

Pattern of Traumatic Maxillofacial Injuries: An Autopsy-Based Observational Study at SMS Medical College, Jaipur, Rajasthan

Running Title: Traumatic Maxillofacial Injuries in Autopsy Cases

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ABSTRACT

Background: Traumatic maxillofacial injuries are frequently encountered in medicolegal autopsies and are commonly associated with road traffic accidents and severe craniofacial trauma. The present study aimed to evaluate the epidemiological profile, injury pattern, and medicolegal significance of fatal maxillofacial injuries. **Methods:** A cross-sectional descriptive autopsy-based observational study was conducted in the Department of Forensic Medicine and Toxicology, SMS Medical College, Jaipur, from September 2024 to January 2025. A total of 100 fatal traumatic maxillofacial injury cases were included. Data regarding demographic profile, mechanism of injury, external facial injuries, facial bone fractures, associated injuries, victim category, helmet use, cause of death, and survival period were collected during medicolegal autopsy and analysed using descriptive statistics. **Results:** Males constituted 89% of cases, with the highest incidence in the 21–30-year age group (35%). Road traffic accidents accounted for 90% of injuries, with two-wheeler occupants forming the largest victim group. External injuries most frequently involved the maxillary region (53%), followed by the mandibular (44%) and zygomatic (41%) regions. Maxillary (28%) and mandibular (27%) fractures were the most common facial bone fractures. Head injury was the leading fatal injury (63%), while coma was the most common cause of death (60%). Among two-wheeler riders, 68.8% were not wearing helmets. **Conclusion:** Fatal maxillofacial injuries predominantly affect young adult males and are mainly caused by road traffic accidents. Strict enforcement of road safety measures, particularly compulsory use of standard full-face helmets, along with improved trauma care, may reduce the incidence and mortality associated with these injuries. Early recognition of facial injuries and strict compliance with helmet use may substantially reduce mortality associated with maxillofacial trauma.

Keywords: Maxillofacial trauma; Autopsy; Road traffic accidents; Facial fractures; Medicolegal; Helmet use.

INTRODUCTION

Maxillofacial trauma refers to any injury to the face or jaw, which can involve bones, muscles, nerves, or other tissues. Due to day to day increasing maxillofacial injuries resulting from accidents, violence, sports

injuries, or falls and are associated with high mortality and morbidity we are doing the study.¹

The facial region provides anterior protection for the cranium and plays an important role in its appearance. Due to their anatomical proximity to critical structures such as the eyes and the brain, maxillofacial injuries can lead to significant complications, including serious

dysfunction and even death.² Assessments of the prevalence of Maxillofacial injuries and the severity of the related injuries are required to determine the importance of prevention strategies. The intricate anatomy of the maxillofacial region means that trauma in this area can have widespread and severe consequences.²

Most of the studies conducted in the local population are focused on bony fractures. There is a scarcity of data on the pattern and etiology of maxillofacial trauma focusing on bony fractures along with soft tissue injuries.³

In India, the patterns of traumatic maxillofacial injuries reveal significant insights into their causes, demographics, and prevalence. Road traffic accidents are the predominant cause, followed by falls, interpersonal violence, and sports injuries.⁴

The mandibular fractures are the most common, accounting for approximately 40-50% of all maxillofacial injuries, with the angle and condylar regions being frequently affected. Zygomatic and maxillary fractures follow in prevalence.⁴

The objective of this study is to determine the pattern of maxillofacial trauma, and factors predicting soft tissue and hard tissue injuries. Such study has not been conducted in the Jaipur region and the colleges affiliated to the Rajasthan University of Health Sciences in the last 5 years. Hence this study is proposed to observe the pattern of maxillofacial trauma so this data can be used in making prevention strategies and compare to studies of other regions. Also attempts has been made to prevent incidence of facial injuries by encouraging riders for wearing full face helmet, seat belt and to suggest the clinician for counselling regarding road safety along with treatment.

Although several studies have evaluated maxillofacial fractures in clinical settings, very limited autopsy-based research has comprehensively assessed both soft tissue injuries and facial skeletal fractures in fatal trauma victims from North-West India. The present study was therefore undertaken to bridge this knowledge gap.

MATERIALS AND METHODS

The present study was a cross-sectional descriptive autopsy-based observational study conducted in the Department of Forensic Medicine and Toxicology, SMS Medical College, Jaipur, a tertiary care teaching institution receiving medicolegal autopsy cases from Jaipur and surrounding regions. The study was carried out from September 2024 to January 2025 till sample size of 100 was achieved, to evaluate the pattern of traumatic maxillofacial injuries in medicolegal autopsy cases.

Inclusion Criteria

- Fatal traumatic maxillofacial injury cases.

- Complete medicolegal records.
- Consent from legal representative.

Exclusion Criteria:

- Putrefied bodies.
- Congenital or pathological facial deformities.
- Non-traumatic facial lesions.

Data were collected through detailed external and internal medicolegal autopsy examinations using a predesigned data collection proforma. Information regarding facial soft-tissue injuries, maxillofacial fractures, associated injuries, victim category, helmet use among two-wheeler riders, cause of death, and survival period was systematically recorded. Relevant demographic and medicolegal details were obtained from inquest reports, hospital records, and police documents. The collected data were entered into Microsoft Excel, cleaned, and analysed using descriptive statistical methods. The results were expressed as frequencies and percentages and presented in appropriate tables and figures.

Sample Size

The sample size of 100 consecutive autopsy cases was determined based on the study duration and availability of eligible cases during the study period.

RESULTS

Among the 100 autopsy cases studied, males constituted 89% of the victims and females 11%, resulting in a male-to-female ratio of approximately 9:1. The highest incidence was observed in the 21–30 years age group (35%), followed by 31–40 years (23%) and 41–50 years (15%), indicating that young adults were the most affected population. Most victims were Hindus (92%), reflecting the demographic profile of the study area.

Regarding educational status, 40% had secondary education, followed by graduates (33%) and primary education (25%), while only 1% were illiterate and educational status was unknown in 1% of cases. Self-employed individuals constituted the largest occupational group (51%), followed by students (19%), unemployed persons (12%), employed individuals (9%), and housewives (8%).

Road traffic accidents were the predominant cause of traumatic maxillofacial injuries (90%), followed by train accidents (5%), assault (2%), and fall from height, heavy object injuries, and unknown causes (1% each).

Most incidents occurred during the evening hours (18:00–24:00; 40%), followed by 12:00–18:00 hours (34%), indicating a higher frequency of trauma during peak traffic hours.

Table 1: External Injury Type wise distribution of cases of Traumatic Maxillofacial Injuries

External injury type	No of Cases
Abrasion	73
Bruise	06
Laceration	33
Incision	00
Diffuse Swelling	21
Stitched wound	20
Crush injuries	05



Image: 1. Showing abrasion over bilateral maxilla region, lower lip & left mandibular region, diffuse swelling of bilateral eyelids in case of RTA. (PMR no. 3056 date- 17-08-2024)



Image: 2. Crush Injury of head PMR no 2902 dated 04-08-2024

In External injuries the maxillary region (53%) was the most commonly affected facial area. This was followed by the mandibular region (44%), zygomatic region (41%), eyelid (37%), and nose (34%). Lip injuries were present in 9% of cases.

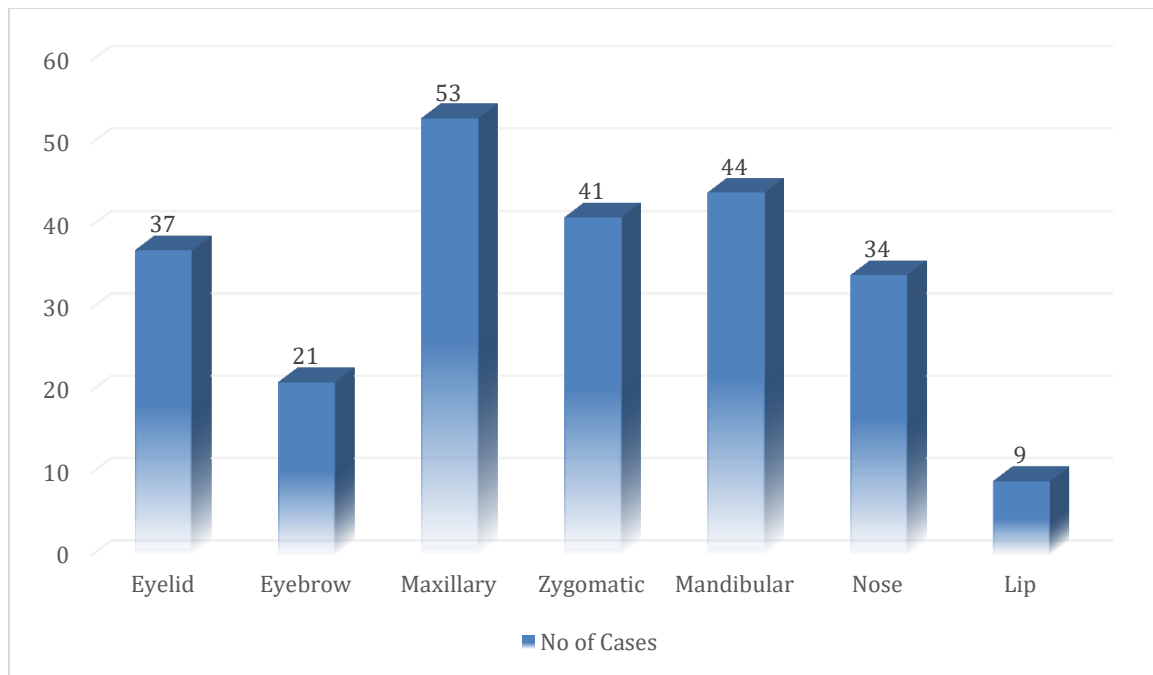


Figure 1: Pattern of External Injury region on face in cases of Traumatic Maxillofacial Injuries

Among the 100 autopsy cases, external injuries were most frequently observed in the maxillary region (53%), followed by the mandibular region (44%), zygomatic region (41%), eyelids (37%), and eyebrows (21%). Maxillary injuries were predominantly left-sided (24 cases), followed by right-sided (15 cases) and bilateral injuries (14 cases). Of the 44 mandibular injuries, 13 were bilateral, 12 right-sided, 11 left-sided, and 8 involved the midline. Among the 41 zygomatic injuries, 17 were left-sided, 12 right-sided, and 12 bilateral. Eyelid injuries were identified in 37 cases, with left-sided involvement in 16 cases, right-sided in 15 cases, and bilateral involvement in 6 cases. Eyebrow injuries were present in 21 cases, comprising 9 right-sided, 7 left-sided, and 5 bilateral injuries.

Table 2: Pattern of Fractures of facial bones in cases of Traumatic Maxillofacial Injuries.

Facial Bone Fracture	Right	Left	Bilateral	No of Cases
Orbital bone	11	09	05	25
Maxilla bone	07	10	11	28
Zygomatic bone	07	09	08	24
Mandible bone	07	08	08	27
Nasal bone	-	-	-	19

Maxillary fractures were the most common facial bone fractures (28 cases), followed by mandibular (27 cases), orbital (25 cases), zygomatic (24 cases), and nasal bone fractures (19 cases). Orbital fractures were predominantly right-sided (11 cases), maxillary fractures were mainly bilateral (11 cases), only in 10 subjects there were Le Fort type of fractures. Among the 10 Le Fort fracture cases, Le Fort Type III fractures were most common (5 cases), followed by Le Fort Type II (4 cases) and Le Fort Type I (1 case). Zygomatic fractures were more common on the left side (9 cases), and mandibular fractures showed equal left-sided and bilateral involvement (8 cases each).



Image: 3. 3D CT of Skull showing multiple fractures of facial bones. PMR 3056 dates 17-08-2024

The most common fatal injury which lead to death was **head injury (63%)**, followed by **multiple bodily injuries (28%)**. Other fatal injuries included **spinal injuries (5%)**, **thoracic injuries (2%)**, and **abdominal injuries (2%)**. The cause of death was **coma in 60% of cases** and **shock in 40% of cases**.

Most victims died **within 12 hours of injury (46%)**. Other survival periods included **12–24 hours (8%)**, **1–3 days (15%)**, **4–7 days (16%)**, **8–15 days (9%)**, **16–30 days (5%)**, and **more than 30 days (1%)**.

Table 3: Victim category of Road traffic accident cases of Traumatic Maxillofacial Injuries

Victim category	No of Cases
Pedestrian	16
Two wheeler Occupants	48
Four Wheeler Occupants	26
Total RTA cases	90

Among the 90 road traffic accident cases, 48 were two-wheeler occupants, 26 were four-wheeler occupants, and 16 were pedestrians. Among 48 two-wheeler riders, 15 were wearing helmets, whereas 33 were not wearing helmets at the time of the accident.

DISCUSSION

The present study demonstrated a marked predominance of traumatic maxillofacial injuries among young adult males, particularly in the 21–30 years age group, which is consistent with the findings of Rupani et al., Kalathil et al., Srivastava et al., and Dalal et al.^{5,6,7,8} This higher incidence may be attributed to greater outdoor activity, occupational exposure, and increased involvement in road traffic.

Road traffic accidents were the leading cause of injury (90%), corroborating the observations of Rupani et al., Kalathil et al., Kumar et al., and Srivastava et al., who also identified RTAs as the principal cause of maxillofacial trauma.^{3,5,6,7} The predominance of two-wheeler victims and the high proportion of non-helmet users in the present study further emphasize the importance of helmet use in preventing severe facial injuries.

Maxillary and mandibular fractures were the most common facial fractures and were frequently associated with head and neck injuries, reflecting the polytrauma nature of high-impact trauma. Similar injury patterns have been reported by Abhinav et al., Rupani et al., and Dalal et al.^{4,5,8} Head injury was the major injury leading to death, with coma being the most common cause of death, highlighting the close association between severe maxillofacial trauma and fatal cranio-cerebral injuries.

Overall, the findings reinforce that traumatic maxillofacial injuries remain a significant medicolegal and public health concern, emphasizing the need for strict enforcement of traffic regulations, promotion of helmet use, and strengthening of trauma care services.

Strengths of the Study

- Autopsy-based study providing accurate injury assessment.

- Simultaneous evaluation of soft tissue and facial skeletal injuries.
- Detailed documentation of helmet use and victim profile.
- Provides regional epidemiological data from Rajasthan where published autopsy-based evidence is scarce.

CONCLUSION

Traumatic maxillofacial injuries in fatal cases predominantly affected young adult males, with road traffic accidents being the leading cause. Maxillary and mandibular fractures were the most common injuries and were frequently associated with head and neck trauma. The findings highlight the significant medicolegal and public health burden of maxillofacial injuries. Strengthening road safety measures, promoting the use of standard protective helmets specially full face helmets, and improving trauma care services are essential to reduce the incidence and mortality associated with these injuries.

Study Limitations

The present study has certain limitations. Being a single-center study with a relatively small sample size of 100 autopsy cases, the findings may not be generalizable to the broader population. As only fatal cases were included, the injury patterns may differ from those observed in survivors. Additionally, information regarding the mechanism of injury, alcohol consumption, and use of protective devices was dependent on medicolegal records and police reports, which may have been incomplete. The lack of detailed radiological correlation in some cases may also have limited the comprehensive assessment of fracture patterns.

Future Directions

Future multicentric studies with larger sample sizes are recommended to validate the present findings. Integration of clinical, radiological, and autopsy data may improve understanding of injury patterns and mechanisms. Prospective studies evaluating risk factors such as helmet use, alcohol consumption, and compliance with traffic regulations are warranted. Further research should also assess the effectiveness of preventive measures and road safety interventions in reducing the incidence and severity of traumatic maxillofacial injuries.

Recommendations

Strict enforcement of traffic regulations, including mandatory use of standard full-face helmets and seat belts, should be prioritized. Road safety awareness programs targeting young adults, particularly males, should be strengthened to promote safe driving practices

and discourage driving under the influence of alcohol. Improvement of road infrastructure, enhancement of trauma care services, and establishment of regional trauma registries are recommended to reduce the burden of maxillofacial injuries and improve patient outcomes.

Ethics Approval

The study was approved by the Institutional Ethics Committee of SMS Medical College, Jaipur. All procedures were conducted according to the Declaration of Helsinki and institutional ethical guidelines.

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Data Availability Statement

The datasets generated and analysed during the present study are available from the corresponding author upon reasonable request.

Informed Consent Statement

Consent from legal representatives was obtained wherever applicable according to institutional ethical guidelines.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this study.

Author Contributions

Dr. Parnita Raj: Conceptualization, data collection, autopsy observations, statistical analysis and manuscript preparation.

Dr. R.K. Punia: Study supervision, methodology, critical revision of the manuscript and final approval.

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