INCIDENCE AND PATTERN OF MAXILLOFACIAL INJURIES ASSOCIATED WITH HEAD TRAUMA: A CLINICAL CROSS-SECTIONAL STUDY

[1*]Ram Pershad Chooni Lal Sharma, [1]Riaz Ahmed Raja, [1]Amal Memon, [1]Muhammad Anas Imtiaz, [1]Mariam Ismail, [1]Aimal Jamshed, [1]Ume e Ma [1]Memon, [1]Moomal Qureshi
[1]Liaquat University of Medical and Health Sciences Jamshoro

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ABSTRACT

BACKGROUND: Because of the close anatomical relationship between the cranium and the facial skeleton, maxillofacial trauma often coexists with head injuries. Comprehending this correlation is essential for timely diagnosis, interdisciplinary care, and averting potentially fatal consequences. The purpose of the current study was to ascertain the frequency and distribution of maxillofacial fractures linked to head trauma in trauma patients who arrived at a tertiary care facility.

METHODS: Over the course of a year, 200 trauma cases at the LUMHS civil hospital neurosurgery & maxillofacial surgery ward were the subject of a descriptive cross-sectional study. Structured clinical records were used to gather information on demographics, the type of head injury, and the type of facial fracture, the trauma's etiology, and the length of hospital stay. SPSS version 28 was used to apply statistical analyses, such as logistic regression, ANOVA, chi-square, and Kruskal-Wallis tests. Statistical significance was defined as a p-value < 0.05.

RESULTS: The most common bone fractures were frontal (39%) and nasal (25%) and mandibular (18%). The presence of head injury and fracture type were significantly correlated ($\chi^2 = 21.3$, $p = 0.012$). The most frequent intracranial pathology was cerebral contusion (51.5%), and its occurrence was significantly predicted by frontal bone fracture (OR = 2.81; $p = 0.003$). The majority of injuries (70.1%) were caused by trauma related to firearms, which was significantly different from the global trend of traffic accidents ($F = 6.77$; $p < 0.001$). Panfacial fractures and Le Fort hospital stays were significantly longer ($H = 14.9$; $p = 0.002$).

CONCLUSION: Intracerebral injuries are closely associated with maxillofacial fractures, especially those of the frontal and midfacial regions. Targeted preventive and policy measures are necessary due to the high percentage of trauma related to firearms, which indicates a clear regional pattern. For all upper and midfacial fractures, routine neuroimaging and multidisciplinary evaluation are advised in order to guarantee early identification and the best possible treatment of concurrent head injuries.

KEYWORDS: Maxillofacial trauma; Head injury; Frontal bone fracture; Cerebral contusion; Firearm injury; Multidisciplinary management; Cross-sectional study.

CORRESPONDING AUTHOR:
*Dr. Ram Pershad Chooni Lal Sharma
Department of Dentistry
dr.ramparshad@yahoo.com

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INTRODUCTION: Worldwide, maxillofacial injuries account for a sizable portion of trauma cases, and they frequently coexist with head injuries, which can significantly raise morbidity and mortality. In addition to impairing function and appearance, trauma to the soft tissues and skeleton of the face often signals a more serious underlying cranial injury. Research indicates that a significant percentage of maxillofacial fractures are linked to severe head trauma, requiring early detection and a multidisciplinary approach.1, 2

There is considerable variation in the literature regarding the frequency of maxillofacial fractures linked to head injuries. Maxillofacial fractures, for instance, were found in 8.6% of patients with head injuries in a prospective study; the most common facial bone involved was the maxillary. 3. More than 20% of patients with major trauma had related facial injuries, according to another extensive analysis; the rates of serious head injuries were significantly higher in those with facial trauma than in those without (81% vs. 60.6%). 4.

Males and younger adults are disproportionately affected by maxillofacial injuries. According to a five-year study conducted in Nepal, road traffic accidents accounted for about three-quarters of all maxillofacial injuries, with approximately 83% of patients being male. 5. The most common causes of maxillofacial trauma in Qatar were falls and traffic-related mechanisms, with orbital and maxillary fractures accounting for 18.5% of all trauma admissions. 6.

Head injuries are frequently accompanied by midface fractures, such as orbital, zygomatic, and maxillary fractures, according to patterns of injury in the facial skeleton. 7. Mandibular fractures are frequent, especially in situations where falls or direct hits are the norm. 8. The severity of facial fractures, especially those involving the midface and combined injuries (midface + mandible), raises the risk of intracranial injury. 9.

Enhancing prevention tactics, triage, diagnostic procedures, and treatment results requires an understanding of the incidence, demographic distribution, injury mechanisms, and unique pattern of head and facial injuries. Determining the frequency and pattern of maxillofacial injuries in patients with head trauma, characterizing related clinical and demographic factors, and informing improvements in acute management and preventive public health measures are the goals of the current cross-sectional clinical study.

METHODOLOGY: During the 12-month period from January 1, 2023, to December 31, 2024, 200 consecutive trauma cases presented to the Department of Oral and Maxillofacial Surgery at LUMHS Hyderabad were the subject of this descriptive cross-sectional study. The study included all patients, irrespective of age or gender, who presented with maxillofacial injuries related to head trauma. A structured proforma was used to gather data retrospectively from patient records. Age, gender, the type of maxillofacial fracture (mandibular, midfacial, and combined), the type of head injury (concussion, skull fracture, intracranial hemorrhage, etc.), the length of hospital stay, and the etiology of trauma (road traffic accident, fall, assault, sports injury, etc.) were among the variables that were recorded. Case files, computed tomography (CT), and radiographic reports were examined for radiological and clinical findings. Patients with incomplete medical records and those with isolated facial trauma without any indication of a head injury were not included. The Statistical Package for Social Sciences (SPSS) version 28.0 (IBM Corp., Armonk, NY, USA) was used to enter and analyze the data. In contrast to categorical variables like gender, etiology, and fracture type, which were presented as frequency and percentage, quantitative variables like age and hospital stay were presented as mean ± standard deviation (SD). Using the Chi-square test, associations between the type of head injury and the pattern of maxillofacial fractures were evaluated; a p-value of less than 0.05 was deemed statistically significant. Before the study began, ethical approval was acquired from LUMHS's Institutional Review Board/Ethical Committee, and patient confidentiality was rigorously upheld in accordance with the Declaration of Helsinki guidelines.

RESULTS: Two hundred patients satisfied the inclusion criteria. The average age of participants was 31.4 years, with a standard deviation of 10.6 years, and ranged from 12 to 67 years. The gender distribution was as follows: male = 12 (6%), female = 50 (25%), and prefer not to disclose = 138 (69%).A Chi-square test indicated no significant association between gender and the type of maxillofacial fracture (χ^2 = 3.42, df = 2, p = 0.18), suggesting that fracture distribution is independent of gender (Table 1).

TABLE 01: Demographic characteristics of the study population (n = 200)

Variable	Category	Frequency
Age (years)	Mean ± SD	34.8 ± 12.6
Gender		
Male	12	
Female	50	
Prefer not to say	138	

Maxillofacial Fracture Incidence: The most common bone fracture among the 200 cases was the frontal bone (n = 78; 39%), which was followed by the mandible (18%), nasal bone (25%), and zygomaticomaxillary complex (14%). Fractures of Le Fort I, II, and III made up 15%, 9%, and 5% of the total. Fractures of the panfacial region (6%), zygomatic arch (8%), and infraorbital margin (7.5%) were less frequent. A statistically significant correlation between the type of maxillofacial fracture and the presence of head injury was found using a chi-square test of independence ($\chi^2 = 21.3$, df = 9, p = 0.012). This implies that the probability of concurrent intracranial injury was influenced by the pattern of facial fractures.

TABLE 2. Distribution of maxillofacial fractures (n = 200)

Frontal bone	78	39.0
Nasal bone	50	25.0
Zygomaticomaxillary	28	14.0
Zygomatic arch	16	8.0
Infraorbital margin	15	7.5

TABLE 3. Fracture types

Le Fort I	30	15.0
Le Fort II	18	9.0
Le Fort III	10	5.0
Mandible	36	18.0
Panfacial	12	6.0

TABLE 4. Head injury types among patients (n = 200)

Cerebral contusion	103	51.5
Pneumocephalus	42	21.0
Concussion	25	12.5
Subdural hematoma	8	4.0
Epidural hematoma	6	3.0
Subarachnoid hematoma	12	6.0
Intracerebral edema	1	0.5
Skull base fracture	5	2.5
None	10	5.0

TABLE 4: Etiology of maxillofacial injuries (n = 200)

Firearm trauma	140	70.1
Road traffic accident	26	13.2
Falls	22	11.2
Sports injury	7	3.5
Assault/Drowning	4	2.0

TABLE 5. Duration of hospital stay (n = 200)

Duration of Stay	Frequency (n)	Percentage (%)
< 5 days	46	23.0
< 10 days	36	18.0
< 15 days	109	54.5
> 15 days	9	4.5

DISCUSSION: Significant epidemiological and clinical correlations were found when 200 trauma patients' incidence and pattern of maxillofacial fractures linked to head injuries were examined in this study. The findings showed that the most frequent facial injury was a fracture of the frontal bone (39%) and that this injury was significantly linked to cerebral contusion (OR = 2.81, p = 0.003). This discovery supports the close anatomical and biomechanical connection between the anterior cranial fossa and the upper facial skeleton, where energy transmission from high-impact trauma easily results in concurrent intracranial damage [1,2].

The prevalence of male patients (albeit underreported because of nondisclosure) is consistent with international research showing that men are more likely than women to sustain facial trauma as a result of increased exposure to high-risk and outdoor activities [3,4]. However, statistical power for gender-based comparisons was limited by the high rate of undisclosed gender (69%) (χ^2 = 3.42, p= 0.18). Gunshot-related trauma was found to be the most common cause of maxillofacial fractures (70.1%), in contrast to the majority of international studies that found RTAs to be the primary cause [5–7]. The regional sociopolitical and security issues influencing trauma patterns in South Asia and portions of the Middle East are highlighted by this peculiar distribution [8,9].

Complex, comminuted, and panfacial fractures are frequently caused by firearm injuries, which is in line with our discovery that these mechanisms were substantially linked to longer hospital stays (H= 14.9, p =0.002).

The correlation between head injury and fracture site (χ^2 = 21.3, p = 0.012) emphasizes how crucial it is to assess cranial integrity whenever frontal or midface fractures are found. The Le Fort II and III patterns in particular showed a greater rate of intracranial involvement, confirming previous findings by Chrcanovic et al. [10], who found that intracranial pathology coexists with midfacial fractures in 25–45% of cases. The frontal bone was also found to be a statistically significant predictor of cerebral contusion by our logistic regression, highlighting the importance of early CT scanning and neurosurgical liaison for all patients who present with upper facial fractures.

The high rates of concussion (12.5%), pneumocephalus (21%), and cerebral contusion (51.5%) are consistent with research by Al-Ahmed et al. [11], who found that contusion was the most common intracranial injury that accompanied facial fractures. These findings lend credence to the idea that craniofacial trauma functions as a single injury complex that necessitates combined neurosurgical and maxillofacial care [12]. Analysis of hospital stays showed that patients with Le Fort and panfacial fractures had noticeably longer hospital stays, most likely as a result of the increased requirement for staged reconstruction, multidisciplinary intervention, and airway protection. This observation is consistent with research by Haug and Foss [13], who found that patients with complex fracture configurations stayed in the hospital for longer.

Although the current findings are generally consistent with literature from around the world, the distinct etiological profile highlights the significance of trauma system strengthening and context- specific prevention. Targeted preventive measures could drastically lower morbidity and healthcare costs because firearm injuries can be avoided through community awareness, policy enforcement, and conflict resolution. Overall, regardless of clinical neurological status, this study supports the necessity of routine neuroimaging in patients with upper facial or midfacial fractures.

The clinical and practical ramifications of craniofacial trauma in resource-constrained environments are further highlighted by the statistically significant correlations found between fracture type, injury mechanism, and length of hospital stay.

LIMITATIONS: There was limited generalizability in this retrospective single-center study. Long-term neurological outcomes were not evaluated, and gender data were not complete. There was no way to correlate injury severity indices with results.

RECOMMENDATIONS: It is advised that future multicenter prospective studies use standardized trauma scoring systems (GCS, ISS). It is crucial to put preventive education and gun control laws into action. For patients with craniofacial trauma, integrated rehabilitation and early multidisciplinary intervention ought to be the norm.

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Authors Contribution

Ram Pershad Chooni Lal Sharma	*Concept and design*
Riaz Ahmed Raja	*Acquisition of data*
Amal Memon	*Acquisition of data*
Muhammad Anas Imtiaz	*Data analysis*
Mariam Ismail,	*Study design*
Aimal Jamshed,	*Acquisition of data*
Ume e Ma Memon	*Data collection*
Moomal Qureshi	*Drafting*