Original Article

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Surgery Section

Clinical Profile, Management and Outcomes of Penetrating Abdominal Injuries: A Prospective Observational Study

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ABSTRACT

Introduction: Penetrating abdominal trauma is a major cause of morbidity and mortality worldwide. Prompt recognition and timely intervention are crucial for improving patient outcomes.

Aim: To evaluate the clinical profile, management strategies, and outcomes of patients presenting with penetrating abdominal trauma at a tertiary care centre.

Materials and Methods: This prospective observational study was conducted in the Department of General Surgery at Government Medical College and Hospital, Aurangabad (Chh. Sambhajinagar), Maharashtra, India between September 2020 and October 2022. A total of 68 patients with penetrating abdominal injuries were included. Patients were evaluated using clinical examination, laboratory investigations, and appropriate radiological imaging. Management was guided by haemodynamic status and clinical findings. Postoperative outcomes and complications were recorded.

Results: The majority of patients were young adults, with peak incidence in the 21-30-year age group 28 (41.2%) patients. The mean age was 31.7±11.2 years, with a male predominance 60 (88.2%) males. Homicidal stab injuries were the most common mode of injury 56 (82.4%) patients. The most frequently injured structures were the mesentery 17 (37.0%) patients and small bowel 16 (34.8%) patients. The most common operative procedures were mesenteric repair and primary bowel repair. The negative laparotomy rate was 13.0%. The mean hospital stay was 7.0±3.4 days. The overall mortality rate was 9 (13.2%) patients, mainly due to haemorrhagic shock and septic complications. Postoperative complications were observed in 17 patients with respiratory complications, surgical site infection, and burst abdomen (23.5% each) being the most common.

Conclusion: Penetrating abdominal trauma predominantly affects young adults and remains associated with significant morbidity and mortality.

Keywords: Laparotomy, Mesenteric injury, Morbidity, Mortality, Stab injury

INTRODUCTION

Trauma continues to be 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]. According to the Global Burden of Disease (GBD) 2019 study, injuries were responsible for approximately 4.4 million deaths globally and accounted for nearly 8% of total global mortality. Road traffic injuries, interpersonal violence, and self-harm constituted major contributors to trauma-related deaths, particularly among younger populations [2].

The abdomen is often referred to as a diagnostic "black box" due to the complexity of clinical assessment and variability in presentation. It is the third most commonly injured body region, with surgical intervention required in approximately 25% of civilian trauma cases [3].

Current management strategies include urgent laparotomy in patients with peritonitis or haemodynamic instability after penetrating injury to the abdomen. It is also clear that certain stable patients without peritonitis may be managed without operation [4].

Despite advances in trauma care, the mortality rate remains high in patients with penetrating abdominal injuries. Among the various mechanisms, penetrating trauma often requires urgent surgical intervention [5]. Most deaths occur within minutes to hours, making these injuries a critical component of surgical emergencies. The most commonly involved organs are the small intestine and colon, and the majority of postoperative complications are related to injuries of these structures [6,7].

Several factors influence outcomes in penetrating abdominal trauma. Therefore, the present study was undertaken to evaluate the clinical profile, management strategies, and outcomes of penetrating abdominal injuries in patients presenting to a tertiary care centre.

MATERIALS AND METHODS

This was a prospective observational study conducted at the Department of General Surgery, Government Medical College and Hospital, Aurangabad, Maharashtra, India from September 2020 to October 2022, after obtaining approval from the Institutional Ethics Committee of Government Medical College and Hospital, Aurangabad (Chh. Sambhajinagar), Maharashtra, India. IEC No: Pharma/IEC-GMCA/134/2020.

The study included patients presenting with penetrating abdominal trauma, defined as an injury caused by the mechanical force of a foreign object breaching the skin in the abdominal area and inflicting damage to the structures in its path and resulting in an open wound [8].

Sample size: A total of 68 patients with penetrating abdominal injuries were included in the study.

Inclusion criteria: All patients with penetrating injury to the abdomen confirmed clinically (presence of abdominal wound, evisceration, signs of peritonitis) and/or radiologically (free fluid, pneumoperitoneum, or organ injury on imaging) were included.

Exclusion criteria:

- Patients with penetrating abdominal injuries who were dead on arrival;
- Patients with blunt abdominal trauma.

- Patients with penetrating trauma involving regions other than the abdomen (chest, extremities, head, neck, face);
- Patients not willing to participate in the study.

Study Procedure

The following parameters were recorded:

- Demographic data - age, Gender;
- Mode of injury - stab, gunshot, bull gore, impalement;
- Time interval between injury and hospital presentation;
- Haemodynamic status at presentation - assessed using vital parameters including pulse rate, systolic blood pressure, respiratory rate, peripheral perfusion, urine output, and level of consciousness. Patients were categorised as haemodynamically stable or unstable based on Advanced Trauma Life Support (ATLS) guidelines [9].
- Clinical findings - abdominal pain, distension, evisceration, peritonitis;
- Imaging findings - X-ray, Focused assessment with sonography for trauma (FAST) , Contrast enhanced computed tomography (CECT) abdomen;
- Operative findings - organ involved, number and type of injuries;
- Operative procedures performed - primary repair, resection and anastomosis, stoma formation, etc.,
- Postoperative complications;
- Duration of hospital stay;
- Mortality.

Clinical Management: All patients were evaluated and resuscitated according to ATLS guidelines, including primary and secondary survey [9].

- Haemodynamically unstable patients, or those with peritonitis/ evisceration, underwent immediate exploratory laparotomy;
- Haemodynamically stable patients were evaluated with imaging modalities such as FAST and CECT before deciding management.

Patients were managed either operatively or conservatively based on clinical and radiological findings and were monitored for postoperative complications.

Outcomes measured:

- **Primary outcome:** Mortality
- **Secondary outcomes:** Morbidity (postoperative complications), organ involvement, type of surgical procedure, and duration of hospital stay.

STATISTICAL ANALYSIS

Data were entered into Microsoft Excel and analysed using Statistical Package for the Social Sciences (SPSS) version 26. Categorical variables were expressed as frequencies and percentages. Continuous variables were expressed as mean±standard deviation.

RESULTS

A total of 68 patients with penetrating abdominal trauma were analysed. The majority were young adults, with peak incidence in the 21-30-year age group 28 (41.2%) patients. The mean age of the study population was 31.7±11.2 years [Table/Fig-1].

Mode of Injury: Homicidal stab injury was the most common mode of injury (82.4%) [Table/Fig-2].

Clinical presentation: Peritoneal penetration was the most common presentation (67.6%), followed by omental evisceration (32.4%) and bowel evisceration (10.3%) [Table/Fig-3]. Radiological investigations: Radiological investigations were performed selectively. X-ray abdomen was performed in 36 patients, FAST in 31 patients, and CT scan in 10 patients [Table/Fig-4]. Significant findings included pneumoperitoneum on X-ray (n=8), free fluid or organ injury on FAST (n=9), and intra-abdominal injury on CT scan (n=5).

Variables	n (%)
Age group (years)	
10-20	7 (10.3)
21-30	28 (41.2)
31-40	17 (25.0)
41-50	12 (17.6)
51-60	4 (5.9)
Gender	
Male	60 (88.2)
Female	8 (11.8)
Total	68 (100)

[Table/Fig-1]: Sociodemographic characteristics of study participants (n=68).

Mode of injury	n (%)
Homicidal stab injury	56 (82.4)
Bull horn injury	4 (5.9)
Self-inflicted stab injury	4 (5.9)
Accidental injuries	4 (5.9)
Total	68 (100)

[Table/Fig-2]: Mode of penetrating injury (n=68).

Clinical presentation	n (%)
Peritoneal penetration	46 (67.6)
Omental evisceration	22 (32.4)
Bowel evisceration	7 (10.3)
Omental with bowel evisceration	5 (7.4)
Haemodynamic instability	5 (7.4)

[Table/Fig-3]: Clinical presentation (N=68).
Note: Multiple clinical features were present in some patients; hence percentages do not sum to 100%.

Investigation	Done (n)	Not Done (n)	Significant findings (n)
X-ray abdomen erect	36	32	8
Ultrasonography (FAST)	31	37	9
Computed Tomography (CT)	10	58	5

[Table/Fig-4]: Radiological Investigations (n=68).
Focused Assessment with Sonography for Trauma (FAST).

Injury Profile and Operative Management

Out of 68 patients, 46 patients underwent operative management, while the remaining were managed conservatively. Among operated patients:

- Single organ injury: 18 patients
- Multiple organ injuries: 22 patients
- No visceral injury: Six patients

The most commonly injured structures were mesentery (37.0%) and small bowel (34.8%), followed by colon (21.7%) and omentum (17.4%) [Table/Fig-5].

The most commonly performed procedures were mesenteric repair (37.0%) and primary small bowel repair (32.6%). *Multiple procedures were performed in some patients.*

In six patients (13.0%), no visceral injury was identified, and these were managed with peritoneal lavage and drainage.

Hospital Course and Outcomes

The mean hospital stay was 7.0±3.4 days. The overall mortality rate was 13.2% (n=9).

Organ involved	n (%) (n=46*)	Operative procedure	n (%)
Small bowel	16 (34.8)	Primary repair	15 (32.6)
		Ileostomy	1 (2.2)
Mesentery	17 (37.0)	Mesenteric repair	17 (37.0)
Colon	10 (21.7)	Primary repair	7 (15.2)
		Transverse colostomy	1 (2.2)
		Sigmoidostomy	2 (4.3)
Omentum	8 (17.4)	Omental repair	8 (17.4)
Vascular	5 (10.9)	Vascular repair/ligation	5 (10.9)
Stomach	3 (6.5)	Gastric perforation repair	3 (6.5)
Liver	1 (2.2)	Haemostatic application in liver laceration	1 (2.2)
Spleen	1 (2.2)	Splenorrhaphy	1 (2.2)
Gall bladder	1 (2.2)	Cholecystectomy	1 (2.2)
Urinary bladder	1 (2.2)	Urinary bladder repair	1 (2.2)
No visceral injury	6 (13.0)	Peritoneal lavage and drainage	6 (13.0)

[Table/Fig-5]: Injured organ and operative procedure (n=46*).
n=46* represents the total number of patients who underwent operative management; some patients had injuries involving multiple organs.

Complications

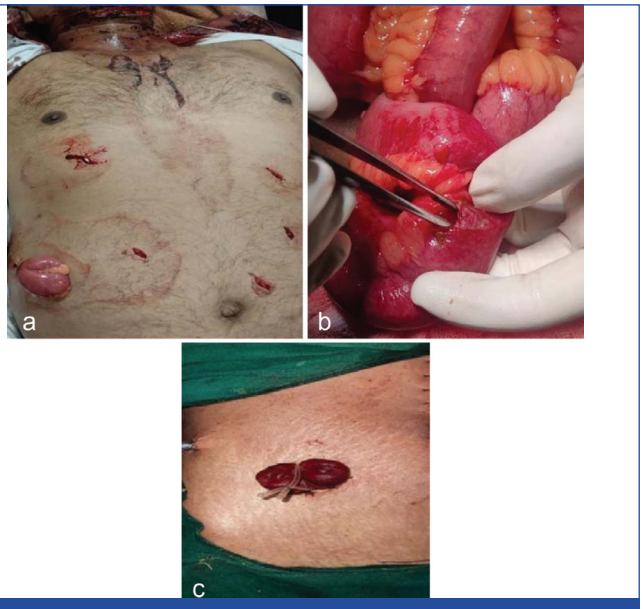
Complications were classified as:

- Early (within 7 days postoperatively);
- Late (after 7 days postoperatively);

Postoperative complications were observed in 17 patients who underwent laparotomy. The most common complications were respiratory complications (pneumonitis/Acute Respiratory Distress Syndrome [ARDS]), surgical site infection, and burst abdomen each 4 (23.5%) patients. Anastomotic leak occurred in 3 (17.6%) patients, while stoma prolapse was noted in 2 (11.8%) patients. Representative images are shown in [Table/Fig-6-9].

DISCUSSION

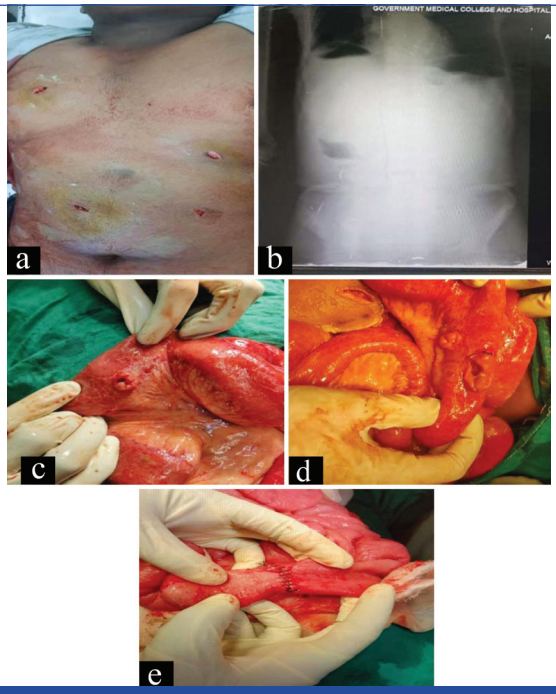
Penetrating abdominal trauma continues to be an important surgical emergency, especially in developing countries where interpersonal violence is still quite common. In the present study, the majority of the patients were young adults, with the highest incidence observed in the 21-30 year age group (41.2%), followed by the 31-40-year age group (25.0%). This observation is consistent with earlier studies by Tillu N et al., in which penetrating trauma to the abdomen was most commonly observed in age groups 16-30 years (68.5%) [10].



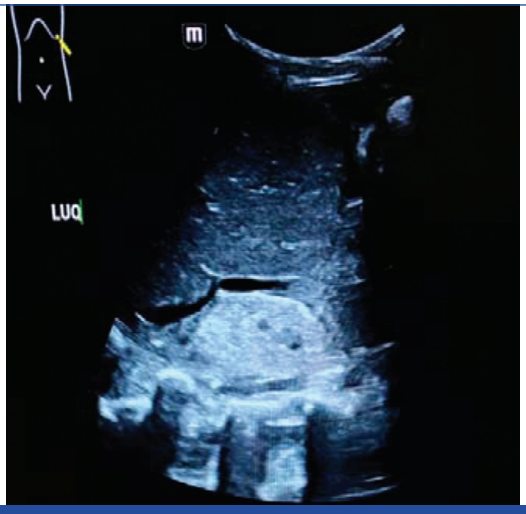
[Table/Fig-6]: a) Multiple stab wounds over the abdomen with evisceration of bowel; b) Intraoperative finding - Ileal perforation; c) Managed by primary closure of ileal perforation with double-barrel ileostomy.

Similarly, Rachha R et al., reported that penetrating abdominal trauma predominantly affected the age group of 21-30 years (41.67%) [11].

In present study, stab injuries, mainly homicidal were the most common cause of trauma, accounting for 82.4% of cases. Tillu N et al., observed that 83.33% of patients sustained homicidal stab wounds [10]. Rachha R et al., observed homicidal stab injury was the commonest mode of penetrating injury (53.33%) followed by self-inflicted stab injury (18.33%) [11], while Kiran SM et al., reported stab wounds as the predominant mechanism of penetrating abdominal trauma in 60% of their patients [12]. Babar KM et al., also found that stab injuries were the most predominant mode that constituting to 51.7% of penetrating abdominal injuries in their study population [13]. These findings likely reflect the increasing burden of interpersonal violence in both urban and semi-urban settings.

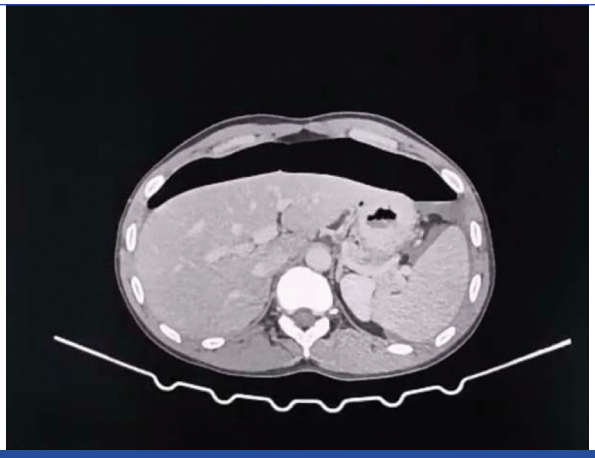


[Table/Fig-7]: a) Multiple stab wounds over the abdomen and chest; b) X-ray abdomen erect showing pneumoperitoneum (air under the diaphragm); c and d) Intraoperative finding showing multiple ileal perforations; e) Ileo-ileal anastomosis.



[Table/Fig-8]: Focused Assessment with Sonography for Trauma (FAST) demonstrating free fluid in the splenorenal recess of the left upper quadrant, indicative of haemoperitoneum.

Regarding the pattern of injury, the mesentery (37.0%) and small bowel (34.8%) were the most commonly involved structures in our study. However, Tillu N et al., observed the jejunum as the most frequently injured organ [10]. This variation may be related to differences in the type and direction of stab injuries encountered in our patients, where tangential penetrating wounds often involve the mesentery along with adjacent bowel loops and vascular structures.



[Table/Fig-9]: Contrast-enhanced axial CT scan of the abdomen demonstrating extensive pneumoperitoneum, suggestive of hollow viscus perforation following penetrating abdominal trauma.

In our study, computed tomography showed a higher diagnostic yield (50%) compared to FAST (29.0%) and plain X-ray (22.2%). In a study by Tillu N et al., 16 patients (29.6%) underwent FAST examination on admission. A total of 38 patients did not undergo FAST examination (70.4%). Of the total cohort of 54 patients, 12 (22.22%) had no abnormality detected on FAST examination, whereas four (7.4%) had positive findings on FAST [10].

The overall mortality rate in our study was 13.2%. Most deaths were related to haemorrhagic shock, sepsis, and delayed presentation. Osinowo AO et al., reported a mortality rate of about 8% [14], while Rajendran G et al., reported a total of six deaths in their study of 40 cases [7]. These observations highlight that haemodynamic instability, associated organ injuries, and delayed intervention remain important predictors of poor outcome in penetrating abdominal trauma.

Postoperative complications were seen in 17 patients who underwent laparotomy. The most common complications were respiratory complications, surgical site infection, and burst abdomen (23.5% each). Anastomotic leak (17.6%) and stoma prolapse (11.8%) were less common. Ramya CH et al., reported postoperative wound infection in 30% of patients and respiratory complications in 40% of cases [6]. Babar KM et al., also documented a high frequency of postoperative wound infection (24%), followed by chest infection (13%) [13]. Overall, our findings support a selective, imaging-guided approach in haemodynamically stable patients, while highlighting the importance of early resuscitation and timely surgical intervention in unstable cases.

Limitation(s)

This study has a few limitations that should be considered while interpreting the findings. Being a single-centre study with a relatively small sample size, the results may not fully represent the broader population of patients with penetrating abdominal trauma. The observational nature of the study also limits the ability to establish definite causal relationships between various clinical factors and patient outcomes. Long-term follow-up after discharge was not carried out, so delayed complications and long-term functional outcomes could not be evaluated. Additionally, advanced imaging modalities such as CT scans were not feasible in all patients because some required immediate surgical intervention, while others were managed in a resource-limited emergency setting. Despite these limitations, the study offers meaningful insight into the presentation, management, and outcomes of penetrating abdominal injuries in a tertiary care hospital setting.

CONCLUSION(S)

Penetrating abdominal trauma predominantly affects young adult males and continues to be associated with substantial morbidity and mortality. Early resuscitation, appropriate patient selection for operative versus selective non operative management, and timely surgical intervention are critical determinants of outcome. Strengthening trauma systems, improving diagnostic facilities, and establishing comprehensive trauma registries are essential to reduce preventable deaths in developing nations.

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