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WAR SURGERY OF THE ABDOMEN*

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In this paper it will be my part to discuss only some of the general principles as they may be applied to the various conditions of warfare.

It is often forgotten that abdominal surgery is of quite recent date, a very large number of the big operations which are seen every day in civilian surgery dating only back to 1880; but so rapid were its strides that in about ten years the customary treatment for all perforating wounds was by open operation. During the Boer War, however, it was advocated by many that the patients should be kept absolutely at rest, with morphine and only small sips of water by mouth. Many cases treated in this way recovered, but it must be remembered that in that campaign the greater number of the injuries were due to rifle-bullet wounds, the rifles having been fired from a considerable distance, so that most of the wounds were clean penetrations; and much stress was laid upon the fact that in such wounds perforations of the intestine and stomach tended to close and to be occluded by protruding mucosa. In the war of 1914-18 an attempt was made in the early stages to pursue a similar line of treatment, with much less satisfactory results, and the monumental work of Sir Cuthbert Wallace with its large collection of statistics showed that in that war, at any rate, the only satisfactory treatment was by open operation. The nature of most of the wounds had changed considerably; a large proportion of them were due to fragments of high-explosive shell and shrapnel bullets, which were round leaden bullets packed into a high-explosive shell. This form of missile is now rarely used, and what is often loosely called a shrapnel wound is really an injury due to a fragment of a high-explosive shell or bomb.

In this war the explosives are of much higher power, and the fragments of shell or bomb are thrown out with greater force. In the close vicinity of the explosion their velocity may be higher than that of a rifle-bullet. They are ragged and irregular, so that not only is their tearing force enormous but they are very prone to carry in with them portions of septic clothing and other foreign material. The fact which has impressed itself upon me most in this war is that wounds from high-explosive fragments do much greater damage to the deep tissues than would be suspected from the surface appearances. In the beginning of the war there was a tendency to treat apparently small perforating wounds with an antiseptic dressing, but time after time I have been struck with the wide extent of laceration of the underlying tissues when there was a skin wound perhaps only a quarter of an inch in diameter, and I have now come to regard it as a constant rule that any penetrating wound, in any part of the body, due to a piece of high explosive must be opened and explored. This is in the main true of abdominal wounds, where the laceration of

the abdominal wall may be accompanied by injury of the underlying viscera. I have vividly in my mind one case in which a small fragment entered the buttock and, lying in front of the sacrum, had torn a large lateral opening into the rectum. Many of the cases of rifle- and revolver-bullet wounds have been of the same disruptive nature. This may be due to the fact that in the present more mobile war the wounds are inflicted for the most part at shorter range before the bullet has steadied on its course, or it may be due to the use of a more powerful explosive. In one of my cases, of a revolver-bullet wound inflicted at close range, four inches of the colon was destroyed entirely except for a narrow strip of the longitudinal muscle, the greater curve of the stomach was cut across giving a wound two inches long, and the left renal artery was completely divided.

The Power of Adaptability

The most valuable asset a medical man can possess in time of war is the power of adaptability. In peacetime you will be operating in a modern theatre with the help of a skilled anaesthetist and assistant and with instruments and equipment of the most modern design. It may well happen in war that you may find yourself confronted with a wound of the abdomen when you have little or no equipment. I was told a few days ago by a man now high up in the Army Medical Services that at one time he was in the African desert and had to treat a man who had a stab wound of the abdomen through which the colon was prolapsed. He pushed back the colon, sutured the skin, gave the man morphine, and sent him back to the base, where he was treated and ultimately recovered. Some of you may be now or may become regimental medical officers and may be faced with similar situations. There is no doubt, as Trueta found in the Spanish War, that the ideal procedure with all serious cases is to get them sent to hospital at the earliest opportunity, and, generally speaking, the correct treatment is to apply a first-aid dressing, administer morphine, and send the man back to the base. The fewer times the wound is inspected and dressed the better. A good deal of harm has happened to many civilian raid casualties, owing to the fact that they have been taken to first-aid centres, time has been wasted in applying first-aid treatment, and only later are they sent to hospital. The ambulance orderlies now have instructions to take all serious cases direct to hospital, but with the difficulties associated with the rescue of casualties from a bombed house, and working in a complete black-out, it is often almost impossible to determine the nature of a patient's injury. In these days of rapid advance it may well happen that the evacuation of an abdominal wound case may be prolonged and difficult, and the regimental medical officer must then exercise his ingenuity as to the best form of treatment. If he is so placed that he has at his command a small theatre with an anaesthetist but very little equipment he will, if he is adaptable, remember that much can

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be done with very little. Most intestinal injuries are best repaired with the use of clamps, but a suture or resection can easily be performed without them. There are very few abdominal operations that at a pinch cannot be performed with a scalpel, a pair of scissors, a pair of dissecting forceps, and half a dozen Spencer Wells forceps. Nor should he be deterred if he finds that he has run out of catgut and silk. Intestine can be readily sutured with an ordinary sewing needle and a boiled reel of cotton. The cotton may later give trouble; but the chance of this is small, and the trouble can be rectified later in a well-equipped hospital. Meanwhile the man's life has been saved. This is perhaps the main difference between civilian and war surgery of the abdomen. The chief consideration is to save the man's life, and methods to obtain this end which will probably lead to subsequent trouble may of necessity have to be adopted.

Resuscitation Treatment

If a surgeon be working in a well-equipped hospital severe abdominal wounds may present themselves under several conditions. In many cases the lesions are associated with profound shock. In the early days of this war the general procedure was to operate upon all severe cases at the earliest opportunity. As the lay papers are so fond of describing it, the patient was rushed to the theatre and operated on at once; but further experience has shown that very few cases are not benefited by a certain amount of treatment in a resuscitation ward. Some surgeons maintain that abdominal wounds are an exception because they are nearly always associated with haemorrhage, but I do not agree that they are exceptions to the general principle. Haemorrhage is as a rule much reduced in the stage of severe shock, and even if present can usually be distinguished from shock. It is true that many cases of severe shock fail to react to transfusion with plasma or saline or to the administration of oxygen. In the early days, when blood transfusion was given to all and sundry, there is no doubt that it was the direct cause of bad results, but even with only plasma transfusions the cases seem to be sharply divided into two groups—those that react and generally do well, and those that steadily and rapidly go down in spite of all our efforts. So marked is this that I am rather leaning to the view that the only forms of resuscitation that should be used are warmth and morphine. In severe wounds in other parts of the body warm sweet drinks or rectal infusions should be added; but with an abdominal wound, where there may be an injury of the stomach or rectum, these may not be possible, and an intravenous transfusion may become essential. My own view, therefore, is that in the case of an abdominal wound a patient with severe shock should have a short period of resuscitation. If there is evidence of haemorrhage he should be operated on at once. If improvement follows he should be operated upon as soon as his condition will stand it. If he rapidly goes downhill it is almost certain that he would not have been improved by operation, but would have died on the table.

Haemorrhage

Haemorrhage, which so often occurs with abdominal injuries, may come from many sources, but in my experience more commonly from an injury of a solid viscus—liver, spleen, or kidney. Not infrequently a large artery is found cut across, but the proximal end has retracted and curled up and very little bleeding has taken place. This may give rise to difficulty at operation, for the divided artery may escape notice and remain as a potential source of later haemorrhage. Partly divided arteries will of course not retract, and will continue to bleed. Severe lacerations

of the solid viscera always give rise to profound haemorrhage, and the same is true of clean incised wounds such as may result from a bayonet thrust. The diagnosis of intra-abdominal haemorrhage from shock is not always easy, but the haemorrhage will rarely cause severe symptoms so early unless it is so extensive that it is likely to be fatal whatever measures are taken. Shock comes on at once and, if progressive in spite of treatment, usually destroys the patient within two hours. Haemorrhage if curable does not give severe symptoms for an hour or more, and causes the characteristic white anaemia, very different from the mild cyanotic appearance of shock, and a blood examination would not show the haemoglobin concentration so characteristic of shock. Naturally, even if the patient's condition is deteriorating from haemorrhage, an operation should be undertaken so long as there is the slightest chance that he will be able to survive it, for it gives him his sole possibility of recovery.

A complication which fortunately so far has only been theoretical is the possibility that a patient has an abdominal wound and at the same time mustard-gas burns. If taken direct to the theatre an operation would be almost impossible owing to the risk of contaminating those working there, and he would therefore have to be decontaminated beforehand, but it is doubtful if many cases would stand such treatment.

The Case for Early Operation

In uncomplicated cases there can be no question that an operation should be undertaken at the earliest opportunity; but to-day this is true of all severe lacerations, to which category most war wounds belong. The most remarkable change that has happened in the results of the treatment of such in recent years has been the almost complete control of sepsis if they can be dealt with in the early stages. This is undoubtedly chiefly due to the cleaning of the wound and the excision of all lacerated tissues; it may be aided by the use of antiseptics, powdering the wound with sulphanilamide, and putting the limb at rest. How much is due to each factor it is impossible to say, for it is not justifiable to carry out control experiments. If a surgeon uses a method which gives a very high percentage of successful results he must stick to it even if he does perform some unnecessary steps. The difference between the universal and profound sepsis of the wounds of the last war and the almost constant primary union or clean granulation of the wounds mainly seen in this war is very striking. This was of course not true of the patients wounded at Dunkirk, for immediate treatment could not be given there, and it may well happen that with future engagements similar conditions may arise and patients only be brought for treatment several days after infliction of their injuries. The case for immediate operation is even stronger with abdominal wounds, where the danger of infection from wounds of the intestinal tract is added to the risk of infection from without.

My opinion may differ considerably from that of most surgeons, but I have been very unhappy with the use of local and intravenous anaesthetics. I am still a firm believer in the use of ether, and—dare I say it?—ether given on an open mask. With the modern apparatus the whole responsibility is thrown on the machine, and in my experience no machine can take the place of human skill.

Technical Outlines of Operation

Having decided that the ideal treatment of all abdominal wounds is early operation it is necessary to consider briefly the technical outlines to be employed. It may again be stressed that these are all ill persons and the operation is

to be performed as a life-saving measure; therefore if there is a choice of two methods the one to be chosen should be the shortest and least disturbing to the patient. If there is only a wound of entry an x-ray plate should be taken before operation. This occupies only a few minutes and may be of great help in locating the missile and in tracing its passage.

The wound of entry should be excised. If small and it is uncertain whether the peritoneum has been entered, the skin should be sterilized and an ellipse made around the wound. If near the midline, the long axis of the ellipse should be vertical, so that the resulting opening into the abdomen will be para- or trans-rectal. If farther out it should lie in the line of the external oblique muscles. If the wound is large and gaping, with prolapsed intestine, this should be cleaned with saline, replaced if not perforated or drawn aside if perforated, and the whole of the edges of the skin excised. Layer by layer, subcutaneous tissue, aponeurosis, muscle, and if necessary peritoneum, are exposed and all lacerated tissue carefully excised. By this means, if there be doubt concerning penetration of the abdominal wall, it is solved as the wound is explored. If the peritoneum is not perforated the wound should be sutured unless there be evidence of injury to a hollow viscus as shown by rigidity and lack of respiratory movements, or of haemorrhage into the peritoneum. It is not wise to open the peritoneum as a routine, for there is risk of infection. By carrying out this treatment of the abdominal wall layer by layer, not only is there a greater chance of removing all dead and infected tissue but the layers are all exposed, so that at the end of the operation the wound can be rapidly closed.

When the peritoneum has been opened a rapid survey must be made. There may be abnormal contents within the cavity—gastric contents, brown fluid from the small intestine, faecal material from the colon, urine from the bladder, or blood from a solid viscus or large artery; but there is here the same danger that occurs in civilian surgery—that the surgeon, having found one lesion, so concentrates his attention upon it that another lesion may be entirely overlooked. In war wounds of the abdomen multiple lesions are so common that they are almost the rule. Therefore before any repair is begun a rapid survey must be made of the whole field, attention being especially directed along the course of the missile as shown by the wounds of entry and exit or by the position of the foreign body as shown on the radiograph. It is in this preliminary survey that experience counts so much: long practice within the abdomen enables the surgeon to inspect all viscera in a few minutes and saves the patient a great deal; for it is handling and exposure of the viscera which not only increase shock but tend to produce post-operative ileus. A recognition of all the lesions will also enable the surgeon to direct his attention first to that which is the more serious. Of the treatment of the individual lesions more will be discussed under the separate headings. It is sufficient to say that openings into the stomach and small intestines must be closed. Sometimes this is more rapidly, neatly, and safely performed by first excising ragged and torn edges of the wound. In the small intestine the wounds should be sutured transversely to the long axis of the gut. If there are several perforations in close proximity it may be quicker and safer to excise a portion of the intestine. Whether continuity be established by closure of the ends and lateral anastomoses or by end-to-end suture is a matter which each surgeon must decide himself. He should use that which he feels is the quicker in his own hands; my own choice is generally end-to-end union. A laceration of the liver in my experience can always be sutured and haemor-

rhage controlled by closing with mattress sutures of thick catgut, and the use of omental pads or grafts is never required. A tear of the spleen, on the other hand, nearly always needs splenectomy. A lacerated kidney sometimes can be saved, at other times has to be removed; generally speaking, the nearer the wound is to the pelvis the more likely is nephrectomy to be required. Lesions of the colon should always be sutured if possible, but in very ill patients it may be wiser to perform a colostomy. The bladder may sometimes be sutured, but is often best treated by suprapubic drainage. If a large artery has been divided the proximal end must, of course, always be ligatured, but it is also essential to determine whether the area supplied is still viable: division of a mesenteric artery, for instance, may require a resection of the gut.

Having repaired the visceral lesion, attention must now be given to the peritoneal cavity. As is well known, leakage from the stomach does not as a rule require any attempts to remove all the stomach contents from the peritoneum, and the attempts made by surgeons some years ago to wash out the peritoneum or to remove the contents with sponges only led to wide diffusion and increased the risk of infection. The same is true of the contents of the intestine and bladder, but if there has been escape of semi-solid faecal content from the colon it may be gently swabbed away. Such leakage is rare, for when severely injured the colon is paralysed and all peristalsis ceases. In all cases of contamination of the peritoneum the patient should be nursed in the Fowler position, and personally I much prefer to drain nearly all cases with a suprapubic tube passing to the bottom of the recto-vesical pouch. Many surgeons dispense with this, but I have never known trouble to arise from the presence of a tube, though not uncommonly difficulty has arisen because one has not been inserted. There is a curious belief that a tube inserted into the pelvis may cause adhesions which may give rise to intestinal obstruction on or about the tenth day. My experience has been the very reverse: nearly every case of this sort that I have operated upon has shown that the adhesions are formed round a localized abscess, and in all either no tube had been inserted or one had been removed too soon. Such a tube should be twisted with forceps each day and more or less allowed to push its way out unless there is no sign of infection, when it may be removed. My old teacher, the late H. Barnard, had a famous saying that "the cause of persistent adhesions is the persistence of the cause of the adhesions": in these cases the cause is the abscess, and if it is drained it cannot persist.

Nowadays very few advocate the use of intraperitoneal antiseptics, although sulphanilamide employed in this way is beginning to have its advocates. I have no experience of it, but should be very chary to use it. In the last war many surgeons washed out the peritoneum with ether and other fluids, but this practice has wisely fallen into abeyance.

The intra-abdominal lesion having been treated, attention must be given to the abdominal wall. In the excision of the lacerated tissues the different layers will have been defined and separated; therefore suture in layers should occupy only a short time, and if the patient can stand this I am sure it should be done. Now and again a patient may be so ill that the wall must be drawn together with a few through-and-through sutures. I am confident that this is more likely to give rise to a ventral hernia, but the primary aim must be always to save the life of a desperately ill patient and the risk may have to be taken. By far the greater number of ventral post-operative herniae are due to the failure to obtain good apposition of the edges of the peritoneum. If the stitches cut out or for some other reason a small gap is left, a piece of omentum is sure to

insinuate itself and a hernial opening is formed; for this reason it has for years been my custom to suture this layer with a running mattress suture which grips the fibres and is therefore much less likely to cut out. The next question that arises is, Should any antiseptic be used in the wound? It is my own custom, after the peritoneum has been sutured and, with all wounds of the limbs, after the lacerated tissues have been excised, to wash out the wound with tincture of iodine, then with surgical spirit to dry it, and dust with powdered sulphanilamide. I have a suspicion that if the surgical cleansing has been thorough these steps are all unnecessary, but the results have been so good that I dare not experiment by cutting out any one of them.

After-treatment

Of the after-treatment but little need be said. All these war wounds are associated with shock, which is prone to be increased by the operation. The essential thing is to give the patient rest and sleep, and there can be no doubt that the most valuable drug we possess for this purpose is morphine. It should be given freely. So long as the patient is restless there is very little risk of giving too much, but as a precaution the respirations should be counted. There is still in some quarters a curious belief that it may give rise to ileus. On the contrary, the best form of treatment for threatening ileus is the administration of morphine. Many will not believe this, although they teach regularly that morphine should not be given in acute intestinal obstruction as it masks all the symptoms. That the patients should be kept warm is of course generally accepted. I am, however, not happy about the modern fashion of administering fluid. I have for years held, and it is now being accepted, that blood should only be given in cases of haemorrhage, when its use is invaluable. Of the value of plasma I am not altogether convinced, and I share with many others the view that intravenous saline should only rarely be given. If fluid is required it should, if possible, be administered as sweet drinks by mouth; but if there is vomiting or there has been a wound of the stomach it should be given by rectum, when it should contain glucose. There is a strange custom of giving the fluid by rectum as saline—I suppose by analogy with intravenous fluid. If one were thirsty one would not drink saline but water, and by the rectum simple tap-water is more rapidly absorbed. If there has been much loss of salts, as by frequent vomiting, then saline may replace the tap-water. Before the war I was often called in to see desperately ill patients after a severe abdominal operation, to find an indwelling tube in the stomach or duodenum, a needle in the subcutaneous tissues or in a vein, or in both, through which fluid was being administered, and often a tube up the rectum. The patient was in a state of profound misery and unable to sleep. The suggestion that the tubes be at once removed, that morphine be given freely, that the stomach if dilated be washed out morning and evening, and that one pint of fluid* be given if necessary by rectum night and morning, afforded the patient comfort, allowed him to sleep, and was often followed by recovery.

Once the shock has been overcome the patient should be placed in the Fowler position. Not only is this a safeguard where there is any possibility of peritoneal infection, but I think that deep respirations are easier and the chance of lung complications, which are the greatest cause of anxiety after modern abdominal operations, is lessened. The position should be maintained by some support, such as a board or an anchored pillow, against which the feet can press, but a knee pillow should never be allowed. It hinders all movements of the legs and consequently their circulation, and presses upon the popliteal veins. I believe

it to be one of the commonest predisposing causes of thrombosis.

How seldom is the value of rest recognized! Just as it is essential for the patient generally, so it is essential to his intestinal tract; but the commonest fault to-day is the attempt to obtain an early action of the bowels. If there is slight distension or discomfort within the abdomen, aperients, enemata, pituitrin, eserine, or hormonal are immediately given. It is forgotten that the gut is partly paralysed from the injury and the handling it has of necessity received even in the most gentle of operations. If it is stimulated while in this condition the paralysis will become complete. The only chance of recovery lies in complete rest, and this can only be gained by the use of morphine. No attempt whatever should be made to obtain an action of the bowels until the third day, when a simple soap-and-water enema should be given. If a good result is obtained then, and not till then, a mild aperient may be administered. If there is no result, only harm will be caused by adding an irritant such as turpentine or the popular ox or human bile to the enema: the gut has not yet recovered, and the patient should be left for a further twenty-four hours and the soap-and-water enema repeated.

The same line of treatment, of rest, should be followed in regard to the wound. If there is no tube the dressing should not be touched until the tenth day, unless there is pyrexia or pain. Much harm and risk of infection are caused by the daily dressing of wounds which if left will heal completely. If there is a tube the wound should be dressed and the tube gently rotated on the second day; as the tube is loosened it may be removed—at once if there is no discharge, and portion by portion as it is extruded if there is a purulent discharge. This, like all other dressings, should be performed with unwashed hands. Washing can rarely be complete, and is impossible if there are forty cases to be dressed in the same ward; but the dressing in every step should be carried out with sterile forceps: even the removal and insertion of sterile safety-pins into tubes can easily be performed with a little practice. The general use of this technique will do more than anything else to reduce cross-infection.

Conclusion

In conclusion I would like to give a word of praise to so many of the young surgeons working in the Services. Men of the surgical specialist or graded surgeon type who are all young and have not had an enormous amount of experience have often been confronted with these dangerous and severe cases. They have risen to the occasion, have operated, and have succeeded in saving patients whose condition appeared to be hopeless. I believe their two greatest assets are the powers of adaptability and of making rapid decisions. Cultivate them and you will succeed in the war surgery of the abdomen.

The Home Office draws attention to the Poisons (Amendment) Rules, 1942 (S.R. & O. 1942, No. 155), which were made by the Secretary of State on January 13, 1942, and came into operation forthwith as provisional rules in England and statutory rules in Scotland. The new Rules provide for the inclusion of surgical spirit (in which a small quantity of brucine has been substituted for diethyl phthalate) in Group II of the Third Schedule to the Poisons Rules, 1935, thereby exempting the new formula from the restrictions governing the sale of brucine. The sale of surgical spirit in accordance with the new formula will, however, remain subject to the Methylated Spirits Regulations, 1930, which require surgical spirit to be labelled "For external use only—not to be taken." The general restrictions which apply to brucine as a poison included in Part I of the Poisons List are not otherwise affected by the new Rules.