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Penetrating Abdominal Injuries: Pattern and Outcome of Management in Khartoum

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ABSTRACT

Background: The pattern and presentation of penetrating abdominal trauma vary according to places and the structure of the present health system. As well controversies in management exist ranging from mandatory exploration to selective non-operative management. Objectives: To determine the pattern of penetrating abdominal trauma, current management practiced and outcome in Khartoum. Patients and Methods: The study was prospective, descriptive and hospital-based. It was carried out at the main three hospitals in Khartoum State. It was conducted over a period of one year from 2012 Mar to 2013 Mar. All patients who presented penetrating injury to their abdomen were included. Results: The study included 85 patients with a mean age of 28 years (SD ± 10). The male to female ratio was 11:1. Most of the patients (89.4%) were in the first four decades of their life. Twenty-three patients (27.1%) presented shock. Stab wound is the commonest mode of trauma seen in 83.5% of our patients. The majority of our patients were managed by exploratory laparotomy (81.2%), however 16 (18.8%) underwent conservative measures. Of the operated group, solid organ injuries were found in 22.9%, yet hollow viscous injuries were reported in 86.9% of the patients. Registrars operated on 78.26% of the patients. The rate of negative laparotomy of this study was 8.7%. Complications and mortality were encountered in 25.9% and 4.7% respectively. The mean hospital stay was 8.47 days (SD ± 10.6). Conclusion: This study demonstrates no difference in the pattern of intra-abdominal injuries. The rate of operative treatment is acceptable, but more laparotomies can be avoided if the haemodynamic stable patients without features of peritonitis were given a period of observation. The overall outcome was satisfactory.

KEYWORDS

Mandatory Laparotomy; Mortality; Non-Operative Management; Penetrating Abdominal Injuries

1. Introduction

Trauma is still the most frequent cause of death in the first four decades of life, and it remains a major public health problem in every country, regardless of the level of socioeconomic development [1]. The policy of mandatory exploration of penetrating abdominal wounds, particularly gunshot wounds (GSWs), remained largely unchallenged until the 1990s, when civilian authors reported the successful use of selective non-operative management of abdominal GSWs [2]. The abdominal viscera are among the most vulnerable organs of the body to penetrating trauma. The small intestine and colon respectively were the most prevalent abdominal organs damaged [3].

2. Patients and Methods

The study is a prospective, descriptive and analytic. It was carried out at the main three hospitals in Khartoum state, namely "Khartoum Teaching Hospital—KTH, Khartoum North Teaching Hospital—KNTH and Omdurman Teaching Hospital—OTH". It was conducted

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over a period of one year from 2012 Mar to 2013 Mar. All patients who presented with penetrating injury to their abdomen were included in the study. Patients presented with blunt abdominal trauma or penetrating trauma other than the abdomen were excluded. Nonprobability sampling technique was used; Data were collected using a predesigned and pretested questionnaire. The variables includes personal data, mode of trauma, presenting symptoms, findings on examination, intervention, operative findings and the outcome of management. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 20, and the P-value was considered significant if <0.05. Consent was obtained from all patients prior to participation into the study, together with the ethical clearance.

3. Results

This study included 85 patients. Their mean age was 28 years (SD ± 10), ranging from 2 to 65 years. Penetrating abdominal injuries (PAIs) were common in the first four decade of life 76 (89.4%). The age group 21 - 40 years was the most involved representing 55 (64.7%) (**Table 1**). Males were predominant 78 (91.8%) whereas females were only 7 (8.2%) making a male to female ratio of 11:1. The patients presented and managed at KTH were 44 (51.8%), OTH 27 (31.8%) and KNTH 14 (16.5%). Twenty three patients 27.1% presented to the accident and emergency department in state of shock and 20 (23.5%) with features of peritonitis. The mode of trauma varies between stab with knives or other sharp structures in 71 (83.5%) and gunshot wounds in 14 (16.5%). According to the site of the stab; the majority of our patients 62 (72.9%) sustained the trauma in their anterior abdomen, 10 (11.8%) in the flanks, 7 (8.2%) in the thoracoabdominal, 4 (4.7%) posterior abdomen and two patients (2.4%) had multiple stabs involving the posterior abdomen and the flank.

Evisceration through the stab wound was noted in 30 (35.3%) of the patients. The majority of them were omentum alone in 10 (33.8%) or associated with bowel in 4 (13.3%), followed by the small bowel alone in 7 (23.3%) or associated with either omentum, stomach or the colon, in 8 (26.7%) of the patients.

Imaging was done to 17 (20%) of the patients. Of them (58.8%) were focused abdominal sonographies in trauma (FAST), 5 (29.4%) plain abdominal and chest radiographies whereas CT scans were only done to two patients (11.8%). Local exploration of the wound was done to 28 (32.9%), in 18 of them (64.3%) it was involving the peritoneum and negative in 10 patients (35.7%). In 67.1% of the study group local wound exploration was not attempted. The operators were registrars, surgeons and medical officers, constituting 54 (78.26%), 14 (20.29%) and one (1.45%) respectively. The mean operative time was 2.6 hours (SD ± 0.84). However it was 1-2 hours in 40 (57.97%) of the patients, more than two hours in 25 (36.23%) and took less than an hour in only four patients. All our patients received prophylactic injectable antibiotics, 60 (70.6%) of them were Cefuroxime and Metronidazole infusion, 15 (17.7%) had Metronidazole with Cefatazidime and the rest Cephalosporin alone. However the majority 56 (81.16%) were contaminated and 13 (18.84%) were dirty wounds and antibiotic was continued as treatment.

Table 1. Age and gender distribution in the study population (n = 85).

Age (years)	Gender		Total
	Male	*Female*	
≤20	18	03	21 (24.7%)
21 - 40	51	04	55 (64.7%)
41 - 60	08	00	08 (09.4%)
≥61	01	0	01 (01.2%)
Total	78 (91.8%)	07 (08.2%)	85 (100%)

3.1. Intra-Operative Findings and Procedures Performed

The majority of our patients were managed by exploratory laparotomy 69 (81.2%) however 16 (18.8%) underwent conservative measures. Different combinations of abdominal organs were seen intra-operatively in many patients 26 (37.7%). However **Table 2** shows the frequency of individual organ damage in the study disregarding these combinations. Hollow viscus injuries (stomach, small and large bowel) occurred in 86.9%, while solid organ injuries (liver, spleen and kidneys) in 22.9%. All stomach, diaphragmatic, vascular, ureteric and isolated anterior abdominal injuries were repaired. Small bowel injuries were seen in 27 (39.1%), two third of them 19 (27.5%) ended with resection and anastomosis due to multiple injuries. While in large bowel trauma 23 (33.3%), colostomies were fashioned to the majority of them (16 (23.2%)). Splenic injuries were reported in 10 (14.5%) and splenectomy was carried out in 8 (11.6%). Renal injuries were seen in 6 (8.7%), and one patient had nephrectomy.

3.2. Outcome

Most of the patients 59 (69.4%) run smooth post-operative course and discharged home in good general condition. Complications were encountered in 22 (25.9%) and four patients died. The causes of their death were (haemorrhagic shock, sepsis and pulmonary embolus). Surgical site infection was seen in 16.4% from the whole study group. It constituted 63.4% from the group who developed complications, entero-cutaneous fistula in

Table 2. Subtype of abdominal injuries (many combinations were seen) and their treatment in the operated patients (n = 69).

Injured organ	No (Percent)	Procedure done	No (Percent)
Stomach	10 (14.5%)	Stomach repair	10 (14.5%)
Small Bowel	27 (39.1%)	R & A[a]	19 (27.5%)
		SB[b] Repair	08 (11.6%)
Large Bowel	23 (33.3%)	Repair of LB[c]	07 (10.1%)
		Colostomy	16 (23.2%)
Liver	06 (08.7%)	Liver repair	06 (08.7%)
Spleen	10 (14.5%)	Splenectomy	08 (11.6%)
		Splenorrhaphy	02 (02.9%)
Kidney	06 (08.7%)	Kidney repair	05 (07.2%)
		Nephrectomy	01 (01.4%)
Diaphragm	06 (08.7%)	Diaphragm repair	06 (08.7%)
Vascular	05 (07.2%)	Vascular repair	05 (07.2%)
Ureter	01 (01.4%)	Ureteric repair	01 (01.4%)
AAW[d]	10 (14.5%)	AAW[d] repair	10 (14.5%)

[a]Resection & anastomosis; [b]Small bowel; [c]Large bowel; [d]Anterior abdominal wall.

13.64% and venous-thromboembolism in one patient, (Table 3). The mean hospital stay was 8.5 days (SD ± 10.6).

4. Discussion

Penetrating abdominal injuries (PAIs) in Africa constituted 30% - 66% of the overall abdominal trauma burden in the accident and emergency department [4-7]. In our study it affects young patients, where the mean age was found to be 28 years. This is comparing to a mean age of 28 to 30 years, reported in other studies [7,8,10-13]. The great majority of our patients (89.4%) were in the first four decades of their life. This had been described by another author previously [8]. The preponderance of male gender 91.9% in our study was well described by others, 82.2% - 96.5% [5,8,9,11-14] and this might be explained by the fact that males were the bread earners.

4.1. Mode of Trauma, Injury Pattern

The causes of PAIs vary from place to place. In Sudan stab with knives or other sharp objects, ranked first as evident from this study 83.5% and a rate of 88.5% had been reported previously in Khartoum [4]. PAI was the mode of trauma in less than half of the patients in other studies [7,8,10], however in further series it was over 60% [6,9,13]. Gunshot injuries was documented in 16.5% in this study which was equivalent to others [4,8,14], however different authors in the literature revised, reported different magnitude of 23.0% [15], 29.4% [9], 31.1% [6], 38.0% [7], 49.2% [8] and 79.8% [10]. This reflects the combination of the associated intra-abdominal injured organs that frequently encountered in gunshot abdominal trauma.

Table 3. Types of complications in patients with penetrating abdominal injuries (n = 22).

Complication	Frequency	Percent
Surgical site infection	14	63.64
Wound dehiscence	01	04.55
Abdominal abscess	02	09.09
Entero-cutaneous fistula	03	13.64
Leak of large bowel	01	04.55
VTE[a]	01	04.55
Total	22	100.0

[a]Venous thrombo-embolism.

4.2. Presentation

The presentation of patients with PAI might be in state of haemorrhagic shock, features of peritonitis or just with omentum/bowel evisceration. In our study 27.1% were haemodynamically unstable when first seen and this agrees with 28% [4], but contrast with 11% in Munguni, *et al*. [8] and 17.9% in Monzon, *et al*. [10] studies. In these cases of shock solid organ injuries were commonly the reason. However peritonitis came next with incidence of 23.5% in our series, which was comparable to others [4,10]. In this respect hollow organ injuries were frequently encountered.

4.3. Site of the PAI

The anterior abdomen was the site commonly wounded, with 72.9% in our study and similarly described by A Salim *et al.*, 65% [11] but to lesser extend 34.8% in Monzon *et al.*, study [10]. Thoraco-abdsominal, which is superiorly delimited by the fourth intercostal space (anterior), sixth intercostal space (lateral), and eighth intercostal space (posterior), and inferiorly delimited by the costal margin [2] seen in 8.2% of the sample we studied, but this is a bit lower than reported 20.5% by A Salim *et al.*, [11]. Although PAIs from the back region was found in only four patients 4.7%, it was considered lower to other 14.5% [11]. In four of our patients 4.7% their surgery was limited only to wound exploration as there was no evidence of peritoneal penetration and this compares well to other studies [13].

4.4. Treatment

Non-operative management of blunt abdominal solid

organ injuries has become the standard of care [16]. However, routine surgical exploration remains the standard practice for all penetrating solid organ injuries. Although there is no debate that patients with peritonitis or haemodynamic instability should undergo urgent laparotomy after penetrating injury to the abdomen, it is also clear that certain stable patients without peritonitis may be managed without operation [17]. The rate of non-operative management in our study was 18.1% and this in agreement with 10.1% [10], 13.8% [7] and 15.3% [4]. However, in one study almost quarter of the patients with PAI were managed conservatively, yet A Salim on his study when to operate on gunshot he managed to discharged 79% from the hospital without surgery [11]. The rate of operative management of 81.2% in our study lie within the range reported in the literature [4-8,10-13,18], **Table 4**.

4.5. Intra-Abdominal Injuries

The most common traumatized abdominal organ in our study, was the bowel 72.5% (large 33.3%, small 39.1%), followed by stomach and spleen each in ten patients 14.5%. In the literature small bowel injuries accounted for 23% - 74% [4,7,10,13,19,20], while large bowel reported in 6.3% - 33.7% [7,9,10,13,20]. It seems clearly that our small bowel and large bowel injuries go well with other's works. The described stomach injuries 0.0% - 23.6% [4,7,10,13,20] and diaphragmatic injuries 0.0% - 9% [9,10,13], were nearly similar to ours.

In 31.9% of our patients solid organs trauma was faced (liver 8.7%, spleen 14.4%, kidneys 8.7%). On revising other studies, the rate of our liver injuries was found to be similar to 7% [9] and 10% [13], whereas it was noticeably contrasting 13.8% [4], 14.6% [10], 26.7% [20] and 33.3% [21]. However splenic injuries in the literature were similar to ours [7,10,13]. No biliary, pancreatic or duodenal injuries were reported in our series as others [7, 22]. Six of our patients (8.7%) were found intra-operatively to have left diaphragmatic injury, following PAI to the thorac-abdominal region. This simulates other findings, where the injury occurs on the left in 66% [10,23]. The difficulty is that diaphragmatic injuries, particularly after penetrating trauma, may initially go unnoticed, and without changes in the CXR images, diagnosis is made difficult, so high index of suspension is required [24]. Our rate of negative laparotomy compares well with Maurice *et al*. (4%) [7] and Pradeep *et al*. 8.1% [12], while M Ohene *et al*. [13] found up to 29.0% of his patients with no significant detected intra-abdominal injury at laparotomy.

Table 4. The percentage of operative treatment in patients with penetrating abdominal injuries among different studies.

Study	Year	OPM[a]
Salim A, *et al*. [11]	2002	21%
Monzon BI, *et al*. [10]	2004	89.9%
Musau PE, *et al*. [6]	2006	75.5%
Pradeep H, *et al*. [12]	2007	42.2%
Alec C, *et al*. (16) [18]	2008	41.4%
Siddig HD, *et al*. [4]	2008	69.4%
Ohene M, *et al*. [13]	2010	85.5%
Maurice, *et al*. [7]	2012	86.2%
Mohammad A, *et al*. [5]	2012	28.3%
Mnguni MN, *et al*. [8]	2012	90%
Current study	2013	81.2%

[b]Operative management.

4.6. Outcome

Patients who recovered satisfactory without complications in our study 69.4% compares well with Maurice *et al.*, 84% [7] and Monzon *et al*., 69.6% [10]. The rate of post-operative morbidity was high in our patients compared to 6% - 8% in other series [4,8]. This was attributed to the development of surgical site infection, though our frequency of 16.4% was comparable to 6.9% - 18% level of wound infection documented by others [7, 11]. In our study there were four mortal cases 4.7% and this is similar to the findings in the literature [3,4,6-8,10, 13]. The duration of admission in this study was 8.5 days, in keeping with previous studies elsewhere that confirmed the mean time for hospitalization to range between 9.2 and 10.5 days [6-8].

5. Conclusion

In conclusion, this study demonstrates no difference in the pattern of intra-abdominal injuries regardless of the mode of penetrating abdominal trauma. The rate of operative treatment is acceptable, but more laparotomies can be avoided if the haemodynamic stable patients without features of peritonitis were given a period of observation. The overall outcome was satisfactory.

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