

TABLE II—Complications of 251 Attempted Laparoscopic Sterilizations

Year	No. Attempted	Failure to Carry Out Procedure. Open Operation Done Instead	Operative Injuries Necessitating Laparotomy	Failed Sterilization (Pregnancy after Operation)	All Failures and Complications
1967	20	2 (Due to poor visualization)	1 (Haemorrhage with haematoma of abdominal wall)		3 (15.0%)
1968	6	1 (Due to poor visualization)	1 (Haemorrhage from bowel wall)		2 (33.3%)
1969	29	1 (Due to electrical short circuit) . . .	3 (2 Perforations of bowel (laparotomy on 3rd and 12th postoperative days respectively); 1 haemorrhage from mesosalpinx)		4 (13.8%)
1970	75		1 (Haemorrhage from mesentery)	1 (Intrauterine pregnancy within 5 months of operation)	2 (2.7%)
1971	121	2 (Due to failure to insert laparoscope)	8 (1 Case of severe postoperative pain (laparotomy on 2nd postoperative day with negative findings); 1 haemorrhage from mesentery; 4 haemorrhages from mesosalpinx; 2 pelvic abscesses (laparotomy on 2nd and 5th postoperative days respectively)	3 (2 Intrauterine pregnancies within 7 months of operation; 1 ectopic pregnancy 8 months after operation)	13 (10.7%)
Total	251	6 (2.4%)	14 (5.6%)	4 (1.6%)	24 (9.6%)

decrease with increasing experience; the results for 1971, however, did not confirm this view. The complication rate for consultants is no lower than that for registrars. Both have complication rates high enough to incur doubts about continuing to sterilize via the laparoscope.

Comment

As a diagnostic tool the laparoscope serves an important function, especially in cases of doubtful ectopic pregnancy, to exclude endometriosis, and in the investigation of primary amenorrhoea and infertility. It is also of value to forestall the "operation-prone" patient who is determined to have a laparotomy.

As an instrument for carrying out sterilization the disadvantages outweigh the advantages—(1) the laparoscopic procedure is no quicker than the "open" operation; (2) the complication rate is higher; (3) it does not appear to be as effective. In a consecutive series of 251 sterilizations carried out by the open operation there were no complications other than wound sepsis and deep vein thrombosis and no pregnancies were subsequently reported, though admittedly the patients might have gone elsewhere. It is, however, reasonable to assume that a woman who becomes pregnant after the open operation is just as likely to return to the hospital where she had the operation as is a woman pregnant after laparoscopic sterilization. During the five-year period we omitted to follow-up

cases by salpingography to establish that the tubes had been occluded.

The chief advantage of laparoscopic sterilization is in the shorter stay in hospital. The average postoperative stay of our patients was 3-4 days. When we are short of beds, however, we allow patients sterilized by the open operation to go home on the fourth day and thus even this advantage is lost.

We agree with Steptoe that diagnostic laparoscopy is a safe procedure but that in the "trained hands" of ordinary gynaecologists like ourselves sterilization with the laparoscope has not proved to be the rapid, safe procedure which the experts would have us believe it to be.

Perhaps in the days of medical audit our true "level of incompetence" will be determined.

The views expressed here are our own. There are three gynaecological teams at Hope Hospital. Two have given up laparoscopic sterilization for the reasons mentioned above, though the use of the instrument as a diagnostic tool has increased. The third unit continues to use the instrument for both purposes.

References

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- 2 Medical Defence Union, *Annual Report*, 1971, p. 51.
- 3 Medical Defence Union, *Annual Report*, 1972, p. 17.
- 4 Medical Defence Union, *Annual Report*, 1973, p. 16.
- 5 Steptoe, P. C., *Laparoscopy in Gynaecology*, p. 73. Edinburgh, Livingstone, 1967.

Surgery of Violence

VII. Gunshot Wounds of the Trunk

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In the management of wounds of the chest and abdomen the basic principles outlined for reception and resuscitation of the

patient are of paramount importance. Blood loss and shock must be treated with the utmost energy and urgency.¹

Thoracic Wounds

A chest drain is inserted into one or both pleural cavities when obvious penetration by a bullet has occurred or when there is any clinical evidence of blood or air in the pleural cavity. An

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estimate is made of the probable track of the missile or missiles, and careful clinical examination, especially of the abdomen, is carried out. Low-velocity missiles are often retained, and x-ray films of chest and abdomen should accompany the patient to the operating theatre.

TYPE OF MISSILE

Gun-fired missiles are commonly divided into low- and high-velocity groups. The former are fired from revolvers and pistols and a variety of short-barrelled automatic weapons and the latter from rifles. Within these two groups the bullets differ in size, weight, and muzzle velocity and also in actual construction. The kinetic energy of the missile is a product of its mass times the square of the velocity; the gyroscopic or spin energy, as well as the type of bullet, also determines its effect on the target.

The low-velocity bullet, while certainly lethal on many occasions, is often deflected by soft-tissue planes. For example, a young man was shot from a height, the bullet passing through the tip of his chin, behind his right clavicle and neatly down the side of the superior vena cava under the mediastinal pleura, finally passing out through the lung. Another patient had a single bullet wound in his left anterior axillary fold. His first chest x-ray showed a left haemothorax but no bullet. Luckily a further view was taken, which showed it lying over his right acromion process. In view of the projected track of this missile through the superior mediastinum it was decided to explore his chest through a median sternotomy. This was, however, a mistaken decision, since the track was well posterior and the missile had penetrated the mediastinum between the oesophagus and the vertebral column—very inaccessible from the anterior approach.

Injury by a high-velocity missile is a much more lethal event, and far fewer of these patients have come to surgery. Where a rifle bullet has passed cleanly through the chest the characteristic effect of high energy dissipation may not be observed, but, if the sternum, ribs, or particularly the vertebral column is struck, widespread pulmonary effects can follow, such as disruption and rapid development of a bilateral wet lung syndrome. Associated damage to the spinal cord is common in this type of injury.

INDICATIONS FOR SURGERY

Absolute indications for surgery in penetrating chest injuries are: (1) Significant or continued haemorrhage; (2) a dangerous predicted track; (3) associated intra-abdominal injury.

The management of the through-and-through wound, with minimal drainage of blood and air, when the patient's condition remains satisfactory, is debatable. In a series reported by Heaton and others² from Vietnam 65% were treated by intercostal tube drainage, 15% by aspiration, and 20% by thoracotomy, with a mortality of 7.9%. In our different circumstances, however, where the number of such casualties at any one time has been smaller, and where full surgical facilities are readily available, thoracotomy has usually been considered desirable except when the injury is obviously trivial or is confined to the chest wall.

The wisdom of this policy was illustrated by the case of a young man who was admitted with an entry wound in his third left intercostal space anteriorly and an exit wound in his eighth left intercostal space in the posterior axillary line. He responded well to minimal resuscitation, and only a little blood drained from his left pleural cavity. There was some guarding, however, in the left subcostal region. On left thoracotomy there were two small holes, one above the other, in the pericardium, two holes side by side in the diaphragm, and a track through the lingula. Further exploration showed that the bullet, presumably of very low velocity, had grooved the left ventricle, traversed the diaphragm, and bounced back off the spleen, which was superficially lacerated.

SURGICAL APPROACH

This is obviously dictated by circumstances. A postero-lateral thoracotomy gives much better access to the hemithorax than does an anterior approach and is preferable, even with bilateral injuries, provided priority can be given to opening one side first. When there appears to be serious bleeding into both pleural cavities a bilateral trans-sternal approach has been used. The low thoraco-abdominal incision has been useful when the abdomen has also been penetrated; it allows good access to the liver or spleen, liver injuries having been particularly troublesome.

One type of injury in which the selection of surgical approach may be difficult is a gunshot wound in the supraclavicular region accompanied by serious bleeding both externally and into the chest cavity. Immediate temporary control of haemorrhage from the subclavian artery and vein at the point of injury is required, but full control to allow repair of the vessels necessitates a much wider access. The first part of the subclavian artery, especially on the left side, lies well posteriorly, and one would be tempted to use a thoracoplasty type of incision for this reason. This is impracticable, however, in the usual circumstances of injury, and we always employ a median sternotomy with extension up into the neck, excising part of the clavicle if necessary, and a further extension into the third intercostal space anteriorly, giving a wide, trap-door type of opening.

PROCEDURE

In the surgical management of pulmonary injuries the use of a double-lumen endotracheal tube is essential to control excessive air leakage and minimize aspiration of blood into the other lung. We have adopted a conservative approach, and, where at all possible, pulmonary wounds are explored, bleeding and air leaks controlled, and the lungs repaired by suture. Few lobectomies have been performed and no pneumonectomies.

Few cardiac wounds have come to surgery. Those that have were preserved from total exsanguination by the temporary effect of tamponade. A young woman was shot from behind with a large-calibre automatic pistol. The bullet traversed her ninth thoracic vertebra and passed upwards and forwards through both atria. On admission to hospital she was very shocked and had a right haemothorax, which drained freely after inserting an intercostal tube. On right thoracotomy a hole was seen in the pericardium just anterior to the phrenic nerve and the pericardial cavity was full of blood. The pericardium was opened anteriorly and the wound in the right atrium closed. The opening of the pericardium, however, appeared to increase the blood loss, and a further tear was palpated in the back of the left atrium. While this was controlled with the finger the lung was displaced forwards and the pericardium opened posterior to the pulmonary veins. It was impossible to apply a clamp, and the use of a Foley catheter, as originally advocated in dealing with an atrial tear at valvotomy, proved life-saving. A No. 20 Foley catheter with a 30 ml balloon, with a syringe full of saline attached to the balloon, was rapidly inserted in the tear; the balloon was inflated and gentle traction applied to the catheter. The haemorrhage was completely controlled and closure effected by an encircling suture pulled tight as the deflated catheter was removed. This girl survived, though with permanent paraplegia.

The chest wall wounds have mostly been small and have been excised and sutured. Where damage has been more extensive the necessary excision has been carried out, the chest cavity closed, and the superficial layers closed by delayed primary suture.

POSTOPERATIVE COURSE

The postoperative course of most patients was uncomplicated.

Some degree of lung contusion was present in all, but development of pulmonary insufficiency and the wet lung syndrome were dependent on the velocity of the missile, the extent of the chest wall injury, and the severity of other injuries.

When this syndrome was expected to develop, a decision to institute special intensive care, including controlled ventilation, was usually taken at the end of operation. The factors responsible for the development of the wet lung syndrome in high-velocity injuries to the chest were recently outlined by Wanebo and Van-Dyke.³

Abdominal Injuries

Of 4851 casualties from civil disturbance treated at the Royal Victoria Hospital during 1969-73, 120 patients sustained severe abdominal injuries and 16 died.

The vast majority of abdominal injuries occurred as a result of bullet wounds, but a small number were due to sharp fragments from bomb explosions. In 52% of our cases more than one viscus was damaged, and in 28% there were associated lung injuries.

ABDOMINAL WALL

Many wounds were limited to the anterior abdominal wall, and half of these were excised and treated by primary suture. The remainder were treated by delayed primary suture or allowed to heal by second intention; 18% of these wounds became infected.

STOMACH, DUODENUM, AND PANCREAS

Damage to the stomach was relatively infrequent, often a simple through-and-through wound, which was treated by simple suture.

Injuries to the pancreas and duodenum were often associated with spinal and liver damage. Perforation of the posterior wall of the duodenum can easily be missed, and if a severe retroperitoneal haematoma has formed a duodenal injury must be carefully looked for. Complete transection of the pancreas was infrequent; it was generally treated by resection of the distal portion.

LIVER

Injuries of the liver, which were often associated with injuries of the gastrointestinal tract or lung, ranged from small surface lacerations to complete avulsion of part of the liver. Any degree of liver injury may result in severe haemorrhage, and massive blood transfusion is often necessary. Control of bleeding may be very difficult. Removal of damaged fragments, followed by deep catgut sutures, may be sufficient. Formal hepatic lobectomy was seldom practicable in our experience because of the extra degree of shock in these patients and multiple coexistent injuries.

SMALL BOWEL

Injuries of the small bowel occurred in 54% of abdominal gunshot wounds, and in most of these the small bowel lesions were multiple; colonic injuries were often found in association. The most frequent injuries were small puncture wounds, which were treated by simple two-layer suture. In a number of cases segments of small bowel were so lacerated or devascularized by damage to the mesentery that resection was necessary. It is interesting that many cases of small-bowel perforation had neither air nor faeces in the peritoneal cavity at the time of laparotomy. Patients with small-bowel injury usually made an excellent postoperative recovery, though the rate for postoperative wound sepsis was 25%.

COLON

The colon was the most frequently damaged part of the gastrointestinal tract, the right colon being more frequently damaged than the left. Injuries varied from single perforation to severe contusion and laceration of the bowel wall; multiple lesions were frequent. Division of the mesocolon or severe vascular damage sometimes resulted in devascularization of the bowel wall. These colonic injuries were treated in a variety of ways. Single perforations, with no associated injury to the mesocolon, can be safely oversewn in two layers by means of non-absorbable suture material for the seromuscular layer. With severe contusion of the bowel wall or damage to the mesocolon interfering with the blood supply, primary resection with end-to-end anastomosis in two layers was the treatment of choice, particularly in lesions of the caecum and ascending colon, which were almost half of the total.

About one-third of our cases had a proximal colostomy or caecostomy, especially when the left colon had been resected. In all cases drainage of the peritoneal cavity was carried out and postoperative antibiotics were given routinely. After primary closure, or resection and anastomosis without proximal decompression, the intraperitoneal sepsis rate was extremely high, and a number of patients developed faecal fistula, though some of these healed spontaneously. The sepsis rate was reduced by proximal decompression. Simple exteriorization of a damaged loop of colon was seldom used, and, though perhaps safer, it inevitably led to gross sepsis in the abdominal wall.

RENAL TRACTS

A number of patients required nephrectomy for severe laceration of the kidney. An attempt was always made to define the extent of renal damage, as profuse perirenal bleeding need not necessarily represent irreparable damage. In one case after careful inspection of the kidney it was found that the upper pole had been avulsed and the rest of the kidney was viable. Upper polar nephrectomy was performed. In another case the kidney was completely divided but the vascular supply was intact, and the kidney was successfully repaired over a nephrostomy tube.

Damage to the ureter was often associated with large-bowel injury and sometimes missed at the initial inspection. When later diagnosed, local sepsis was almost inevitable, and secondary repair was usually impossible. In this situation the kidney should be drained by nephrostomy or ureterostomy with a view to later replacement or, better still, implantation of the proximal ureter into the opposite side.

Conclusions

Since the Royal Victoria Hospital has been almost at the centre of the "battle zone" and the ambulance services, both civil and military, have been extremely efficient, casualties have reached hospital in a remarkably short time. On average 39 minutes has elapsed between the receipt of a bullet wound and the start of hospital treatment. Consequently some patients with injuries of terrible severity—wounds of the aorta, the vena cava, the heart, and massive disruption of the liver—have presented as surgical problems. In other war situations these patients would probably have died before reaching hospital. Early treatment often allowed us to prevent the onset of severe oligaemic shock, and to operate before prolonged contamination of the pleural and peritoneal cavities had made sepsis inevitable. Apart from the immediate deaths from uncontrollable haemorrhage the main causes of death were infection and renal and hepatic failure.

References

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