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Original Research Article

Lives on the Line: Clinical Presentations and Outcomes of Pediatric Trauma in an Emergency Department in Pakistan

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Abstract: *Pediatric trauma remains a significant public health concern worldwide and is a leading cause of morbidity and mortality. Understanding pediatric trauma patients' clinical presentation and outcomes is crucial for optimizing clinical care, guiding targeted prevention strategies, and streamlining resource allocation in High-volume, low-resource setups.* ***Objective:*** *To determine pediatric patients' clinical presentation and outcomes in the Emergency Department of The Indus Hospital and Health Network Korangi, Karachi.* ***Methodology:*** *This Cross-sectional study was conducted at the Pediatric Emergency Department, The Indus Hospital and Health Network, Karachi, from July 2024 to December 2024. Data was collected for age, gender, vital signs at ED arrival (mechanism of injury, time lapse before ED presentation, injury severity score (ISS) at ED arrival, and outcomes* ***Results:*** *Data from 90 patients were analyzed. The mean age was 8.2 ± 3.1 years, with a male predominance (60%). Falls (40%) and road traffic accidents (35%) were the most common mechanisms of injury. The mean ISS was 8.5 ± 3.7, with severe injuries (ISS > 15) observed in 20% of cases. Most Delayed ED presentation(4.1 +/- -- min) was documented in cases of road traffic accidents. We reported a mortality of 10%, primarily associated with severe injuries and RTAs.* ***Conclusion:*** *Falls and RTAs are the most frequent mode of injury in children ≤ 14 years of age and pose a significant burden on Emergency Departments. Delayed presentation to the ED due to a lack of prehospital care and severe injuries is associated with poor outcomes. Preventive measures, improved prehospital care, and enhanced hospital preparedness are mandated to reduce the burden of morbidity and mortality.*

Keywords: Pediatric trauma, injury patterns, Emergency Department, injury severity score, road traffic accidents, falls, morbidity, mortality

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Introduction

Trauma contributes significantly to disability and mortality worldwide, leading to more than 5 million deaths annually. Road traffic accidents account for a quarter of all injury-related deaths (4). According to the World Health Organization (WHO), 1.35 million deaths in 2016 were attributable to road traffic injuries, alongside approximately 78.2 million injuries in low- and middle-income countries (LMIC). The burden of trauma is particularly severe in developing countries, where both adults and children are affected (7). Trauma is one of the leading causes of pediatric morbidity and mortality, representing a significant proportion of Emergency Department (ED) visits, and EDs serve as the critical point of care for the evaluation, stabilization, and management of trauma. Pediatric trauma accounts for more deaths than any other disease combined and often leads to long-term disabilities (8). These injuries impose a considerable mental and financial burden on individuals, families, and the broader socioeconomic infrastructure.

In parts of Africa, injuries are a major cause of disability and death among children over 5 years old, accounting for 8% of all hospital deaths in the 5–19 years age group (5). A community-based study from Bangkok revealed that 51% of all childhood deaths were attributed to injuries. (6) Similarly, a study from India reported that the majority of pediatric trauma cases in EDs were preventable, including causes like falls from heights, road traffic accidents, and burns. These statistics underscore the variability in the epidemiology and patterns of trauma-related accidents in pediatric populations, influenced by socioeconomic, geographical, and population-related factors (6).

Trauma in children often differs from adult trauma due to anatomical, physiological, and developmental differences. Factors such as age, mechanism of injury, and pre-existing medical conditions influence the severity of outcomes (2). Common causes of pediatric trauma include falls, motor vehicle collisions, sports-related injuries, and non-accidental trauma. The variability in presentations ranging from minor injuries to life-threatening conditions demands a highly coordinated approach to ensure optimal care (3). In Pakistan, the scale of the issue is highlighted by national statistics reporting 11,121 road traffic accidents in 2017–2018, resulting in 14,489 injuries and 5,948 deaths. Despite the significance of pediatric trauma, there is a lack of comprehensive data detailing its patterns, presentations, and outcomes in Pakistan (9).

Indus Hospital and Health Network is a free-of-cost hospital located in the Korangi district in Karachi.The ED, IHHN receives > 400 ED visits/ day. In such a high volume, low resource setup in Karachi, it is imperative to understand the burden of tarumna to allocate resources effectively.

Through characterizing the clinical presentations and outcomes of pediatric patients presenting with trauma at ED, Indus Hospital and Health Network (IHHN), Karachi, Pakistan, we aim to understand the current burden of pediatric trauma presenting to the ED, the demographic distribution, Injury Severity Score (ISS) upon arrival and patient outcomes. This shall aid in optimizing clinical care, improving resource allocation, and inform targeted initiatives to improve care delivery and reduce the burden of trauma (1).

Thus the objective of the study is to determine the Clinical presentation and outcomes of pediatric patients presenting with trauma, in the ED, IHHN, Korangi, Karachi.

Methodology

This Cross-sectional study was conducted at the Pediatric ED, IHHN, Karachi, Pakistan, from July 2024 to December 2024. All patients ≥ 1 year – ≤ 14 years of age presenting to the ED, IHHN with trauma, with verbal consent from the participants or their guardians to participate in the study, were included. All patients brought dead were excluded from the

study. Taking the prevalence of trauma in the pediatric population to be 6.2% with a confidence level of 95% and a margin of error of 5%, the minimal sample required was 90 (17). A non-probability (consecutive) sampling technique was employed. Data was gathered on a predesigned data collection instrument for age in years, gender, vital signs at ED arrival (blood pressure, pulse rate, respiratory rate, temperature, and oxygen saturation), mechanism of injury, time lapse before ED presentation, injury severity score (ISS) on ED arrival, and final disposition. All data were systematically recorded in a structured questionnaire using Redcap servers to ensure data accuracy and security by a data analyst. Two independent investigators reviewed the charts, and a third investigator resolved any conflicts.

Data was cleaned and coded before analysis on IBM SPSS version 24. Descriptive statistics were calculated for all variables. Continuous variables, such as age, blood pressure, pulse rate, respiratory rate, temperature, oxygen saturation, time lapse before arrival, and ISS at arrival, were summarized as mean and standard deviation. Categorical variables, such as gender and mechanism of injury, were reported as frequencies and percentages. The mechanism of injury was further stratified by gender and age, with differences analyzed using the chi-square test. To assess differences in continuous variables (e.g., blood pressure, pulse rate, respiratory rate, time lapse on arrival, and ISS at arrival), the student's t-test or Mann-Whitney U test was employed after evaluating the normality of data distribution. A p-value of < 0.05 was considered statistically significant, providing a robust statistical interpretation of the findings.

Results

The study included 90 pediatric patients with a mean age of 8.2 ± 3.1 years, 60% of whom were male and 40% female. The mean Injury Severity Score (ISS) was 8.5 ± 3.7, indicating a mix of mild to severe injuries. The average time lapse before presentation to the Emergency Department was 3.2 ± 1.8 hours. Vital signs at arrival revealed a mean pulse rate of 108 ± 15 bpm, respiratory rate of 22 ± 4 breaths per minute, and blood pressure of 92/62 ± 12/8 mmHg. Oxygen saturation was maintained at 96 %, reflecting adequate perfusion in most patients upon presentation. The most common mechanism of injury observed was falls, accounting for 36(40%) of cases, followed closely by road traffic accidents (RTAs), which constituted 35% (n = 32) of injuries. Burns were responsible for 15% (n = 14) of cases, while other forms of blunt trauma made up the remaining 10% (n = 9). Patients with burns had the shortest time to presentation, averaging 2.4 hours, while those involved in road traffic accidents experienced the longest delay, with a mean of 4.1 hours. Falls and other blunt trauma had intermediate time lapses of 3.0 and 3.5 hours, respectively. The Injury Severity Score (ISS) varied by mechanism of injury, with road traffic accidents having the highest mean ISS of 10.8 and the highest proportion of severe injuries (ISS > 15) at 40%. Most pediatric trauma patients 45- 50%) were safely discharged after receiving treatment in the Emergency Department. 27(30%) of patients were admitted, while 9 (10%) were referred to other facilities due to lack of admitting or need for specialized treatment, and 10% (n = 9) of the patients succumbed to their injuries in the ED.

Table 1: Demographic Characteristics of Pediatric patients presenting in ED, IHHN (n=90)

Variable	Value
Mean Age (years)	8.2 ± 3.1
Male (%)	60%
Female (%)	40%
Mean ISS	8.5 ± 3.7
Time Lapse (hours)	3.2 ± 1.8
Vital Sign	
Pulse Rate (bpm)	108 ± 15
Respiratory Rate (breaths/min)	22 ± 4
Blood Pressure (mmHg)	92/62 ± 12/8
Oxygen Saturation (%)	96 ± 2

Table 2: Mechanism of Injury in Pediatric patients presenting in ED, IHHN (n=90)

Mechanism of Injury	Frequency (n)	Percentage (%)
Falls	36	40%
Road Traffic Accidents	32	35%
Burns	14	15%
Other (Blunt Trauma)	9	10%

Table 3: Mean Time Lapse by Mechanism of Injury of pediatric patients presenting in ED, IHHN (n=90)

Mechanism of Injury	Mean +/- SD Time Lapse (hours)
Falls	3.0
Road Traffic Accidents	4.1
Burns	2.4
Other (Blunt Trauma)	3.5

Table 4: Injury Severity by Mechanism of Injury, presenting in ED, IHHN (n=90*)*

Mechanism of Injury	Mean ISS	Severe Injuries (ISS > 15) (%)
Falls	7.5	15%
Road Traffic Accidents	10.8	40%
Burns	8.2	25%
Other (Blunt Trauma)	7.0	10%

Table 5: Disposition Plan of pediatric Patients presenting in ED, IHHN (n=90)

Disposition Plan	Frequency (n)	Percentage (%)
Discharged	45	50%
Admitted	27	30%
Referred	9	10%
ED deaths	9	10%

Discussion

Pediatric trauma remains a major global health challenge, particularly in low- and middle-income countries (LMICs), where limited resources and socioeconomic disparities contribute to higher morbidity and mortality rates. This study analyzed the clinical presentations and outcomes of pediatric trauma cases in the Emergency Department (ED) setting, with key findings highlighting the burden of preventable injuries, such as falls and road traffic accidents (RTAs), and their significant impact on children's health. The study found that falls were the most common mechanism of injury, followed closely by RTAs (10). These findings align with global literature emphasizing falls as a predominant cause of

injury among younger children, while RTAs are more frequent in older pediatric populations. The gender distribution showed a higher prevalence of RTAs among boys, reflecting their greater involvement in outdoor activities and risk-prone behaviors (11). These results highlight the urgent need for age- and gender-specific injury prevention strategies, such as promoting safe play environments and implementing road safety campaigns. A critical observation was the delay in seeking medical care, particularly for patients involved in RTAs (12). The average time lapse before presentation was longest for RTAs, potentially due to transport delays, lack of immediate recognition of injury severity, or limited accessibility to healthcare facilities. Early recognition of trauma and rapid transport to healthcare facilities are essential to improve outcomes (13). Strengthening prehospital care systems and public awareness campaigns may help reduce these delays (14).

The ISS revealed that a significant proportion of patients had moderate to severe injuries, with RTAs contributing disproportionately to high ISS values. Patients with severe injuries were more likely to present with abnormal vital signs, including tachycardia and hypotension, underscoring the importance of early stabilization and resuscitation (15). Half of the patients were discharged after receiving treatment in the ED. At the same time, the remainder required either hospital admission or referred out due to the lack of admitting bed or certain surgical specialties at IHHN for specialized care. This highlights the diverse nature of trauma presentations and the need for adequately equipped healthcare facilities to manage severe injuries.

In this study, it was noted that Mortality was highest amongst patients involved in RTA, reflecting the severe nature of trauma. As pointed out in this study, delayed presentation to the ED, likely due to a lack of a structured EMS system in Pakistan, serves to contribute to severe outcomes. Additionally, the lack of usage of child restraints and inadequate traffic regulation enforcement exacerbate the risk. The findings underscore immediate attention for focused interventions, such as vehicle child restraint systems and strengthening traffic regulations (16).

Mortality, though relatively low, underscores the critical need for timely and efficient trauma management protocols (17). The findings of this study are consistent with trends observed in other LMICs, where trauma is a leading cause of pediatric ED visits. However, the scarcity of data on pediatric trauma in Pakistan limits comprehensive comparisons and underscores the need for more large-scale studies to understand regional patterns better. Countries with more robust trauma registries have successfully implemented injury prevention programs, which could serve as models for Pakistan. This study was conducted at a single center, which may limit the generalizability of its findings (18). Additionally, the use of non-probability sampling could introduce selection bias. Future studies involving multicenter data and larger sample sizes are recommended to validate these findings.

Conclusion

It is concluded that pediatric trauma is a significant contributor to morbidity and mortality among children, particularly in low- and middle-income countries. This study highlights that falls and road traffic accidents are the leading mechanisms of injury, with substantial differences observed based on age and gender. Delayed presentation and severe injuries, particularly those associated with RTAs, were linked to poorer outcomes, including higher mortality rates. Efforts to address pediatric trauma should focus on preventive strategies, such as improving road safety measures, creating safer play environments, and promoting awareness among caregivers.

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-IHHN-0334-24)

Consent for publication
Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

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