The spectrum of injuries resulting from posterior abdominal stab wounds: a South African experience

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ABSTRACT

INTRODUCTION The spectrum of injury associated with anterior abdominal stab wounds (SWs) is well established. The literature on the spectrum of organ injury associated with SWs to the posterior abdomen, however, is limited.

METHODS We reviewed our experience of 105 consecutive patients who had established indications for laparotomy managed over a 4-year period in a high volume trauma service in South Africa.

RESULTS Of the 105 patients, 97 (92%) were male and the overall mean age was 24 years. Fifty-seven patients (54%) had immediate indications for laparotomy. The remaining 48 patients (46%) initially underwent active clinical observation and the indications for laparotomy became apparent during the observation period. Of the 105 laparotomies performed, 94 (90%) were positive and 11 (10%) were negative. Of the 94 positive laparotomies, 92 were therapeutic and 2 were non-therapeutic. A total of 176 organ injuries were identified: 50 (53%) of the 94 patients sustained a single organ injury while the remaining 44 (47%) sustained multiple organ injuries. The most commonly injured organs were the colon ($n=63$), spleen ($n=21$) and kidney ($n=19$).

CONCLUSIONS The pattern of intra-abdominal injuries secondary to SWs to the posterior abdomen is different to that seen with the anterior abdomen. Colonic injury is most commonly encountered, followed by injuries to the spleen and kidney. Clinicians must remain vigilant because of the potential for occult injuries.

KEYWORDS

Stab wound – Posterior abdomen – Intra-abdominal injury

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Selective non-operative management (SNOM) of stab wounds (SWs) to the anterior and posterior abdomen has been practised for over three decades in South Africa.^{1,2} There is a considerable body of literature describing the spectrum of injury for SWs to the anterior abdomen but very little for SWs of the posterior abdomen.^{3–7} In light of this, a review was conducted of all patients requiring a laparotomy following a SW to the posterior abdomen to define the associated spectrum of organ injury.

Methods

This was a retrospective study undertaken at the Pietermaritzburg Metropolitan Trauma Service (PMTS) in South Africa. Our regional trauma registry was reviewed over a five-year period from January 2008 to December 2013. Ethics approval for this study and for the maintenance of the registry was endorsed formally by the Biomedical Research Ethics Committee of the University of KwaZulu-Natal

(reference BE 207/09). The PMTS provides definitive trauma care to the city of Pietermaritzburg, the capital of the KwaZulu-Natal (KZN) province. It also serves as the trauma referral centre for 19 other hospitals in the province, with a total catchment population of over 3 million. Approximately 3,000 trauma cases are admitted to the PMTS per year, over 40% with penetrating trauma. This is a direct reflection of the high incidence of interpersonal violence and serious crime experienced throughout the region.

Management protocol

We define the posterior abdomen by the area enclosed by the inferior angle of the scapula, the iliac crest and the posterior axillary line.⁸ The initial assessment of injury closely follows *Advanced Trauma Life Support*® principles.⁹ Further comprehensive assessment includes an appropriate history, physical examination, routine laboratory tests, urinalysis (for haematuria) and an erect chest x-ray (CXR).

We consider the following as absolute indications for immediate laparotomy: haemodynamic instability, frank peritonitis, pneumoperitoneum on CXR, bowel evisceration, necrotising fasciitis (especially if the injury occurred more than 48 hours previously). Patients who do not fulfil these criteria are admitted to the general trauma ward for active clinical observation.

We do not perform local wound exploration. Owing to the risk of developing necrotising fasciitis from a retroperitoneal colonic injury, we do not suture the wound and a clear colostomy bag is applied. Patients are kept nil by mouth with two-hourly vital signs recorded (including temperature, heart rate and blood pressure). Regular repeated physical examinations, undertaken by the same trauma surgeon, are performed to determine any change to the patient's clinical condition. Those who exhibit (or subsequently develop) signs of sepsis (new onset pyrexia, trending rise of leucocyte count, persistent tachycardia, increasing tenderness away from the site of injury, peritonitis, gastrointestinal intolerance or any unexplained clinical deterioration) proceed to laparotomy at the discretion of the duty trauma surgeon. All patients are observed actively for up to 48 hours. Thereafter, if the patient's clinical status remains unchanged, he or she is discharged home with advice to return.

Patients

Data were extracted from the trauma registry, which included all patients who sustained a SW in the defined anatomical region and who underwent a laparotomy. Those with concurrent injuries to the anterior abdomen were excluded. All patients with gunshot wounds were also excluded. Basic demographics information included age, sex and mode of presentation. Further detailed clinical information was obtained from reviewing each patient's charts, and included time of injury, time of presentation, site of injury, time to decision for laparotomy, complications, hospital stay and mortality.

The time from initial assessment to establishing the decision for laparotomy was further classified as <3 hours, <6 hours, <12 hours, <18 hours, <24 hours and >24 hours. Patients with an indication for immediate laparotomy (eg haemodynamic instability) were classed under the time period <3 hours.

Operative findings were classified as either positive or negative. A positive laparotomy denotes any organ injury (however minor) found intraoperatively as a direct result of the SW. A negative laparotomy is one where there are no injuries identified. Positive laparotomies were further divided into therapeutic or non-therapeutic. A positive therapeutic laparotomy was defined as findings of a significant organ injury that required operative repair (when failure to do so would result in an adverse outcome). A positive non-therapeutic laparotomy was defined as findings of an injury that was considered insignificant and if left alone, would not have amounted to any significant morbidity. These include minor splenic or liver laceration and non-bleeding small serosal or mesenteric injuries. The findings of injury were classified as either single organ or multiple organs. The spectrum of injuries was classified according to the frequency of the injury and the individual organ involved.

Table 1 Indications for laparotomy in the 105 patients. Over half of all patients developed peritonitis following stab wounds. Evisceration denotes visible protrusion of either bowel and/or omentum.

Indications	n
Peritonitis	52 (50%)
Haemodynamic instability	26 (25%)
Necrotising fasciitis	12 (11%)
Evisceration	8 (8%)
Pneumoperitoneum on chest x-ray	7 (7%)

All relevant data were extracted and initially summarised on an Excel® (Microsoft, Redmond, WA, US) spreadsheet for review.

Results

During the five-year study period, the PMTS managed 1,025 patients who had sustained a SW to the posterior abdomen. Of this total cohort, 105 patients (10%) required a laparotomy. Of these, 92% (97/105) were male and the mean overall age was 24 years.

Indications for laparotomy

Of the 105 patients, 57 (54%) had indications for immediate laparotomy. The remaining 48 patients (46%) were observed actively and the indications for laparotomy became apparent during the observation period. This constituted 5% (48/968) of all patients who underwent active clinical observation. All but one of the observed patients developed peritonitis. One patient absconded from the hospital during the observation period, represented 96 hours after initial assessment with septic shock from necrotising fasciitis and was operated on immediately. Table 1 summarises the indications for laparotomy in these 105 patients. Figure 1 shows the timescale from initial assessment to subsequent decision for laparotomy.

Operative findings

Of the 105 laparotomies performed, 94 were positive (90%) and 11 (10%) were negative. Of the 94 positive laparotomies, 92 were therapeutic and 2 were non-therapeutic. Both patients in the non-therapeutic group had minor splenic lacerations. Figure 2 summarises the operative findings.

Pattern of organ injury

The accuracy of physical examination in identifying the presence of organ injury was 90% (94/105). Among the 94 patients with positive laparotomies, 176 organ injuries were identified: 50 patients (53%) sustained a single organ injury while the remaining 44 (47%) sustained multiple organ injuries. Figure 3 shows the pattern of the 176 organ

injuries identified in the 94 patients. Table 2 summarises the operative procedures performed for the 176 organ injuries identified.

Morbidity and mortality

The overall complication rate for all 105 patients was 14% (15/105): 8 patients had renal impairment, 4 had minor wound sepsis and 3 developed pneumonia. The overall mortality rate was 5% (5/105); all five deaths were due to delayed presentation of retroperitoneal colonic injury, which presented as necrotising fasciitis and associated

septic shock states. All 12 patients who presented with necrotising fasciitis had colonic injuries and 8 of these had an isolated colonic injury. One patient had a concurrent renal injury, one had a concurrent duodenal injury, one had concurrent duodenal and gastric injuries, and one had concurrent duodenal, gastric and small bowel injuries. Eleven of the twelve cases with necrotising fasciitis were referrals from other hospitals.

The median time from injury to arrival at our trauma unit was 72 hours. All except one patient had had their

Table 2 Operative procedures performed for all organ injuries. Primary repair denotes simple closure of defects. Organ sparing procedures involve either simple packing or application of haemostatic agents. A corrugated rubber drain is routinely placed in the lesser sac following pancreatectomy (or alone as the definitive procedure) to allow external drainage.

Organs injured	n=176	Operative procedures	n=176
Colon	63	Primary repair	45
		Exteriorisation	15
		Anastomosis	3
Spleen	21	Organ sparing procedures	11
		Splenectomy	10
Kidney	19	Nephrectomy	15
		Organ sparing procedures	4
Pancreas	9	Drainage only	5
		Pancreatectomy	4
Diaphragm	15	Primary repair	15
Small bowel	14	Primary repair	14
Mesentery	10	Primary repair	10
Stomach	9	Primary repair	9
Liver	6	Packing	6
Duodenum	6	Primary repair	6
Ureter	2	Primary repair	2
Major vessels	2	Primary repair	2

wound sutured prior to assessment. (One patient presented directly to our trauma unit but absconded and subsequently re-presented at 96 hours following injury). All 12 patients required intensive care unit admission. The median length of hospital stay was 18 days. Five of the twelve patients eventually died from intractable sepsis and multiple organ failure. The mortality rate in this subgroup with necrotising fasciitis was 42%.

Discussion

The SNOM of anterior abdominal SWs is generally accepted as a safe approach and several studies have shown that a similar approach is also appropriate for posterior abdominal SWs. Anterior abdominal SWs are associated with intra-abdominal injuries in up to 40% of cases.¹⁵ The spectrum of organ injuries from SWs to the anterior abdomen is well documented. The most commonly involved organs are the liver (40%), small bowel (30%) and diaphragm (20%).⁹

Only 10% of cases with SWs to the posterior abdomen require a laparotomy, making it difficult for any single centre to accumulate sufficient experience to describe accurately the full spectrum of organ injury likely to be encountered in this specific type of injury.^{10–12,14–16} The

thick paraspinal musculature of the posterior abdomen may offer some degree of protection to the retroperitoneal structures, which may account for the much lower frequency for the need for laparotomy in these patients.

Our current study is one of the first to fully describe the spectrum of organ injury specifically associated with SWs to the posterior abdomen. It has shown that colonic injury is the most commonly encountered injury and represents over a third of all organ injuries. This is most likely due to its relatively fixed position in the retroperitoneum, along with its length, which occupies a large area of the posterior abdomen.^{12,14–17}

It is also common to encounter multiple organ injuries in this setting owing to the close proximity of the colon to solid organs.^{15,16} Intraoperative identification of colonic injury (especially in the posterior wall) requires generous mobilisation and other associated injuries must always be considered. The next most commonly injured organs are the spleen and kidney, which is once again in keeping with their posterior locations in the abdominal cavity. Pancreatic and duodenal injuries can be subtle, and the potential for these injuries must be considered in all patients with SWs to the posterior abdomen, especially if one does not deal with these injuries on a frequent basis. One should adhere strictly to careful and methodical operative exploration as missed injuries in this setting can be potentially disastrous.

In the subgroup of patients who presented with necrotising fasciitis, however, all were associated with missed retroperitoneal colonic injury. All of these patients were referred exclusively from rural healthcare facilities and presented with a protracted delay in referral (up to 80 hours). Furthermore, all but one patient had their wounds sutured, which we consider to be protocol violation and inappropriate management. In our experience, if an occult retroperitoneal colonic injury exists, provided that the wound is not sutured, a fistula will usually form and the potential for developing necrotising fasciitis is reduced dramatically.¹² Once necrotising fasciitis develops, the associated mortality is extremely high (42%). In the developed world, the liberal use of routine triple contrast computed tomography as the initial diagnostic choice has been described.^{18,19} Although it may allow early identification of certain injuries, this is generally not applicable in a resource constrained, developing world setting.

Conclusions

The pattern of intra-abdominal injuries secondary to SWs to the posterior abdomen is markedly different to that seen with the anterior abdomen. Colonic injury is most commonly encountered, followed by injuries to the spleen and kidney. Clinicians must remain vigilant because of the potential for occult retroperitoneal injuries.

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