AN ADDRESS

ON THE

ORGANISATION OF ASEPTIC OPERATIONS AND
SOME OF THE CAUSES OF FAILURE.*Delivered before the Leamington Medical Society*

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WHEN you did me the honour to invite me to deliver an address to this Society I had reason to think that it would meet with your approval if I took aseptic surgery for my subject. I propose, therefore, to speak about the organisation of an aseptic operation, and in doing so to lay stress upon some of the causes of failure. I am sure you will pardon me if I repeat what I have said elsewhere; for, as you are aware, this is not the first time I have dealt with this topic.

It is hardly necessary to begin with a defence for the manner in which the term aseptic will be used. In what follows it will be applied to the end, not to the means.

There can, of course, be only one kind of asepsis—that in which bacteria are absent; the means by which this end can be attained are of almost infinite variety. To endeavour to limit the use of the term aseptic to a method which relies entirely upon heat is doomed to end in inconsistency. Chemicals have to be used for the sterilisation of the hands of the surgeon and of the skin of the patient, and thus the domain of so-called "antiseptic" surgery is invaded. As soon as we admit that the end of aseptic surgery is the absence of bacteria we have at once a simple test of success or failure, and a test which is very easy to apply. I have from time to time during the past ten years published reports in the *BRITISH MEDICAL JOURNAL*,¹ in which I have detailed the success or failure of the methods which I have been in the habit of using, and I now propose to give what is practically the substance of a further report.

THE STANDARD OF EXCELLENCE.

Since the earliest attempt the standard of excellence has become higher. For some time it has been my endeavour to attain sterility of the skin of the patient and everything brought in contact with the wound, and lastly, of the wound itself. No one who has not made this endeavour knows how difficult the task is to accomplish or what careful organisation is required. Consider the matter in detail. What care has to be exercised by the house-surgeon or dresser who disinfects the skin of the patient; in the sterilisation of the instruments and utensils; in the sterilisation of the sutures and ligatures, and especially in the sterilisation of sponges and towels; in the performance of the operation to prevent contamination; and lastly, in the dressing and closure of the wound to prevent infection from without. This all implies the greatest care, not only on the part of the surgeon, but of all concerned; in other words, the organisation of the operation has to be perfection.

It is obvious that with so many possibilities of error asepsis must be difficult to attain. I myself have been able to record but few cases which have come up to the standard of excellence which I have adopted. With the help of Mr. Pollard, the House-Surgeon, I succeeded in the operation for the removal of a goitre and in a case of appendectomy. Also, helped by Mr. Borrow, the present House-Surgeon, I have succeeded in a case of radical cure of hernia and in another appendectomy. In this the skin of the patient, the skin of the hands of the surgeon and of his assistant, the silk, the fishing gut, sponges and towels were all sterile, and, finally, nothing grew in culture tubes inoculated from the wound on the eighth to the tenth day. I believe that other surgeons are working on similar lines, and it would be interesting to learn their results.²

To my mind one of the leading characteristics of aseptic surgery is its extreme simplicity. I do not know of any detail which cannot be carried out in a private house as well as in the most elaborate and expensive operation theatre. In truth I have sometimes thought the elaborate equipments of some theatres

rather overwhelming. The use of foot taps which often get out of order seems rather superfluous if the surgeon does not know when his hands are sterile, never having tested the skin. Nor can I see the advantage of marble slabs if the sponges have not been submitted to investigation. Recently I had a striking instance of the value of the simple test which I am advocating. At the end of a hysterectomy it was suggested that I should put some sterilised water in the abdomen with a view of combating the distressing thirst which so frequently follows an operation which is attended with some loss of blood. Before acceding to this request I inquired whether the so-called sterilised water had been tested, and was informed that it had been tested twice, and in both cases contained bacteria, whereupon I declined to use it. Perhaps I ought to say that I may have been rendered suspicious by some serious cases of sepsis which had followed operations performed in the same place.

[After mentioning the details of the organisation of an operation the preparation of the patient was discussed.]

DISINFECTION OF THE PATIENT'S SKIN.

Everyone is well aware of the extreme importance of the disinfection of the skin within the field of operation. It used to be the custom to begin the preparation many hours before the operation and usually over night. After shaving and thoroughly washing with soap and water, the fat is removed from the skin with turpentine, a chemical disinfectant applied, and then a dressing adjusted with the view of preventing further infection, and of continuing the process of disinfection. A comfortable night is not likely to be passed by a person wrapped up in a moist and unaccustomed dressing. Happily our later methods of disinfecting the skin, if not perfect, are so efficient that the old method can be dispensed with, much to the comfort of the patient. Therefore, I am now in the habit of having the preparation and disinfection of the skin performed an hour or so before the operation, and in the case of a lady or of a child it is deferred until they are under the anæsthetic. Obviously the cleansing of the skin of the cleanly gentle folk is not such a difficult problem as that of the hospital patient.

The disinfection of the skin is performed as follows:

1. It is, if necessary, shaved.
2. It is thoroughly washed with soap and water to remove all dirt, superfluous epithelium, and sebaceous matter.
3. As much as possible of the remaining fat is extracted with ether, or turpentine, or benzine; of these turpentine is probably the most convenient and perhaps the best; it can be obtained in almost every house, and besides being an excellent grease extractor has some powers of disinfection.
4. After the thorough extraction of the grease the skin is saturated for not less than two minutes with a solution of biniodide of mercury in methylated spirit (1 in 500).³

The disinfection of the skin by this or any other process requires practice and minute attention to details. Some house-surgeons are very much more successful than others, and a good deal depends upon the region. The skin of the limbs is easy to disinfect, especially that in front of the knee, a point of some importance when we consider how often arthrotomy is performed. The skin of the front of the abdomen is likewise easy, also the skin of the breast. The skin of the groin, scrotum, and scalp are difficult, especially the last. During the last two months we have tested the skin of the patient in some cases at the beginning of the operation, and in some at the end. In twenty-four tests made at the beginning of the operation it was septic five times, and in twelve tested at the end of the operation it was septic twice. It is natural to inquire whether these results have been obtained at the cost of much dermatitis. I perhaps am not an unbiassed observer, and the question is not quite so easy to answer as might be thought. I should say myself that dermatitis was rarely caused by the disinfection of the skin by this method, provided that it was applied without unnecessary violence. When dermatitis has occurred, it has most frequently been caused by iodoform, by carbolic acid, or by one of the mercuric dressings. The idiosyncrasies of patients are very remarkable. Not long since a little finely powdered iodoform dusted upon the patient's face caused a violent dermatitis with large bullæ. She said that iodoform had had the same effect before. I have seen dilute carbolic acid lotion act in the same way.⁴

DISINFECTION OF THE HANDS.

There cannot be a more important question than the disinfection of the "principal instrument" of the surgeon, and perhaps I ought to add of the obstetrician and gynaecologist. When we make allowances for the infirmities of human nature, it will be readily conceded that the fewer the hands engaged in an operation the fewer the chances of error. The surgeon, however, must in most cases have an assistant, and the nurses must touch some of the appliances. It is quite clear that the method ought to be simple, and not necessitate elaborate appliances, several sorts of chemicals, or complicated methods. Therefore, after the nails have been cut close and all outside dirt and grease removed, we use the solution of biniodide of mercury and methylated spirit which was used for the disinfection of the patient's skin. Not less than half a pint of this fluid should be placed in a capacious sterilised bowl. It is to be remembered that for many abdominal operations it is necessary to disinfect not only the hands but also the wrists and forearms.

Our last tests of the results of this method are as follows: The skin of my own hands tested 24 times at the beginning of the operation was septic once; it was tested 12 times at the end of the operation and was septic thrice. The skin of the house-surgeons was tested 24 times at the beginning of the operation and was septic once, and 13 times at the end of the operation and was septic once; the skin of the nurse was aseptic on 6 occasions. I think I may claim that these results are good. Improvement has been steady, since everyone has learned to realise the difficulty of the task. It is interesting to observe that the hands which were used the most in operative manipulations were oftenest septic at the end of the operation. I think this fact will have to be taken into consideration, and that it may lead to some alteration in our methods.

As to the effects which this method of preparation has upon the skin of the hands, here again idiosyncrasy comes in. My own hands at once become rough and inflamed when brought in contact with strong solutions of carbolic acid or of sublimate. During the years that I have used spirit and biniodide of mercury I have hardly suffered at all from these inconveniences. Should the skin become rough during inclement weather a mixture of glycerine and eau de cologne applied at night brings about a speedy cure. The house-surgeons and sisters likewise favour this method of disinfection, and it is not without significance to remark that since I introduced the use of the solution of biniodide of mercury and methylated spirit at the Great Northern and St. Bartholomew's Hospitals, it has been adopted by nearly all my surgical colleagues.

STERILISATION OF INSTRUMENTS AND MATERIALS.

I now return to the remaining portion of the organisation of an aseptic operation. As far as possible each step should be carried out under the direct supervision of the surgeon. Before proceeding to an operation the necessary instruments are chosen and sterilised by boiling them for fifteen to twenty minutes in a solution of ordinary washing soda and water (1 drachm to the pint). They are taken out of this solution, and wrapped in antiseptic gauze, and securely folded in an outside dressing. After the patient has been anaesthetised, it is a simple matter to place the instruments into a basin of 1 in 60 carbolic lotion ready for use.

I have not time to discuss the various materials which may be used for sutures and ligatures. For all ordinary cases it is necessary to provide fishing gut, and one or two sizes of twisted silk. For the neatest and most accurate closure of skin incisions the finest trout gut is best, and when it is fine the sutures may be placed very close together, with a correspondingly neat and accurate closure of the wound. A very accurately-closed wound heals with extreme rapidity. In a few hours this may have gone far enough to prevent deep infection should the wound by any mischance become exposed to the air. It is hardly necessary to remark how much the patient appreciates a scar which is almost invisible. For the ligature of small vessels such as are met with in amputation of the breast, No. 00 twisted silk is quite strong enough, and I have never seen it reappear. Moreover, it is expeditious. Catgut, in the use of which I have had considerable experience, is apt to slip or break.

Of late years, where suppuration has occurred, it has almost invariably been due to a collection of blood in the depths of the wound. The blood has, I think, escaped from the small arteries of cut muscles, and these are difficult to secure even with silk. For abdominal wounds thicker fishing gut, and for pedicles thicker silk must be provided. The sterilisation of these materials is very simple; they are boiled for twenty minutes in water, and then placed in a jar of 1 in 20 carbolic acid for conveyance to the operation. Some time ago I was greatly troubled by the brittleness of the silk provided for my hospital operations, and I discovered that the house-surgeons were in the habit of boiling it along with the instruments in the solution of washing soda and water. The effect of the soda is to remove an element from the silk upon which its strength depends. The remedy for brittle silk is obvious. The results of this method of preparation are perfect. Our tests show that the silk was sterile 18 times before and 10 times after use; the fishing gut 15 times before and 10 times after use.

BURIED SILK SUTURES.

The success of many operations on the abdominal wall depends upon the precision with which the surgeon is able to introduce buried sutures. This remark applies especially to operations for the radical cure of hernia, to the closure of wounds in the abdominal parietes, to nephrorrhaphy, and to the closure of gaps left by the removal of tumours. In my last series of 50 cases of radical cure of non-strangulated inguinal hernia, there were 2 cases of suppuration. Doubtless the day will come when this will be improved upon, although I regret to say that the present series does not promise to be quite so good. Here I propose to refer to one of the difficulties I have met with in the practice of aseptic surgery. It is clear that if the silk extrudes it is not the fault of the silk. Now, in operations for the removal of the vermiform appendix it is an obvious advantage to close the abdominal wound with layer upon layer of buried silk sutures. In this way we may hope to allow the patient to resume his occupation at an earlier date, and at the same time be free from the risk of ventral hernia. With these objects in view, I have on ten occasions sutured the small abdominal wound after the removal of the appendix with four layers of sutures. First, a layer in the peritoneum; secondly, a layer in the internal oblique and transversalis; thirdly, a layer in the aponeurosis of the external oblique; and fourthly, a row in the skin. Now, although cases were chosen in which no pus was found, nevertheless, out of the 10 cases treated in this manner 3 suppurated with extrusion of some, if not all, of the sutures. A percentage of nearly 30 per cent. was, to say the least, somewhat disconcerting. The proportion of suppuration in 33 similar cases closed with a single row of fishing gut sutures was 4, slightly over 12 per cent. But even this proportion is high when compared with the radical cure of hernia in which nearly as much silk is buried. I soon came to the conclusion that some of these failures were attributable to the nature of the operation, and that as a matter of fact the wounds became infected during the removal of the appendix. At that moment the interior of the appendix is opened, and in spite of the most careful precautions septic contents escape. Furthermore, I have now histological evidence that even in non-suppurating cases the inflamed tissues around the diseased appendix are often infested with bacteria. It is not to be wondered therefore that after appendix operations buried silk sutures are apt to be extruded. In support of the truth of this contention, I would add that whilst these operations were being performed large quantities of silk were buried in wounds in the abdominal wall in operations for the cure of ventral hernia (6 cases), removal of tumours of the abdominal wall (4 cases), nephrorrhaphy (5 cases), and that none of these were followed by suppuration or by the reappearance of a suture. With regard to the 4 cases of suppuration in which single rows of fishing-gut sutures were used one occurred in a case of tubercle of the appendix and some time after the wound had healed, another was due to hæmorrhage from the abdominal wall, another in a gentleman who was suffering from dysentery and malaria, and the last in a man with formidable adhesions, in whom a small laceration of the intestines occurred. I have not abandoned hope that we shall learn how to bury silk in the abdominal wall in appendix operations.

Fine silk has also been successfully buried for the obliteration of cavities after the removal of innocent tumours of the thyroid body and of the breast. This is the most effectual way of stopping hæmorrhage and shortens the time necessary for repair.

CATGUT SUTURES.

It is clear that it is unsafe to use silk to secure septic pedicles, such, for instance, as the meso-appendix in gangrenous appendicitis, or in perforation of the appendix with acute peritonitis. Under these circumstances bacteria abound in the appendix and its mesentery, and likewise, I might add, in the omentum should it happen to be involved. Therefore it is desirable to have at hand sterilised catgut. Inasmuch as this substance is made from the intestines of sheep, it abounds in bacteria, and as sheep sometimes die of anthrax its dangers can easily be imagined.

Many of the methods for sterilising catgut are complicated, and require special apparatus. The following is simple and reliable. The raw catgut is bought from the manufacturer or surgical instrument maker. The first step, as Reverdin pointed out, is to extract the grease which has been rubbed upon it to give it a smooth surface; this is the only troublesome part of the process. The catgut is wound upon a flat board and thoroughly scrubbed with soap and water, next it is placed in a quantity of ether for not less than twenty-four hours, indeed the soaking in ether should be continued until globules of oil cease to appear, the catgut is transferred from the ether to a watery solution of biniodide of mercury 1 in 250, in which it can be preserved indefinitely, but is not used until it has remained in the solution for at least 72 hours. Catgut treated in this way is quite strong after a lapse of many months. Different samples of it were sterile on the last five occasions on which we tested it; the fewness of the tests is due to the fact that catgut is so seldom used. I may add that catgut prepared in this way is most useful in cases of circumcision, and for suturing the wounds of children, who are so apt to be terrified at the extraction of sutures of silk or fishing gut.

OPERATIONS ON THE GENITO-URINARY TRACT.

Some other of the septic conditions which are present when the operation is performed seem to me not always adequately recognised. I know of no part of the body in which the results of operations are more influenced by pre-existent sepsis than those which are performed upon the genito-urinary tract.

Last year I had two striking instances. I had under my care at the same time two cases of urethrotomy which were almost identical in all respects but one. Both were men of about the same age. Both had narrow strictures in the penile urethra and impassable strictures in the perineum. In both the same operation was performed but with very different results. I divided the anterior strictures by internal urethrotomy and the posterior after the admirable method of Wheelhouse. In the first case the urine was septic and contained a quantity of pus. The operation was followed by the usual signs of sepsis, the temperature ran up, the pulse quickened, the patient became exceedingly ill, and the large soft catheter which had been left in the bladder had to be removed on the third day because the internal urethrotomy wound was septic. After having been very ill the patient ultimately made a good recovery. In the second case an instrument had never been passed, the urine was clear, and was retained all night. The anterior stricture was divided from within, and the perineal stricture from without, and a full-size soft catheter left in the bladder. The patient, who had had malaria, had a slight attack after the operation. The bladder was thoroughly washed out twice a day with boracic lotion. The urine remained clear and acid throughout. The catheter was removed on the ninth day perfectly clean. A coudé catheter was inserted for a few days longer. It is doubtful whether any urine ever escaped from the perineal wound, which was healed within three weeks. I cannot help attributing this remarkable result to the absence of sepsis.

Last year also 2 cases of cystotomy for papillomata afforded a similar contrast. A man whose urine was septic was seen with the cystoscope to have a papilloma near the neck of the bladder. This was exposed by suprapubic incision. Owing to hæmorrhage a clamp had to be applied to its pedicle. Immediately the

ammoniacal urine began to deposit phosphates, and it was only with the greatest difficulty, and after the abundant use of acid lotions, that this was got rid of and the closure of the wound ultimately secured. The second case was that of a woman whose urine was clear and whose bladder was healthy in spite of several small papillomata which could be seen with the cystoscope around its neck. Suprapubic cystotomy was performed and the papillomata destroyed with scissors and cautery. The abdominal incision and the opening into the bladder were closed with a single row of fishing-gut sutures. The urine never escaped from this wound, which was soundly healed within three weeks, although on one occasion shortly after the operation, some pus and perhaps sloughs escaped with the urine. The decision to close the bladder in this last case was entirely based upon the absence of sepsis. In the first it would have been unwise to close the wound because of the presence of sepsis, even if the clamp had not been applied.

FISHING-GUT.

Fishing-gut is such excellent material for skin sutures and abdominal incisions that it is used by most surgeons. It is easily sterilised with heat and is boiled along with the silk. Some time ago we had to note an occasional failure, but the last 15 specimens tested before the operation were sterile, and likewise 10 tested after the operation. The thicker sizes ought to be boiled for at least 20 minutes. Perhaps I may refer here to one of the difficulties of aseptic surgery. With the finest kind of fishing-gut skin incisions can be closed with such accuracy as to be almost invisible. Last year I removed an innocent tumour from the thyroid body of a woman. It was globular and had a diameter of about $2\frac{1}{2}$ inches, and required an incision of corresponding length. The cavity left by its removal was obliterated with buried silk sutures and the skin incision brought accurately together with the finest fishing gut. At the end of three weeks I remember asking my class if they could discover what had been done, for hardly any trace of the operation could be discovered. Alas! within a month she returned with a thick line of red and obtrusive keloid. I do not know to what extent surgeons used to be troubled by the growth of keloid. I remember the late Sir James Paget telling me that he was always anxious lest it should follow operations upon the face. I cannot help thinking that keloid is especially prone to complicate wounds treated with chemicals. Therefore, in performing plastic operations upon the face, I have of late used 1 in 10,000 biniodide of mercury lotion, and contented myself with painting the wound with a little collodion. Should further protection be necessary, a little sterilised wool or gauze is applied.

SPONGES AND TOWELS.

I now come to the question about which there are differences of opinion. I have experience of various materials for clearing the wound of blood, but no swab that I have ever seen is as good as a sponge of good quality. I suppose those who eschew sponges do so because they have doubts as to their asepticity, and in my opinion the gravest doubts ought always to be entertained unless the sponge has been prepared and disinfected by the surgeon himself, or by someone upon whom he can implicitly rely. Furthermore, by whomsoever the sponges are prepared, they ought to be submitted to frequent tests. It is hardly necessary for me to describe at length this most important part of the organisation of an aseptic operation. An ordinary round sponge of suitable quality costs about one shilling. The sand should be beaten out of it, the shell and coral dissolved with a dilute solution of mineral acid (sulphuric or hydrochloric). Next, the sponge is treated with a solution of washing soda to neutralise the acid and remove any albuminous material; lastly, the sponge is disinfected and bleached by being submerged in a 1 in 5 solution of sulphurous acid in water.⁴ Our last results of this sulphurous acid method of disinfecting sponges show that 20 tested before the operation were all sterile, and likewise 11 tested after the operation. The credit of such good results is due to Nurse Carson, who has never yet had a septic sponge or septic towel. The towels which are used to surround the field of operation and to prevent the ligatures, sutures, hands, or instruments being contaminated by contact with the clothing or undisinfected parts, are sterilised by boiling for half an hour in a boiler or saucepan. In hospital practice

Lautenschläger's sterilisers are used because they are convenient; 18 towels tested before the operation were sterile, as were 11 tested after the operation. We have often exposed plate cultures of gelatine to the air of our operation theatre, and know that vast quantities of bacteria fall from it upon the towels and field of operation. But they are not necessarily pathogenic. Dr. Drysdale kindly exposed culture media whilst operations were being performed. He found on each occasion a growth of yellow sarcinae, and of other common coloured organisms of the air. The sterile results after the operation seem therefore to be contradictory, but it is to be remarked that the sterilised towels are usually transferred from the steriliser into 1 in 40 carbolic lotion, and in addition during the performance of the operation they are continually wetted with the biniodide of mercury lotion 1 in 2,000, used for the sponges and for the hands of the surgeon and of his assistant. Presumably these chemicals suffice for the destruction of the organisms. Biniodide of mercury lotion possesses many advantages—first, it is perhaps the most powerful germicide; secondly, it is unirritating; and thirdly, it does not combine with albumen. Owing to this last peculiarity it is often employed when other chemicals would be unsafe.

Not long since I operated upon a case in which a suppurating ovarian cyst had burst into the peritoneal cavity. The abdomen was full of pus, and after removal of the cyst its interior was thoroughly washed out with biniodide of mercury solution, 1 in 4,000. The patient made an uneventful recovery, without any sign of mercurial poisoning. Had sublimate or carbolic lotion been used in this manner, it may safely be assumed that some of the chemicals would have remained in the abdomen in combination with the tissues and albuminous fluids. For similar reasons biniodide of mercury lotion is most efficacious for cleansing sponges. At the beginning of the operation a single sponge is handed to the assistant in a bowl of lotion, in which from time to time it is wrung out, the lotion merely requiring to be renewed.

For any operations a single sponge will suffice, and at the end is so free from blood and albumen that one often wonders whether it is really necessary for it to pass through the elaborate sulphurous acid method before being used for other operations. I have reason to be familiar with the use of sublimate lotion for cleansing sponges. After a little while albuminate of mercury collects in the sponge and it becomes inelastic and sodden, and incapable of taking up blood or any other fluid. It adds to the safety of the patient to be able to perform abdominal operations with a small number of sponges, four round and one flat suffice, and with so few it is difficult for any to be lost. In the choice of antiseptics I have learned to look with extreme suspicion upon the various patent preparations; many of them are mixtures of an efficient germicide with some kind of diluent; the germicide is dear, the diluent is cheap; the result can be imagined when it is remembered that profits are to be earned.

In conclusion various occlusive dressings for wounds of the groin, scrotum, abdomen, and breast, and which Sister Paget had very kindly prepared, were shown and described.

NOTES AND REFERENCES.

¹ BRITISH MEDICAL JOURNAL, October 25th, 1890; May 28th, 1892; January 27th, 1894; July 11th, 1896; and September 17th, 1898. The methods are given in these and in *Aseptic Surgery*, by C. B. Lockwood, 2nd edition, London, 1899. ² The method of testing is exceedingly simple. A piece of skin, sponge, ligature, towel, and so forth, is cut off and dropped into a tube of nutrient broth, which is placed in an incubator, at the temperature of the body, for a week, and the result recorded. Inasmuch as chemicals are used for keeping the instruments and ligatures aseptic, it is obvious that a little chemical is introduced into the broth with each test. To some this may seem a source of error, but this is easily put aside. I have added 30 drops of 1 in 1,000 sublimate solution, and 60 drops of 1 in 20 carbolic lotion to the broth in a culture tube, and then grown ordinary skin bacteria in it; next the largest quantity of chemical is carried into the broth by bits of sponge, but I have inoculated some which remained sterile, and obtained a rapid and abundant growth. ³ Although the term biniodide of mercury is not quite correct; nevertheless, it is in general use, and cannot easily be displaced. The solution of biniodide of mercury and methylated spirits is easily made by using soloids. ⁴ BRITISH MEDICAL JOURNAL, vol. ii, 1898, p. 802.

THE biennial dinner of the Metropolitan Branch of the British Dental Association will be held on Saturday, March 3rd, at 7.15 P.M., at the Hotel Cecil, when Mr. Ashley Barrett, M.B.Lond., M.R.C.S., L.D.S., will be in the chair.

NOTES

ON

SOME CASES OF GUNSHOT WOUNDS FROM SOUTH AFRICA.

BY MAJOR WILLIAM DICK, M.B., F.R.C.S. EDIN.,

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THE following notes of some cases of gunshot wounds from South Africa which have passed through Netley Hospital may prove interesting. They have been mostly caused by Mauser bullets, and the majority of them seem to have done little injury. I have been in the habit of teaching that in gunshot wounds of the abdomen the diagnosis of penetration was sufficient ground for performing a laparotomy, on the hypothesis that when there was penetration of the abdominal cavity there was probably injury to some of its contained viscera, and that this demanded active operative interference.

Since, however, seeing these men with wounds by Mauser bullets, my opinion has become modified. Both the exit and entrance wounds are small, and from the track of the bullet, as determined by the position of these wounds, the abdomen must have been penetrated, and one fails to see how the bowel, etc., could have escaped. The manner in which these wounds heal is a matter for future investigation—possibly the wounds being small extravasation is prevented by contraction—the shock not being so great as that caused by large bullets, so that there is no paralysis of the intestinal wall, and this contraction being rapidly followed by plastic effusion, resulting in permanent occlusion of the openings.

Some of the cases of injury to the head, neck, and chest are also interesting. Perforations of bones seem to be accompanied by little or no fissuring, and heal up as rapidly as wounds of the soft parts, and the great vessels have escaped in many cases. Perforations of the lung seem to have healed rapidly and to have given rise to very few acute symptoms; probably here also contraction has immediately taken place round the narrow track of the small-bore bullet, rapidly followed by permanent occlusion.

WOUNDS OF THE HEAD, NECK, AND CHEST.

Private H. L. was wounded at Elands Laagte by a Mauser bullet on October 24th, 1899. The entrance was in the middle of the right cheek, and the bullet was cut out below the left eye. He arrived home on December 25th. He has been discharged to duty. In this case there were no pieces of bone to be taken away.

Private J. L. was wounded by a Mauser at the Modder River on November 28th, 1899. The bullet made its entrance at the anterior border of the left trapezius and its exit in the right mid-axillary line over the tenth costal interspace. This man states that beyond a little pain he never had any urgent symptoms indicating implication of the lung, although it is difficult to see how it could have escaped. The man arrived home on January 5th, and has been discharged to duty.

Private P. V. was wounded at Nicholson's Nek on October 30th. The bullet entered behind the middle of the posterior border of the left scapula, and made its exit 1½ inch below the middle of the left clavicle. He spat at first a little blood. No bones seem to have been injured. He arrived home on December 25th, and has since gone out of hospital fit for duty.

Private F. A.'s case was almost identical, except that the bullet perforated the infrascapular portion of the left scapula.

Private W. B. was shot at Elands Laagte. The bullet perforated the middle of the sternum, and made its exit in the eleventh costal interspace. This was followed by hæmothorax, which was incised. He had, of course, dyspnoea and hæmoptysis. He had perfectly recovered on arrival home.

Corporal S. C. was wounded at Estcourt on November 23rd, 1899. He arrived home on January 5th, practically fit for his duty. In his case the bullet had entered below the spine of the right scapula, and came out at the anterior border of the trapezius. In this case another bullet entered the middle of the left sterno-mastoid, and came out at the inner canthus of the left eye.

In one case which occurred at the Modder River the bullet entered in front of the right sterno-mastoid, fractured the spine of the right scapula, and was there excised.

The next case is very interesting. The bullet entered above the left zygomatic arch (the scar of this wound is small), and came out 1½ inch behind the left mastoid process (the scar of this wound is large). It is stated that fragments of bones were removed. There is here a depression of the occipital bone. No history of definite symptoms could be elicited from the man. The wound was received at Elands