Original Article

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Prevalence and Outcomes of Patients with Abdominal Trauma Referring to the Trauma Center of Shahroud University of Medical Sciences During 2019–2021

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Abstract

Background and Objective: Abdominal trauma is a major cause of morbidity and mortality worldwide and represents a significant public health concern, particularly in developing countries. Rapid urbanization, increased motor vehicle use, and industrial development have contributed to the growing burden of trauma in Iran. Understanding the epidemiological characteristics and outcomes of abdominal trauma is essential for improving management and prevention strategies. The present study aimed to investigate the frequency and clinical outcomes of patients with abdominal trauma presenting to the trauma center of Shahroud University of Medical Sciences.

Materials and Methods: This descriptive-analytical cross-sectional study was conducted on patients with abdominal trauma admitted to Imam Hossein Hospital in Shahroud between 2019 and 2021. Data were extracted from medical records using a structured checklist, including demographic characteristics, injury-related variables, clinical management, and outcomes. Data were analyzed using SPSS software (version 18). Continuous variables were expressed as mean ± SD or median (IQR) depending on the distribution, and categorical variables as frequencies (%). Comparisons were performed using independent t-tests, ANOVA, and Chi-square tests. A P-value < 0.05 was considered statistically significant.

Results: A total of 196 patients with abdominal trauma were included in the study (69.4% male). Blunt trauma was most common (92.9%), and traffic accidents were the leading mechanism (66.3%); penetrating trauma (7.1%) occurred only in men and was mainly related to interpersonal violence. Overall, 36.7% of cases required emergency surgery; 60.2% were admitted to the surgical ward, 33.7% to the ICU, and 6.1% died. Mean time to emergency department arrival was 77 min and mean hospital stay was 8.7 days. Analytical findings showed that patients with blunt trauma were significantly older than those with penetrating injuries (p=0.001). Penetrating trauma was also more frequently associated with the need for emergency surgery (*P*=0.001) and ICU admission as a clinical outcome (*P*=0.007). In addition, clinical outcomes were significantly associated with marital status (*P*=0.006), mechanism of injury (*P*=0.006), and the need for emergency surgery (p=0.001). In contrast, sex (*P*=0.978), underlying disease (*P*=0.141), and recent substance use within 24 h prior to trauma (*P*=0.401) were not significantly related to clinical outcomes.

Conclusion: Abdominal trauma in this setting predominantly affected males in economically active age groups and was mainly caused by traffic accidents and stab wounds. These findings highlight the importance of implementing effective preventive measures, including stricter enforcement of traffic safety regulations, public education on road safety, and community based violence prevention programs, to reduce the incidence of abdominal trauma and its associated complications.

Key words: Abdominal Injuries, Blunt Trauma, Penetrating, Stab Wounds, Trauma Centers, Wounds

Introduction

Trauma continues to be one of the most significant public health challenges worldwide, contributing substantially to mortality, long term disability, and economic burden. It is consistently reported as a leading cause of death among individuals aged under 40 years and remains a major contributor to the global burden of disease across all age groups (1). The growing number of road traffic accidents, interpersonal violence, and occupational injuries—particularly in low and middle income countries—has further increased the need for rapid diagnosis and effective management in trauma care systems (2). Among different categories of traumatic injuries, abdominal trauma holds a special clinical importance because it may involve damage to multiple vital organs such as the liver, spleen, kidneys, intestines, and major blood vessels. These injuries often present with subtle or nonspecific symptoms, making early recognition and timely intervention essential to prevent serious complications and reduce fatality (3).

Abdominal trauma is generally classified into blunt and penetrating types, each with distinct epidemiological characteristics and outcomes. Blunt abdominal trauma, frequently caused by motor vehicle collisions, falls, or sports injuries, is the most common type in many countries and is often associated with high energy impacts. Penetrating abdominal trauma—often resulting from stab wounds or gunshot injuries—tends to cause more localized but severe organ damage and may require immediate surgical intervention (4). Numerous studies conducted in different regions have demonstrated considerable variability in the prevalence, mechanism, and outcomes of abdominal trauma. For instance, some studies in developed countries have reported decreasing trends in penetrating trauma due to stricter weapons regulations, whereas studies from developing regions indicate high rates of blunt trauma related to traffic accidents (5). These variations underscore the influence of cultural, socioeconomic, and infrastructural factors on trauma patterns and highlight the importance of generating local and up to date evidence for health system planning (6). Despite a number of investigations in countries such as Turkey, India, and Nigeria, the epidemiology of abdominal trauma still shows wide regional differences, emphasizing the need for context specific studies (7).

In Iran, although trauma represents a major cause of emergency admissions and is a leading contributor to mortality—especially among young adults—recent evidence on the epidemiology and outcomes of abdominal trauma is limited (8). Most available studies in the country have examined general trauma patterns or specific mechanisms of injury, with insufficient focus on abdominal trauma as a distinct clinical entity (9). Moreover, data from various provinces indicate considerable regional variation in trauma mechanisms and outcomes, suggesting that localized studies are essential for accurate understanding and effective planning (10). In Semnan Province, and particularly in the city of Shahroud, updated information on the prevalence, characteristics, and clinical outcomes of abdominal trauma is scarce. The absence of recent and region specific data creates a significant gap in knowledge, potentially affecting the quality of trauma care, resource allocation, and prevention strategies (11). Therefore, the present study aims to determine the prevalence, demographic characteristics, mechanisms of injury, and clinical outcomes of abdominal trauma among patients referred to the Trauma Center of Shahroud University of Medical Sciences during the years 2019–2021, with the goal of providing evidence that can support clinical decision making and improve regional trauma management.

Materials and Methods

Study design

This study was designed as a retrospective descriptive–analytical cross sectional study.

Participants

The present study was conducted at Imam Hossein Hospital in Shahroud, which serves as the main referral trauma center in Semnan Province, Iran. All patients with abdominal trauma who were admitted to this hospital between 2019 and 2021 were identified through a review of hospital medical records. Because the objective of the study was to determine the frequency and clinical outcomes of abdominal trauma during a defined period, a census sampling approach was applied and all eligible cases were included. Therefore, no formal sample size calculation was performed. After reviewing all available records and applying the inclusion and exclusion criteria, a total of 196 patients were included in the final analysis. The total number of screened records, excluded cases, and reasons for exclusion were documented based on the available

hospital data. Patients were identified retrospectively through emergency department admission registries, hospitalization records, and surgical reports. The inclusion criteria were age greater than 12 years, presence of abdominal trauma caused by traffic accidents, interpersonal violence, or falls, and being alive at the time of arrival to Imam Hossein Hospital. The exclusion criteria included patients transferred from other hospitals after receiving initial management, outpatients, individuals who died at the scene of the accident or during transportation to the hospital, patients discharged against medical advice, and patients with severe traumatic brain injury such as intracranial hemorrhage or skull fractures detected on brain CT scans.

Sample size

In this study, a census sampling method was employed, including all eligible patients with abdominal trauma who were admitted to Imam Hossein Hospital during the study period (2019–2021). Since the study aimed to include the entire available population of trauma cases during this timeframe to determine frequency and clinical outcomes, no formal sample size calculation or power analysis was performed. Following the screening of hospital records and the application of inclusion and exclusion criteria, a total of 196 patients were included in the final analysis.

Data sources/measurement

Data were extracted from patients' medical records using a structured checklist designed by the research team based on previously published trauma studies. Prior to the main data collection, the checklist was pilot tested on 15 medical records to assess clarity and feasibility. Minor revisions were made accordingly. Data extraction was carried out by trained research assistants under the supervision of the principal investigator. When ambiguities were encountered in the records, the cases were re evaluated and resolved through discussion. The collected variables included demographic characteristics such as age, sex, and marital status. Age was recorded in complete years and subsequently categorized into age groups (13–20, 21–40, 41–60, and >60 years). Clinical and injury related variables included the mechanism of injury (traffic accident, fall, or interpersonal violence), type of abdominal trauma (blunt or penetrating), time interval between injury and hospital arrival, vital signs on admission (systolic and diastolic blood pressure and heart rate), presence of underlying diseases documented in the medical records, and history of alcohol or drug use when available. Diagnostic and therapeutic variables such as imaging methods used (Focused Assessment with Sonography for Trauma or abdominal CT scan), requirement for surgical intervention, and admission to the intensive care unit (ICU) were also recorded.

Standard trauma severity indices such as the Injury Severity Score (ISS), organ injury grading systems, and complete Glasgow Coma Scale (GCS) scores were not consistently documented in all patient records. Due to the retrospective nature of the study and incomplete documentation, these indicators could not be reliably analyzed and were therefore not included in the statistical analysis. This limitation was acknowledged as a methodological constraint of the study. The primary outcome of the study was in hospital mortality, defined as death occurring at any time during the hospital admission. Secondary outcomes included length of hospital stay (measured in days), ICU admission, need for surgical intervention related to abdominal trauma, and recorded in hospital complications when available in the patient records. Outcome data were obtained from discharge summaries, operative reports, and daily clinical notes. Medical records with missing essential information related to eligibility or the primary outcome were excluded during the screening stage. For other variables, analyses were performed using a complete case approach, meaning that cases with missing data for a specific variable were excluded only from analyses involving that variable. The number of missing observations for each variable was reported in the results tables, and no data imputation procedures were performed.

Statistical methods

Data analysis was performed using SPSS software version 18 (SPSS Inc., Chicago, IL, USA). Categorical variables were presented as frequencies and percentages, while continuous variables were summarized as mean and standard deviation or median and interquartile range depending on the distribution of the data. The normality of continuous variables was assessed using the Kolmogorov–Smirnov test and visual inspection of histograms, and the homogeneity of variances was evaluated using Levene's test. The independent samples t test was used to compare the mean length of hospital stay between two groups, while one way analysis of

variance (ANOVA) was used for comparisons among more than two groups. Associations between categorical variables, such as mechanism of injury and mortality or type of trauma and ICU admission, were examined using the chi square test. A p value less than 0.05 was considered statistically significant.

Results

A total of 196 patients with abdominal trauma were included in the study. Most patients were aged 20–39 years (40.8%), male (69.4%), married (65.3%), and without underlying disease (83.7%). No patient reported alcohol consumption within 24 h before trauma, while 23.5% had a history of drug use. Blunt abdominal trauma was the most common type of injury (92.9%), and traffic accidents were the leading mechanism (66.3%), followed by falls from height (18.4%). Overall, 36.7% of patients required emergency surgery. Most patients were admitted to the surgical ward (60.2%), 33.7% required ICU admission, and 6.1% died. The mean time from injury to hospital arrival was approximately 77 min, the mean GCS on admission was 14.7, and the average length of hospital stay was about 9 days (Table 1).

Table 1. Frequency Distribution of Demographic Variables in the Study Population

Variable	Category	Frequency	Percentage
Age (years)	<20	26	13.3
	20-39	80	40.8
	40-59	58	29.6
	≥60	32	16.3
Sex	Male	136	69.4
	Female	60	30.6
Marital status	Single	68	34.7
	Married	128	65.3
Underlying disease	No	164	83.7
	Yes	32	16.3
History of alcohol consumption within 24 hours before trauma	No	196	100
	Yes	0	0
History of drug use within 24 hours before trauma	No	150	76.5
	Yes	46	23.5
Type of abdominal trauma	Blunt abdominal trauma	182	92.9
	Penetrating abdominal trauma	14	7.1
Mechanism of injury	Traffic accidents	130	66.3
	Fall from the same level	12	6.1
	Fall from height	36	18.4
	Interpersonal violence (assault)	18	9.2
Need for emergency surgery	No	124	63.3
	Yes	72	36.7
Diagnostic method	Ultrasonography	112	36.7
	CT scan	84	42.9
Outcome	Admission to surgical ward	118	60.2
	Admission to ICU	66	33.7
	Death	12	6.1

	Mean	SD	Min	Max
Time elapsed from incident to arrival at the emergency department (minutes)	76.99	72.99	20	600
Glasgow Coma Scale on admission (GCS)	14.67	1.63	4	15
Systolic blood pressure on admission (mmHg)	121.11	19.04	80	170
Diastolic blood pressure on admission (mmHg)	76.50	12.03	50	100
Heart rate on admission (beats per minute)	89.98	17.68	52	140

Respiratory rate on admission (breaths per minute)	17.22	2.52	12	28
Blood oxygen saturation (%)	94.97	4.16	74	99
Length of hospital stay (days)	8.73	6.50	1	59

Patients with blunt trauma were generally older than those with penetrating injuries, and this difference was statistically significant. However, the time taken to reach the emergency department and the length of hospital stay were similar between the two groups, showing no significant differences (Table 2).

Penetrating trauma occurred only in men and was mostly caused by interpersonal violence, while blunt trauma was mainly due to traffic accidents. Patients with penetrating injuries required emergency surgery and ICU care much more often. In contrast, marital status and recent substance use showed no meaningful difference between the two groups (Table 3).

Table 2. Association between demographic variables and type of trauma.

Variable		Type of trauma		*P*-value
		Blunt	Penetrating	
Age	Mean	41.91	28.14	0.001
	Standard deviation (SD)	16.83	8.64	
Time elapsed from incident to arrival at the emergency department	Mean	77.03	76.43	0.976
	Standard deviation (SD)	74.51	51.19	
Number of days hospitalized / length of hospital stay	Mean	6.51	6.29	0.806
	Standard deviation (SD)	9.05	2.20	

Table 3. Association between demographic and trauma-related variables and the type of abdominal trauma.

Variable		Type of trauma		*P*-value
		Blunt	Penetrating	
Gender	Male	122(67)	14(100)	0.006
	Female	60(33)	0(0)	
Marital status	Single	62(34.1)	6(42.9)	0.565
	Married	120(65.9)	8(57.1)	
History of substance use within 24 h prior to trauma	No	140(76.9)	10(71.4)	0.743
	Yes	42(23.1)	4(28.6)	
Mechanism of injury	Traffic accidents	128(70.3)	2(14.3)	0.001
	Fall from standing height	12(6.6)	0(0)	
	Fall from height	36(19.8)	0(0)	
	Interpersonal violence	6(3.3)	12(85.7)	
Need for emergency surgery	No	122(67)	2(14.3)	0.001
	Yes	60(33)	12(85.7)	
Clinical outcome	Admission to the surgical ward	114(62.6)	4(28.6)	0.007
	Admission to the intensive care unit (ICU)	56(30.8)	10(71.4)	
	Death	12(6.6)	0(0)	

The results showed that age and length of hospital stay were significantly related to clinical outcomes. Patients admitted to the surgical ward were older on average than those admitted to the ICU or those who died. In addition, patients who required ICU admission had the longest hospital stay, while those admitted to the surgical ward had the shortest stay. Although patients who died arrived at the emergency department sooner on average, the time from injury to hospital arrival did not differ significantly between the outcome groups (Table 4).

Table 5 showed that marital status, mechanism of injury, and need for emergency surgery were significantly associated with clinical outcomes. Single patients and those injured in traffic accidents had more severe outcomes. Patients requiring emergency surgery were more likely to be admitted to the ICU or die. Gender, underlying disease, and recent substance use were not significantly associated with outcomes.

Table 4. Comparison of mean age, time elapsed from incident to arrival at the emergency department (minutes), and length of hospital stay according to clinical outcomes in the study population.

Variable		Clinical outcome			*P*-value
		Admission to the surgical ward	Admission to the intensive care unit (ICU)	Death	
Age	Mean	43.90	36.52	36	0.009
	Standard deviation (SD)	17.63	13.15	19.99	
Time elapsed from incident to arrival at the emergency department	Mean	85.17	68.03	45.73	0.097
	Standard deviation (SD)	86.89	43.69	24.57	
Number of days hospitalized / Length of hospital stay	Mean	2.66	13.12	7.67	0.001
	Standard deviation (SD)	1.58	12.08	6.43	

Table 5. Association between demographic and trauma-related variables and clinical outcomes.

Variable		Clinical outcome			*P*-value
		Admission to the surgical ward	Admission to the intensive care unit (ICU)	Death	
Gender	Male	82(69.5)	46(69.7)	8(66.7)	0.978
	Female	36(30.5)	20(30.3)	4(33.3)	
Marital status	Single	32(27.1)	28(42.4)	8(66.7)	0.006
	Married	86(72.9)	38(57.6)	4(33.3)	
Underlying disease	No	94(79.7)	60(90.9)	10(83.3)	0.141
	Yes	24(29.3)	6(9.1)	2(16.7)	
History of substance use within 24 h prior to trauma	No	94(79.7)	48(72.7)	8(66.7)	0.401
	Yes	24(20.3)	18(27.3)	4(33.3)	
Mechanism of injury	Traffic accidents	68(57.6)	52(78.8)	10(83.3)	0.006
	Fall from standing height	12(10.2)	0(0)	0(0)	
	Fall from height	28(23.7)	6(9.1)	2(16.7)	
	Interpersonal violence	10(5.1)	8(12.1)	0(0)	
Need for emergency surgery	No	114(96.6)	10(15.2)	0(0)	0.001
	Yes	4(3.4)	56(84.8)	12(100)	

Discussion

The present study provides a detailed overview of the epidemiology, mechanisms, and outcomes of abdominal trauma in a major referral center. Our findings demonstrate that abdominal trauma predominantly affects young adult males between 20 and 39 years of age, a demographic pattern consistently reported in global trauma research. The World Health Organization highlights young men as the most vulnerable population to severe injuries due to their greater participation in high risk behaviors, occupational exposures, driving patterns, and

societal roles (12). This alignment with international data reinforces the global significance of trauma as not only a medical challenge but also a social and behavioral phenomenon.

In our study, blunt abdominal trauma accounted for the majority of injuries. Road traffic accidents were identified as the leading cause, reflecting a widespread global trend. Despite significant advancements in vehicle engineering and road safety, road traffic injuries continue to constitute a major public health concern, particularly in low and middle income countries where enforcement of safety regulations and infrastructure development are limited (13). The high prevalence of vehicular trauma observed in our study mirrors findings from multiple trauma centers worldwide, where high energy impacts frequently result in complex injuries involving multiple organs (14, 15).

Notably, falls from height emerged as the second most common mechanism of injury. This pattern is particularly relevant in regions with rapid urbanization, extensive construction activity, and increased use of high-rise structures. Occupational exposure in fields such as construction, agriculture, and industrial labor significantly contributes to fall-related injuries. Similar observations have been documented in regional and international studies, suggesting that fall-related trauma is strongly influenced by workforce demographics and safety compliance standards (14, 15).

Penetrating abdominal trauma constituted a smaller yet clinically significant proportion of cases. Stab wounds were the predominant mechanism among these injuries. In contrast, firearm-related injuries dominate the spectrum of penetrating trauma in regions such as the United States, South Africa, and Latin America, where firearm accessibility is substantially higher (16). This difference highlights the influence of sociopolitical context, weapon accessibility, and patterns of interpersonal violence on trauma epidemiology. The predominance of stab wounds in our study is consistent with trauma patterns reported in Middle Eastern and Mediterranean countries, where knife-related violence is more frequent than gun-related assaults.

From a clinical standpoint, 36.7% of patients required surgical intervention. This proportion aligns with the global transition toward selective non-operative management (SNOM) for stable patients with blunt abdominal trauma, as recommended by the World Society of Emergency Surgery guidelines (17-19). Nevertheless, the considerable percentage of patients requiring laparotomy emphasizes the severity of injuries encountered in our center and underscores the importance of timely decision-making based on hemodynamic status, imaging findings, and standardized trauma protocols.

Additionally, ICU admission was required in 33.7% of cases, reflecting the complexity and potential instability associated with abdominal trauma. Differences in ICU utilization across institutions are often influenced by available resources, staffing, organizational structure of trauma systems, and clinical thresholds for intensive monitoring. High ICU demand indicates the need for well equipped trauma centers capable of managing multi system injuries, hemorrhage control, and post operative complications.

The overall mortality rate in this study was 6.1%, consistent with previously published data reporting mortality rates between 4% and 8% in abdominal trauma patients (15, 20). Importantly, all recorded deaths were associated with blunt injuries. This observation aligns with international evidence showing higher mortality among blunt trauma patients, often attributable to delay in diagnosis, hidden internal bleeding, and involvement of multiple organ systems (20). Effective resuscitation, early imaging, and adherence to Advanced Trauma Life Support (ATLS) principles are essential to reducing preventable deaths (21).

A key strength of the present study is its detailed evaluation of mechanisms of injury, correlation with clinical outcomes, and integration with internationally recognized trauma guidelines. Unlike many previous local studies, this research provides comprehensive insight into both blunt and penetrating trauma patterns while contextualizing findings within global trauma trends.

Despite its strengths, this study has unavoidable limitations. Its retrospective, single center design may limit external validity, and incomplete documentation of variables such as ISS, time to intervention, and organ specific injury grading may have influenced outcome interpretation. Additionally, excluding referred or multi-trauma cases may have underestimated the true mortality burden. Future studies should employ prospective designs, multicenter collaboration, and standardized trauma scoring systems.

Conclusion

Abdominal trauma remains a significant clinical and public health problem, particularly among young adult males. In this study, road traffic accidents were the leading cause of blunt abdominal trauma, followed by falls and stab wounds, highlighting the need for improved road safety measures and effective injury prevention strategies. The considerable proportion of patients requiring surgical intervention and ICU admission reflects the severity of these injuries and emphasizes the importance of well equipped trauma centers and timely management. Although the mortality rate was comparable to global reports, early diagnosis, rapid resuscitation, and adherence to standardized protocols such as ATLS are essential for improving patient outcomes. Future prospective multicenter studies using standardized trauma scoring systems are recommended to better identify risk factors and optimize trauma care.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of Shahroud University of Medical Sciences (Ethics Code: [IR.SHMU.REC.1401.138]). All patient information was anonymized before analysis, and no identifiable personal data were recorded in the research dataset. Access to the data was restricted to the research team, and confidentiality was maintained throughout the study.

Consent for Publication

Not applicable.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Author's Contribution

ZSN conceptualized and designed the study, developed the methodology, and supervised the research process. ASR collected the data and prepared the original draft of the manuscript. OG critically reviewed and edited the manuscript. HRM was responsible for the synthesis of the nanomaterials. All authors contributed to the interpretation of the findings, read and approved the final version of the manuscript, and agreed to be accountable for all aspects of the work.

Conflict of Interest

The authors declared no conflicts of interest.

Declaration of Generative Artificial Intelligence in Scientific Writing

We have not used any AI tools or technologies to prepare this manuscript.

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