

Frequency, Etiology and Covariates of Maxillofacial Trauma in Children Presenting to the Oral and Maxillofacial Surgery Department at Tertiary Care Hospital

Saif Ullah, Zahid Qayyum, Harmain Kayani, Hina Amin, Humna Sattar, Muddasar Ahmed

Department of Oral & Maxillofacial Surgery, Hayatabad Medical Complex, Peshawar, Pakistan.

Abstract

Background: Maxillofacial traumas is one of the most common pediatric emergency and has which requires urgent care and hospital admissions. Rapid urbanization, poor implementation of safety regulations, a rise in traffic accidents, and restricted access to specialized healthcare all make the burden worse in low- and middle-income nations.

Objective: To determine the frequency, etiology, and associated covariates of maxillofacial trauma among children presenting to the oral and maxillofacial surgery department of Hayat Abad Medical Complex, Peshawar, Pakistan.

Materials and Methods: The study design was cross-sectional observational and was conducted from 1 October 2024 to 30 November 2025 at the Department of Oral and Maxillofacial Surgery, Hayatabad Medical Complex, Peshawar, Pakistan. Pediatric patients aged 1–13 years presenting with maxillofacial trauma were included and the sampling technique was consecutive sampling. Data collection included data regarding the demographics, mechanism of injury, anatomical site involved, type of injury, associated injuries, and management. For summarization of finding descriptive statistics were used and for checking the associations between variables the chi-square test or Fisher's exact test, with a p-value <0.05 considered statistically significant.

Results: A total of 180 pediatric patients were included in the study and the mean age of the participants was 6.23 ± 3.47 years. Males constituted 61.7% of cases. The most common cause of injury was falls, followed by road traffic accidents and sports-related injuries. Fractures and combined injuries accounted for a substantial proportion of cases, with the dentoalveolar region and multiple facial bones being the most frequently involved sites. There was a significant association between age group and mechanism of injury, mechanism of injury and type of injury, and type of injury and hospital admission. The most common injured were younger children which was due to falls, whereas older children sustained more injuries related to road traffic accidents and sports related activities.

Conclusion: Pediatric maxillofacial trauma in Hayatabad Medical complex Peshawar Pakistan was predominantly associated with preventable mechanisms such as falls and road traffic accidents, with distinct age-related injury patterns. The findings of our study emphasized the need for age-specific injury prevention strategies, early risk stratification, and appropriate resource allocation for the management of pediatric trauma in tertiary care hospitals.

Keywords: Pediatric Trauma, Maxillofacial Injuries, Wounds and Injuries, Oral and Maxillofacial Surgery, Cross-Sectional Studies, Facial Fractures

Introduction

Maxillofacial traumas are one of the most common presentations in pediatric emergency departments and are a significant public health concern worldwide, requiring urgent care and hospital admissions.^{1,2} Facial injuries account for a large proportion of pediatric trauma cases, and the prevalence is different across different regions due to differences in demographic characteristics, environmental exposures, and healthcare infrastructure.^{3,4} The burden is exacerbated in low and middle-income countries due to rapid urbanization, limited enforcement of safety measures, and increased road traffic accidents, as well as limited access to specialized healthcare.^{5,6} Pediatric maxillofacial injuries are clinically significant because of their potential impact on facial growth and development, airway function, speech, dentition, vision, and psychosocial well-being. If these injuries are not managed timely, long term functional impairment, facial deformity, psychological distress can results.^{7, 8} maxillofacial trauma and multifactorial and the factors involved are falls, road traffic accidents and sports related injuries.^{9,10} The younger children are more prone to falls, and older children and adolescents are more exposed to outdoor

activities and vehicle incidents. Understanding this mechanism is important as it highlights the importance of age-specific injury patterns and contributing factors in injuries in the pediatric population[11]. The previous studies described the overall prevalence and the anatomic distribution of pediatric maxillofacial trauma, the contributing factors, and the most commonly affected sites, such as the maxilla, dentoalveolar structure, zygomatic complex, and mandible.^{12–14} Several studies have investigated etiological factors and associated covariates, such as age, gender, mechanism of injury, and environmental hazards. In these studies, the predominance proportion is males, especially among young and older children, due to their greater participation in outdoor activities. The reported frequency, pattern of injury, and etiological factors varied across different regions and health care settings, showing differences in social behavior, traffic conditions, preventive strategies, and referral pathways,^{9, 12, 15}

International data is available; however, there are gaps in the literature as the evidence from resource-limited and developing countries is limited, and many of the regions don't have an institute-based pediatric trauma registry. Most of the previous studies focused primarily on injury patterns with limited exploration of covariates, which can influence the occurrence and distribution of maxillofacial trauma. There is a lack of recent local data which restricts the generalizability of findings from other populations, and it needs context-specific research.^{16, 17}

The evaluation of etiology, frequency, and covariates of maxillofacial trauma among children presenting to a tertiary care hospital is very important, and it will provide clinical and epidemiological hospital-based data. The results can help in prevention strategies, resource allocation, and clinical planning. There are differences in anatomical, physiological characteristics of injuries, studying pediatric maxillofacial trauma separately from adult populations is essential for developing age-appropriate preventive and management approaches.

Corresponding Author

Zahid Qayyum,

Department of Oral & Maxillofacial Surgery, Hayatabad Medical Complex, Peshawar, Pakistan.

Email: Zahid3308@yahoo.com

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The primary objective of this study was to determine the frequency, etiology, and associated covariates of maxillofacial trauma among children presenting to the oral and maxillofacial surgery department of a tertiary care hospital.

The secondary objectives of the study were to assess the distribution of maxillofacial trauma, the distribution stratification by age and gender, and to identify the most common anatomical sites involved, and to explore associations between etiological factors and injury patterns in the pediatric population.

Materials and Methods

This was a cross-sectional study conducted at the Department of Oral and Maxillofacial Surgery, Hayatabad Medical Complex, Peshawar, Pakistan, from 1 October 2024 to 30 November 2025. Ethical approval was obtained from the ethical review board of Hayatabad Medical Complex (Approval number 2020, dated 04/09/2024). Written informed consent was obtained from the parents or legal guardians of all participating children, and assent was obtained from children when developmentally appropriate. All data were handled confidentially and used solely for research purposes.

Children aged 1–13 years presenting to the Department of Oral and Maxillofacial Surgery, Hayatabad Medical Complex, Peshawar, with maxillofacial trauma during the study period from 1 October 2024 to 30 November 2025 were eligible for inclusion. Maxillofacial trauma was defined as a traumatic injury involving the facial bones, dentoalveolar structures, or associated facial soft tissues. Isolated dentoalveolar injuries were also included.

Patients with associated head injuries or other systemic injuries were included provided that they had a concomitant maxillofacial traumatic injury. Patients presenting through either the emergency department or outpatient department were also eligible for inclusion.

Patients without documented maxillofacial trauma were not eligible for inclusion. Patients with insufficient information to classify the principal study variables were excluded from the final analysis. No formal a priori sample-size calculation was performed because a consecutive/census-based sampling approach was used. All eligible pediatric patients presenting with maxillofacial trauma during the predefined study period were enrolled consecutively. Thus, all eligible cases available during the study period were included, resulting in a final sample of 180 patients. The type and anatomical distribution of the maxillofacial trauma were assessed as the primary outcomes. The injuries were categorized according to the regions of the face involved, such as the mandible, maxilla, zygomatic complex, nasal bones, dentoalveolar structures, and associated facial bones. The nature of injury was further classified as fractures, soft-tissue injuries with skeletal involvement, or combined injuries. For the purpose of this study, covariates referred to demographic and injury-related variables examined for their unadjusted associations with the mechanism and pattern of maxillofacial trauma. No multivariable analysis was performed; therefore, the observed associations were interpreted as unadjusted associations and not as independent predictors.

Data were collected prospectively by an Oral and Maxillofacial Surgery (OMFS) resident who served as the principal investigator, using a structured data-collection proforma. The proforma was used to systematically record demographic characteristics, mechanism and place of injury, anatomical site involved, type of injury, associated head and systemic injuries, treatment modality, and hospital admission status.

The diagnosis and classification of maxillofacial trauma were established on the basis of clinical assessment using the structured proforma and radiographic imaging findings where applicable. The anatomical site and type of injury were recorded according to the clinical and radiographic assessment. Data were recorded at the time of presentation and subsequently entered into the study database for statistical analysis.

Statistical analysis was performed using IBM SPSS Statistics version 26. Continuous variables were summarized using means and standard deviations, while categorical variables were presented as frequencies and percentages. Associations between categorical variables were assessed using the Pearson chi-square test when the assumptions for the test were satisfied. For contingency tables with sparse expected frequencies, the Fisher–Freeman–Halton exact test was used. Effect size for categorical associations was assessed using Cramer's V. All

statistical tests were two-sided, and a p-value <0.05 was considered statistically significant.

Results

A total of 180 pediatric patients presenting with maxillofacial trauma were included in the final analysis. The mean age of the study population was 6.23 ± 3.47 years. The ages of the participants ranged from 1 to 13 years. Children aged 1–5 years were 42.2% of the total cases, followed by children aged 6–10 years (43.9%) and 11–13 years (13.9%). There was male predominance as 61.7% (n = 111) of the participants were males and 38.3% (n = 69) females.

Falls were the most common mechanism of injury, accounting for 56.1% of cases, followed by road traffic accidents (RTAs) (25.6%) and sports-related injuries (13.9%). Interpersonal violence and other causes were less frequent, accounting for 1.7% and 2.8% of injuries, respectively. The home was the most frequent place of injury (35.0%), followed by the road (27.2%), playgrounds (17.2%), and schools (15.6%).

With regard to the type of injury, fractures were identified in 44.4% of patients, while combined injuries accounted for 36.1%, and soft-tissue injuries with skeletal involvement for 19.4%. The most commonly involved anatomical sites were the dentoalveolar region (27.2%) and multiple facial bones (27.2%), followed by the mandible (18.9%), zygomatic complex (9.4%), nasal bones (8.9%), and maxilla (8.3%).

Associated head injuries were documented in approximately 15% of patients, while other systemic injuries were present in 14.4%. Overall, 57.2% of patients were managed conservatively, whereas 42.8% required surgical intervention. Hospital admission was required in 47.2% of cases. The baseline injury profiles are summarized in Table 1.

Table 1. Injury profile of pediatric patients with maxillofacial trauma (n = 180)

Mechanism of injury	
Falls	101 (56.1)
Road traffic accidents	46 (25.6)
Sports injuries	25 (13.9)
Interpersonal violence	3 (1.7)
Other	5 (2.8)
Place of injury	
Home	63 (35.0)
Road	49 (27.2)
Playground	31 (17.2)
School	28 (15.6)
Other	9 (5.0)
Type of injury	
Fracture	80 (44.4)
Combined injury	65 (36.1)
Soft tissue with skeletal involvement	35 (19.4)
Anatomical site involved	
Dentoalveolar region	49 (27.2)
Multiple facial bones	49 (27.2)
Mandible	34 (18.9)
Zygomatic complex	17 (9.4)
Nasal bones	16 (8.9)
Maxilla	15 (8.3)
Associated head injury	
Yes	27 (15.0)
No	153 (85.0)
Other systemic injuries	
Yes	26 (14.4)
No	154 (85.6)
Treatment modality	
Conservative	103 (57.2)
Surgical	77 (42.8)
Hospital admission	
Yes	85 (47.2)
No	95 (52.8)

Association Analyses

A statistically significant association was observed between age group and mechanism of injury (χ^2 test, $p < 0.001$). Younger children (1–5 years) sustained injuries predominantly due to falls, whereas older children demonstrated a higher proportion of injuries related to RTAs and sports activities (Table 2).

Table 2. Association between age group and mechanism of injury

Age group	Falls, n (%)	RTA, n (%)	Sports, n (%)	Violence, n (%)	Other, n (%)	Total
1–5 years	58 (76.3)	13 (17.1)	3 (3.9)	0 (0.0)	2 (2.6)	76
6–10 years	35 (44.3)	21 (26.6)	18 (22.8)	3 (3.8)	2 (2.5)	79
11–13 years	8 (32.0)	12 (48.0)	4 (16.0)	0 (0.0)	1 (4.0)	25
Total	101	46	25	3	5	180

A statistically significant association was observed between age group and mechanism of injury ($\chi^2(8) = 31.149$, $p < 0.001$, Cramer's $V = 0.294$). Younger children predominantly sustained injuries due to falls, whereas road traffic accidents and sports-related injuries were relatively more frequent among older children. Similarly, the distribution of mechanisms of injury did not differ significantly by gender ($p = 0.611$).

A significant association was identified between mechanism of injury and type of injury ($p = 0.001$), with RTAs more frequently resulting in fractures and combined injuries compared with other mechanisms (Table 3). Furthermore, type of injury was significantly associated with hospital admission ($p = 0.001$), with fractures and combined injuries showing a higher likelihood of admission compared with soft-tissue injuries (Table 4).

Table 3. Association between mechanism of injury and type of injury

Mechanism of injury	Fracture, n (%)	Combined injury, n (%)	Soft tissue + skeletal, n (%)	Total
Falls	40 (39.6)	32 (31.7)	29 (28.7)	101
Road traffic accidents	29 (63.0)	15 (32.6)	2 (4.3)	46
Sports injuries	6 (24.0)	15 (60.0)	4 (16.0)	25
Interpersonal violence	3 (100.0)	0 (0.0)	0 (0.0)	3
Other	2 (40.0)	3 (60.0)	0 (0.0)	5
Total	80	65	35	180

Table 4. Association between type of injury and hospital admission

Type of injury	Admitted, n (%)	Not admitted, n (%)	Total
Fracture	33 (41.3)	47 (58.8)	80
Combined injury	42 (64.6)	23 (35.4)	65
Soft tissue + skeletal	10 (28.6)	25 (71.4)	35
Total	85	95	180

A statistically significant association was observed between age group and mechanism of injury ($\chi^2(8) = 31.149$, $p < 0.001$, Cramer's $V = 0.294$). Younger children predominantly sustained injuries due to falls, whereas road traffic accidents and sports-related injuries were relatively more frequent among older children.

A statistically significant association was also observed between mechanism of injury and type of injury ($\chi^2(8) = 26.660$, $p < 0.001$, Cramer's $V = 0.272$). Road traffic accidents were associated with a higher proportion of fractures, while combined injuries were relatively frequent among patients with sports-related injuries.

Furthermore, a statistically significant association was found between type of injury and hospital admission ($\chi^2(2) = 13.920$, $p < 0.001$, Cramer's $V = 0.278$), with admission occurring more frequently among patients with fractures and combined injuries than among those with soft-tissue injuries with skeletal involvement.

Discussion

In this cross-sectional study, the frequency, etiology, and covariates of pediatric maxillofacial trauma presenting to Hayatabad Medical Complex's oral and maxillofacial surgery department were evaluated. The results of this study demonstrated that the most common cause of injury was falls among younger children, while road traffic accidents and sports-related injuries were more prevalent in the older age groups. Most of the cases were of fractures and combined injuries. A

clear male predominance was observed. The most frequent sites involved in the injuries were the dentoalveolar region and multiple facial bones. There was a significant association between age group and mechanism of injury, type of injury and mechanism of injury, and hospital admission, highlighting clinically relevant patterns within the pediatric trauma population. The results of our findings add updated local evidence on pediatric maxillofacial trauma patterns and associated factors in a tertiary care setting.

The most frequent cause of pediatric maxillofacial trauma observed in our study was falls, which is consistent with recent international reports, especially from low- and middle-income countries, in which younger children are more susceptible to domestic injuries due to limited motor coordination and inadequate supervision.^{3,18,19} The recent studies from East Asia and Europe and have reported a similar pattern in age-dependent variation in trauma etiology and the falls as the leading cause in early childhood, and road traffic accidents and sports injuries as the leading cause increasing with age, which shows greater outdoor exposure and risk-taking behaviors in older children and adolescents.^{13,14}

There was a male predominance observed in our study, which is similar to trends in international literature, which observed higher participation of males in outdoor activities and contact sports.^{8,11} The injury patterns observed in our study the frequency of dentoalveolar injuries and multi-site facial involvement was higher which is comparable to findings from recent multicenter pediatric trauma studies, which emphasize the vulnerability of developing dentition and facial structures in children.¹⁷ There were variations in the relative frequency of specific fracture sites across different studies, which may be due to differences in imaging availability, the referral pathways, and inclusion criteria, as well as geographic variation in the mechanisms of trauma.

Regional data from Pakistan and neighboring South Asian countries also demonstrated similar patterns to those observed in the present study.^{2,9,17} A few recent hospital-based studies from Pakistan have reported falls and road traffic accidents as the primary causes of pediatric maxillofacial trauma and a male predominance and higher injury burden among younger children.^{17,20} A study from India on pediatric facial injuries also identified falls as the leading cause of injury in children under 10 years, and road traffic accidents contributing more significantly in older age groups.¹² The similarity of all these findings highlighted the influence of shared regional factors such as limited use of protective equipment, road safety challenges, crowded living conditions, and variable supervision of children.

This study provides data from a major tertiary care hospital and reflects the real-world burden of maxillofacial trauma in the pediatric population. The internal validity of the findings is strengthened by the use of a comprehensive assessment and inclusion of multiple demographic and etiological covariates. There are several limitations, such as single centered study and a cross-sectional study design. Future research should focus on multicenter and prospective studies, integration of pediatric trauma registries, and evaluation of long-term outcomes for better informed policy development and resource allocation for pediatric maxillofacial trauma care.

Conclusion

This study demonstrates that pediatric maxillofacial trauma presenting to a tertiary care hospital is predominantly associated with preventable mechanisms, particularly falls and road traffic accidents, with distinct age-related injury patterns. Younger children were more frequently affected by domestic falls, while older children sustained injuries related to road traffic incidents and sports activities. Fractures and combined injuries constituted a substantial proportion of cases and were significantly associated with hospital admission, underscoring the clinical burden of these injuries. The findings highlight the importance of age-specific injury prevention strategies, early risk stratification, and resource planning in tertiary care settings.

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Author Contributions

1. **Saif Ullah:** Conceptualization, data collection, manuscript drafting
2. **Zahid Qayyum:** Study design, supervision, critical revision, final approval
3. **Harmain Kayani:** Data collection, data analysis
4. **Hina Amin:** Data collection, literature review
5. **Humna Sattar:** Data interpretation, manuscript drafting
6. **Muddasar Ahmed:** Statistical analysis, manuscript editing