AL-BUTANA JOURNAL Of APPLIED SCIENCE
http// : ojs.abutana.edu.sd ISSN: 1858-6616
Issue (18), June 2026, Page NO. 31-36

Management of Penetrating Abdominal Injuries during the Sudan

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Abstract

Penetrating abdominal injuries have become a global health issue. In Sudan, their occurrence has risen due to the armed conflict that began in April 2023, impacting the healthcare system in the capital city. This study aimed to assess the management challenges and outcomes of penetrating abdominal injuries at Wad Medani Teaching Hospital during the armed conflict. A retrospective, hospital-based cohort study conducted from April to October 2024 included all patients presenting with penetrating abdominal injuries related to the Sudan arm conflict. Data on demographics, injury mechanisms, clinical outcomes, surgical interventions, and complications were collected and analyzed using SPSS version 29. The study included 74 patients with a mean±SD age of 27.81 years, and a male majority of 69 (93.2%). Gunshot wounds were the most common injury type (71.6%), followed by stab wounds (18.9%), explosion-related injuries (6.8%), and penetrating injuries (2.7%). Laparotomy was the primary surgical intervention needed in 98.6% of cases. Blood transfusions were necessary for 93.2% of patients, and 43.2% required ICU admission. Postoperative complications included peritonitis (27.0%) and hemorrhage (25.7%).The mortality rate was 13.5%, and 74.3% of patients achieved full recovery. Challenges in providing care involved limited surgical resources (41.9%) and a lack of medical supplies (28.4%).The study concluded Critical insight into the management of PAT in conflict settings, emphasizing the need for timely access to care adequate surgical resources and comprehensive postoperative managements.

***Key words**: Abdominal injuries, penetrating abdominal injuries, Sudan arm conflict, laparotomy, and peritonitis*

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Introduction:

Trauma remains the leading cause of death among young adults. In developed countries, trauma accounts for 25% of deaths in the USA and is the primary cause of death for individuals aged 1 to 44 years [1]. Additionally, it presents a significant public health challenge worldwide, particularly in developing nations [2]. It has a substantial impact on the healthcare system, hospitalizations, and the socio-economic well-being of patients and their families [3].The abdominal viscera are the most vulnerable organs to penetrating trauma, with the small intestine and colon being the most frequently damaged abdominal organs [4]. Penetrating abdominal trauma is usually diagnosed easily and accurately. It is generally categorized into stab wounds and gunshot wounds, each requiring different treatment approaches [5]. Gunshot wounds and firearms are major threats to life because they increase patients' morbidity and mortality [6]. In Africa, especially in sub-Saharan countries, gunshot injuries and firearms pose a significant health concern, as millions of weapons are in use [7]. A severe conflict has erupted in Sudan between two military forces, one of which is paramilitary, in the context of power struggles, leading to the collapse of the healthcare system .The war that began in April 2023 in the capital of Sudan destroyed the infrastructure of well-equipped hospitals and specialized medical centers in Khartoum, which is considered the center of health services in Sudan [8]. Beyond the physical destruction of healthcare infrastructure, the war has also caused a severe shortage of medical staff [8]. Over 200 violations against healthcare workers have been recorded, including killings, kidnappings, and assaults, resulting in the deaths of 38 medical professionals. Many healthcare workers have fled the capital, leaving hospitals understaffed and struggling to handle the influx of injured patients and the increasing needs of the displaced population [9, 10].

Material and Methods

Study design

This study was a retrospective, descriptive hospital-based cohort study conducted from April to October 2024.

Ethical approval:

This study strictly adhered to the ethical standards outlined in the Declaration of Helsinki. This research was approved by the ethical review committee of the Sudan Medical Specialization Board, number 2/2024.

Study setting

The study area was Wad Medani Teaching Hospital, located in Wad Medani, Sudan. It is the central and referral hospital working during the armed conflict and providing a surgical facility. During the

arm-conflict most surgeons and health facility providers were displaced. The blood bank and the radiology department were not working.

Inclusion criteria

Patients admitted with abdominal stab or gunshot wounds and managed surgically at Wad Medani Teaching Hospital, with complete medical records, were included. The abdominal injuries should be related to conflict-related trauma.

Exclusion criteria

Patients with abdominal injuries from non-conflict causes or those with non-abdominal injuries were excluded from the study.

Sample size

The number of patients 74 were participate in the study population included all patients who presented with penetrating abdominal trauma at Wad Medani Teaching Hospital during the study period.

Data collection technique

Data were collected retrospectively from patient medical records using a standardized data collection sheet. The variables included demographic data such as age, sex, and occupation; types of abdominal injuries (e.g., gunshot or stab wounds); and time from injury to admission. Outcomes outlined included length of hospital stay, postoperative complications (e.g., infection, reoperation, bleeding), and mortality.

Data analysis

Data were entered into a statistical software program (SPSS version 29) for analysis. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. A p-value of <0.05 was considered statistically significant.

Results and Discussion:

This study emphasizes the impact of armed conflict on health services in Sudan. It causes significant morbidity and mortality among civilians and soldiers alike [11]. It reflects the severe effects of violence on healthcare systems and patient outcomes, as well as the resilience of medical professionals working under extreme conditions [12]. Despite the rising occurrence of such injuries, comprehensive data on their outcomes and complications in the context of this conflict are lacking. For instance, the mean age of 27.81 years and the male predominance (93.2%) are consistent with studies conducted in Afghanistan [13,] and Syria [14]. This study found that gunshot wounds

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accounted for 71.6% of penetrating abdominal injuries, with a mortality rate of 13.5%. Postoperative complications, such as peritonitis (27.0%) and hemorrhage (25.7%), were common. Gunshot wounds were the most common mechanism of injury (61.4% civilian 86.7% military), followed by stab wounds (18.9%) and explosion-related injuries (2.3. % civilian 13.3% military) Table 2. It was clearly observed that a small number of patients were seen in the study, which can be explained by many struggles and difficulties in accessing the hospital, in addition to those who did not survive to reach it and those who died at the scene. This in agreement with the findings of Arafat et al. [15]. The high rate of associated injuries (28.4%) in this study matches data from northern Iraq, where 92.3% of patients with penetrating liver injuries had additional injuries [16].These findings emphasize the need to strengthen trauma systems in conflict zones [14]. The higher prevalence of gunshot wounds in this study may reflect the specific nature of the armed conflict in Sudan, where firearms are more commonly used compared to explosive devices. The high rate of associated injuries (28.4%) in this study

is consistent with findings from northern Iraq, where 92.3% of patients with penetrating liver injuries had additional injuries [15]. This underscores the complexity of managing PAT in war zones, where multi-organ injuries are common and require comprehensive surgical interventions. The most frequent associated injuries 49 in this study were to the lower limb (8.1%) and upper limb (6.8%), which is similar to the findings of Arafat et al. [8], where multi-organ injuries were more common in gunshot victims. Blood Transfusion Requirement (Table 1). Blood transfusion was required for 93.2% of civilians and 93.3% of military patients (p = .980), showing no significant difference .ICU Admission ICU admission rates were similar between civilians (45.5%) and military personnel (40.0%) (Table 1).

Table -1 Blood Transfusion and ICU Admission

Parameter	Response	Count (N)	Percentage (%)
Blood Transfusion Required	NO	5	6.8%
	Yes	59	93.2%
ICU Admission Required	No	42	56.8%
	Yes	32	43.2%

Table -2 Type of Injury by Patient Status

Type of injure	Civilian N=44	Military N=30	P value
Gunshot wound	27 (61.4%)	26 (86.7%)	.001
Stab wound	14 (31.8%)	0 (0.0%)	
Explosion-related injury	1 (2.3%)	4 (13.3%)	
Penetrating injury	2 (4.5%)	0 (0.0%)	

Conclusion:

Critical insight into the management of PAT in conflict settings, emphasizing the need for timely access to care adequate surgical resources and comprehensive postoperative managements.

Consent for publication

Not applicable.

- Availability of supporting data

Data is collected with the corresponding author and is available upon request.

- Competing interests

Authors are declaring no competing interests

- Funding

No fund

- Authors' contributions

NMO and AMA conceived the idea and collected the data. MM designed the study. All authors wrote the manuscript, read the article, and approved the final version

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