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Original Research Article

OUTCOME OF ABDOMINAL TRAUMA MANAGEMENT IN A LEVEL 1 TRAUMA CENTRE: 1-YEAR DESCRIPTIVE ANALYSIS

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ABSTRACT

Background: *Abdominal trauma constitutes a substantial proportion of emergency surgical admissions and remains a leading cause of preventable mortality in high-volume trauma centres. A comprehensive evaluation of perioperative trends, operative findings, complications, and short-term outcomes is essential to optimise trauma care pathways and guide effective resource allocation, particularly in low- and middle-income settings.* ***Objective:*** *To describe peri-operative status, intra-operative findings, post-operative complications, in-hospital mortality, and 30-day clinical outcomes among patients presenting with abdominal trauma at a Level 1 trauma centre.* ***Study Design:*** *Descriptive observational cohort study.* ***Settings:*** *Shaheed Mohtarma Benazir Bhutto Trauma Centre, Karachi, Pakistan.* ***Duration of Study:*** *1 January 2024 to 1 January 2025.* ***Methods:*** *A cohort of 100 patients presenting with abdominal trauma was analysed. Data collected included perioperative transfusion requirements and mortality; operative findings, such as gastrointestinal injury patterns and surgical procedures; intraoperative parameters; postoperative complications; length of hospital stay; and 30-day follow-up outcomes, including readmission, mortality, and functional recovery. Categorical variables were summarised as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation.* ***Results:*** *Pre-operatively, 48% of patients required blood transfusion, with a mean transfusion volume of 1.17 ± 1.39 units. No pre-operative mortality was observed. Among operative patients (n = 63), minor bowel injuries (28%) and colonic injuries (19%) were the most frequent hollow viscus injuries. Primary repair was the most commonly performed procedure (34%), and no intraoperative mortality occurred. The mean arrival-to-surgery time was 2.94 ± 2.34 hours, the mean estimated blood loss was 840.51 ± 358.55 mL, and the mean intensive care unit stay was 1.65 ± 1.94 days. Post-operative complications occurred in 39% of patients, with surgical site infection being the most frequent (40%). In-hospital mortality was 8%, and the mean hospital stay was 9.99 ± 3.48 days. At 30-day follow-up, 10% of patients required readmission, no additional mortality was recorded after discharge, and 69% of patients returned to premorbid functional status.* ***Conclusion:*** *Abdominal trauma at a Level 1 trauma centre was associated with moderate post-operative morbidity, predominantly driven by infectious complications and a notable in-hospital mortality rate. Although most survivors achieved functional recovery, the observed outcomes highlight the need for targeted improvements in perioperative optimisation, infection prevention strategies, and structured post-discharge follow-up.*

Keywords: Abdominal Trauma, Emergency Surgery, Peri-Operative Outcomes, Hollow Viscus Injury, Trauma Centre, Postoperative Complications

INTRODUCTION

Trauma remains a leading cause of death and disability among young adults worldwide, with low- and middle-income countries bearing a disproportionate burden of injury-related mortality and socioeconomic loss (1). Abdominal trauma contributes significantly to this burden and represents a significant component of emergency surgical admissions, accounting for a substantial proportion of preventable trauma-related deaths, particularly when diagnosis or intervention is delayed (2,3).

Patterns of abdominal trauma vary according to region, mechanism of injury, and healthcare infrastructure. Studies from Pakistan and neighbouring countries consistently demonstrate a predominance of young male patients, with road traffic accidents as the most common mechanism and blunt abdominal trauma occurring more frequently than penetrating injuries (3,4). A recent multicenter study further reported that blunt abdominal trauma is associated with a more extended hospital stay, increased intensive care unit admission, and higher transfusion requirements, mainly due to associated multisystem injuries (5).

Penetrating abdominal trauma remains an essential contributor to surgical workload in urban trauma centres. However, less frequent than blunt trauma in many civilian populations, penetrating injuries are associated with higher operative rates, increased transfusion needs, and greater resource utilisation (6,7). These injuries also carry a higher risk of intra-abdominal contamination and postoperative infectious complications, particularly when hollow viscus injury is present (8,9). Over the past two decades, management of abdominal trauma has evolved toward selective non-operative management in hemodynamically stable patients with solid organ injuries. Contemporary evidence supports non-operative management of blunt hepatic and splenic trauma, with reported success rates exceeding 80% in carefully selected patients (10–12). However, failure of non-operative management is more likely in patients with high transfusion requirements, combined organ injuries, or physiological instability, emphasizing the importance of careful patient selection and vigilant monitoring (10,11).

In contrast, hollow viscus injury remains associated with substantial morbidity and mortality, particularly when diagnosis or operative intervention is delayed. Systematic reviews and extensive cohort studies have shown that even short diagnostic delays significantly increase complication rates and mortality in blunt bowel injuries (13,14). Regional and international studies consistently identify delayed presentation, shock on arrival, and higher injury severity scores as key predictors of adverse outcomes (15–17).

Despite these advances, there remains a lack of comprehensive prospective data from high-volume Level 1 trauma centers in Pakistan that simultaneously evaluate injury patterns, time-to-intervention, operative versus non-operative strategies, and short-term outcomes,

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including 30-day follow-up. This one-year descriptive analysis was therefore undertaken to address this gap.

METHODOLOGY

This study was a prospective, descriptive analysis conducted at the Shaheed Mohtarma Benazir Bhutto (SMBB) Trauma Center, a Level 1 trauma centre in Karachi, Pakistan, from 1st January 2024 to 1st January 2025. After approval from the Institutional Review Board, all consecutive patients presenting with abdominal trauma over 12 months were enrolled. The study population consisted of patients aged ≥18 years with clinical, radiological, or intra-operative evidence of abdominal injury following either blunt or penetrating trauma. Patients who were dead on arrival, those referred after definitive laparotomy at another hospital, those with isolated extra-abdominal injuries, and those who declined consent or had incomplete records were excluded. A total of 100 consecutive eligible patients were included, providing sufficient precision for descriptive estimates of primary outcomes in this high-volume trauma setting.

Data were collected prospectively using a structured pro forma completed by the principal investigator and the on-call surgical team, without interrupting routine clinical workflow. At presentation, demographic variables (age, sex) and injury-related variables (mechanism, intent, mode of transport, and associated injuries) were recorded. Physiological parameters on arrival included systolic blood pressure, heart rate, and shock status; shock was defined as systolic blood pressure <90 mmHg and/or a shock index ≥0.9. Patients with shock on arrival were categorized into "responders" and "non-responders". Responders were defined as shock patients who responded to resuscitation and sustained hemodynamics; non-responders were defined as shock patients who did not respond to resuscitation and failed to maintain hemodynamics. Time intervals were documented as (i) injury-to-hospital arrival time (hours) and (ii) arrival-to-surgical intervention time (hours) for those undergoing laparotomy. Initial assessment and resuscitation details included focused assessment with sonography in trauma (FAST), contrast-enhanced CT where feasible, and early blood product use. The pattern of trauma was classified as blunt or penetrating, and primary organ-specific injuries (liver, spleen, kidney, pancreas, hollow viscus, or multiple organs) were recorded based on operative findings or imaging reports.

Management strategy was recorded **as** operative **or** non-operative**.** For patients undergoing laparotomy, intra-operative variables included type and extent of gastrointestinal (GI) injury (stomach, small bowel, colon, mesentery), presence of multiple GI injuries, estimated intra-operative blood loss, hemodynamic fluctuations, and operative procedures performed (primary repair, resection and anastomosis, stoma formation, damage-control surgery). Indications for surgery, need for intraoperative transfusion, and intraoperative mortality were also documented. For patients managed non-operatively, details of monitoring protocols, need for ICU admission, serial imaging, and delayed conversion to surgery were recorded. Pre-operative outcomes included deterioration before surgery, early transfusion requirements, and pre-operative mortality. Post-operative outcomes captured surgical-site infection, anastomotic leak, intra-abdominal infection secondary to intra-abdominal source, respiratory complications, wound dehiscence, need for re-operation, ICU length of stay, total hospital length of stay, and pre-discharge mortality. All patients were scheduled for a 30**-day postoperative follow-up** in clinic or by telephone, during which 30-day mortality, readmissions, late complications (e.g., infection, leak, bowel obstruction), and return to pre-morbid functional status were assessed. Outcome definitions were standardised prior to data collection: surgical-site infection, systemic infection, and respiratory complications were defined using conventional clinical and microbiological criteria, while return to pre-morbid function was defined as resumption of pre-injury daily activities without significant limitation. In patients with delayed presentation (>24 hours) and clinical features suggestive of peritonitis or gross contamination, the operative approach favored stoma formation over primary anastomosis when bowel injury was present, to reduce the risk of anastomotic failure in contaminated fields and physiologically compromised patients.

Data were entered into a secure database and were analysed using standard statistical software. Categorical variables (sex, mechanism, pattern of injury, shock status, management strategy, organ-specific injuries, and complication categories) were summarised as frequencies and percentages. Continuous variables (age, injury-to-arrival time, arrival-to-surgery time, transfusion units, estimated blood loss, ICU stay, and hospital stay) were summarised as means and standard deviations, or as medians and interquartile ranges when distributions were skewed. The primary analysis was descriptive, focusing on trends in injury patterns, management approaches, and outcomes. Exploratory comparisons between blunt versus penetrating injuries and operative versus non-operative management were planned using chi-square or Fisher's exact tests for categorical variables and Student's t-test or Mann–Whitney U-test for continuous variables, with a p-value <0.05 considered statistically significant.

RESULTS

The study included 100 patients with abdominal trauma, with a mean age of 31.14 ± 10.09 years. Males predominated in the cohort, accounting for 82%, while females accounted for 18%. Blunt trauma was the most common mechanism of injury (67%), followed by penetrating trauma (33%). Shock on arrival was observed in 33% of patients. Among those assessed for response status, 75% were responders and 25% were non-responders. The mean injury-to-arrival time was 4.00 ± 3.01 hours. Operative management was required in 63% of cases, whereas 37% were managed non-operatively (Table 1). Peri-operative assessment showed that 48% of patients required pre-operative blood transfusion, most commonly due to external hemorrhage (21%), internal hemorrhage (20%), and chronic anemia (7%). There was no pre-operative mortality. The mean number of transfusion units administered pre-operatively was 1.17 ± 1.39 units (Table 2).

Among the operative patients (n = 63), minor bowel injury was the most frequent gastrointestinal injury (28%), followed by multiple gastrointestinal injuries (25%), colonic injuries (19%), and gastric injuries (6%). Primary repair was the most commonly performed hollow viscus procedure (34%), followed by resection with anastomosis (28%) and stoma formation (15%). Solid organ procedures included splenectomy (8%), liver packing (6%), liver repair (3%), and damage-control liver surgery (3%). Re-exploration was required in 8% of cases, with no intra-operative mortality. The mean arrival-to-surgery time was 2.94 ± 2.34 hours, and the mean estimated blood loss was 840.51 ± 358.55 mL (Table 3).

Postoperatively, complications occurred in 39% of patients. Surgical site infection was the most common complication (40%), followed by systemic infection secondary to intra-abdominal sources (24%), anastomotic leak (16%), respiratory complications (3%), and wound dehiscence (8%). Reoperation was required in 5% of cases. In-hospital mortality was 12%. The mean ICU stay was 1.65 ± 1.94 days, while the mean total hospital stay was 9.99 ± 3.48 days (Table 4).

Among non-operative patients (n = 37), blunt trauma accounted for 89.2% of injuries. None of these patients presented with shock on arrival. Pre-operative transfusion was required in 35%. Isolated solid organ injuries were most common, particularly liver-only (37.8%) and spleen-only injuries (29.7%), with no hollow viscus injuries observed. Mild-to-moderate hemoperitoneum on CT was noted in 51.4% of

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cases. ICU admission was required in 30% of cases. The mean hospital stay was 8.1 ± 1.4 days, and the mean ICU stay was 0.3 ± 0.8 days. Most patients returned to pre-morbid functional status (89.2%), with a 30-day readmission rate of 8.1% (Table 5).

At 30-day follow-up, readmission occurred in 10% of patients, while 82% had no readmission; 8% were not applicable due to in-hospital mortality. There was no mortality reported after discharge within 30 days. Return to pre-morbid function was achieved in 69% of patients, whereas 23% did not fully recover functional status; 8% were excluded due to in-hospital death (Table 6).

Table 1: Demographic and clinical parameters

Variable	Category	Mean and Frequency
Age (Years)		31.14 ± 10.09
Sex	Male	82 (82%)
	Female	18 (18%)
Mechanism of Injury	Blunt	67 (67%)
	Penetrating	33 (33%)
Shock on Arrival	Yes	33 (33%)
	No	67 (67%)
Responders	Yes	25(75%)
Non Responders	No	8 (25%)
Injury-to-arrival time (hours)		4.00 ± 3.01
Operative Management	Yes	63 (63%)
	No	37 (37%)

Table 2: Peri-operative outcomes

Variable	Frequency
Pre-operative Transfusion Required	48 (48%)
1. External hemorrhage 2. Internal hemorrhage 3. Chronic Anemia	21% 20% 7%
Pre-operative Mortality	0 (0%)
Pre-operative transfusion units	1.17 ± 1.39

Table 3: Intra-Operative Outcomes (Operative Patients Only, n = 63)

Variable	Category	Mean and Frequency (%)
GI Injury Type	Small bowel	18 (28%)
	Colon	12 (19%)
	Multiple GI	16 (25%)
	Stomach	4 (6%)
Surgical Procedures (hollow viscus)	Primary repair	22 (34%)
	Resection + anastomosis	18 (28%)
	Stoma formation	10 (15%)
Surgical procedures (solid organ)	Liver packing	4 (6%)
	Liver suturing/repair	2 (3%)
	Damage-control liver surgery	2 (3%)
	Splenectomy	5 (8%)
Reexploration	Yes	5(8%)
Intra-operative Mortality	No	0
Arrival-to-surgery time (hours)		2.94 ± 2.34
Estimated blood loss (mL)		840.51 ± 358.55

Table 4: Post-operative outcomes

Variable	Frequency (%)
Post-operative Complication	25 (39%)
Surgical Site Infection (SSI)	10 (40%)
Anastomotic Leak	4(16%)
Systemic infection secondary to an intra-abdominal source	6 (24%)
Respiratory Complications	3 (3%)
Wound Dehiscence	2 (8%)
Reoperation	5 (5%)
In-hospital Mortality	8 (12%)
ICU stay (days)	1.65 ± 1.94
Total hospital stay (days)	9.99 ± 3.48

Table 5: Detailed Characteristics of Non-Operative Patients (N = 37)

Variable	Category	Frequency (%)
Mechanism of injury	Blunt	33 (89.2%)
	Penetrating	4 (10.8%)
Shock on arrival	Yes	0 (0%)
	No	37 (100%)
Pre-operative transfusion required	Yes	13(35%)
	No	24 (64%)
Solid organ injury distribution	Liver only	14 (37.8%)
	Spleen only	11 (29.7%)
	Kidney only	6 (16.2%)
	Liver + Spleen	3 (8.1%)
	Liver + Kidney	2 (5.4%)
	Spleen + Kidney	1 (2.7%)
Hollow viscus injury	Present	0 (0%)
Hemoperitoneum (CT)	Mild–Moderate	19 (51.4%)
	None/Trace	18 (48.6%)
ICU admission	Required	11(30%)
	Not required	26(70%)
Hospital LOS	Mean ± SD	8.1 ± 1.4 days
ICU LOS	Mean ± SD	0.3 ± 0.8 days
30-day readmission	Yes	3 (8.1%)
	No	34 (91.9%)
Return to pre-morbid function.	Yes	33 (89.2%)
	No	4 (10.8%)

Table 6: Outcome at 30 days

Variable	Category	Frequency	(%)
30-day Readmission	Yes	10	10
	No	82	82
	NA (died in-hospital)	8	8
30-day Mortality	Yes	0	0
	No	92	92
	NA (died in-hospital)	8	8
Return to Pre-morbid Function	Yes	69	69
	No	23	23
	NA (died in-hospital)	8	8

DISCUSSION

In this one-year descriptive cohort, nearly half of the patients required pre-operative blood transfusion, reflecting significant hemorrhage and physiological compromise at presentation. Transfusion requirement is a well-recognized marker of injury severity and has been consistently associated with higher rates of operative intervention and adverse outcomes in abdominal trauma (18). In resource-limited settings, transfusion needs may also reflect delayed presentation and limitations in prehospital care (19).

Among operative patients, small bowel and colonic injuries were the most frequently encountered hollow viscus injuries. This pattern aligns with previously published abdominal trauma series in which bowel injuries predominate among patients undergoing laparotomy and are associated with increased contamination burden and

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postoperative morbidity (20). The predominance of primary repair in this cohort reflects current surgical practice. At the same time, the selective use of damage-control surgery in physiologically unstable patients is well supported in modern trauma systems (21).

Postoperative morbidity occurred in 39% of operative patients, with surgical site infection being the most common complication. Similar infection rates have been reported following trauma laparotomy, particularly in patients with bowel injury and penetrating mechanisms (8,22). Penetrating abdominal trauma is known to carry a higher risk of postoperative infection and sepsis due to contamination and tissue devitalization (9). Systemic infection secondary to intra-abdominal sources and anastomotic leak rates observed in this study are consistent with outcomes reported in mixed abdominal trauma cohorts (17,22).

In-hospital mortality in the operative group was comparable to rates reported in other regional and international trauma studies (15,16). Mortality following abdominal trauma is strongly influenced by physiological status at presentation, presence of hollow viscus injury, and timeliness of operative intervention. Multiple studies have demonstrated that diagnostic delays, even as short as five to eight hours, significantly increase mortality in blunt bowel injury (14,18). The relatively short arrival-to-surgery time observed in this cohort may have contributed to acceptable mortality outcomes despite significant injury burden (13,17).

At 30-day follow-up, readmission occurred in a notable proportion of patients, emphasizing the importance of post-discharge surveillance in abdominal trauma care. Readmission due to late abdominal complications is increasingly recognized as an essential quality indicator, particularly following penetrating injuries and bowel trauma (22). Although most patients returned to pre-morbid functional status, a significant minority had not fully recovered at 30 days, highlighting the prolonged functional impact of abdominal trauma and the need for structured follow-up and rehabilitation pathways (18,21).

This study has several limitations. First, it was conducted at a single Level 1 trauma center, which may limit the generalizability of the findings to other settings with different patient populations and resource availability. Second, the descriptive design precludes causal inference and limits the ability to identify independent predictors of outcomes.

CONCLUSION

This one-year descriptive analysis showed that abdominal trauma at a Level 1 centre was associated with substantial peri-operative resource use, with nearly half of patients requiring pre-operative transfusion and most operative cases managed with primary repair. Post-operative morbidity was moderate, dominated by infectious complications such as SSI and systemic infection secondary to an intra-abdominal source, while in-hospital mortality remained clinically significant. At 30 days, readmissions occurred in 1 in 10 patients, and nearly 1 in 4 had not returned to premorbid function, highlighting the ongoing burden beyond discharge. These findings support strengthening early resuscitation and timely intervention pathways, alongside robust infection-prevention measures and structured 30-day follow-up to improve outcomes.

DECLARATIONS

Data Availability Statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned. (IRBEC-DUHS-0348/24)

Consent for publication

Approved

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

KAINAT SHEIKH*

Conceived the study, coordinated data collection, performed initial analysis, and prepared the first draft of the manuscript

OMER BIN KHALID JAMIL

Assisted in study design, data acquisition, and manuscript editing

MUNAZZA SHAMIM

Contributed to literature review, data organization, and interpretation of results

BUSHRA SAEED KHAN

Participated in data collection, patient coordination, and preparation of tables and figures

ABDULLAH NADEEM

Assisted in statistical analysis, data verification, and results compilation

IMRANA ZULFIKAR

Contributed to proofreading, critical revision, and final approval of the manuscript

All authors read and approved the final version of the manuscript.

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