CHAPTER 46
WOUNDS OF THE ABDOMEN

The rate of survival after abdominal war wounds was not much improved in the years following 1918. In the Spanish war Jolly recorded a death rate of 50 per cent, and at first sight it would appear that little better was achieved in the 1939-1945 war. The overall recovery rate from abdominal wounds in the Middle East was not better than 50 per cent, though in one series it rose above 70 per cent. In New Guinea the general rate was about 50 per cent, though in some small series it did not exceed one-third recoveries. Such figures are illusory and without consideration of circumstances give no idea of the value of the work done.

The extended use of resuscitation, particularly transfusion of blood, improved the outlook somewhat; so too did the wider application of duodenal drainage. But as in earlier experiences in the field simple methods, deftness in applying appropriate techniques, and speed, both in decision and in operating were important factors. Figures alone do not give an accurate picture of the part played by the surgeon in patients' recovery, for the variable factors such as the time elapsing before surgical aid can be given, the facilities for handling the casualties needing attention, and for securing post-operative care, depend largely on the tactical situation and the nature of the country to be traversed both in front of and behind the operating centre. The problem is always a potentially grave one, for as Gordon-Taylor has well said: "In the abdomen there are no insignificant wounds."

The first Australian experiences in the early desert campaign were limited as regards abdominal surgery, but they followed along the lines expected. The nature of the visceral damage was often unpredictable. The surgeon who carried the responsibility of triage or selection of patients suitable for operation and the priority of their claims was guided by the usual signs of an abdominal emergency, such as the facial expression, rigidity of muscles, pain and tenderness, vomiting, and a rising pulse rate. Loss of blood, overt or concealed, modified this picture according to the degree of shock present. The wound of entry was not always helpful in the making of a decision, as of course it was often not in the abdominal wall or in the back, but in the thorax or even the buttock. Sometimes laparotomy only could settle the diagnosis. The frequency with which intra-abdominal blood vessels were damaged usually made blood replacement necessary. Experience showed too that death could occur from internal bleeding during what might otherwise have been the recovery period. There were, of course, as was only too often found in the 1914-1918 war, men whose abdominal wounds were too grave for surgery. A realistic view was necessary with these patients for whom morphine alone remained. Damage of intestine was common, and in general, abdominal wounds involving hollow viscera were much more dangerous than
others. Repair or resection of damaged bowel was carried out according to the indications. Usually there was not time for elaborate techniques. On occasion good results followed when anastomoses were performed with only a single line of suture. Wounds of the colon had a high mortality, though the outlook was somewhat improved later when exteriorisation was practised. Drainage of the abdominal cavity depended, as usual, on judgment: it was not found as important as once thought.

C. A. M. Renou in 1942 recorded the results in the case of 72 patients with abdominal wounds treated at a forward operating centre. All patients were screened in the X-ray room in the presence of the surgeon. This could usually be done on the way from the resuscitation ward to the theatre. Foreign bodies were located and marked. Even in this small series the seriousness of wounds of hollow viscera is evident; 8 out of 9 men died with wounds of the stomach, 20 out of 29 with wounds of the small intestine, and 15 out of 25 with wounds of the colon. Many of these wounds were of course of complicated type, involving other structures.

The influence of favourable factors additional to competent surgery is emphasised in a series published by T. Giblin, setting forth the results of abdominal operations on 90 men at a field ambulance. The conditions here at Alamein were favourable; accommodation though in tents was good, the warfare was static, and a casualty clearing station within four hours’ journey. The team had the advantage of using special stainless steel theatre furniture designed by Lieut-Colonel F. J. Clark for a mobile surgical team and presented by the Australian Red Cross Society. Patients were held at least seven days before being sent to the clearing station. The usual routines of transfusion and post-operative gastric suction were followed, and the daily output of urine was watched, fluid being given intravenously until it reached a litre. During a period when all these routines attained a high degree of efficiency the recovery rate rose as high as 72 per cent. This exceptional rate was held over a small series only. On the whole the recovery rate after abdominal wounds in the Middle East was not better than 50 per cent. The lesson to be learned, however, is that the recovery rate can be improved if the surgeon has the advantages of prompt reception of patients, good operating facilities, bed accommodation for an adequate period of after treatment, and smooth transport to a base hospital.

Ileus was not an uncommon complication in abdominal injuries. A tube for duodenal drainage of the Ryle type was used, but the demand made it necessary to extemporise. E. S. J. King earlier recorded that his own surgical team and another independently devised a tube made from a perforated cartridge case. Giblin’s figures showed that men who recovered and were ultimately sent on to the base averaged 9 hours from their first aid treatment in an aid post, whereas those whose transit had averaged 13 hours in duration died. Ten hours appeared to be the critical period: after this the results deteriorated greatly. The general condition of patients of course was an important factor in all abdominal work. Severe shock meant delay and resuscitation to a point where operation was practicable:
this in its turn depended on the severity of the wound. The anaesthetic used for most abdominal wounds was “open” ether.

The influence of sulphonamides was hard to assess. In this Alamein series a suspension of sulphadiazine (10 grammes in 100 c.c.m.) was available from the R.A.M.C. transfusion unit, and this was thought to be of definite value where the bowel was injured. It was introduced at intervals for two or three days through a small drainage tube.

Unexplained deaths sometimes occurred from abdominal injuries. An increasing pulse rate after twelve hours or more was a warning sign, even when there was no indication of peritonitis or ileus. This phenomenon is somewhat reminiscent of those patients with thoracic injuries who do not achieve equilibrium; though the mechanical factors of the chest wounds are here not present there is always the possibility of concealed bleeding. Death after a latent period of days might also be due to ischaemic renal necrosis.

In Tobruk at the 2/4th Australian General Hospital where emergency surgery could be performed under conditions of reasonable deliberation it was thought that a neuro-vascular reflex might be responsible for producing shock associated with blood concentration. This is mentioned in the section on shock, but it cannot be said that any such factor of importance has been clearly established. It was noticeable, however, that as experience of surgeons in abdominal war wounds grew the extreme value of early resuscitation by blood or serum replacement became even more highly esteemed. An officer was assigned to the work of resuscitation in surgical teams and patients being so treated were carefully watched by him and by the surgeon. In 1942 a more rapid rate of blood flow than that previously practised was found practicable and desirable: 500 cubic centimetres of serum were given in the first five to ten minutes, instead of at the more usual rate of a pint in thirty to forty minutes. If the patient was not very exsanguined another 500 c.c.m. of serum were given, followed by blood at the rate of a pint in ten minutes or less for the first two pints. This method generally secured a rise of blood pressure to the desired safe standard minimum of 100 millimetres of mercury in one and a half hours. Reactions were rare and appeared to be due to causes other than too rapid a rate, as they ceased when another blood was substituted.

In New Guinea the conditions were very different. During the first campaign fought over the Owen Stanley Ranges to the coast the results were good considering the difficulties, especially on the flat muddy country near the north coast. The recovery rate here averaged nearly 50 per cent. Air evacuation, previously impossible, was later practicable. Resuscitation was by wet serum, blood from local donors, and followed by glucose and saline. Malaria was so prevalent that all sick and wounded were given 30 grains of quinine per day as a routine. Only a few abdominal wounds were treated by surgical teams at Myola and Wau; few men survived the difficult conditions. In the later Salamaua campaign abdominal injuries, though few in number, again carried a serious prognosis. Here and following the Lae landing, that is, in the 1943-1944 period, the survival rate
was about 33 per cent. The adverse factors here were the delays before patients reached an operating unit, due to the nature of the country, the trying climate, the lowering of patients' resistance by malaria, the limitations in supplies of blood, and the scarcity of sulphadiazine. Of these factors the first was of prime importance. In spite of the drawbacks alleged to exist in the use of barbiturates for patients with abdominal wounds, "Pentothal" was used with success in these campaigns. Good relaxation was obtained and little trouble encountered.

The introduction of penicillin improved the outlook in abdominal injuries. At Aitape, for example, in one small series of men with 15 abdominal wounds only one death occurred and that from multiple injuries.

During the actions on Borneo the moderate resistance offered by the enemy lowered the surgical casualty rate and facilities for early treatment were good.

Throughout all the campaigns certain principles familiar in the treatment of abdominal war wounds were emphasised. As already pointed out, all abdominal wounds are potentially serious, but provided the wounded man can survive the immediate hazards of the days following operation he has a good chance of making a full recovery. At the moment of wounding his prospect depends on the intrinsic seriousness of his wound, and the difficulty of transporting him to a surgical unit. His wound will vary in seriousness according to the amount of bleeding or soiling of the peritoneum, the degree of damage to solid and hollow viscera and the involvement of other parts. These elements of danger depend to a considerable extent on the nature and velocity of the missile. A nearly spent fragment of shell is much more disruptive than a high velocity bullet. The amount of intra-abdominal bleeding is important, as the need for its control and for replacement of blood depends on the factor of time.

Wounds of the colon carry a greater risk of widespread peritoneal infection: colostomy or the exteriorisation of the colon has lessened this somewhat. Diversion of the colon's contents from the vulnerable peritoneum and the local or parenteral use of sulphadiazine or similar sulphonamide drug and in later years the use of penicillin have materially increased the chance of recovery.

Thoraco-abdominal wounds deserve special mention. The least serious may involve the chest only as a port of entry of a missile: the most serious may cause extensive damage of organs in both body cavities. Such a wound may be predominantly thoracic, and it may be possible to deal with abdominal damage from the thoracic aspect. Separate access to the abdomen may be necessary to deal with wounds of greater gravity.

The importance of the time elapsing between first aid and efficient resuscitation for humoral shock has already been stressed. The longer the delay in effecting repair and stopping bleeding, the worse the prognosis. This in turn depends largely on the nature of the terrain and the distance of the surgical post from the place of wounding, which is usually the front line, if such has geographic existence. Such a distance must in any case be reckoned in hours and not in miles. Another danger arising from
WOUNDS OF THE ABDOMEN

the terrain itself is that of infection: it was found that in abdominal wounds, as in others, the hazard was less in the dusty but relatively clean desert air than in the contaminated soil of banana groves in Syria or the muddy coastal plains in New Guinea with their risk of anaerobic infection.

After operation the wounded man has to face the risks of peritonitis, now considerably lowered by sulphonamides and penicillin, and of ileus. The use of the Miller-Abbott tube and its variants has lessened the risk of the latter.

Extemporised fittings can carry out the function of drainage of the duodenum or jejunum very well. Indeed a "Soluvac" set was successfully adapted for this purpose, using a 3-16th inch rubber drainage tube with a blocked end and lateral holes. Through this, continuous infusion of fluids could be maintained, especially in all patients with a ruptured viscus. Salt requirements could simply be met by using either 5 per cent glucose in water or normal saline solution according to indications to preserve the electrolyte balance. The excretion of a litre of urine in twenty-four hours was a fair indication of equilibrium. Fluid balance charts were kept to check intake and output.

These technical procedures are within the reach of orderlies with some training: some of these men attained high degrees of skill, though much more personal supervision of sick men by surgeons was necessary than when trained nurses were available. In the forward units female nurses were not to hand, but the advantages of their care and influence were obvious in clearing stations and hospitals where they were stationed. The work involved in maintaining correct posture, checking and maintaining fluid balance and the ordered flow of fluid through a tube, which perversely blocks at busy times in a ward, is no light matter. If equilibrium in fluid balance is not gained there is too the risk of anuria even with abdominal wounds in which the renal tract is not known to be damaged. This is all the more important as prompt recognition and treatment are imperative if the patient is to have a good chance of recovery.

The need for keeping men for a week at least after operation caused deep concern in some areas. Where an operating unit was semi-stationary, arrangements for holding men during the anxious first post-operative days could be made without embarrassment, but one critically injured man could hold up a unit. In the first desert campaign a loose union of two field ambulances solved this problem temporarily, as parts of the unit could perform the "leap-frog" manoeuvre. But it was obvious that in highly mobile warfare an independent forward unit would be needed, as even when air transport was possible it could not follow up the operating teams. The position was different in jungle fighting: there transport by land was equally difficult, though for different reasons, but high mobility of units was not needed nor indeed was it usually possible. These questions are largely administrative, but they have so much bearing on certain types of war wounds that they are stated here.

Even after a wounded man had been promptly brought to the surgeon, promptly dealt with and held under observation for a safe period, pre-
ferably a week, he still needed smooth and appropriate transport to a base area. During this last journey it was usually desirable that the Fowler position adopted during his post-operative period, should be maintained. Patients carried in ambulances in the semi-sitting posture travelled much better than when carried lying flat. The adoption of this position in an ambulance robbed the vehicle of one stretcher space. In an aircraft this mattered little: it was the ideal method of travel for wounded men.

Though the mortality of abdominal wounds is high, experience has shown that attention to every relevant factor can lower the death rate. Recognition that some of the causes of death are often preventible, such as ileus and haemorrhage, has been a stimulus in a field in which greater advances have been made than mass statistics show. Finally, even granted the most favourable conditions, great balance and judgment are required. Forlorn chances among dying men cannot prejudice the recovery of those waiting, but no man can be allowed to run unnecessary risks for the want of a little extra time and care in exploration.

REFERENCES

D. W. JOLLY, "Field Surgery in Total War." Hamish Hamilton 1940.