Remarks

ON

THE APPLICATION OF STRONG ANTISEPTICS TO INFECTED AND NON-INFECTED WOUNDS.

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THE good results which have followed the thorough application at the earliest possible moment of some efficient germicide to wounds which, from their nature and surroundings, are almost certainly infected, has already tended to allay the feeling of hesitancy with which at the beginning of the war surgeons adopted an antiseptic as opposed to an aseptic line of treatment.

Inasmuch, however, as some apprehension may still exist as to the degree of injury which such applications inflict on the cells and tissues of the body, I feel prompted to record some observations which I have recently carried out, primarily with the object of satisfying myself as to the capacity of tissues to heal in the presence of strong antiseptics, and I venture to hope the facts so recorded may be useful at the present time.

In order to state with confidence and accuracy the effect of the application of strong germicides like carbolic acid or iodine to wounds in general, it is necessary to simplify the problem and first ascertain the effects of such reagents on wounds in which the possibility of the presence of disease organisms has been excluded.

I have therefore recently taken advantage of the opportunity afforded by a series of operations for hernia, varicose veins, etc., on recruits rejected for physical disability to treat in a few cases the extensive incisions made for the removal of varicose veins in the leg and thigh in the following way:

The usual preparatory treatment as used in the aseptic method is first carried out.

In one leg the wound left by the long incision on the inner side of the calf, which may measure 6 or 8 in. in length and (after the necessary dissection) 3 or 4 in. in width, was well rubbed over with pure carbolic acid until the tissues assumed the dirty white appearance characteristic of the reagent.

In the other leg of the same patient the corresponding incision was treated with tincture of iodine (*B.P.* strength).

In other patients, out of a number of incisions on the same limb, one was treated with pure carbolic, one with tincture of iodine, one with mercury perchloride lotion (1 in 1,000), and one with carbolic acid lotion (1 in 20), and the other incisions with no antiseptics at all.

The edges of the wounds were coated in all cases by Michel's metal clips, and all were dressed alike with plain white sterilized gauze, wool, and bandage.

The only difference that could be ascertained in the patients' own sensations after recovery from the anaesthetic was that incisions treated with carbolic acid smarted rather less than incisions treated with iodine.

There was little or no difference, as far as painful sensations were concerned, between wounds treated with and those treated without antiseptics, such slight irregular differences as were present might well be accounted for by entanglement of delicate nerve endings in the ligatures.

In regard to the more important point of the influence of such antiseptics on the healing of the wound, I can only say that it is usually impossible to tell from the appearance of the line of the incision or the condition of the parts round, after the removal of the dressing on the second day, or at a later period, which of the wounds had been treated by one method and which by the other. All healed by primary union without undue local reaction or any elevation of temperature in the ordinary way.

I fully realize that, put in this simple way, this statement is likely to be misinterpreted. In the first place, I am alive to the fact that in applying a reagent like pure carbolic to a recent wound in which no organisms are present or are likely to gain access, we are by

chemical means killing and injuring a number of fixed and wandering cells over and above those which have been necessarily killed or injured by mechanical means, by the knife, forceps, or ligature. The fact, however, thus ascertained, that the free application of strong antiseptics like pure carbolic acid at the time of operation to extensive wounds, free from disease germs, does not materially affect the healing of such wounds is important.

There is, no doubt, a considerable margin in all healthy tissues of capacity of repair in response to injury, and such tissues are probably able to deal with far larger numbers of dead cells than are killed by the chemical reagent used, but in the carrying out of this work the defensive cells must not be hampered by the presence in the wound of disease germ or their toxins.

This safety margin of reparative power is, of course, well shown in the ease with which destroyed cells are removed and injuries recovered from in wounds in which there is no solution of skin continuity and to which no germs gain access.

I lay stress on the thorough application of the antiseptic on one occasion only because there are reasons for thinking that one application of a strong antiseptic like pure carbolic acid does less permanent injury to the tissues than the repeated application of weaker solution; furthermore, the strong reagent has a far greater chance than the weaker solution of killing the invading organisms if used at a sufficiently early period.

The real question is:

To what extent does the presence of pathogenic organisms and their toxins in a wound hamper the defensive cells in their efforts to remove the cell debris caused by chemical or mechanical injury? This will depend upon—it is, indeed, an index of—the virulence of the organisms concerned. It varies with different species of organisms, and with different strains of the same species.

We have already ascertained that the initial application of a strong antiseptic, like pure carbolic acid, does not materially prejudice the healing of a wound in which the injury to the tissues by mechanical means has been moderate, and from which organisms have been excluded. Can we apply this conclusion to wounds in which the damage to the tissues is much greater, and into which pathogenic organisms have been introduced either at the time of injury or shortly afterwards? In other words, we want to know whether the application of a strong antiseptic to an infected wound materially adds to the difficulties of the defensive cells in their struggle with the disease organisms on the one hand, and in their effort to remove cell debris and regenerate new cells on the other. The problem is one of balance of advantage. If the antiseptic destroys or inhibits the growth of the invading organisms, it certainly promotes healing, even if it kills a few more tissue cells. If, however, it damages a considerable number of defensive cells and fails to destroy or inhibit the growth of the disease organisms, it will do more harm than good.

The result in any given case will depend to a considerable extent on the variety and numbers of the invading organisms, also to some extent on the amount of injury to the tissues, but it will depend less on the kind of antiseptic employed than on the time which has elapsed between the infection of the wound and the application of the antiseptic, or, in other words, the extent to which the disease organisms have established themselves in the wound and invaded the tissues.

Several distinguished surgeons have lately drawn attention to the rapid improvement which often takes place in the patient's condition and in a wound after the removal of bits of infected clothing or other foreign bodies, or detached bone fragments. No doubt such treatment acts by establishing free drainage and by removing the nidus for the growth of organisms; but it also relieves the defensive cells from the strain of dealing with these foreign bodies and so leaves them free to repel the organisms and their toxins.

If, then, extensive destruction of body cells is quite consistent with the rapid healing of a wound in which micro-organisms are absent, and if, as we have seen, the single application of a powerful antiseptic to a recently made aseptic wound does not materially affect the healing process; and if further, as we know from abundant experience, the

application of a sufficiently strong antiseptic does, under favourable conditions as to time and the nature of the wound, materially aid in destroying the infection and preventing its spread, then it seems clear that such an application should be made in all suitable cases.

The point is, What is the best form of antiseptic to use and what is the best way of using it?

One fact which emerged from these observations is that all the antiseptics—carbolic, iodine, and mercury—when used in freshly-made aseptic wounds, seem about on a par as regards their influence on the healing of the wound.

If the conditions were the same in a wound as in a culture tube, the best form of antiseptic would have been decided in the laboratory long ago. The free use of almost any antiseptic in sufficient concentration will (apart from the question of spores) destroy or inhibit the growth of most organisms when these are present only on the surfaces, internal and external, of the wound. Hence the divergent views as to the germicidal power of different antiseptics, a divergence of opinion which indicates that in surgery as in medicine the complete control of and the curative remedy for infection in all its phases has not yet been arrived at.

We do not fully know the length of time after infection within which the application of an antiseptic to a wound holds out any prospect of doing good. Hence it is probably wise to make one efficient application of a sufficiently strong antiseptic even in doubtful cases.

If, in addition to the removal, at the proper time, of foreign bodies, bone fragments, etc., and the establishment of free drainage, one such thorough application fails to check the spread of the infection, then it is not very likely that the repeated use of weaker solutions will have a better result. Experience shows that this is true in a general sense and under these conditions reliance must be placed on stimulating the defensive mechanism of the body by vaccines and in other ways.

It is, however, not my present object to discuss infection and different methods of wound treatment generally; I desire rather to show from direct observation that the application of even a powerful antiseptic does not prejudicially affect the healing process under certain conditions, and by showing this to remove any lingering reluctance to employ suitable reagents in the treatment of infected wounds, and in this way to promote the antiseptic as opposed to the aseptic method in wounds received in war.

Hitherto I have confined my observations to wounds of the limbs and body tissues generally; I have not included wounds of the large serous cavities and their contained viscera. Although the details of application require considerable modification, I think the general principle—namely, that the efficient application on one occasion of a powerful antiseptic is better than the repeated application of weaker solutions—still holds good. One, perhaps the chief, factor influencing the result is that the destruction, by chemical or mechanical means over any considerable area, of the endothelial cells which line these serous cavities increases the risk of the transmigration of pathogenic organisms through the walls of the hollow viscera, and it also predisposes to the subsequent formation of adhesions between opposing surfaces. But bearing this fully in mind, I think that the dread of carbolic acid within the abdominal cavity under all circumstances is a somewhat unreasonable dread. From what I have seen of the application of pure carbolic acid to the stumps of amputated appendices and in some cases to adjacent areas of the caecum or small intestine, and on a still more extensive scale to the stumps of infected Fallopian tubes and abscess cavities in the female pelvis, I feel sure that the localized and careful application of even such a powerful antiseptic as pure carbolic acid at the time of operation has done good in many cases.

The governing factor is, of course, not so much the antiseptic as the mode of infection. If the infecting organisms are passing through the wall of the bowel, as in a case of general peritonitis with obstruction, then the application of any antiseptic to the peritoneal coat of the gut will only do harm. If, on the other hand, the infecting material is being introduced into the peritoneal cavity from outside, as it is in wounds of the abdomen, and as it is also in a localized perforation of a hollow viscus with escape of its contents, then after ensuring that the two urgent requirements—namely, the removal of the

extravasated material and the prevention of further leakage—are both fully carried out we must look round for further means by which to aid the organism to repel the invasion. If it is probable that in some limited area the local application of a strong antiseptic will do more good by destroying germs than it will do harm by killing a certain number of tissue cells, then it is wise to use it.

In conclusion, I hope it will not be supposed that, in recording these simple observations on the effect of antiseptics in aseptic wounds, I am advocating the routine use of these reagents in wounds made by operation under strict aseptic conditions; such a suggestion is quite foreign to my intention. What I do wish to suggest is that if it can be shown, as it certainly can be, that the proper application of strong antiseptics does not materially affect the healing of certain aseptic wounds, this fact should encourage us in the fuller use of efficient germicides in infected wounds at the earliest opportunity and under suitable conditions.

[This article was written before the publication of Sir W. Watson Cheyne's Hunterian Oration on "The Treatment of Wounds in War." We may reasonably hope that the very important researches carried out by Sir Watson Cheyne and his colleagues on the power of diffusion and bactericidal capacity of various germicides will bring the problem of the efficient disinfection of wounds received in war a step nearer solution. With increasing knowledge of the germicidal capacity of different antiseptics there still remains the need for further investigation concerning the action of these reagents on the body cells and tissues. It is this side of the problem that I have ventured to discuss in my remarks.]

Further Report

ON

THE TREATMENT OF PERNICIOUS ANAEMIA BY SALVARSAN AND NEO-SALVARSAN.

BY

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IN March, 1911, I published in this JOURNAL (p. 547) two cases of pernicious anaemia in which great improvement resulted from the intramuscular injection of salvarsan, and on June 22nd, 1912, and May 24th, 1913, I published in this JOURNAL additional papers showing the future progress of these cases and giving particulars of 10 additional cases in which the same method of treatment was employed.

I now propose to record the progress of the cases previously reported and the results in 9 additional cases treated in the same way. These 21 cases include every case of pernicious anaemia I have personally treated by salvarsan or neo-salvarsan, with the exception of 3 cases which have quite recently come under observation and in which sufficient time has not yet elapsed to show the effects of treatment.

One case, which was at first diagnosed as a case of pernicious anaemia and was treated by salvarsan, but which proved to be a case of malignant disease of the stomach and spleen, and 3 cases of pernicious anaemia seen once in consultation in which salvarsan was advised, but in which I do not know if the treatment was employed or not, are not included.

Since I introduced the arsenical treatment of pernicious anaemia in 1875 I have had a large experience of the disease. I have notes, more or less complete, of 141 cases. Excluding 7 cases in which arsenic was not given, the 21 cases treated with salvarsan or neo-salvarsan recorded in this paper, and the 3 cases treated by neo-salvarsan which have quite recently come under observation, there remain 110 cases treated with arsenic by the mouth in the form of Fowler's solution. Of these 141 cases, 70 were hospital and 71 were private patients.

The impression which has been made on my mind by