

Original Research Article

PATTERNS OF PAEDIATRIC TRAUMA IN A TERTIARY CARE HOSPITAL OF ASSAM

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ABSTRACT

Background: Pediatric trauma is a major cause of emergency department attendance and may vary according to demographic characteristics, injury mechanism, severity, anatomical location etc. As there is limited data in hospitals of North-East India regarding this issue, the present study was undertaken to assess the patterns of trauma among pediatric patients attending the emergency department of a tertiary care hospital in Assam.

Materials and Methods: This was a prospective observational study conducted over a period of one year, from July 2024 to June 2025, at a tertiary care institute in Assam. The pediatric trauma patients up to the age of 18 years brought to the Emergency Department of the institute were included in the study. Demographic variables, Injury related characteristics, and Treatment related factors were recorded. Data were analyzed using descriptive and inferential statistical methods using Jamovi.

Results: 185 pediatric trauma patients were initially assessed for eligibility and finally 149 patients were included in the analyses. The mean age of the cohort was 7.71 ± 3.89 years. There were 107 males (71.8%) and 42 females (28.2%). Falls from height and road traffic accidents together accounted for more than half of all pediatric trauma cases (29.5% and 27.5% respectively). A statistically significant association was observed between sex and mechanism of injury by Pearson's Chi-square test ($p = 0.018$). Mechanism of injury also differed significantly across age groups. Mild injuries constituted the majority of cases (69.8%). A Chi-Square test of independence demonstrated that injury severity was significantly associated with patient outcome ($p < 0.001$). Hospital admission varied significantly according to the injured body system and patients with multisystem involvement or polytrauma had the highest admission rate. After adjustment for age, sex and severity, severe injury was associated with higher odds of hospital admission compared with mild injury (adjusted OR 2.304) in multivariate binary logistic regression. Kruskal-Wallis H test utilized to evaluate differences in length of stay across clinical severity categories revealed a statistically significant difference in hospital duration based on injury severity ($p = 0.001$).

Conclusion: The mean age of 7.71 ± 3.89 years reflects the fact that children are increasingly prone to injury as they grow due to increased exposure to outdoor activities, greater mobility and decreased parenteral monitoring. The pediatric trauma population was predominantly male, with fall from height and road traffic accidents being the major causes of trauma. Our findings highlight that organised and timely triage can create a pathway for the disposition of pediatric trauma patients without requiring hospital admission as was evident by the high percentage (47.7%) of patients discharged directly from the emergency department and only two-fifths (37.6%) of patients requiring hospital admission. The study findings also highlight the importance of understanding local pediatric trauma patterns for emergency care planning and resource allocation.

Keywords: Pediatric Trauma, wounds, injury, accidental falls

INTRODUCTION

Trauma is one of the main causes of morbidity and mortality in children worldwide. Improving emergency care and preventative measures requires an understanding of the trends and consequences of pediatric trauma.^[1] Depending on its cause, trauma can be categorized as either blunt or penetrating. Childhood head injury represents a particular public health problem because of its potential for lifelong disability and burden. Pediatric trauma differs significantly from adult trauma because of the unique anatomical, physiological, and developmental characteristics of children.^[2]

The emergency department (ED) serves as the first point of contact for the majority of injured children requiring immediate medical attention. Rapid assessment, timely resuscitation, and appropriate referral are essential to improve outcomes and reduce disability. Information regarding the epidemiological profile, mechanism of injury, place of injury, severity of injury, and outcomes of pediatric trauma presenting to emergency departments is valuable for resource allocation, planning trauma services, and developing preventive interventions.^[3] However there is limited data in hospitals of North-East India regarding this issue. Hence, the present study was undertaken to assess the patterns of trauma among pediatric patients attending the emergency department of a tertiary care hospital.

Aims and Objectives

Aim: To assess the patterns of trauma among pediatric patients attending the emergency department of a tertiary care hospital.

Objectives

Primary objective: To describe the demographic characteristics, patterns, mechanisms, anatomical distribution and severity of pediatric trauma patients presenting to the emergency department.

Secondary objectives

1. To determine the association of demographic factors with the mechanism of injury.
2. To assess the association between injury severity and patient outcome.
3. To evaluate the association between injured body system and hospital admission among the patients.
4. To identify factors independently associated with hospital admission after adjustment for relevant demographic and clinical variables.
5. To compare the duration of hospital stay across injury-severity categories.

MATERIALS AND METHODS

Our study was a prospective observational study conducted over a period of one year, from July 2024 to June 2025, at a tertiary care institute in Assam. This institute caters to injured patients who are brought directly to the centre and those referred from other peripheral healthcare centres. The study was

approved by the Institutional Ethics Committee of KMCH. Upon arrival, the emergency department team stabilized the patient in the emergency, and thereafter, the data were recorded by an investigator.

Inclusion Criteria

1. Pediatric trauma patients up to 18 years of age presenting to the emergency department of KMCH.
2. Patients with complete demographic and clinical outcome data
3. Patients whose parents gave consent for the study.

Exclusion Criteria

1. Trauma patients not fulfilling the age criteria
2. Patients with incomplete demographic and clinical outcome data
3. Patients whose parents did not give consent for the study.
4. Patients who presented with a history suggestive of child abuse or intentional self-harm.
5. Patients not accompanied by parents or legal guardian.

Data collection

After the investigator obtained consent from one of the parents or the legal guardian of the child, demographic variables were taken including age, gender, and place of residence. Injury related characteristics recorded were the mechanism of injury (road traffic accident, fall, fall of heavy object, or others), type of injury (blunt, penetrating, or mixed), the anatomical region involved, and the injury severity score (ISS). Treatment related factors included referral status (direct or referred), level of the referring facility (primary, secondary, or tertiary), mode of transport to the center (ambulance or private vehicle), choice of definitive therapy (operative or conservative), duration of hospital stay, and outcome of hospital stay (discharged, left against medical advice [LAMA], absconded, or expired). Severity of injury was measured using the ISS. Patients were categorised as having mild (ISS 1–8), moderate (ISS 9–15), or severe (ISS ≥ 16) injury.⁴ The confidentiality and anonymity of patient data were strictly maintained.

Data Analysis

The data were entered into Microsoft Excel 2019 on a password-protected computer and analyzed using Jamovi (Computer software, version 2.7). Data were analyzed using descriptive and inferential statistical methods. Continuous variables are expressed as mean $\pm$ standard deviation (SD) while categorical variables were reported as frequencies and percentages. Categorical variables were compared using Chi-square tests. Multivariate binary logistic regression was performed to identify factors associated with hospital admission with results expressed as adjusted Odds ratios (OR) and 95% confidence intervals (CI). Duration of hospital stay was analyzed using Krushal-Wallis H test because of its non-normal distribution, followed by Dwass-Steel-Critchlow-Flinger (DSCF) pairwise comparisons. All statistical tests were two-sided and $p < 0.05$ was considered statistically significant.

RESULTS

A total of 185 pediatric trauma patients were initially assessed for eligibility during the study period. Of these, 19 patients were excluded because they did not meet the eligibility criteria or had incomplete records. The remaining 166 eligible patients were enrolled. During data cleaning and analysis, 17 additional patients were excluded because of incomplete clinical information or missing outcome data, leaving a final sample of 149 patients. The participants' selection process is illustrated in Figure 1.

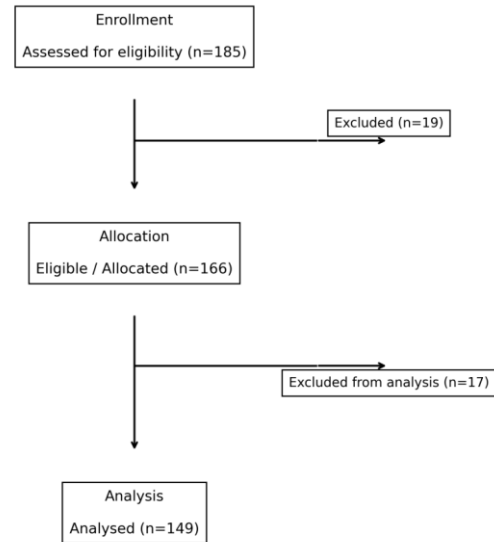


Figure 1: Flow diagram of participant selection

Patient Characteristics

A total of 149 pediatric trauma patients were included in the final analyses (Table 1). The median age was 8.0 years (IQR: 4.5–11.0 years), with a mean age of 7.71 ± 3.89 years (range: 0.25–14 years). There were 107 males (71.8%) and 42 females (28.2%), with a male-to-female ratio of approximately 2.5:1. The majority of the patients belonged to the 6–12-year age group (56.4%).

Table 1: Baseline demographic and clinical characteristics of the study population (N = 149)

Variable	Category	Value
Age (years)	Mean $\pm$ SD	7.71 ± 3.89
	Median (IQR)	8.0 (4.5–11.0)
	Range	0.25–14
Sex	Male	107 (71.8)
	Female	42 (28.2)
Age group	0–5 years	47 (31.5)
	6–12 years	84 (56.4)
	>12 years	18 (12.1)

Pattern of Injury

Falls from height and road traffic accidents together accounted for more than half of all pediatric trauma

cases (29.5% and 27.5% respectively). Home (60.4%) was the most common place of injury, followed by road-related incidents (28.9%).

Table 2: Pattern of pediatric trauma

Variable	Category	n (%)
Mode of injury	Fall from height	44 (29.5)
	Road traffic accident	41 (27.5)
	Fall on level ground	28 (18.8)
	Accidental cut	16 (10.7)
	Sports injury	12 (8.1)
	Assault	8 (5.4)
Place of injury	Home	90 (60.4)
	Road	43 (28.9)
	School	11 (7.4)
	Playground	5 (3.4)
Severity	Mild	104 (69.8)
	Severe	40 (26.9)
	Moderate	5 (3.4)

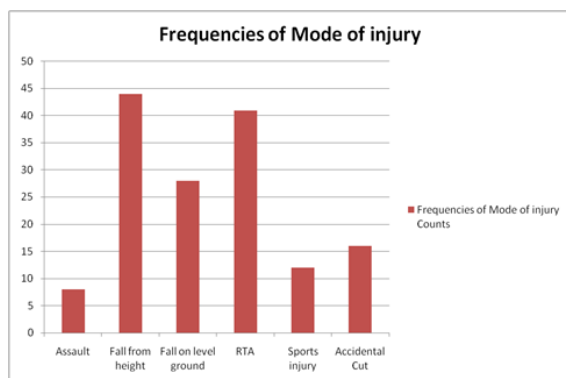


Figure 2: Bar diagram showing modes of injury

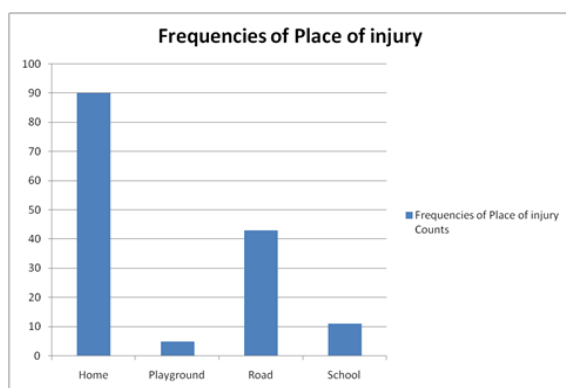


Figure 3: Bar diagram showing places of injury

Association of Demographic Factors with Mechanism of Injury

A statistically significant association was observed between sex and mechanism of injury by Pearson's Chi-square test ($\chi^2(5) = 13.6$, $p = 0.018$, Cramer's $V = 0.303$). Mechanism of injury also differed significantly across age groups ($\chi^2(10) = 30.6$, $p < 0.001$, Cramer's $V = 0.320$).

Injury Severity and Clinical Outcomes

Mild injuries constituted the majority of cases (69.8%), followed by severe (26.9%), and moderate (3.4%) injuries. Overall, nearly two-fifths (37.6%) of patients required hospital admission, while almost half (47.7%) were discharged directly from the emergency department. A Chi-Square test of independence demonstrated that injury severity was significantly associated with patient outcome ($\chi^2(6) = 61.1$, $p < 0.001$, Cramer's $V = 0.453$).

Table 3: Injury severity and patient outcomes

Severity	Outcome				Total
	Admitted	Discharged	LAMA	Referred	
Moderate	3	2	0	0	5
Mild	33	66	5	0	104
Severe	20	3	3	14	40
Total	56	71	8	14	149

Body System Involvement and Hospital Admission

Hospital admission varied significantly according to the injured body system ($\chi^2(3) = 8.92$, $p = 0.031$,

Cramer's $V = 0.245$). Patients with Multisystem involvement or Polytrauma had the highest admission rate.

Table 4: Hospital admission according to body system involved

Systemic Involvement	Total Cases (n)	Admitted (n)	Admission Rate (%)
Multi-system / Polytrauma	53	28	52.80%
Isolated Musculoskeletal (Orthopedic)	74	23	31.10%
Craniomaxillofacial & TBI	21	5	23.80%
Isolated Abdominal	1	0	0.00%
Total	149	56	37.60%

Factors associated with hospital admission

A multivariate binary logistic regression model was constructed to examine predictors of hospital admission. After adjustment for age, sex and severity, severe injury was associated with higher odds of

hospital admission compared with mild injury (adjusted OR 2.304; CI = 1.078-4.93; $p = 0.031$). Neither Age nor Sex was independently associated with hospital admission.

Table 5: Multivariable logistic regression for predictors of hospital admission

Model Fit Measures			
Model	Deviance	AIC	R^2_{MCF}
1	188	198	0.0447

Predictor	Estimate	SE	Z	p	Odds ratio	95% Confidence Interval	
						Lower	Upper
Intercept	-0.6899	0.4276	-1.614	.107	0.502	0.217	1.16
Sex:							
Female – Male	0.6387	0.3819	1.672	.094	1.894	0.896	4.00
Severity:							
Moderate – Mild	1.1978	0.9527	1.257	.209	3.313	0.512	21.43
Severe – Moderate	-0.3632	0.9826	-0.370	.712	0.695	0.1014	4.77
Severe – Mild	0.8346	0.3877	2.153	.031	2.304	1.078	4.93
Age in years	-0.0374	0.0457	-0.818	.413	0.963	0.881	1.05

Duration of Hospital Stay

As the distribution of hospital stay duration was positively skewed and violated assumptions of normality, a non-parametric Kruskal-Wallis H test was utilized to evaluate differences in length of stay across clinical severity categories. The test revealed a statistically significant difference in hospital duration based on injury severity ($\chi^2(2) = 13.1$, $\varepsilon^2 = 0.0888$, $p = 0.001$).

Patients with Severe injuries demonstrated the highest median length of stay (Median = 1.0 day; IQR 0.0 – 2.0), whereas patients with Mild injuries had the lowest (Median = 0.0; IQR 0.0 – 1.0) and Moderate (Median = 1.0; IQR 0.0 – 1.0) injuries fell intermediately.

To determine which specific groups differed, Dwass-Steel-Critchlow-Fligner (DSCF) pairwise comparisons were conducted. The post-hoc analysis indicated that length of stay was significantly longer for patients with Severe injuries compared to those with Mild injuries ($p = 0.001$). No other pairwise comparisons reached statistical significance ($p = 0.397$ for Moderate vs. Mild, and $p = 0.770$ for Moderate vs. Severe).

DISCUSSION

This study describes the demographic characteristics, injury patterns, clinical severity, hospital disposition, and length of stay among pediatric trauma patients presenting to a tertiary care hospital. Among the 149 patients analyzed, males were predominant, accounting for 71.8% of cases while the overall mean age was 7.71 ± 3.89 years. Children aged 6-12 years constituted the largest age group (56.4%). It may reflect the fact that children are increasingly prone to injury as they grow due to increased exposure to outdoor activities, greater mobility and decreased parenteral monitoring. The predominance of males may probably be due to high risk taking behaviour and over inquisitiveness towards the external environment as often seen in pre adolescent male children. Here our findings are consistent with other comparable studies.^[5,6] However these explanations cannot be established from the present observational data and should be interpreted cautiously.

The home was the most frequent location of injury (60.4%) followed by road. Studies from other states of India and from other countries, such as Trinidad and Nigeria,^[6,7,8] demonstrated similar findings. The home is generally considered the safest place for

children, but results from this study demonstrated that domestic surroundings carry an unrecognized risk of injury for the pediatric population.

In our study, falls from height were the leading cause of trauma across all age groups, followed by RTAs as the second most common cause of injury, which correlates with reports from other studies.^[9,10] The predominance of falls and road traffic injuries also suggests that injury-prevention strategies should consider both household safety and road-safety measures.

A statistically significant association was observed between sex and mechanism of injury ($\chi^2(5) = 13.6$, $p = 0.018$), while mechanism of injury also differed significantly across age groups ($\chi^2(10) = 30.6$, $p < 0.001$). These findings suggest that the distribution of trauma mechanisms were not uniform across demographic groups. The association of age may reflect differences in children's activities and environments at different developmental stages. However the cross-sectional design of the study does not permit causal conclusions.

Our study demonstrated that mild injuries constituted the majority of cases (69.8%), followed by severe (26.9%) and moderate (3.4%) injuries. Nearly two-fifths (37.6%) of patients required hospital admission, while almost half (47.7%) were discharged directly from the emergency department. This is broadly reassuring and indicates that organised and timely triage can create a pathway for the disposition of pediatric trauma patients without requiring hospital admission. The relatively strong association between severity and disposition is clinically plausible, as more severe injuries generally require longer monitoring and treatment.

The majority of injured children had sustained musculoskeletal injury, consistent with findings from other studies in India, Western Iran, and Australia which reported orthopedic injuries as the most common in children.^[6,11,12] Hospital admission also differed according to body system involvement ($\chi^2(3) = 8.92$, $p = 0.031$). In our study, the highest admission rate was seen among pediatric patients with polytrauma (52.8%) This findings rather than isolated injury involving a single anatomical region. This finding is complimented by the logistic regression analysis, which showed that severe injury (by ISS category) remained an independent predictor of hospital admission after adjustment for age and sex. Taking this into consideration, ISS-based severity stratification should guide triage and admission

policy in pediatric trauma patients. However the small number of patients in the moderate-severity group (n=5) may have resulted in imprecise estimates for some severity comparisons.

The length-of-stay analysis further supports the clinical importance of severity grading, as patients with severe injury had a longer hospital stay than those with moderate or mild injury ($\chi^2(2) = 13.1$, $p = 0.001$). DSCF post-hoc analysis showed a significant difference between severe and mild injuries ($p = 0.001$), whereas the other pairwise comparisons were not statistically significant. The findings indicate that greater injury severity was associated with longer hospitalization, but the relatively small effect size ($\epsilon^2 = 0.0888$) suggests that severity alone cannot account for all variation in hospital stay.

CONCLUSION

Pediatric trauma is a significant cause of morbidity and mortality in India, accounting for almost one-fifth of injured patients and represents a substantial contributor to emergency department workload. It affects more male children than female children, with the most frequent injuries arising from falls and road traffic accidents in and around the home. While the majority of cases were mild and managed without admission, injury severity was found to be the principal determinant of the need for hospitalization and duration of hospital stay. The consistency of these injury patterns with reports from other parts of India and other countries suggests that domestic and peridomestic environments, particularly the home environment, represent a priority target for injury-prevention initiatives aimed at children. The findings of our study can help emergency departments in guiding resource allocation, staff training, and the deployment of age-appropriate safety programmes to prevent trauma in children. However the interpretation should consider the limitations of the study mentioned below.

Limitations of the study

Our study has several strengths, including its prospective design, data collected directly at the point of care, and the use of a standard scale, the Injury Severity Score (ISS), which allows comparison with studies from other centres. But the study has several limitations too as it was conducted in a single centre with a short study period on a comparatively modest

study population. In addition, long-term functional outcome and post-discharge morbidity were outside the scope of the study. A wider and more extensive study may further be undertaken in the future to study a wider geographic location to supplement our current findings.

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Conflicts of interest: There are no conflicts of interest.

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