THE SELECTION OF ABDOMINAL CASES FOR OPERATION.

WITH REFERENCE TO A SERIES OF 200 OPERATIONS.

BY

OWEN RICHARDS, D.S.O., F.R.C.S.,
TEMPORARY COLONEL A.M.S.

At this stage of the war it is not worth while to give details of a series of cases essentially similar to others which have already been published. The value of early operation and the best technique are generally agreed on, and the percentage mortality is fairly constant. If it varies much from the average in any special collection of cases, the reason can usually be found in temporary and local conditions, which affect the time that the wounded take to reach hospital and the state in which they arrive there.

In a series of over 1,200 cases Wallace¹ found the rate of recovery to be 46 per cent. in all cases operated on, and 35 per cent. in those with wounds of the hollow viscera. In the present series the corresponding figures are 41.5 and 38 per cent. respectively.

"Successful" and "Profitable" Operations.

The percentage of patients who survive operation is, however, no real index of the value of treatment. In a large number of cases injuries are found which no surgery could cure; in others there are minor ones which would not have proved fatal even if they had been left alone. To count these as "failures" and "successes" respectively is unreasonable. In the first class of case we have failed to do what was in any case impossible; in the second our only success consists in not having killed the patient. Operation in both was unprofitable. The only kind of operation which is "profitable" as well as "successful" is one in which we find a fatal injury and cure it. These constitute the real successes.

The real failures are the cases in which the patient is wrongly classed as moribund when operation might have saved his life, and those in which a penetrating wound of the abdomen is not recognized as such until it is too late. Failures due to bad surgery are relatively rare, for the general level of surgical skill in the clearing stations is a high one. The difficulty lies rather in the selection of cases, and it is here, rather than in any point of technique, that most difference exists in the practice of individual surgeons.

Men who reckon every case "moribund" who has been wounded for more than twelve hours, or has a pulse of 120, will be able to show good statistical results. Those who operate on practically every living patient will waste much energy, and have a high death-rate—they will, however, save a few more lives.

The difficulty lies in determining the circumstances under which operation ceases as a rule to be worth while, even though it may yield an occasional success. This is important mainly for the sake of other patients. A hopeless abdominal case is only injured by operation in the sense that his life may be shortened by a few hours, while an exploration which proves unnecessary is rarely fatal. But every "unprofitable" operation means that time is wasted, and that other wounded have to wait longer. During an engagement, which is the time at which most cases have to be dealt with, this is a very serious matter. There may be in one station thirty or more cases waiting for operation, and developing sepsis and gangrene meanwhile. Every hour wasted makes the chances of all of them definitely worse. So that under these conditions any wrong selection has very far-reaching effects, for the inclusion of unsuitable cases may result in the loss of lives or limbs of other patients.

It is therefore worth while to consider what guidance can be got from the experience available. The present series is small, but it probably represents a fair average both as regards results and conditions.

Certain classes of injury may be at once ruled out. Wounds limited to the solid organs, with no progressive bleeding, and no large missile retained, do not usually need operation, and patients with other grave injuries of head, chest, or limbs are commonly unfit to stand it. In the vast majority of the remainder it can usually be

recognized that the abdomen is penetrated, but the nature and extent of the internal injury is almost always unknown.

In civil surgery the risks of a known injury or disease can to some extent be weighed against those of a set operation; but here both are unknown, and the abdomen is opened on the broad grounds that most men wounded in this part of the body die, but that some of them can be saved by operation. Whether operation is necessary or not can only be discovered by performing it, and if it is at all likely to be, exploration is fully justified.

Under these conditions we have to base our decision in each case on such facts as we can know. Practically these consist of the time which has elapsed since the injury, and the condition of the patient, of which the best index is the pulse.

Interval between Wound and Operation.

In this series the time which had passed since the injury was recorded in 164 cases; 120 were operated on within twenty-four hours, and 44 later. The recoveries in the early cases were 48 (40 per cent.), and in the later 19 (43 per cent.). This latter figure is remarkable, for there is usually a higher death-rate in late cases. Wallace in 79 cases operated on after twenty-four hours found 27 survivals (33 per cent.). Probably these late cases were more carefully selected and the numbers are small, but on grounds of percentage mortality there is in this series little to choose between the two classes.

When, however, they are examined in detail, to see how far the successful cases are profitable, there is a marked difference. Of the late cases only 7 of the survivors had wounds of the alimentary canal, namely, 3 of the colon, 4 of the small intestine. Two of the latter are included in the only 4 cases of the whole series who are known to have died after arrival at the base. So that out of 19 "successful" cases operated on after twenty-four hours, only 5 (26 per cent.) were permanent cures of men wounded in the stomach or intestines. The rest of the survivors were men whose chief essential injury was haemorrhage from solid organs, mesentery, or omentum.

In the early cases the proportion is quite different; 80 cases were operated on within twelve hours, and 33 recovered. Of these, 26 (80 per cent.) were wounded in the stomach or intestines.

Apparently what happens is that most men wounded in the abdomen, with the exception of those already referred to in whom the injury is obviously limited to the liver and kidneys, have some injury to the alimentary canal. As time goes on some of these die, and others develop peritonitis which proves fatal whether they are operated on or not. The survivors, with or without operation, are almost all those whose chief injury is haemorrhage. Their bleeding has by this time ceased, and is not necessarily fatal if left alone. In these late cases, then, there is a much greater chance of performing an unnecessary and unprofitable operation. This is not shown in statistics, where unnecessary operations, unless they kill the patient, are shown as successes.

The question is what extent of delay renders operation as a rule unprofitable. A German surgeon in an advanced operating centre was led by his experience² to fix a limit of twelve hours. This is certainly too low. Out of the 15 recoveries in this series amongst those operated on between twelve and twenty-four hours, 10 (66 per cent.) were wounds of the alimentary canal.

A distinction has already been drawn between operations which are "successful" in the sense that the patient survives them, and those which are "profitable" in the sense that they cure an otherwise fatal injury. If we assume that wounds which open the stomach or intestine are necessarily fatal if untreated, and that haemorrhage is not, the proportion of profitable operations in this series to those which were merely successful is—

In the first twelve hours	...	...	4 to 1
In the second twelve hours	...	...	2 to 1
Later	...	...	1 to 3

It is impossible to lay down any rule (this series includes a successful resection after thirty-six hours), but roughly it seems that operation is very profitable in the first twelve hours—and well worth while in the second twelve hours.

After this time the chances are in favour of its being unnecessary, even if the patient survives it—so that preference should always be given to early cases, even if their condition is less good.

General Condition: Pulse.

As regards the pulse the cases may be divided into those with a rate under 120, and those with a rate of 120 or over. The pulse was counted on the table before the anaesthetic was given and after measures had been taken to improve the patient's condition by rest and warmth. The quality of the pulse is almost equally important, but cannot be so accurately expressed. Here the distinction in mortality is sharply marked. Of the 131 cases in which the pulse was counted, in 77 it was under 120, and of these, 42 (54 per cent.) recovered. Of the 54 in whom it was 120 or over, only 14 (25 per cent.) recovered.

As far as these cases are concerned, therefore, the chance of survival of men with a pulse under 120 is more than double that of men with a more rapid pulse, and this in spite of the fact that some of the most seriously injured cases had originally a slow pulse, which rose suddenly in the course of the operation.

To make a rule never to operate on cases with a pulse over 120 would, however, in this series, have resulted in the loss of about a dozen lives. The most unpromising cases can occasionally be saved—for example:

Cpl. P., a delicate-looking youth, in civil life a chartered accountant, took part in a raid on June 27th, 1916. He was returning in charge of six prisoners when the enemy opened fire with a machine-gun. He and his prisoners tumbled hastily into our trench, and he fell on to a bayonet which entered his abdomen and chest.

Seven hours later he arrived in hospital collapsed and pulseless. After rest, warmth, and infusion, the pulse became "just perceptible." He was pale and cold, with a rigid abdomen and occasional haematemesis. There seemed no prospect of improvement, so his abdomen was opened, a quantity of blood cleared out, and two wounds of the stomach repaired. In the course of the night he vomited violently and burst open his wound. This was sewn up again, and the third day he was rather better, with a pulse of 120. His haemothorax then became septic, and was drained. He recovered, and was sent to the base on July 29th. The medical officer in charge notes that his general condition was then "excellent."

The objection to risking a death on the table is largely sentimental. If the patient is as fit as he is ever likely to be, and has a reasonable chance of surviving the operation, this danger may be faced like any other. The operation may be unsuccessful, but it is not likely to be unnecessary. But if conditions do not allow of all cases being treated promptly it is clearly better to take those with a low pulse rate first, and to try and improve the condition of the others meanwhile.

Cases of Apparently Slight Wounds.

If care is taken to exclude those who have been wounded too long, and those whose condition is too bad, there still remains the danger of failing to include those who have scarcely any symptoms. Minute wounds of the abdominal wall, without pain, rigidity, or vomiting, are sometimes associated with serious internal injuries—for example:

Case 1.—Pte. W., admitted February 1st, 1917, with tangential bullet wound of lower abdominal wall received four hours before admission. Condition excellent; pulse 90; no vomiting; abdomen soft, movable, and painless; no tenderness except over the actual track. Wound explored; a slit half an inch long found in the peritoneum. Laparotomy: Three perforations of the small intestines. Repair; recovery.

Case 2.—Cpl. C., admitted January 14th, 1917, with small bomb wound near the umbilicus received two and a half hours earlier. Condition very good; pulse 90; no rigidity or vomiting. The wound was explored and found to penetrate. Laparotomy: One wound in the small intestine, plugged by the missile. Repair; recovery.

Case 3.—Spr. D., small central wound of abdomen received twenty-six hours before admission. Condition very good; pulse 100; vomited once on being hit, never since. Abdomen soft and free from tenderness. The only positive symptom a slight "diarrhoea pain." Some free blood, a wound of the jejunum, which was empty. Repair; recovery.

Case 4.—Second Lieutenant C., admitted December 21st, 1916, with minute grenade wound in right iliac fossa received nineteen hours earlier. This appeared, and was considered, a superficial graze, and the patient came in as "G.S.W. eyes." Pulse 100; no rigidity; had vomited once only. There was

slight local pain under the wound. Explored: Much free blood; one wound of caecum, three of small intestine. Repair; recovery.

As is seen in these four cases, the results of operation before symptoms occur are very good. Their absence is probably due to the wounded gut being empty at the time, and if it can be repaired before it fills and leaks no infection of the peritoneum need arise.

The only way to avoid missing these very profitable cases is to explore every wound of the abdominal wall, front or back, whether symptoms are present or not. If the missile is in the wall, the patient is quit of it at the cost of a two-inch incision. If the track is found to penetrate, or is lost in the direction of the peritoneum, or if the skin is peppered with a number of minute wounds, the best course is to open the abdomen rather than to miss the best opportunity by waiting for signs of peritonitis to develop.

Organization of Operations.

The only other difficulty which arises in selection is to balance the claims of abdominal cases against those of other wounded in busy times. Keen surgeons are apt to concentrate on these technically interesting cases to the prejudice of other men whose lives are equally valuable, and who have more chance of being rendered fit for further service.

This tendency can be controlled by having an experienced and sensible surgeon in charge of the pre-operation ward, whose duty it is to decide the order in which cases go to the theatre, and, if necessary, the surgeons to whom they are allotted.

The real remedy, however, is to be found in eliminating waste of time, which is the chief reason why any cases, abdominal or other, fail to receive prompt treatment. Most time is wasted, not in actual operating, but in getting patients in and out of the theatre, anaesthetizing and cleaning them. If there is a sufficient supply of stretcher-bearers under a competent N.C.O., and if two tables are available for each surgeon, so that a second patient can be anaesthetized and cleaned on the other table by the time the first operation is finished, this kind of delay can be entirely got rid of. The operator has only to change his gloves and go straight on.

The other avoidable cause of delay is slowness in operating. Provided an operation is gentle and thorough, the quicker it is done the better. Men wounded in the abdomen are nearly all suffering from shock, what pulse they have is liable to fade away under prolonged exposure of their viscera, and ten minutes more or less may turn the scale between death and recovery. So that in the interests of the individual patient, as well as of others, speed is essential. Rapid work depends more on character than on manual dexterity. Method, decision, and silence are essential to it, and a clock in the theatre is the only known antidote to self-deception.

A competent surgeon, with a good sister helping him, can open the abdomen, search the small and large intestines, and close it, in twenty minutes. Ordinary repairs will extend this time to half an hour. But operators who habitually take an hour or more over a simple case should not be allowed to attempt this branch of surgery.

CONCLUSIONS.

1. The decision as to whether a man wounded in the abdomen should be operated on or not is usually based on the time which has elapsed since the injury and the rate and character of the pulse.

2. Of the patients who survive operation performed in the first twelve hours a high proportion will have had their lives saved by it, and this is true in a lesser degree of those operated on in the second twelve hours. After this time most of those who survive operation are those whose injuries were not originally fatal.

3. Men with a pulse of 120 or over have less than half the chance of survival of men with a lower pulse.

4. Recently wounded men, with a rapid pulse, should nevertheless be operated on, provided that their condition is as good as it is ever likely to be, that they have a reasonable prospect of surviving the actual operation, and that the time taken does not prevent the proper treatment of other wounded.

5. Every wound of the abdominal wall, however slight, should be explored, whether signs of internal injury are present or not. If it is found to be penetrating, the abdomen should be opened.

6. The necessity for deciding between the claims of abdominal and other cases can be best avoided by good theatre organization, the provision of two tables for each surgeon, and by not allowing slow operators to do abdominal work. If these measures are insufficient the decision should be left in the hands of the surgeon in charge of the pre-operation ward.

REFERENCES.

¹ *British Journal of Surgery*, April, 1917. ² *Brun's Beiträge, Kriegschirurgisches Heft* 106, iii.

ABDOMINAL OPERATIONS AT AN ADVANCED OPERATING CENTRE.

FIFTY CONSECUTIVE CASES OF PENETRATING WOUNDS OF ABDOMEN, IN SIXTEEN OF WHICH THE CHEST WAS ALSO INVOLVED.

BY

CHARLES F. M. SAINT, M.D., M.S., F.R.C.S. ENG.,
CAPTAIN R.A.M.C.(T.).

The Operating Centre.

The centre was situated in a village in advance of the corresponding group of casualty clearing stations. The roads between them at the time presented a very rough surface, and were heavily charged with transport, so that at least one hour's very bad journey was saved.

The accommodation comprised part of a building, without any special heating or lighting arrangements, and marquees. The heating was done by oil stoves, the lighting by an acetylene plant. In the building were the operating theatre, sterilizing room, and a post-operative room of twelve beds, while outside were the reception marquee and thirty-eight extra beds, partially distributed in a long ward of four contiguous marquees and in two separate.

The operating theatre was large enough for two tables, had a tiled floor, and large windows looking both east and south. The walls were distempered white. The sterilizing room adjoined the theatre, and was fitted with a large metal-lined washing-up trough. The post-operative ward of twelve beds was a large, light, airy room, with distempered walls and a parquet floor. The marquees were conveniently arranged adjacent to the building. The reception marquee was fitted with four pairs of trestles for stretchers, and served also as pre-operation and resuscitation departments. The big ward of four marquees joined together had accommodation for twenty-six patients, and two other single marquees were each fitted with six beds, one for officers and one for badly infected cases.

The Staff.

With the exception of the first few days, when a second team was attached (Captain Stevenson, R.A.M.C.), the operative work was done by one surgical team, consisting of surgeon, anaesthetist, sister, and theatre orderly, while the general administration was carried on most of the time by a section of the field ambulance to which the centre was attached. Four extra sisters were attached to superintend the nursing in the wards, the staff of orderlies being supplied by the field ambulance. At a later period, with an increase in the military activities, three extra surgical teams were attached to the centre, and the beds increased to 75. A special marquee was set apart for resuscitation, and a second for those cases considered as hopeless on admission, the reception marquee being utilized only for the reception of cases and the preparation of those to be operated on at once.

PRE-OPERATIVE TREATMENT.

Special efforts were made to evacuate the abdominal cases as quickly as possible from the line, and all concerned displayed the greatest keenness in achieving this. How far it succeeded will be seen in the study of the time intervals between wounding and arrival at the centre.

The reception marquee was always kept very warm, and on arrival the patient was taken to it, examined, and judged fit or unfit for operation.

If considered fit for operation he was washed and put in pyjamas, and morphine and atropine administered hypodermically if necessary. It was not uncommon for the patient to arrive already deeply under morphine; this was found to be especially dangerous in those cases with chest wounds, as great difficulty was sometimes experienced with the respiration after the operation. Rinsing of the mouth with water was allowed, but no drinks. The urine was always examined before operating, but if the patient failed to pass it himself catheterization was deferred till he came into the operating theatre. The operation was commenced one hour after his arrival. At the suggestion of Captain Stevenson a special stretcher was used for these cases to avoid any excessive amount of lifting about. A coarse palliasse was stitched down the sides so as to leave two tunnels through which the stretcher poles could pass, and two iron bars with rings at the ends were slipped over the pole handles to keep them apart. Over this was placed a ground sheet and then an ordinary sheet. The advantage of this was that the patient remained on the palliasse until he arrived in the ward, the poles being slipped out when he was placed on the operating table.

If the patient was considered unfit for operation the usual resuscitation procedures were carried out. He was made as comfortable as possible, morphine was administered if necessary and heating up was done by a Beatrice stove in a kerosene tin with a chimney leading under a cradle over the stretcher. Stimulants were given hypodermically as required, and saline, preferably by the intravenous method. In a few cases blood transfusion was performed, but only one of these was an intraperitoneal lesion. The method used was vein to vein by means of an improvised tube—an ordinary 6 in. glass testing pipette with $\frac{1}{2}$ in. lumen; it was bent into a U-shape, the limbs of the U being 1 in. long. A small flange was made at the ends to prevent the tube slipping out of the veins. The tube was sterilized and washed through with liquid paraffin before use (soft paraffin is undoubtedly better). The median basilic veins were used, an injection of $\frac{1}{2}$ per cent. novocain being given to produce anaesthesia. In one case, where the blood refused to flow into the vein of the recipient, a second incision was made in the neck and transfusion made into the external jugular vein, which was seen to empty with each inspiration. The veins were connected for twenty minutes. The tube can easily be modified for an artery to vein transfusion, and may be made of metal. The method is not so good as Crile's No. 17 transfusion tube, but in an emergency is easily carried out, especially if none of the usual means is at hand. In the abdominal case so treated the pulse-rate came down from 142 to 108 in twenty minutes and remained so for about half an hour, when the patient quite suddenly collapsed again and died in another hour. The time for operation was settled by the progress of the case.

If the interval between wounding and admission was more than eighteen to twenty-four hours expectant treatment was adopted. The patient was put on a Fowler frame, the wound dressed, and fomentations applied to the abdomen, if necessary. Morphine was given, and fluid by the mouth gradually commenced.

When the case was judged hopeless the patient was made as comfortable as possible, morphine was not withheld, and fluids were allowed by the mouth.

A chamber for heating the pyjamas was made of a box the bottom of which was knocked out and replaced by wire netting. It was placed on a stand with a Beatrice stove underneath. By this means a stock of warm clothing was always ready for use.

OPERATIVE TREATMENT.

The patient was taken to the operating room, which was kept at a temperature of 65° to 70° Fahr. The anaesthetic administered was chiefly ether, reinforced at times by chloroform, and given by the Shipway apparatus. In the worst cases continuous oxygen was given simultaneously by attaching a cylinder. If the patient had been unable to micturate, a catheter was now passed and the urine examined.

The skin was prepared under the anaesthetic; it was shaved with spirit soap for preference, followed by the