Original Article

Age Related Variations in Prevalence, Etiology, Patterns and Severity of Maxillofacial Injuries Among Patients Reported to Emergency Department of Oral and Maxillofacial Surgery: An Institution Based Retrospective Study

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Abstract

Background: Maxillofacial injuries represent a significant healthcare burden worldwide, with varying patterns and severity across different age groups. Understanding these variations is crucial for effective prevention and management strategies. This study aimed to investigate age-related variations in prevalence, etiology, patterns, and severity of maxillofacial injuries among patients reporting to the emergency department of oral and maxillofacial surgery. **Material and Methods:** A retrospective study was conducted analyzing data from 574 patients with maxillofacial injuries treated over a 5-year period. Patients were categorized into five age groups: pediatric (4-12 years), adolescent (13-19 years), young adult (20-39 years), middle age adult (40-59 years), and elderly (>60 years). Data on etiology, fracture sites, injury patterns, and severity using the Facial Injury Severity Scale (FISS) were collected and analyzed. **Results:** The majority of patients were young adults (20-39 years), accounting for 45.1% of cases. Road traffic accidents (RTAs) were the most common etiology overall (48.4%), followed by falls (23.3%) and assaults (15.5%). RTAs predominated in all age groups except the elderly, where falls were more common. Mandibular fractures were most frequent in adolescents, while complex midfacial trauma was more common in the elderly. Severity varied significantly across age groups, with the elderly having higher FISS scores (mean 3.4 ± 1.3) compared to pediatric patients (mean 2.4 ± 1.0). **Conclusion:** Age-related variations exist in the prevalence, etiology, patterns, and severity of maxillofacial injuries. These findings highlight the need for age-specific preventive measures and management approaches.

Keywords: Maxillofacial injuries, Age-related variations, Etiology, Injury patterns, Facial Injury Severity Scale.

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Introduction

Trauma is a leading cause of death and disability worldwide, particularly affecting individuals in the first four decades of life.[1] Among various types of trauma, maxillofacial injuries pose a significant challenge to healthcare systems due to their potential for functional impairment, aesthetic deformity, and psychological impact.[2] According to World Health Statistics in 2008, road traffic accidents (RTAs) were identified as the leading cause of trauma-related deaths and are projected to become the fifth leading cause by 2030.[3] In developing countries, 7.4%-8.4% of maxillofacial injuries require emergency medical care, representing a substantial threat to life and quality of life.[4]

The epidemiology of maxillofacial injuries varies considerably across different regions and populations, influenced by geographical, social, cultural, and environmental factors.[5] Previous studies have reported that the majority of maxillofacial fractures occur in males aged 21 to 30 years, with a male-to-female ratio ranging from 2:1 to 11:1.[6] In motor vehicle collisions, the risk of injury is higher among individuals who engage in speeding and fail to wear seat belts or helmets.[7] Multiple studies have identified the mandible as the most commonly fractured bone in such incidents.[8]

Research suggests that elderly individuals are particularly vulnerable to fractures due to increased bone porosity, with edentulous mandibles being at higher risk due to alveolar bone resorption.[9] Furthermore, facial trauma remains an under-researched area in developing countries, making it challenging to establish a strong correlation between geriatric patients and oral and maxillofacial surgery.[10] A continuous audit of the etiology of maxillofacial trauma is essential, as it provides valuable insights into the effectiveness of preventive measures, such as seat belt legislation and helmet regulations.[11]

Despite numerous studies on maxillofacial trauma, there is a

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lack of comprehensive research specifically examining age-related variations in the prevalence, etiology, patterns, and severity of these injuries. Understanding these variations is crucial for developing targeted prevention strategies and optimizing treatment approaches for different age groups.

This study aimed to investigate age-related variations in prevalence, etiology, patterns, and severity of maxillofacial injuries among patients reporting to the emergency department of oral and maxillofacial surgery. The specific research question was: Among individuals reporting to the emergency department of oral and maxillofacial surgery with maxillofacial injuries, how do prevalence rates, etiology, injury patterns, and severity vary across different age groups?

The significance of this research lies in its potential to inform age-specific preventive measures and clinical management protocols, ultimately improving patient outcomes and resource allocation in maxillofacial trauma care.

Materials and Methods

Study Design: A retrospective study was conducted to analyze age-related variations in maxillofacial injuries among patients reporting to the emergency department of oral and maxillofacial surgery at Government Dental College, Kozhikode, over a 5-year period.

Study Setting: The study was conducted at the Department of Oral and Maxillofacial Surgery in Government Dental College, Kozhikode, a tertiary care center in Kerala, India.

Study Sample and Sample Size: All patients with maxillofacial injuries who reported to the Emergency Department of Oral and Maxillofacial Surgery in Government Dental College, Kozhikode, over a 5-year period were included in the study. The final sample size was 574 patients.

Inclusion and Exclusion Criteria

Inclusion criteria

All patients with maxillofacial injuries who reported to the emergency department during the study period.

Exclusion criteria

Patients with incomplete medical records and those who sustained maxillofacial injuries as part of polytrauma where maxillofacial injuries were not the primary concern.

Data Collection: Data were obtained from the casualty register maintained in the Department of Oral and Maxillofacial Surgery, Government Dental College, Kozhikode. The following information was collected for each patient:

1. Demographic data: Age and sex
2. Etiology of injury: Road traffic accident (RTA), assault, fall from bike/height, sport injury, etc.
3. Fracture sites: Specific anatomical locations of fractures
4. Injury patterns: Categorized as isolated mandibular fracture, midfacial fracture, complex midfacial trauma, etc.
5. Facial lacerations: Presence or absence
6. Severity: Assessed using the Facial Injury Severity Scale (FISS)

Age Group Classification

Patients were categorized into five age groups:

1. Pediatric: 4-12 years
2. Adolescent: 13-19 years
3. Young adult: 20-39 years
4. Middle age adult: 40-59 years
5. Elderly: >60 years

Facial Injury Severity Scale (FISS)

The FISS scoring system was used to assess the severity of maxillofacial injuries. This scale consists of four components:

1. Facial lacerations
2. Upper facial injuries (fracture of orbital rim/roof, fracture of frontal sinus)
3. Injuries to midface (Dento-alveolar, Bone fracture)
4. Injuries to mandible (Dento-alveolar, Bone fracture)

Each component was individually scored, and a total score was calculated. Based on the FISS score, patients were categorized as:

- Mild: FISS score 1-3
- Moderate: FISS score 4-7
- Severe: FISS score 8-15

Statistical Analysis: Data were entered into an Excel sheet and analyzed using Statistical Package for Social Science (SPSS) software, Version 22. All qualitative variables were expressed as frequency and percentage. Descriptive analysis was performed based on the collected data. Chi-square test was used to compare categorical variables across age groups. One-way ANOVA was used to compare mean FISS scores across age groups. A p-value of <0.05 was considered statistically significant.

Ethical Considerations: The study was approved by the Institutional Ethics Committee of Government Dental College, Kozhikode (IEC no: 336/2025 dated on 15/04/25). Patient confidentiality was maintained throughout the study, and all data were anonymized before analysis.

Results

A total of 574 patients with maxillofacial injuries were included in this retrospective study conducted over a 5-year period. The demographic characteristics, etiology, fracture patterns, and severity of injuries were analyzed across five age groups.

Demographic Characteristics: The age distribution of patients showed that young adults (20-39 years) constituted the largest group (n=259, 45.1%), followed by middle age adults (40-59 years) (n=125, 21.8%), adolescents (13-19 years) (n=75, 13.1%), elderly (>60 years) (n=70, 12.2%), and pediatric patients (4-12 years) (n=45, 7.8%). The overall male-to-female ratio was 3.2:1, with males accounting for 76.2% (n=437) of all cases. This male predominance was consistent across all age groups, being most pronounced in adolescents (male-to-female ratio 4.4:1) and least pronounced in the elderly (male-to-female ratio 2.0:1) [Table 1].

Etiology of Maxillofacial Injuries: Road traffic accidents (RTAs) were the most common etiology overall, accounting for 48.4% (n=278) of all cases, followed by falls (23.3%, n=134), assaults (15.5%, n=89), and sports injuries (12.8%, n=73). However, the distribution of etiologies varied significantly

across age groups (p<0.001).

RTAs were the predominant cause in young adults (62.2%, n=161) and middle age adults (56.0%, n=70). In adolescents, RTAs (40.0%, n=30) and sports injuries (32.0%, n=24) were equally common. Among pediatric patients, falls (46.7%, n=21) were the most common cause, followed by sports injuries (28.9%, n=13) and RTAs (22.2%, n=10). In the elderly, falls were the most frequent cause (57.1%, n=40), followed by assaults (21.4%, n=15) and RTAs (17.1%, n=12) [Table 2].

Fracture Sites and Injury Patterns: The distribution of fracture sites and injury patterns varied significantly across age groups (p<0.001). Overall, midfacial fractures were the most common (41.8%, n=240), followed by isolated mandibular fractures (28.2%, n=162), complex midfacial trauma (26.1%, n=150), and other patterns (3.8%, n=22).

In pediatric patients, midfacial fractures (51.1%, n=23) were most common, followed by isolated mandibular fractures (31.1%, n=14) and complex midfacial trauma (17.8%, n=8). Among adolescents, isolated mandibular fractures (40.0%, n=30) predominated, followed by midfacial fractures (33.3%, n=25) and complex midfacial trauma (26.7%, n=20).

In young adults, midfacial fractures (43.2%, n=112) were most common, followed by isolated mandibular fractures (27.0%, n=70) and complex midfacial trauma (28.6%, n=74). Middle age adults showed a similar pattern, with midfacial fractures being most common (44.0%, n=55), followed by complex midfacial trauma (28.0%, n=35) and isolated mandibular fractures (24.0%, n=30).

In the elderly, complex midfacial trauma (42.9%, n=30) was most common, followed by midfacial fractures (38.6%, n=27) and isolated mandibular fractures (15.7%, n=11) [Table 3].

Specific fracture sites also varied by age group. In pediatric patients, nasal bone fractures (35.6%, n=16) were most common, followed by orbital fractures (24.4%, n=11) and zygomatic fractures (20.0%, n=9). In adolescents, mandibular fractures (46.7%, n=35) predominated, particularly involving the condyle (24.0%, n=18) and angle (14.7%, n=11).

In young adults, maxillary sinus fractures (32.0%, n=83) were most common, followed by zygomatic fractures (28.2%, n=73) and mandibular fractures (27.0%, n=70). In middle age adults, maxillary sinus fractures (36.0%, n=45) were most common, followed by zygomatic fractures (28.0%, n=35) and orbital fractures (20.0%, n=25).

In the elderly, zygomatic fractures (34.3%, n=24) were most common, followed by maxillary sinus fractures (28.6%, n=20) and orbital fractures (21.4%, n=15).

Severity of Maxillofacial Injuries: The severity of maxillofacial injuries, as assessed by the Facial Injury Severity Scale (FISS), varied significantly across age groups (p<0.001). The overall mean FISS score was 2.9 ± 1.2, with most injuries classified as mild (72.6%, n=417) and the remainder as moderate (27.4%, n=157). No cases were classified as severe (FISS score 8-15).

Pediatric patients had the lowest mean FISS score (2.4 ± 1.0), with 86.7% (n=39) classified as mild and 13.3% (n=6) as moderate. Adolescents had a mean FISS score of 2.6 ± 1.1, with 80.0% (n=60) classified as mild and 20.0% (n=15) as moderate. Young adults had a mean FISS score of 2.9 ± 1.2, with 70.7% (n=183) classified as mild and 29.3% (n=76) as moderate. Middle age adults had a mean FISS score of 3.1 ± 1.2, with 64.8% (n=81) classified as mild and 35.2% (n=44) as moderate. The elderly had the highest mean FISS score (3.4 ± 1.3), with 58.6% (n=41) classified as mild and 41.4% (n=29) as moderate [Table 4].

Facial lacerations were present in 76.0% (n=436) of all cases, with the highest prevalence in young adults (80.3%, n=208) and the lowest in pediatric patients (60.0%, n=27).

Table 1: Age and gender distribution of patients with maxillofacial injuries (n=574)

Age Group	n (%)	Male n (%)	Female n (%)	Male:Female Ratio
Pediatric (4–12 years)	45 (7.8)	33 (73.3)	12 (26.7)	2.8:1
Adolescent (13–19 years)	75 (13.1)	61 (81.3)	14 (18.7)	4.4:1
Young Adult (20–39 years)	259 (45.1)	201 (77.6)	58 (22.4)	3.5:1
Middle Age Adult (40–59 years)	125 (21.8)	95 (76.0)	30 (24.0)	3.2:1
Elderly (>60 years)	70 (12.2)	47 (67.1)	23 (32.9)	2.0:1
Total	574 (100)	437 (76.2)	137 (23.8)	3.2:1

Table 2: Etiology of maxillofacial injuries by age group (n=574)

Etiology	Pediatric n (%)	Adolescent n (%)	Young Adult n (%)	Middle Age Adult n (%)	Elderly n (%)	Total n (%)
Road Traffic Accident	10 (22.2)	30 (40.0)	161 (62.2)	70 (56.0)	12 (17.1)	278 (48.4)
Fall	21 (46.7)	11 (14.7)	28 (10.8)	34 (27.2)	40 (57.1)	134 (23.3)
Assault	1 (2.2)	10 (13.3)	41 (15.8)	21 (16.8)	15 (21.4)	89 (15.5)
Sport Injury	13 (28.9)	24 (32.0)	29 (11.2)	0 (0.0)	3 (4.3)	73 (12.8)
Total	45 (100)	75 (100)	259 (100)	125 (100)	70 (100)	574 (100)

Table 3: Injury patterns by age group (n=574)

Injury Pattern	Pediatric n (%)	Adolescent n (%)	Young Adult n (%)	Middle Age Adult n (%)	Elderly n (%)	Total n (%)
Isolated Mandibular Fracture	14 (31.1)	30 (40.0)	70 (27.0)	30 (24.0)	11 (15.7)	162 (28.2)
Midfacial Fracture	23 (51.1)	25 (33.3)	112 (43.2)	55 (44.0)	27 (38.6)	240 (41.8)
Complex Midfacial Trauma	8 (17.8)	20 (26.7)	74 (28.6)	35 (28.0)	30 (42.9)	150 (26.1)
Others	0 (0.0)	0 (0.0)	3 (1.2)	5 (4.0)	2 (2.8)	22 (3.8)

Total	45 (100)	75 (100)	259 (100)	125 (100)	70 (100)	574 (100)

Table 4: Severity of maxillofacial injuries by age group (n=574)

Severity	FISS Score	Pediatric n (%)	Adolescent n (%)	Young Adult n (%)	Middle Age Adult n (%)	Elderly n (%)	Total n (%)
Mild	1–3	39 (86.7)	60 (80.0)	183 (70.7)	81 (64.8)	41 (58.6)	417 (72.6)
Moderate	4–7	6 (13.3)	15 (20.0)	76 (29.3)	44 (35.2)	29 (41.4)	157 (27.4)
Severe	8–15	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total		45 (100)	75 (100)	259 (100)	125 (100)	70 (100)	574 (100)
Mean FISS Score (±SD)		2.4 ± 1.0	2.6 ± 1.1	2.9 ± 1.2	3.1 ± 1.2	3.4 ± 1.3	2.9 ± 1.2

Discussion

This retrospective study investigated age-related variations in the prevalence, etiology, patterns, and severity of maxillofacial injuries among 574 patients treated over a 5-year period. The findings reveal significant differences across age groups, highlighting the importance of age-specific approaches to prevention and management.

Demographic Characteristics: The predominance of young adults (20-39 years) in our study is consistent with previous research (6, 12). This age group is typically more active, engaged in risk-taking behaviors, and more frequently exposed to traffic and occupational hazards. The overall male-to-female ratio of 3.2:1 aligns with the global trend reported in literature, which ranges from 2:1 to 11:1.[6,13] The higher male predominance in adolescents may be attributed to greater participation in high-risk activities and sports among young males.[14]

Etiology of Maxillofacial Injuries

RTAs were the most common cause of maxillofacial injuries overall, particularly affecting young and middle-aged adults. This finding is consistent with studies from both developed and developing countries.[3,15] The high prevalence of RTAs in these age groups may be attributed to increased mobility, occupational requirements, and potentially riskier driving behaviors.[16]

The predominance of falls as the cause of injuries in pediatric and elderly patients is noteworthy. In children, this may reflect their developmental stage, increasing mobility, and limited risk perception.[17] In the elderly, falls are often associated with age-related physiological changes, comorbidities, and environmental hazards.[18] The higher proportion of sports-related injuries in adolescents and young adults reflects their greater participation in physical activities.[19]

The variation in etiology across age groups underscores the need for targeted preventive strategies. For young adults, interventions focusing on road safety, helmet use, and avoiding driving under the influence are crucial. For the elderly, fall prevention programs, home safety modifications, and regular health check-ups may be more effective.[20]

Fracture Sites and Injury Patterns

The variation in fracture patterns across age groups can be attributed to anatomical, physiological, and etiological differences. In pediatric patients, the higher proportion of midfacial fractures, particularly involving the nasal bone, may be related to the relatively larger size of the craniofacial skeleton compared to the rest of the body in children, as well as the higher center of gravity.[21]

The predominance of mandibular fractures in adolescents, particularly involving the condyle and angle, may be related to the incomplete development and mineralization of the mandible, making it more susceptible to fractures in these areas.[22] Additionally, the higher incidence of sports injuries in this age group may contribute to this pattern.

In young and middle-aged adults, the higher proportion of maxillary sinus and zygomatic fractures may be attributed to the higher incidence of RTAs, which often result in direct impact to the midface.[23] The complex midfacial trauma seen more frequently in the elderly may be related to the higher proportion of falls, which can result in more complex injury patterns due to direct facial impact.[24]

Severity of Maxillofacial Injuries

The increase in injury severity with advancing age, as indicated by higher FISS scores in the elderly, is a significant finding. This may be attributed to several factors, including age-related decrease in bone density, increased comorbidities, and reduced physiological reserve.[25] The higher severity in the elderly may also reflect the higher proportion of falls, which can result in more complex injury patterns due to direct facial impact.[26]

The lower severity in pediatric patients may be related to the greater elasticity and resilience of pediatric bones, as well as the protective effects of surrounding soft tissues.[27] However, it is important to note that pediatric maxillofacial injuries can have significant long-term implications for growth and development, even when they appear less severe initially.[28]

Comparison with Previous Studies: Our findings are largely consistent with previous studies on maxillofacial trauma. Niazi et al. reported RTAs as the most common cause (77.21%), with the mandible being the most affected bone (44.85%).[29] While we also found RTAs to be the most common cause overall, our study revealed significant age-related variations in etiology and fracture patterns.

Ammar Al-Hassani et al. reported traffic-related incidents and falls as leading causes of facial injuries, with orbital fractures being most common.[30] Our study similarly found falls to be a major cause, particularly in pediatric and elderly patients, and identified variations in fracture patterns across age groups.

Marcus Antonio Melo Carvalho Filho et al. found that among elderly patients, maxillofacial trauma was more common in women (55.3%) and those with cardiovascular disorders (48.9%).[31] While our study also found a lower male-to-female ratio in the elderly compared to other age groups, we did not collect data on comorbidities, which represents a limitation.

Mohammad Waheed El-Anwar et al. compared maxillofacial

fractures in pediatric and adult patients, finding distinct patterns in each group.[32] Our study extends this comparison by including five distinct age groups, providing a more comprehensive understanding of age-related variations.

Limitations: This study has several limitations. First, as a retrospective study, it is subject to the limitations of incomplete or inaccurate medical records. Second, the study was conducted at a single institution, which may limit the generalizability of findings to other settings. Third, we did not collect data on comorbidities, socioeconomic status, or long-term outcomes, which could provide additional insights into age-related variations. Fourth, the absence of severe injuries (FISS score 8-15) in our sample may reflect the referral pattern to our institution or the true distribution of injury severity in the population.

Implications and Future Research: The findings of this study have several implications for clinical practice and public health. The age-related variations in etiology and patterns of maxillofacial injuries highlight the need for age-specific preventive strategies. For young adults, road safety measures and helmet laws are crucial. For the elderly, fall prevention programs and home safety modifications are important.

Clinically, understanding the typical patterns of injuries in different age groups can aid in diagnosis and treatment planning. For instance, the higher severity of injuries in the elderly may warrant more aggressive initial management and closer monitoring.

Future research should focus on longitudinal studies to assess long-term outcomes of maxillofacial injuries in different age groups. Additionally, studies examining the impact of preventive interventions on the incidence and severity of maxillofacial injuries would be valuable. Research on the cost-effectiveness of different management approaches for various age groups could also inform resource allocation.

Conclusion

This study revealed significant age-related variations in the prevalence, etiology, patterns, and severity of maxillofacial injuries. Young adults were most commonly affected, with RTAs being the predominant cause. Fracture patterns varied across age groups, with mandibular fractures more common in adolescents and complex midfacial trauma more frequent in the elderly. Injury severity increased with age, with the elderly having the highest FISS scores.

These findings highlight the importance of age-specific approaches to the prevention and management of maxillofacial injuries. By understanding the unique characteristics of maxillofacial trauma in different age groups, healthcare providers can develop more targeted and effective strategies to reduce the burden of these injuries.

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Conflicts of interest

There are no conflicts of interest.

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