, even in things good and apparently pure. The antiseptic principle, having its basis in purity, ought to have, and I believe has, little alloy if any. The greater number of operations which it induces ought not to be set against it, for it has thus proved itself to be a means of cutting short many maladies that formerly were deemed incurable; and the somewhat greater length of time required in the first dressing of the wound is amply compensated for by the less time, to say nothing of the less suffering, required in subsequent dressings. Indeed, it needs a sharp, an almost hypercritical eye to discern the evils attendant upon the antiseptic treatment. I sometimes fear that the sort of fervour with regard to it, and the thoughtlessness with which it is somewhat indiscriminately applied, may lead to a revulsion—a reaction as we call it—against it; just as the carbolic spray, about which we used to take so much pains, and which seemed a reasonable mode of purifying the atmosphere and affording some additional security in our often crowded operating theatres, has, I believe, quite gone out of use. I sometimes think there is a needless, possibly a rather harmful, piling on of antiseptic dressings in cases which, in the nature of things, cannot be aseptic, as in operations about the anus, and where freer escape of discharges and freer admission of air would be advantageous; and in wounds of the face, which heal perfectly well without any dressings, these are, for the most part, better omitted. I say “for the most part,” because, when erysipelas is prevalent, they may serve as a protection against that malady. The mention of such points shows how slight are the real objections to the practical application of the great principle; and probably they would occur only to the thought of one who was long wedded to the open-air method of treating wounds.

While recognising the evils of accumulations from oozing into the wound, we must not fail to appreciate the value of the presence of a slight amount of coagulating material whereby the divided surfaces are agglutinated and held in contact, and in which repairing work is carried on. In slight wounds the retention and protection of this material between the closely-approximated surfaces is all that is required, and the sealing up of a wound in its own blood is the best of treatment. In a wound of the hand, for instance, the best plan is to cover at once with collodion or a piece of adhesive plaster thoroughly soaked in hot water and bound on till it is dry. The soaking and softening of the plaster enables it to be adapted accurately and minutely to the surface so that it will adhere, undisturbed by subsequent washings, till it wears off and leaves the part healed. The blood covered in by it forms a solid cake with it, which further aids in protecting and allowing the healing work to go on. When, some years ago, I cut my left forefinger rather badly in pruning a tree, I bound the part up with several layers of rag and soaked these with glue, so as to form a solid case, which was left on for a month, which was an effectual defence, and which enabled me to use the hand and finger with little impediment. When this solid case was removed, the wound was soundly and firmly healed.

These remarks recall to mind and contrast with the narratives we have read of the treatment of wounds in former days, when they were plugged to the bottom by pledgets and irritating unguents to ensure cleansing from peccant humours, and to promote suppuration from the depths of the wound, it not occurring to the officious surgeons that these peccant tumours were the produce of the treatment. So firmly were this evil theory and its associated practice rooted in the surgical and popular mind, that it required the ingenious device of the “sympathetic cure” to eradicate them. By this the irritating appliances and the mischievous attentions were transferred to the weapon which inflicted

the wound, and which was accredited with exerting a sympathetic influence upon it, while the wound itself was simply covered up and left to itself. The beneficial effects of this surreptitiously, as it were, introduced method can scarcely be overestimated, and it is an illustration of the manner in which long-standing and erroneous impressions are, now and then, by counter and equally erroneous, though less mischievous impressions, summarily dislodged.

THE GOULSTONIAN LECTURES ON THE SUPRARENAL BODIES.

Delivered before the Royal College of Physicians of London,

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LECTURE II.

PHYSIOLOGY OF THE SUPRARENAL BODIES.

BROWN-SÉQUARD, stimulated by the pathological researches of Addison, investigated the physiology of the suprarenal capsules in dogs, cats, rabbits, and guinea-pigs, by removing them and noting the results. From a series of sixty experiments on animals he came to the following conclusions:

1. That the suprarenal capsules are absolutely essential to life.
2. That suppression of their functions is more rapidly fatal than suppression of the secretion of urine.
3. That the function of the suprarenal bodies was to modify or to destroy a substance which had the property of transforming itself into pigment. When the suprarenal capsules are removed or destroyed the pigment collects in the blood, but there is no pigmentation of the skin.
4. That in an animal from whom the suprarenal capsules have been removed the blood becomes poisonous, and when injected into other animals of the same species often produces death.

Dominicis¹ quite recently has found removal of the suprarenal capsules invariably fatal in a very few hours. Gratiolet² repeated Brown-Séquad's experiments; he often removed the left suprarenal capsule in guinea-pigs without any serious symptoms resulting, but the additional removal of the right one was fatal in three days, and since peritonitis and hepatitis were present, the fatal result was thus explained by him.

Philippeaux³ removed both the suprarenal capsules from rats without producing any symptoms, and therefore considered that death, when it follows this experiment, is due to lesions of other organs. Tizzoni⁴ criticises these results, and considers that a sufficient time was not allowed to elapse after the operation, and that because the animals did not die soon after the removal of the suprarenal capsules it was too hurriedly assumed that they had recovered.

George Harley⁵ came to the conclusion that the suprarenals are not absolutely necessary to life; that when death follows their removal it is in most cases due to injury to neighbouring tissues, chiefly the sympathetic. He successfully removed both suprarenals from rats which survived the operation without ill effects for months.⁶

Schiff, Nothnagel,⁷ Martin-Magron, Chatelain,⁸ and recently Pal⁹ and Berdach,¹⁰ obtained results in favour of the view that the suprarenal bodies were not necessary to life. In a later paper Brown-Séquad expressed himself as convinced of the correctness of his views, and further stated that the results of removal could not be explained by any concomitant lesions such as peritonitis, hepatitis, damage to kidneys, renal veins, inferior vena cava or sympathetic.

In addition to Tizzoni's criticism there is this objection that even when both suprarenal bodies have been completely removed the presence of accessory suprarenal bodies in various situations mentioned above may compensate for the removal of the normal glands. Stilling has shown that under such conditions the accessory adrenals may undergo a compensatory hypertrophy. Alexander points out that, owing to the very close connection of the right suprarenal capsule with

the inferior vena cava it is not improbable that fragments of it might be left behind, and by compensatory hypertrophy might prevent the development of symptoms due to complete removal.

MacMunn,¹¹ by means of spectroscopic examination, found a histohæmatin in the cortex and free hæmochromogen in the medulla of the suprarenal capsules. Hæmochromogen, the writer considers, is an excretory stage in the history of of blood pigment, and is probably formed by a downward metabolism from hæmoglobin and histohæmatins. He put forward the hypothesis that the function of the suprarenals is to pick out of the circulation the effete or worn-out pigments of the blood and their accompanying proteids. He further stated that when these pigment-metabolising organs are diseased there should be present in the urine incompletely metabolised pigments. This he found in a body he called urohæmatoporphyrin.

Foa and Pellacani¹² found injection of aqueous and alcoholic extracts of suprarenal bodies fatal to frogs, rabbits, and dogs. Alexander¹³ believed that in the preparation of these extracts artificial poisons were produced. Schäfer and Oliver¹⁴, by injection of large quantities (equal to 50 grains of the gland) of aqueous suprarenal extract, produced death in rabbits in twenty-four hours.

The poisonous body has been thought to be neurine, which, being continually formed by the activity of the muscular and nervous systems, is eliminated or destroyed by the suprarenal bodies (Marino Zucco,¹⁵ Carbone¹⁶); it is said to have been found in urine of Addison's disease.¹⁷

It was suggested that the toxic effects were due not so much to neurine as to combinations of phosphoric acids with that base (Marino Zucco¹⁸), the toxic properties of the extract being destroyed by the addition of hydrochloric acid, which broke up the phosphate of neurine.

Oliver and Schäfer showed that the symptoms of toxic doses of suprarenal extract do not correspond to those of neurine, and that the phosphate and hydrochlorate of neurine have the same effect as the base. Supino¹⁹ repeated Marino Zucco's experiments with a negative result as regards neurine.

What the active principle of the extract of the suprarenal bodies may be is at present not established. Bodies such as leucin (Virchow), lecithin,²⁰ taurocholic and hippuric acid (Vulpian and Closz), and benzoic acid have been extracted from the suprarenal capsules, but there is nothing to show that the effects of injection of suprarenal juice are due to any of them, or that they have been picked out of the circulation, and are in process of being removed by the instrumentality of the suprarenal bodies.

Mr. Moore²¹ has found that the active principle of suprarenal extract is not a proteid or a carbohydrate. It is not affected by acids or by boiling for some minutes, but is destroyed by alkalies, reducing agents, and by continued boiling. It dialyses and it has a powerful reducing action. It has not been isolated; its properties resemble those of a reducing agent found in 1856 by Vulpian in the medulla of the suprarenal bodies.

As leucin is a product of downward metabolism of proteids, its occurrence in extracts of the suprarenal bodies is probably explained as the result of decomposition taking place. Leucin is not poisonous. Subcutaneous injections of increasing quantities of leucin into animals have been described as giving rise to nephritis²² and albuminuria. These results do not follow removal of the suprarenal bodies or the injection of suprarenal extract, and since leucin is normally transformed by the liver into urea, there is no reason to believe that leucin has anything to do with the suprarenal bodies.

Lecithin is found in most parts of the body; in itself it has no toxic effects, but it may be changed into choline,²³ which has poisonous properties like those of neurine. The effects of neurine and of extract of suprarenal capsules have been shown by Schäfer and Oliver to be different; hence as the properties of neurine and choline are alike,²⁴ it may be concluded that the presence of choline or lecithin cannot explain the activity of suprarenal extract, or an accumulation of these bodies in the blood account for the toxic symptoms resulting after removal of the suprarenal capsules.

In the same way benzoic, hippuric, and taurocholic acids cannot be held to be responsible for the active properties of