

Penetrating abdominal trauma

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Summary

Penetrating abdominal trauma (PAT) is seen daily in our trauma ward. We present a retrospective study of the patients managed in our hospital (Polokwane Hospital, Limpopo) from January 1999 to March 2000.

Epidemiology, mechanism of injury, patterns of injury, management, morbidity and overall mortality were recorded for analysis. Morbidity and mortality were commonly associated with peritonitis and multiple organ dysfunction syndrome.

Trauma is a very well-known factor in premature death among young healthy individuals, and is the first cause of death in people below the age of 44 years. It also carries a heavy burden in terms of the economy of any country.^{1,2}

Penetrating injuries to the abdomen are commonly related to interpersonal violence and the distribution of injuries varies greatly. Sadly, pre-hospital deaths cannot be controlled by medical action. However, the way patients are managed once they get to hospital can influence the outcome of such injuries.

The purpose of this study was to give an overview of the characteristics of patients presenting with penetrating abdominal trauma (PAT) in our area, and to try to identify a pattern of organ-specific injury that could influence the morbidity and mortality of our patients, if such a pattern was present.

Material and methods

The results of a retrospective study of the patients admitted and treated at Polokwane Hospital (PH) with a diagnosis of PAT between January 1999 and March 2000 are discussed.

The Polokwane Mankweng Complex is the end-referral surgical and trauma service for Limpopo Province (formerly Northern Province). It serves a population of approximately 6 million people, with 60% in rural and remote areas. PH offers level II trauma services.

Inclusion criteria

All patients with a diagnosis of PAT (stab, gunshot or other) admitted and treated at PH during the review period were included in the study.

Patients with associated penetrating injury to the head were excluded from the study, as were those with penetrating injuries to the abdomen who were pronounced dead on arrival.

The period of study was from 5 January 1999 to 6 March 2000, a total of 14 months.

Our trauma team comprises a general surgeon in training, a consultant specialist surgeon, two medical officers (casualty officers) and several nurses. Members of other services were called in on a discretionary basis to assist in evaluation and management.

Initial assessment and management were always carried out using Advanced Trauma Life Support protocols.

Clinical presentation, mechanism and location of injuries, type of organ-specific injury, definitive treatment and morbidity and mortality were analysed in a linear retrospective mode, using data from patient records.

Results

During the study period 2 437 trauma patients (major trauma) were seen at PH, averaging about 174 patients per month or 5 - 6 patients per day, 89 of whom were included in the study (3.6%). The majority were male, with ages ranging from 8 to 79 years (Table I).

TABLE I. PATIENT CHARACTERISTICS

| Age (yrs) | Males (N) | Females (N) |
|--------------|-------------------|-------------------|
| 0 - 15 | 1 | - |
| 16 - 30 | 31 | 1 |
| 31 - 45 | 26 | 15 |
| 46 - 60 | 11 | 2 |
| 60 + | 2 | - |
| Total | 71 (79.7%) | 18 (20.2%) |

Forty-two male patients versus 17 females had stab wounds, and 29 v. only 1 female had gunshot wounds (GSWs) (Table II). The majority of stab and GSWs were located in the anterior or posterior abdominal wall, followed by both flanks and the buttocks. Six patients had combined thoraco-abdominal trauma, with the primary wound in the chest (Table III).

TABLE II. MECHANISM OF INJURY

| Wound | Males (N) | Females (N) | Total (N) | % |
|----------------|-----------|-------------|-----------|-------------|
| Stab | 42 | 17 | 59 | 66.2 |
| Gunshot | 29 | 1 | 30 | 33.7 |
| Total | 71 | 18 | 89 | |

Time elapsed between injury and arrival at our hospital varied greatly. Only 37% of patients presented in the first hour after injury; the majority were transported to hospital between 1 and 12 hours after injury and the remaining group came after 12 and even 24 hours after injury (Table IV).

TABLE III. WOUND LOCATION

| Location | Stab (N) | Gunshot (N) |
|------------------|----------|-------------|
| Anterior wall | 21 | 10 |
| Right flank | 12 | 3 |
| Left flank | 10 | 2 |
| Posterior wall | 7 | 8 |
| Buttocks | 6 | 3 |
| Chest | 2 | 4 |
| Other (perineum) | 1 | – |
| Total | 59 | 30 |

TABLE V. CLINICAL PRESENTATION

| Clinical features | Stab patients | | Gunshot patients | |
|--------------------|---------------|------|------------------|------|
| | N | % | N | % |
| Haemorrhagic shock | 10 | 11.2 | 16 | 17.9 |
| Peritonitis | 32 | 35.9 | 14 | 15.7 |
| Disembowelment | 8 | 8.9 | – | – |
| Abdominal pain | 5 | 5.6 | – | – |
| Nonspecific | 4 | 4.4 | – | – |
| Total | 59 | | 30 | |

TABLE IV. TIME TO ARRIVAL AT DEFINITIVE CARE

| Hours | Stab patients | | Gunshot patients | |
|---------|---------------|--------|------------------|--------|
| | N | % | N | % |
| 0 - 1 | 12 | (13.4) | 11 | (12.3) |
| 1 - 6 | 17 | (19.1) | 5 | (5.6) |
| 6 - 12 | 19 | (21.3) | 3 | (3.3) |
| 12 - 24 | 5 | (5.6) | 9 | (10.1) |
| 24 + | 6 | (6.7) | 2 | (2.2) |
| Total | 59 | (66.2) | 30 | (33.7) |

TABLE VI. INITIAL TREATMENT

| Treatment | Stab patients | | Gunshot patients | |
|----------------------|---------------|------|------------------|------|
| | N | % | N | % |
| Damage control | – | – | 3 | 3.3 |
| One-stage laparotomy | 50 | 56.1 | 27 | 30.3 |
| Non-operative | 9 | 10.1 | – | – |

On arrival 26 patients had symptoms and signs of haemorrhagic shock; 46 presented with frank signs of peritonitis, and the remaining patients all had stab wounds featuring disembowelment, abdominal pain, and nonspecific symptoms and signs (Table V).

The majority of our patients were immediately taken for operative treatment. Three patients with GSWs needed damage control surgery, and 77 underwent single-stage laparotomy for injury control. The rest were initially treated in non-operative fashion. Four of these 9 patients needed a late laparotomy due to persistent abdominal pain, after a period of observation of about 6 hours. Only 1 had a significant organ injury, viz. a left kidney inferior pole laceration with a non-expanding retroperitoneal haematoma (Table VI).

At laparotomy most patients were found to have 2 or more injuries. Of 59 stab wound patients, 39 had mesenteric laceration and 36 had multiple small-bowel perforations, followed by colonic injury in 17 patients, and gastric and liver lacerations in 10 and 6 patients respectively. Two patients had diaphragmatic rupture with visceral herniation. Five of 50 did

not have any organ injury found during laparotomy (8.4%).

All GSW patients had mesenteric and multiple small-bowel perforation. Colonic injury was the next most common injury, found in 23 patients, followed by gastric laceration, injuries to major abdominal vessels and kidney, liver and diaphragmatic injuries. There were no negative laparotomies in this group (Table VII).

Sixty-two of 89 patients recovered without complication; 15 needed at least 3 repeat laparotomies to control persistent peritonitis, and 19 developed sepsis and multiple organ dysfunction syndrome (MODS).

The mortality in the series was related to these late events. Thirteen of the patients who developed MODS died despite all treatment efforts. There were 2 early deaths during damage control surgery – both patients had GSWs, with injury to major abdominal vessels (Table VIII).

Discussion

Our group of patients followed a classic pattern of distribution for age and sex in trauma victims.^{1,3,5} The only child of in cohort (8 years old) was injured while playing with a pistol after the adults of the house had fallen asleep during a long party.

TABLE VII. LAPAROTOMY FINDINGS

| Organ injury | Stab patients | | Gunshot patients | |
|----------------------------------|---------------|------|------------------|------|
| | N | % | N | % |
| Mesenteric laceration | 39 | 66.1 | 30 | 100 |
| Multiple small-bowel perforation | 36 | 61.0 | 30 | 100 |
| Colon and rectum injury | 17 | 28.8 | 23 | 76.6 |
| Gastric laceration | 10 | 16.9 | 11 | 36.6 |
| Major abdominal vessel injury | 1 | 1.6 | 10 | 33.3 |
| Liver injury | 6 | 10.1 | 7 | 23.3 |
| Diaphragm injury | 2 | 3.3 | 4 | 13.3 |
| Kidney injury | 1 | 1.6 | 8 | 26.6 |
| Pancreas and duodenum injury | – | – | 3 | 10.0 |
| Spleen injury | – | – | 2 | 6.6 |
| Urinary bladder/ureters injury | 1 | 1.6 | 3 | 10.0 |
| Gallbladder/CBD injury | – | – | 1 | 3.3 |
| No organ injury | 5 | 8.4 | – | – |

CBD = common bile duct.

TABLE VIII. OUTCOME

| Outcome | Full recovery (N) | Repeat laparotomy (N) | Sepsis/MODS (N) | Deaths (N) |
|---------|-------------------|-----------------------|-----------------|------------|
| Stab | 38 | 6 | 7 | 7 |
| Gunshot | 24 | 9 | 12 | 8 |
| Total | 62 | 15 | 19 | 15 |
| % | 69.6 | 16.8 | 21.3 | 16.8 |

MODS = multiple organ dysfunction syndrome.

In our study we did not separate patients by geographical location (urban/rural). Knowing the geographical implications of transporting injured patients to definitive care in the province, our main concern was to evaluate how fast PAT patients were assessed and identified for surgical treatment and transferred for definitive care.

Transport problems explain why there are so many patients with peritonitis: theoretically patients should be managed within the 'golden hour'¹ after injury, but the evacuation capabilities and ability of doctors in peripheral hospitals are stretched to impossible limits. Patients with massive haemorrhage will die, and those who survive the initial insult will develop peritonitis.

In USA, Canada, Europe and other developed countries where health structures are different, signs of haemorrhage always surpass those of peritonitis in the patients presenting to hospital care.⁵⁻¹³ For the same reasons our treatment modalities focused mostly on immediate operative treatment, because the selection of patients for non-operative treatment is initially made in the peripheral institutions; in our series we managed only 9 patients in non-operative fashion; 4 of them needed later operation due to persistent abdominal pain. Only 1 had a significant intra-abdominal injury.

Per se this contradicts recent popularised methods of selective non-operative treatment in patients with penetrating abdominal injuries, but it is not always possible to apply internationally recommended methods to our local reality. Furthermore, all the GSW patients in the series had injuries requiring surgical repair, so non-operative management would have been a failure in this particular group of patients.^{3,5-8}

Only 3 of the patients needed damage control surgery, but we did not expect a large number due to the small number of patients. Other locations in the country and abroad may deal with larger numbers of such cases.^{7,8} Two patients died early due to progressive coagulopathy that we were unable to control.⁸⁻¹¹ The other one survived an injury to the superior mesenteric artery that was primary repaired over a temporary shunt. The patient later needed an extensive resection of small bowel and right colon due to arterial thrombosis, plus repair of a 'missed' duodenal injury using a 'T' tube.⁸⁻¹²

The patterns of organ injury are not different from other reports except that the liver and spleen were not the most damaged organs in the abdomen (probably related to long time elapsed between injury and definitive care). In our patients the leading roles were played by small bowel, colon and stomach, largely consistent with other series.³⁻⁶ In only 5 patients the laparotomies (5.6%) were declared negative (no injury found): 3 of the 9 patients initially managed non-operatively and later operated on because of persistent abdominal pain, and 2 patients identified as having peritonitis in the initial assessment who turned out to be free of visceral injuries. Some other series have shown a higher number of negative laparotomies.^{10,11}

Of 89 patients, 62 had an uneventful recovery. Fifteen patients needed 1 or more laparotomies to effectively control persistent peritonitis and MODS, which are the more commonly reported causes of serious morbidity in penetrating

trauma to the abdomen.^{7,9,14-18}

In our series 19 patients developed sepsis and MODS, largely in the GSW patients (latecomers with generalised peritonitis with obvious deterioration of physiological status). In these patients the commonest combination of organ failure was lung (ARDS), renal failure and cardiovascular failure (persistent shock status with increased need for inotropes). Other associated systems in failure were digestive and haematological (persistent anaemia and low platelets). These patients needed an average of 3 repeat laparotomies.

The overall mortality for the group of patients was 16.8%, largely related to sepsis and MODS, which is not different from other reports.^{1,3,4,7,14-18}

In our province, with the obvious disadvantages of long distances and the spread of medical services, with trauma services often far from the accident scenes, PAT is characterised by a high incidence of peritonitis, a factor that largely contributed to the overall results of the treatment, with longer stay in hospital and elevated costs. A prospective analysis of the incidence, morbidity and mortality related to PAT in our entire province is underway.

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