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Original Research Article

Clinical and demographic profile of zygomatico-maxillary complex fracture in a tertiary referral centre- A retrospective study

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Abstract

The aim of the study was to evaluate the clinical and demographic profile of zygomatic-maxillary complex fracture in patients treated in Govt. Dental College Kottayam, in the year 2021-22- Two-year study.

Materials and Methods: A retrospective hospital-based study was carried out to determine the demographic etiology of the patient presenting with ZMC fracture at the Govt. Medical College Kottayam. Zygomatic-maxillary fracture occurs mainly in the younger age group 52%. The main etiological factor was RTA 66.5%, fall from height 26%, work related 63%, assault 51.6%. Most common side affected in our study was Right side patients than the left side. In our study pattern, males are more affected 82.2% than females 17.8%.

Conclusion: Data regarding etiological factors of ZMC fracture basically comprises RTA. It is a preventable cause. Proper preventive measures and road safety precautions can be considered.

Keywords: Zygoma, Zygomatico-maxillary Complex, Assault.

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1. Introduction

Zygomatic fractures are among the most commonly encountered injuries in maxillofacial trauma.[3,5] These fractures typically result from high-impact events, with road traffic accidents (RTAs) being the leading cause.[1,4,12] Other etiological factors may include interpersonal violence, sports injuries, and accidental falls.[10,13] Among the various types of facial fractures, the Zygomaticomaxillary Complex (ZMC) fracture ranks as the second most frequent, following nasal bone fractures.[8] Other commonly seen fractures in maxillofacial trauma include orbital fractures, Naso-orbito-ethmoidal (NOE) fractures, and mandibular fractures.

The ZMC fracture is particularly significant due to the complex anatomy it involves.[6] It affects several bones, including the frontal process of the zygoma, the maxillary bone, the sphenoid bone, and the temporal bone, and it also comprises the lateral wall of the orbit. As a result of this anatomical involvement, ZMC fractures are often associated with ocular symptoms and complications. Since the zygoma contributes to the orbital structure, any disruption can potentially impair vision.[9] In severe cases, especially in major RTAs, the fracture may directly or indirectly involve the globe of the eye, orbital muscles, and surrounding soft tissues, leading to diplopia, enophthalmos, or even damage to the optic nerve.[6,12]

Moreover, due to the proximity of the infraorbital nerve, ZMC fractures frequently lead to paresthesia or numbness in the infraorbital region, affecting the cheek, upper lip, and sometimes the upper teeth. Patients may also present with trismus, resulting from the involvement of the temporalis muscle or impingement on the coronoid process. These

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functional disturbances can significantly affect the patient's quality of life.[7,15]

Aesthetic concerns are also a major aspect of ZMC fractures. The zygoma plays a key role in maintaining midfacial contour and prominence. Any displacement or asymmetry caused by the fracture can lead to noticeable facial deformities, such as flattening of the cheek, orbital dystopia, or asymmetrical facial appearance.[5-6] This can have a considerable psychological impact on patients, especially in younger individuals.

In summary, ZMC fractures are critical injuries in the field of maxillofacial surgery due to their anatomical complexity, impact on ocular and sensory function, and their implications for facial aesthetics. Accurate diagnosis and timely intervention are essential to restore both form and function.[7]

2. Materials and Methods

2.1. Study design and population

A retrospective observational study was carried out at the Government Dental College (GDC), Kottayam, focusing on patients diagnosed with Zygomaticomaxillary Complex (ZMC) fractures. The study period spanned two full years, from January 2021 to December 2022. The data was collected from both the Casualty Unit of the Oral and Maxillofacial Surgery (OMFS) Department as well as the Outpatient Department (OPD) of OMFS, GDC Kottayam.

This study aimed to evaluate the demographic distribution, etiology, and pattern of ZMC fractures among patients who presented to the institution with maxillofacial injuries. Detailed examination of patient records was undertaken to derive meaningful insights regarding the prevalence, cause, and laterality of ZMC fractures in the given population.

2.2. Inclusion criteria

The study included all patients who reported to the casualty and outpatient clinics of the Department of Oral and Maxillofacial Surgery at GDC Kottayam with documented ZMC fractures, as part of their maxillofacial injury profile. The inclusion was irrespective of gender or age, provided the cause of trauma could be identified and was consistent with common etiologies such as road traffic accidents (RTA), workplace injuries, sports-related injuries, or other forms of accidental trauma.

Patients with incomplete records, or fractures not involving the ZMC, were excluded from the study to maintain the specificity and reliability of the data.

2.3. Parameters evaluated

Relevant data were meticulously extracted from patient clinical records and trauma sheets. The following parameters were documented and analyzed:

Gender of the patient

Age at the time of injury

Etiology of the trauma (e.g., RTA, workplace injury, sports injury, fall, assault)

Side of the fracture (right or left hemiface involvement)

This information provided a basis for identifying demographic trends, causative patterns, and anatomical predilection of ZMC fractures within the study population.

2.4. Statistical analysis

The collected data were compiled and statistically analyzed using the Statistical Package for the Social Sciences (SPSS), version 20. Descriptive statistics were used to summarize demographic variables and distribution patterns. Inferential statistics were applied to determine associations between categorical variables.

A Chi-square test was employed to assess the statistical significance of differences between groups, especially for qualitative variables such as gender distribution and side of involvement. A p-value of less than 0.05 was considered statistically significant, indicating a strong association between the variables studied.

3. Results

A total of 600 patients were collected. The age ranged from 20-80 years. (Mean age 46.5years)
Standard deviation (±44.5)
They were divided into four groups
Distribution of patients by age group and gender

Age					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	< 21 years	9	4.6	6.1	6.1
	21-40 years	77	39.1	52.0	58.1
	41-60 years	48	24.4	32.4	90.5
	61-80 years	14	7.1	9.5	100.0
	Total	148	75.1	100.0	
Total		197	100.0		

The study analyzes 197 cases of Zygomatico-Maxillary Complex (ZMC) fractures treated at GDC Kottayam over two years. The demographic data shows that the majority of patients (52%) belonged to the 21–40-year age group, indicating that young adults are most commonly affected. followed by the 41–60 years group (32.4%). The <21 years and 61–80 years groups had significantly fewer cases, at 6.1% and 9.5%, respectively. This age-wise distribution illustrates that young adults are the most vulnerable, possibly

due to higher levels of physical activity and road usage. The gender-wise graph highlights a significant male predominance, with 82.2% males and only 17.8% females, reinforcing the trend observed in trauma-related studies globally.(**Table 1**).

The primary cause of ZMC fractures was road traffic accidents (RTAs), responsible for 66.5% of the injuries, followed by falls (26.4%), assaults (5.1%), workplace injuries (1.5%), and sports injuries (0.5%). This highlights RTAs as the leading and preventable cause of such fractures (**Table 2**).

Table 1: Etiology

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	RTA	131	66.5	66.5	66.5
	Assault	10	5.1	5.1	71.6
	workplace injury	3	1.5	1.5	73.1
	sports injury	1	.5	.5	73.6
	Accident fall	52	26.4	26.4	100.0
	Total	197	100.0	100.0	

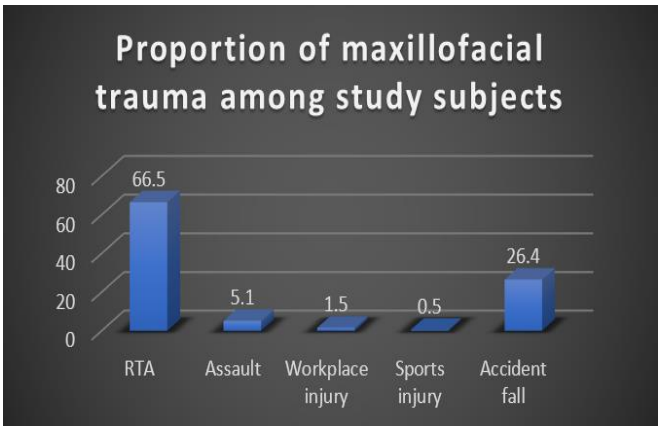

Figure 1: Proportion of maxillofacial trauma among study subjects

Table 2: Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Males	162	82.2	82.2	82.2
	Females	35	17.8	17.8	100.0
	Total	197	100.0	100.0	

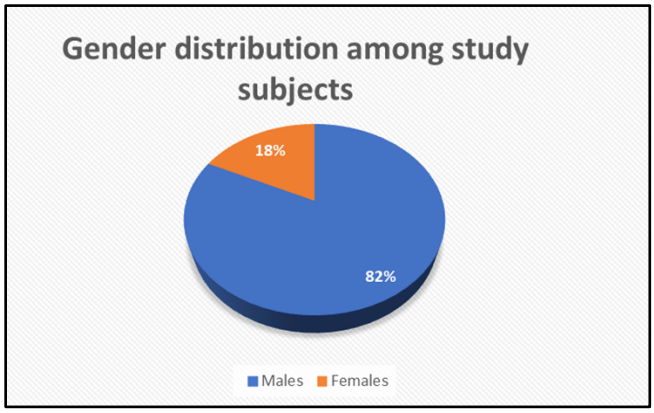

Figure 2: Gender distribution among study subjects

Analysis of the affected side (either Right of Left side)

Table 3: Side

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Right	94	47.7	48.5	48.5
	Left	98	49.7	50.5	99.0
	both right and left	2	1.0	1.0	100.0
	Total	194	98.5	100.0	
Total		197	100.0		

Regarding the side of the face affected, a nearly equal distribution between left (50.5%) and right (48.5%) sides, with a very small proportion (1%) involving bilateral fractures. This balance suggests that the side of impact may depend on situational factors during trauma.(**Table 3**).

These findings emphasize the need for targeted road safety measures and public awareness, particularly among young adult males, to reduce the incidence of facial trauma.

4. Discussion

In this retrospective observational study, it was clearly observed that the most commonly affected demographic group among patients diagnosed with Zygomaticomaxillary Complex (ZMC) fractures was young adults, particularly individuals between the ages of 21 and 40 years. This age group constituted the majority of the cases recorded during the study period. A possible explanation for this finding lies in the high level of physical activity, mobility, and social engagement that characterizes this age bracket. People within this group are often actively involved in outdoor recreational activities, are more likely to be employed in physically demanding or travel-intensive occupations, and tend to use personal transportation-especially two-wheelers on a regular basis. Such patterns of behavior significantly increase their exposure to situations where trauma can occur, particularly road traffic accidents (RTAs), which have been identified as a major etiological factor in maxillofacial injuries.[2,8]

Additionally, a strong male predominance was noted in the incidence of ZMC fractures, with a significantly higher number of male patients affected compared to female patients[2,11,13] This finding is consistent with several previously published studies, both within India and globally, which have consistently reported a similar trend. The higher incidence of trauma among males may be attributed to a variety of reasons. Males are often more involved in high-risk environments, including construction sites, industrial workplaces, driving, and contact sports. They may also be more prone to engaging in high-speed driving, alcohol consumption, and interpersonal conflicts, which could result in trauma. Moreover, societal roles and cultural norms in many regions still assign more outdoor and labor-intensive tasks to men, further increasing their risk of injury. Socioeconomic factors, including unemployment and lifestyle behaviors, may also contribute to this gender disparity in trauma statistics.

Road traffic accidents were clearly established as the most frequent and dominant cause of ZMC fractures in the current study population. This was followed in frequency by injuries resulting from assault or physical altercations, and finally, by accidental falls from a height. The predominance of RTAs as a causative factor is particularly evident in developing nations like India and Egypt, where the rate of motor vehicle usage is high, but where road safety infrastructure and regulations may still be developing or inadequately enforced. Poorly maintained roads, lack of pedestrian infrastructure, overcrowded urban traffic, and limited public awareness about traffic safety all contribute to the high incidence of vehicular accidents. In contrast, studies from developed countries frequently cite interpersonal violence or assault as the most common cause of facial fractures.[10,14] These differences in the patterns of etiology may reflect variations in social behavior, alcohol and substance abuse prevalence, unemployment, and urban crime rates between developing and developed nations.

The study also emphasized the vital importance of preventive measures and legal enforcement of road safety protocols. The implementation of strict regulations concerning the compulsory use of helmets for two-wheeler riders and seatbelts for all vehicle occupants has been shown to significantly reduce the severity of injuries in motor vehicle collisions. Educational campaigns, public awareness drives, and routine monitoring by traffic authorities play a critical role in enhancing safety compliance among the public. Promoting responsible driving behavior and spreading awareness about the consequences of neglecting protective measures can significantly reduce the occurrence of such trauma in the future.[13-14]

Another important observation that emerged from the data was the lateralization of fractures. A higher incidence of left-sided ZMC fractures was recorded compared to those on the right side. This asymmetry may be associated with common patterns of injury mechanics, such as assaults by right-handed individuals or the dynamics of road traffic impacts, where the left side of the face is more exposed to external forces, especially in two-wheeler accidents. Bilateral zygomatic fractures were found to be extremely rare and were typically associated with high-velocity trauma or severe polytrauma scenarios.

The zygomatic bone is one of the most structurally and aesthetically significant bones of the facial skeleton. It is the most prominent bone of the midface and contributes not only to facial contour and symmetry but also plays a critical role in protecting vital orbital structures. As a component of the lateral and inferior orbital wall, the zygoma serves as a shield for the eye and associated neurovascular contents. Consequently, trauma to this area can lead to significant aesthetic deformity, ocular complications such as diplopia or enophthalmos, and functional impairments like trismus and infraorbital nerve paresthesia. Its prominence and anatomical positioning make it highly susceptible to direct impact during trauma, explaining the high frequency of ZMC fractures in maxillofacial injuries.[6,9,12]

5. Conclusion

Zygomaticomaxillary Complex (ZMC) fracture is one of the most frequently encountered maxillofacial fractures, with road traffic accidents being the leading cause in the studied population. These fractures are more prevalent among young adult males and are often associated with other injuries involving the facial skeleton, hands, and limbs. Early diagnosis and appropriate management are essential to prevent long-term functional and aesthetic complications. The standard treatment modality for ZMC fractures is open reduction and internal fixation using titanium plates and screws, which provides stability and restores facial symmetry. However, due to the limitations in sample size and the single-institution nature of this study, a broader understanding of the epidemiology and treatment outcomes of ZMC fractures requires data from larger populations. Therefore, multicentric studies involving various regions and healthcare centers are recommended to derive more comprehensive and generalizable conclusions. Such studies would not only enhance the understanding of injury patterns but could also help in developing targeted preventive strategies and public health policies at the national level.

6. Source of Funding

None.

7. Conflict of Interest

None.

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