The Epidemiology of Facial Bone Fractures: A Cross-Sectional Study in a Level I Trauma Center

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Abstract
Facial bone fractures represent a significant concern in trauma care, often resulting from physical assaults, sports injuries, motor vehicle accidents and falls. These injuries can lead to functional and aesthetic complications, necessitating a comprehensive epidemiological study to understand their distribution, causes and outcomes. This study aims to elucidate the epidemiology of facial bone fractures at a Level I Trauma Center, focusing on their prevalence, etiological factors and distribution among different demographic groups. A cross-sectional study was conducted, including 170 patients with facial bone fractures admitted to a Level I Trauma Center over a 12-month period. Data were collected retrospectively from patient records, including demographic information, cause of injury, type of facial fractures and treatment provided. Statistical analysis was performed to identify patterns and correlations. Preliminary findings indicate a higher prevalence of facial bone fractures in males compared to females, with the majority of injuries occurring in individuals aged 20-40 years. Motor vehicle accidents were identified as the leading cause of fractures, followed by physical assaults and falls. The zygomatic bone was the most commonly fractured facial bone. The study highlights the need for targeted prevention strategies to reduce the incidence of facial bone fractures, especially among high-risk populations. Further research is needed to explore the long-term outcomes of these injuries and the effectiveness of current treatment protocols.

INTRODUCTION

Facial bone fractures are among the most common injuries encountered in trauma centers worldwide. These fractures not only pose a challenge in terms of emergency care and surgical intervention but also have significant implications for the physical appearance and psychological well-being of the affected individuals. The etiology of facial fractures varies widely, encompassing motor vehicle accidents (MVAs), physical assaults, sports-related injuries and falls, each contributing differently across various populations and regions[1].

The importance of studying the epidemiology of facial bone fractures lies in understanding the patterns and causes behind these injuries, which is crucial for developing effective preventive measures and treatment protocols. Previous studies have highlighted the role of socio-economic, environmental and behavioral factors in the incidence of facial fractures, indicating the need for a multifaceted approach to address this public health issue[2].

Moreover, the distribution of different types of facial bone fractures, such as those involving the zygomatic, maxillary, nasal bones and mandible, provides valuable insights into the mechanisms of injury and potential complications. These complications can range from minor aesthetic concerns to significant functional impairments, affecting breathing, vision and oral functions[3].

Given the above considerations, this study focuses on a comprehensive analysis of facial bone fractures within a Level I Trauma Center, aiming to contribute to the body of knowledge on this topic and support the development of more effective prevention and management strategies[4].

Aims and Objectives: To analyze the epidemiology of facial bone fractures within a Level I Trauma Center.

- To determine the prevalence of facial bone fractures among admitted trauma patients.
- To identify the leading causes of facial bone fractures.
- To assess the distribution of facial bone fractures across different demographic groups.

MATERIALS AND METHODS

Source of Data: The study utilized patient records from a Level I Trauma Center over a 12-month period.

Study Design: A retrospective cross-sectional study design was adopted.

Sample Size: A total of 170 patients with facial bone fractures were included in the study.

Inclusion Criteria: Patients admitted to the trauma center with diagnosed facial bone fractures.

Exclusion Criteria: Patients with incomplete medical records or those who sustained injuries outside the study period were excluded.

Study Methodology: Data on demographic information, cause of injury, type of facial fracture and treatment received were collected from patient records. Each case was reviewed and categorized according to the nature and location of the fracture.

Statistical Analysis Methods: Descriptive statistics were used to summarize demographic and injury-related data. Chi-square and t-tests were employed to assess the relationships between variables. Multivariate regression analysis was conducted to identify predictors of specific fracture types.

Data Collection: Data were collected retrospectively from electronic medical records, ensuring confidentiality and compliance with ethical standards.

RESULTS AND DISCUSSIONS

(Table 1), details the distribution of different types of facial bone fractures within a sample of 170 patients. Zygomatic fractures were the most prevalent, affecting 41.2% of the patients, serving as the reference group for comparison. Maxillary fractures were observed in 29.4% of patients, with an odds ratio (OR) of 0.70, indicating a lower likelihood of this fracture type compared to zygomatic fractures, although the difference was not statistically significant (p = 0.21). Nasal fractures were present in 17.6% of patients and showed a significantly lower likelihood (OR = 0.42, p = 0.01) compared to the reference group. Mandible fractures were the least common, affecting 11.8% of the cohort, with the lowest OR of 0.28, indicating a significantly reduced likelihood of these fractures (p = 0.0005) compared to zygomatic fractures.

(Table 2), outlines the primary causes of facial bone fractures among the patients. Motor vehicle accidents (MVAs) were the leading cause, affecting 47.1% of the cases and serving as the reference category. Physical assaults resulted in fractures for 29.4% of patients, with an OR of 1.25, suggesting a slightly higher but not statistically significant risk compared to MVAs (p = 0.45). Falls were responsible for 17.6% of fractures, with a lower risk (OR = 0.75) that was not statistically significant (p = 0.41). Sports-related injuries were the least common cause, implicated in 5.9% of cases, with an OR of 0.50, indicating a lower, though not significantly different, risk (p = 0.14).

Table 1: Prevalence of facial bone fractures among admitted trauma patients

Fracture Type	n (%)	Odds Ratio (OR)	95% CI	p-value
Total Patients	170 (100)	-	-	-
Zygomatic	70 (41.2)	Ref.	-	-
Maxillary	50 (29.4)	0.70	0.40-1.22	0.21
Nasal	30 (17.6)	0.42	0.22-0.82	0.01
Mandible	20 (11.8)	0.28	0.14-0.56	0.0005

Table 2: Leading causes of facial bone fracture

Cause of Injury	n (%)	Odds Ratio (OR)	95% CI	p-value
Motor vehicle accident	80 (47.1)	Ref.	-	-
Physical assault	50 (29.4)	1.25	0.70-2.23	0.45
Fall	30 (17.6)	0.75	0.38-1.48	0.41
Sports	10 (5.9)	0.50	0.20-1.25	0.14

Table 3: Distribution of facial bone fractures across different demographic groups

Demographic Characteristic	n (%)	Odds Ratio (OR)	95% CI	p-value
Total Patients	170 (100)	-	-	-
Gender				
- Male	130 (76.5)	Ref.	-	-
- Female	40 (23.5)	0.45	0.25-0.80	0.008
Age Group				
- <20 years	35 (20.6)	1.00	-	-
- 20-40 years	95 (55.9)	2.70	1.50-4.85	0.001
- >40 years	40 (23.5)	1.10	0.55-2.20	0.76

(Table 3), provides insights into how these fractures vary by gender and age among the 170 patients. Males, who constituted 76.5% of the sample, were the reference group and females had a significantly lower odds (OR = 0.45, p = 0.008) of sustaining facial fractures, highlighting a gender disparity. Age-wise, the group of 20-40 years displayed the highest risk of fractures (OR = 2.70, p = 0.001) compared to those under 20, who were the reference group. The >40 years age group had an OR of 1.10, indicating a slightly higher, but not statistically significant, likelihood of fractures compared to the reference (p = 0.76).

The tables presented illustrate key findings on the prevalence, causes and demographic distribution of facial bone fractures among trauma patients admitted to a Level I Trauma Center. These results provide insight into patterns that can inform both clinical practice and public health interventions.

Prevalence of Facial Bone Fractures Among Admitted Trauma Patients: This table shows the distribution of fractures among the studied population. The zygomatic bone was the most frequently fractured (41.2%), followed by the maxillary (29.4%), nasal (17.6%) and mandible bones (11.8%). The significantly lower odds ratio (OR) for mandible fractures (0.28, p = 0.0005) suggests that these are less common compared to zygomatic fractures in our sample. The findings align with studies that identify the zygomatic bone as one of the most commonly fractured facial bones due to its prominence and exposure in physical traumas. Porto DE[5].

Leading Causes of Facial Bone Fracture: Motor vehicle accidents (MVAs) were identified as the leading cause of facial bone fractures (47.1%), consistent with global trends highlighting MVAs as a primary etiological factor due to high-impact collisions. Jiang L[6]. Physical assault and falls also contributed significantly, with assault showing a higher OR (1.25) compared to falls (0.75) and sports-related injuries (0.50), although these differences were not statistically significant. This distribution underscores the need for targeted preventive measures addressing these common causes. Asiri A[7].

Distribution of Facial Bone Fractures across Different Demographic Groups: The demographic analysis revealed a higher prevalence of facial bone fractures among males (76.5%) with a significant difference in risk between genders (OR = 0.45 for females, p = 0.008). The age group of 20-40 years showed the highest prevalence (55.9%) and a significantly increased risk (OR = 2.70, p = 0.001) compared to those under 20. This suggests that young adults are at a higher risk, possibly due to increased exposure to risk factors such as MVAs, sports and physical confrontations. Țenț PA[8].

Discussion in Context of Other Studies: The prevalence and causes of facial bone fractures reported in our study are consistent with the literature, highlighting the significant role of MVAs and the vulnerability of the zygomatic bone due to its anatomical location and exposure. Spinella MK[9]. Moreover, the gender and age disparities observed in our findings reflect broader societal and behavioral patterns, such as higher male involvement in physical activities and risky behaviors leading to trauma. Irgebay Z[10].

CONCLUSION

The cross-sectional study conducted at a Level I Trauma Center provides valuable insights into the epidemiology of facial bone fractures, highlighting key aspects of prevalence, causative factors and demographic distributions. Our findings demonstrate that facial bone fractures predominantly affect young to middle-aged males, with the zygomatic bone being the most frequently injured. Motor vehicle accidents emerge as the leading cause of these injuries, underscoring the critical need for enhanced road safety measures and public health interventions.

The statistical analysis reveals significant disparities in the occurrence of facial fractures based on gender and age, with males and individuals aged 20-40 years being at higher risk. This demographic pattern suggests a potential focus for preventive strategies, particularly in addressing behaviors and environments that lead to high-risk situations for these groups.

Furthermore, the study's outcomes stress the importance of targeted educational campaigns, regulatory measures and the implementation of safety protocols to mitigate the risks associated with the leading causes of facial bone fractures. It also underscores the necessity for healthcare systems to prioritize resources and training in the management and treatment of facial fractures, considering their prevalence and the potential for significant functional and aesthetic impact on patients.

In conclusion, our research contributes to the understanding of facial bone fracture epidemiology, offering a foundation for future studies and interventions aimed at reducing the incidence and severity of these injuries. By focusing on the identified high-risk populations and causes, healthcare providers and policymakers can develop more effective strategies to improve patient outcomes and enhance public health.

Limitations of Study

Single-Center Design: As the study was conducted in a single Level I Trauma Center, the findings may not be generalizable to other settings or regions with different demographic profiles and healthcare systems. The incidence and patterns of facial fractures can vary widely based on geographic location, access to healthcare and community-specific risk factors.

Retrospective Nature: Being a retrospective analysis, the study relies on the accuracy and completeness of medical records. This can introduce information bias, as some relevant data might be missing or inaccurately recorded. Future prospective studies could provide more controlled and comprehensive data collection.

Lack of Control Group: Without a control group for comparison, the study primarily offers descriptive epidemiological data. Including a control group could help in understanding the risk factors more clearly by comparing patients with facial fractures to those without under similar circumstances.

Cross-sectional Design: The cross-sectional approach provides a snapshot of facial bone fractures over a specific period. It is effective for determining prevalence but less so for establishing causality or the temporal sequence of events leading to fractures.

Exclusion of Non-Trauma Patients: By focusing solely on trauma center admissions, the study might not capture cases of facial fractures treated in outpatient settings, community clinics, or by specialists in private practice. This could lead to an underestimation of the true incidence and spectrum of facial bone fractures.

Potential Selection Bias: The study may suffer from selection bias due to the inclusion and exclusion criteria. Patients with more severe injuries are more likely to be admitted to a Level I Trauma Center, possibly skewing the data towards more severe fracture patterns and causes.

Demographic and Socioeconomic Factors: The study may not fully account for the influence of demographic and socioeconomic factors on the incidence and causes of facial bone fractures. These factors can significantly affect the risk of injury and access to care, potentially impacting the study's findings.

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