SURGICAL PROBLEMS OF WAR

This contribution is the second of four articles written by a Canadian surgeon who had considerable experience of war surgery in 1914-18

GUNSHOT WOUNDS OF THE ABDOMEN

BY

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The success of Richards and Fraser (now Sir John) in gunshot wounds of the abdomen in 1915, in the Second Army under Sir Cuthbert Wallace, was overlooked and not given the attention and publicity that the extraordinary results warranted. However, by the autumn of 1915 and certainly the early spring of 1916 it was generally recognized—if not universally adopted—that early operation was indicated in gunshot wounds of the abdomen; that

quickly decide and hasten to carry out the resections. Time is an important factor in such cases, and speed in operating is life-saving. Every young surgeon should carefully read and digest *The Abdominal Injuries of War* by that master of surgical judgment, daring, and skill, Gordon-Taylor. In extensive wounds of the ascending and descending colon with widespread soiling where colon septicaemia (Fraser) may be expected, a posterior incision may be made in the loin adjacent to the site of the wound, and a large soft rubber tube can be sutured in position, just penetrating the peritoneum, but not further. Multiple

FIG. 1.—Distribution of wounds of the abdomen according to their gravity and their tendency to heal spontaneously. The gravity of wounds corresponds to the density of the shadows: the darkest region to the highest degree of gravity.

approximately 50 per cent. could then be saved, depending largely on how early operation could be undertaken; and that the policy of abstention in undoubted peritoneal wounds was tragically wrong. The scope of this article will not permit me to deal at length with gunshot wounds of the abdomen further than to point out the necessity for operating at the earliest possible moment, preferably not later than four to twelve hours after being wounded; accurate localization of the missile, if retained; purse-string or mattress suture of the bowel and patching with omental tags rather than resection, which must be avoided if at all possible; end-to-end anastomosis rather than lateral anastomosis, if required; control of all bleeding points; a thorough and complete toilet of the abdomen and its contents with sponges wrung out of saline; perhaps the use of a little ether for its cleansing properties; and rarely drainage, except in the late cases, when a supra-pubic drain may be left in. Resections are, however, frequently necessary, and double (even triple) resection must unfortunately be carried out if life is to be saved. It is particularly in such patients that the surgeon must

FIG. 2.—Various wounds of small bowel and types of closure—catgut, silk (fine), or linen thread.

FIG. 3.—Horizontal section of the abdomen. Note: Tangential passages of missiles from entrance to exit may miss bowel and other viscera and heal spontaneously.

ileostomies or jejunostomy, to prevent obstruction of small bowel and to offset distension incident to peritonitis, proved of no value. A high jejunostomy with a catheter sutured in position was valuable, as it permitted feeding of the patient after extensive repairs of the stomach, duodenum, or jejunum. An appendicostomy or caecostomy acted as a valuable outlet to prevent undue distension with fluid and gas after repair of extensive wounds of the colon. A Rankin clamp should be at hand to ensure aseptic resection of the large bowel when found necessary.

Liver, Spleen, Kidneys, and Bladder

Many painful experiences taught us to deal conservatively with wounds of the liver, spleen, and kidneys. Most liver wounds can best be treated by careful cleansing, muscle or omental tags, and packing. Sutures often will not hold, and may cause additional haemorrhage, spread infection, and indeed delay the operation.

If the spleen is not too badly injured and if the artery is intact, and if bleeding has ceased when the spleen is

exposed, apply a hot pack to it, deal with other lesions in the abdomen, then return to the spleen and hesitate to do a splenectomy if there is no active haemorrhage. Pulmonary embolus following splenectomy was so common in the last war that after August, 1916, we reserved it only for patients with such extensive rupture and destruction of the organ that bleeding could not otherwise be controlled.

Likewise in dealing with gunshot wounds involving a kidney we soon came to realize that every effort should be made to save the kidney, providing the artery, vein,

FIG. 4.—A. Bursting wound of a kidney that can generally be saved. B. Bursting wound of a kidney that might be saved if bleeding has ceased. C. Bursting wound of a kidney, with destruction of pelvis and renal vessels, requiring nephrectomy. (a = artery ; v = vein.) D. Bursting wound of a kidney that requires nephrectomy though bleeding may have ceased.

and ureter were intact and the organ was not too badly shattered by the missile. While it is not easy to suture the spleen because of bleeding, the kidney capsule and perirenal fat permit of encircling sutures that will often control bleeding from the cortex. Wide drainage can, in addition, be easily and safely established without doing any harm from pressure or contact with the tube.

Wounds of the bladder must be promptly dealt with, particularly to avoid extravasation into the deep tissues of the perineum ; otherwise, if the patient is passing urine, bladder wounds when entirely extraperitoneal should be treated conservatively. Suprapubic drainage should be avoided.

Abdomino-thoracic Wounds

Abdomino-thoracic wounds involving the left diaphragm particularly are as a rule best treated by early operation. Practically any wound of the diaphragm, when the patient has survived to reach an operating table, can be sutured. Whether to deal with such wounds by the abdominal route, a thoracic approach, or a combined abdomino-thoracic

incision depends on the location of the wound or wounds, the course of the missile, and the probable organs injured. In extensive wounds involving the periphery or where there has been considerable loss of tissue, as may occur with shrapnel or shell-casing, it may be necessary to expose the phrenic nerve in the neck and either crush it or inject alcohol so that the diaphragm on that side will be put at complete rest until healing is accomplished. Living suture may occasionally be necessary in an extensive lesion of the diaphragm. Flat catgut (prepared) in tubes should be available for repair of the diaphragm, as for the repair of the spleen and kidneys.

Peritonitis

There are patients with gunshot wounds of the abdomen who for one reason or another are not brought to the casualty clearing station until peritonitis is already well established, and yet must be dealt with surgically if there is reasonable evidence of involvement of the bowel. We operated upon many as late as forty hours after being wounded, and even when two or three days had elapsed. Fortunately, in the latter group as a rule the peritonitis was fairly well localized. In this group, when it is necessary to operate to close the openings or rents in the bowel, the greatest care must be taken in handling the intestines not to convert a localized peritonitis into a spreading general peritonitis. The Alonzo-Clark or so-called Ochsner treatment should be adopted post-operatively. Patients are placed in Fowler's position as early as possible after operation. Small injections of morphine are repeated till the patient's respirations are reduced to 14 to 16 per minute. Continuous blood transfusion with preserved blood may be employed at the outset, otherwise intravenous glucose 1 minim every five seconds should be given. A rectal drip of glucose and sodium bicarbonate may be valuable. Nothing is given by mouth. The lips are merely moistened with gauze wrung out of water. Heat in some form such as hot linseed may be applied to the abdomen. If there is considerable distension eserine, pitressin, acetylcholine, or some such drugs may be valuable two or three days after operation.

The patient may be kept in this condition for days, and a proportion of such wounded men will live who would most certainly have otherwise died. I have at hand particulars of a man operated on at No. 53 Casualty Clearing Station in the spring of 1917 who had lain out in a shell hole for forty-eight hours. We sutured twelve holes in the small bowel and kept him in a deep sleep for eleven days. Although he had a well-marked peritonitis it was fairly well localized, and he recovered.

Location of Missiles

Every advanced operating centre in this war should be adequately equipped with radiographic apparatus to permit of accurate location of missiles before operation. Unfortunately, it was late in 1916 before x-ray equipment was available for casualty clearing stations. The site of missiles can be established with the greatest accuracy and with dispatch. Captain J. B. Donaldson, R.A.M.C., one of the most outstanding radiologists of the war, developed the location of missiles to such a degree of ease and accuracy that I have known him to locate them in ninety-six patients in a day, and in the many months he served with us from late in 1916 to the end of the war he was only wrong once, and then by not more than two to three centimetres, with a small missile measuring about 1 by 1½ by ½ cm. in the anterior mediastinum on the left side.

The extreme importance of the probable course of a missile from the entrance wound to where it lodged cannot be exaggerated. No man, however experienced, can with any degree of accuracy foretell the course that a missile, particularly a bullet, may take through the body. Innumerable instances could be cited to prove the bizarre course that missiles take ; suffice it to point out that I have known a bullet fired from an aeroplane to enter the right

deltoid muscle three inches below the shoulder, and be found lodged in the crest of the left ilium, and yet no serious damage was done to the chest, the abdomen, or either kidney.

Repair of Vessels and Nerves

In this war there should be a much higher percentage of suture of arteries and nerves. Every effort must be made to repair and preserve main arteries and nerves.

FIG. 5.—Arterial suture: Carrel's method. 1. Note adventitia drawn over cut end of artery preliminary to removal. 2. Three stay sutures in position, making vessel triangular to suture. 3. Suture of second triangle with vessel partly rotated and then continuous suture through all coats of vessel (vaselined Japanese silk used).

The outstanding contribution of Murray and his associates in the use of heparin should make it imperative that Governments at once take steps to have it produced in commercial quantities and at reasonable cost. Every casualty clearing station should have at hand, threaded and prepared for immediate use, small curved and straight needles (No. 15) for suture, and for special sutures such as Japanese silk. Two or three men in every casualty clearing station should be prepared to take on the suture of these important structures—men who have acquired a special aptitude for such work; and with the mass of surgery that passes through a casualty clearing station such surgeons can be rapidly trained and developed if not already proficient.

MORE NOTES ON PENETRATING CHEST WOUNDS

BY

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Dr. F. G. Thomson's paper on this subject in the *British Medical Journal* of January 13, 1940 (p. 44), brought into the foreground of my memory some of my experiences during the last war when I was in charge of a ward in a base hospital in France set aside for such cases. I regret that I cannot give figures as Dr. Thomson is fortunate enough to be able to do, because I was recalled in November, 1917, "to serve the needs of the civil population"; at that moment these were mainly represented by attendance on cases of whooping-cough and German measles in a colliery village in Fife!

But I would like to supplement Dr. Thomson's notes by some of the experiences which stand out as landmarks in my medical journey. One of these was the first case of penetrating chest wound which I saw in hospital.

I had only arrived at the base from the front a few days previously, and there was no special ward for such cases at the time. The patient had been admitted to my medical ward with an "e. and e." wound through his right chest. On examination I found all the physical signs of pneumonia, complete over his right side and also over the lower lobe of his left lung. He seemed perfectly well, with a normal pulse and temperature, and very little embarrassment of his breathing. Obviously he had no pneumonia at all, but I could not explain the physical signs present. I requested the services of our consulting physician, the late Sir John Rose Bradford, and while awaiting his arrival I talked over the case with our pathologist, the late Major Sydney Rowland (microscopist to the Lister Institute). I remarked to him, rather casually, I fear, that physical signs in the war zone were different from those met with at home. He countered with, "Physical signs *never* vary; it is your interpretation of them that is at fault." Does that not apply to very many aspects of our work? That lesson I have never forgotten.

Sir John quickly explained the apparent anomaly. The rifle bullet had traversed the right lung, producing a large haemothorax, with complete compression of the lung; this meant that although the right thoracic cavity was full of blood, almost up to the clavicle, there was a conducting medium all the way from my stethoscope to the main bronchus, through the blood and the solid lung; hence the tubular breathing with a few crepitations, suggestive of pneumonia, and not the "silent chest" associated with pleural effusion one meets in civil life. The condition of the left lung was due to "contralateral collapse" of the lower lobe, a condition fairly frequently associated with haemothorax, and possibly, according to Sir John Rose Bradford, due to mechanical causes, the whole mediastinum having been pushed over (in this case) to the left side.

Such was my introduction to the problems of penetrating chest wounds. The next lesson I learnt was that for accurate diagnosis, especially in such cases as these, an intimate knowledge of physical signs was valuable to an extent I had never before realized; and that, to acquire this, constant and unremitting practice was necessary and the use of a skin pencil essential, and when possible the results should be checked by radiographs. This seems so elementary that it should not need elaboration or even repetition, but my knowledge of final-year medical students and of recent graduates does not bear this out.

Another important point in the examination of the chest which Dr. Thomson has omitted to mention is the position of the apex beat. The heart is always displaced away from the effusion, and this is a valuable clue to the diagnosis.