LESSONS FROM THE PAST AND EXPECTATIONS FOR THE FUTURE IN WAR WOUNDS OF THE ABDOMEN

By BRIAN MCN. TRUSCOTT, M.B.E., F.R.C.S.

Addenbrooke's Hospital, Cambridge

The results of treatment in abdominal war injuries, as shown by figures, show a striking improvement of the years 1939-45 as compared with the years 1914-18. This improvement is even more marked when it is realized that greater speed of transport, improved communications and better methods of resuscitation in forward areas meant that cases that would have died before reaching the surgeon in 1914-18 reached the surgeon and were operated on in 1939-45. Therefore, more of the extensive and major abdominal injuries were treated.

The reasons for this are many and when one considers the calibre, surgical dexterity, and courage of the surgeons of the earlier war it is obvious that these reasons are other than any improvement on their ability. Easier availability of blood, intravenous fluid administration, improved anaesthesia, and the antibiotics are the four outstanding ancillary services that helped the improvement in the results of war surgery.

Teaching and learning of war surgery, although based on fundamental surgical principles, must be very different from peace-time surgery by the nature of things. The experience gained from the war lies fallow and may be forgotten. It is well that it should be considered from time to time and brought up to date with the advance of ancillary services and technique that have become available during the interim phases. There are lessons to be learnt by the beginner and only those who have had experience can teach him. On the other hand, it is easy for the experienced to become resistant to the introduction of new ideas from the new minds. In my opinion there were two types of dangerous surgical minds during the last war. Firstly, the young inexperienced man who was reluctant to listen to advice and tried methods that had been tried before and had failed; secondly, the more experienced man who, having found a technique that gave results, was reluctant to change it. An example of the danger of the latter was the long adherence to wound excision and healing by second intention and the reluctance to use early secondary suture,

eventually corrected by the work of Edwards and Stammers in Italy.

When considering the lessons of war surgery of the abdomen, technique and administration of the Medical Services are of equal importance.

Administration

The forward surgeon dealing with the vast majority of wounds of the abdomen must be:

1. Properly sited.
2. Adequately supported.
3. Well informed.

Site. In choosing the best site when operating on abdominal wounds there are two major factors which are to some extent in conflict. The nearer the site is to the scene of the wounding the less the delay in resuscitation and surgery, the shorter the distance the unfortunate has to be carried and the greater the chance of success. On the other hand, if this forward siting is carried by enthusiasm to excess the surgeon finds himself operating in continuous noise, uneasiness and danger. This affects the surgeon himself and also the patient. The actual moment of operating becomes much more fatiguing and the post-operative period must be unnecessarily distressing to the patient. No one who has seen post-operative 'belly cases' struggling from the stretcher to the ground pulling the intravenous drips with them to take cover when the surgical unit is being shelled would willingly allow himself to be sited in such a place again if an alternative a little farther back is available.

It is impossible to give a description of the ideal site because it will, of course, vary according to the local condition. During the 1939-45 War it was found that somewhere just behind the medium artillery worked well. This was usually far enough back to be out of range of counter battery fire. Changing weapons may well alter this and the consultant surgeons to the Army Medical Services should be kept informed of these changes.

The forward surgeon must also be protected from the enthusiastic divisional general, particu-

larly of armoured formations, who tries to collect 'my own field surgical unit.' This may well result in almost daily moves, leaving behind small numbers of cases not yet fit to be moved back along the lines of communication.

Support. The surgeon needs the support of: (1) A host unit to house and nurse his cases; (2) a transfusion officer and unit to resuscitate his cases; and (3) at least one other surgeon if possible. Dealing single-handed with casualties is uneconomical and leads rapidly to exhaustion.

Information. The information referred to here is not the tactical situation, important as that may be, but rather the kind of information that was so well spread about by the consultant surgeons of the army in the last war. It might almost be termed 'surgical gossip' and consisted of reports on the activities of colleagues, reports from the base hospital of the condition of patients on arrival, welcome praise when things were going well, and tactful rebuke when mistakes had been made, and any other information which prevented a feeling of isolation. The visits of these consultants were always welcome and, thanks to their tact, gave no feeling of supervision.

Surgical Technique

This is not the place to cover in detail every possible type of wound of the abdomen which might occur, itemizing all the injuries and advising on exact steps to be taken to deal with them. Rather it is an attempt to describe the basic principles in dealing with abdominal wounds in field conditions.

Diagnosis. The diagnosis depends mainly on the presence of a penetrating wound in the right situation, supported by the usual signs of intraperitoneal damage. A word of warning about suspecting a small penetrating wound in the thigh, buttock or perineal areas is worth repeating. Under pressure of a large number of casualties the surgeon may feel reluctant to waste time in conducting a long drawn out, careful examination of all the abdominal viscera in an uncertain case. In these circumstances Donald suggested that a small opening should be made in the abdomen and a swab put down to the pelvis. He pointed out that if there were any injury of the viscera the swab would show blood. This test has some merit.

Pre-operative treatment. Pre-operative treatment means resuscitation and this will usually be adequately dealt with by the transfusion officer and consists in the main of administration of blood to counteract the blood lost. It is well, however, to mention simple matters which may be forgotten and point out that it is no use trying to resuscitate a patient who is lying in wet clothes on a dirty

stretcher. There is also an optimum time at which to operate and it is no use prolonging resuscitation beyond a certain point in the hope that further improvement will be gained. No hard-and-fast rules can be laid down for this optimum. It is learnt by experience and based on impression rather than any exact clinical tests.

Operative Technique

When confronted with a penetrating wound of the abdomen it seems to me that there are two main subdivisions in the operation. First, there is the *search*, and after the search the *repair*.

Search. It is well to try and forecast the extent of the intraperitoneal damage and the organs likely to have been wounded before the incision is made. This can be done to some extent by considering the path that the missile has taken. If there is an entry and an exit wound it is relatively simple. If, however, there is no exit wound and radiology is easily available an X-ray of the chest, abdomen and pelvis may show the present site of the missile. The site of the incision will depend to some extent on this estimate. It is perhaps unnecessary to say that the incision must be large enough to allow an easy and rapid inspection of the whole peritoneal cavity. If the aphorism that 'plan your incision long enough and then double it' is true in ordinary emergency civilian surgery, it is doubly so in war surgery. The exact nature of the incision—midline, paramedian, transverse, etc.—will depend on the individual taste of the surgeon, but emphasis will always be on speed rather than on the cosmetic result.

When the abdomen is open it is well to have a systematic plan of search to avoid missing one of a number of injuries. Again the plan of search will vary from surgeon to surgeon, but a simple and satisfactory one is to start with the hollow viscera, working from top to bottom and marking each injury as it is found, leaving the repair until the sum total has been discovered. This allows the assessment to be made as to whether several holes in pieces of bowel can be sutured or whether a length of damaged bowel is to be resected. During this search of the hollow viscera particular attention should be paid to the duodenum, which, if not specifically looked at, may lie damaged but unnoticed.

The solid organs can be inspected after the search of the hollow viscera has been completed.

Repair

Solid viscera. A wound of the *liver* is usually only of danger because of haemorrhage. In my experience the majority of these injuries were small and the haemorrhage had been largely stopped by the time the abdomen was opened. In

this case simple draining of the wound site is enough. If, however, haemorrhage is persistent and severe, suture of the liver must be undertaken in the usual manner.

A wound of the *gall bladder* is easily treated by cholecystectomy and a wound of the *common bile duct* by suture.

Rupture of the *spleen* or penetration of the spleen by a missile is treated by splenectomy. It should always be remembered that the unwary may be caught by only removing the part that is shattered.

As in civilian surgery injury to the *kidney* does not of necessity mean that the kidney must be removed and in cases where the only symptom is mild haematuria conservative treatment can be used. If, however, an injury of any size is discovered during a laparotomy for multiple injuries, a nephrectomy is indicated. Complete removal was the standard treatment during the last war, but I think it reasonable to believe that heminephrectomy may now have a place.

Wounds of the *suprarenals* were rare as one would expect when considering its size and its situation. In my experience they were almost invariably fatal and presented with the same picture that one sees in idiopathic suprarenal haemorrhage. The patient has all the signs of a formidable blood loss with pallor and imperceptible blood pressure, profound shock and yet has a relatively normal blood picture. The use of cortisone in such cases might be of value.

Hollow viscera. When dealing with the hollow viscera they can conveniently be considered in two groups, from the stomach to the ileocaecal valve, and from the caecum to the rectum.

In the former group single perforations are treated by suture. If the perforations are multiple or if there is interference with the blood supply due to an added injury of the mesentery, then resection may be required. One has to make up one's mind as to whether it is easier and quicker to resect a portion of bowel or suture several perforations. The tendency has been to avoid resection if possible in the past, but, with the improvement in post-operative care of small bowel resections, I think it is reasonable to believe that it will be undertaken a little more readily in the future.

Wounds of the large bowel showed a marked improvement during the last war. The reason for this was due to the major advance in technique initiated and sustained by Ogilvie. Broadly speaking, the change was that instead of attempting to repair an injury, the injured portion was exteriorized by making a colostomy at the injured site. Where the large bowel cannot easily be brought outside the abdomen and particularly in

the region of the lower sigmoid colon to the anal canal, a proximal defunctioning colostomy with a drain to the wound site is the treatment of choice.

While the newer antibiotics, potent against the intestinal organisms, should in the future result in even better results, I do not see that they can mean a return to the older method of treatment. Although primary resection and anastomosis of the colon is now much safer in civilian surgery its safety depends on a proper pre-operative sterilization of the bowel, a feature which is manifestly impossible in war surgery.

A wound of the *bladder* was treated by suture and a suprapubic cystotomy. This may seem too drastic a form of treatment and one may be tempted to use an indwelling catheter rather than a suprapubic. The danger here lies in the fact that a catheter needs far more supervision than a suprapubic tube and this supervision may not be available in forward areas.

To summarize, injuries of the alimentary canal require closure by suture, resection if the number of perforations makes it the easier procedure, and exteriorization in the colon.

Post-operative Care

Basically, the post-operative care of an abdominal wound is no different in war from civilian surgery. There are, however, certain modifications necessary because of the environment of war.

A forward surgeon is nursing his cases with the minimum of trained staff in circumstances which are often barely adequate. He has to evacuate his cases as early as possible to units farther back.

Post-operative care must therefore be based on simple measures, easily understood and supervised and if possible without costly and cumbersome equipment or dependence on laboratory investigations.

Sufficient sedation, gastric suction and intravenous fluid administration are the tripod on which care rests.

The better understanding of the blood chemistry of the post-operative case is one aspect of progress recently. A simple and reliable method of checking this would be of inestimable value in forward areas and one hopes that ideas will soon be crystallized out enough to make this possible.

'Belly cases' travel badly if evacuated early. They should be held until peristalsis is firmly re-established, the patient is hydrating and feeding himself by mouth and the boundary between 'holding his own' and being 'on the mend,' so difficult to describe and yet so easy to recognize, has been crossed. This usually means a minimum of four days and may be longer.

Summary

The forward surgeon dealing with abdominal injuries must be in the right place with the right support at the right time. His operations will be based on ordinary civilian surgery, but must be

made through adequate incisions to allow treatment of injuries which are likely to be multiple. His post-operative care must be simple and carried on long enough to ensure safe travel to the next unit behind.

THE MANAGEMENT OF THE FLUID BALANCE IN INTESTINAL OBSTRUCTION IN INFANCY AND CHILDHOOD

By THOMAS STAPLETON, M.A., D.M., M.R.C.P., D.C.H.

Assistant Director, Paediatric Unit, St. Mary's Hospital Medical School; Sometime Radcliffe Travelling Fellow

Delays in diagnosis and mistakes in the management of the fluid balance are responsible for nearly all the difficulties which arise in cases of intestinal obstruction in the paediatric age group. The technical procedures required to correct the obstruction, whether in the newborn period or later, are now done so well that they seldom cause trouble. This article will deal with the management of the fluid balance in four types of case: the newborn with oesophageal atresia or with obstruction lower down in the gastrointestinal tract, infantile hypertrophic pyloric stenosis, acute intussusception and appendicitis with peritonitis.

Some general principles will first be stated. The aim of fluid administration is to provide (1) water and electrolytes in the amounts which the child would require if he were not ill—i.e. maintenance requirements—and (2) a replacement for those lost through vomiting, gastric or duodenal suction, or diarrhoea.

The maintenance requirements for children of different ages and weights have now been worked out and it is seldom necessary, or advisable, to take blood from the infant for biochemical examinations to be made in the laboratory. The maintenance requirements by age and weight are shown in the following table (modified after Dodd and Rapoport):

WATER			
First five days	..	..	40 ml./kg.
Up to one year	..	..	160 ml./kg.
One to two years	..	..	120 ml./kg.
Two to four years	..	..	100 ml./kg.
Ten years	..	..	70 ml./kg.

SODIUM AND CHLORIDE

	g. NaCl	ml. 'physiological' saline
First five days	 None	None
Up to one month	 0.25-0.5	25-50
One month to six months	 1.0	100
Six months to two years	 1.5-2.0	150-200
Older children	 2-4	200-400

Because the administration of some glucose prevents as much tissue breakdown from occurring as would occur if the patient were completely starved, the water requirements are given as a solution of glucose. Dextrose has at least two other important actions in starvation, namely, reducing the sodium loss in the urine and reducing the output of organic acids. It is desirable to spread the administration of the maintenance electrolyte requirement over as long a period as possible. Thus a most useful solution is 1/5 'physiological' saline made isotonic with glucose (i.e. 0.18 per cent. NaCl and 4.3 per cent. dextrose). Recently it has been suggested that cane sugar may be used to supply more energy than glucose, as it can be given in a 10 per cent. solution without causing glycosuria, whereas glucose, if given in more than a 5 per cent. solution, tends to cause glycosuria and have a dehydrating effect; the continuance of intravenous fluids is usually only necessary for such a short time that, in the writer's opinion, the proper use of glucose and electrolyte solutions gives very satisfactory results.

The route of administration of parenteral fluids should be the intravenous one, unless, as is the case in most cases of pyloric stenosis, it is only