Prevalence and Pattern of Zygomatic Complex Fracture in a Tertiary Care Hospital of Central Nepal

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ABSTRACT

Background

Zygomatic complex fracture is one of the commonest fractures of face leading to facial asymmetry. Various classification systems describing the pattern have been reported. The aim of this study was to determine the prevalence and pattern of Zygomatic maxillary complex fracture in tertiary centre hospital of Nepal based on two different classifications.

Methods

A prospective observational study was conducted on College of Medical Sciences, Teaching Hospital, Chitwan from September 2021 to August 2023 with all cases of facial injuries. Computed Tomography scan of the cases were considered and 371 cases with Zygomatic maxillary complex fracture were studied. Apart from the demographic data, Knight and North classification and Zing Classification of the fractures were recorded. The data was tabulated and analysed using SPSS 20.

Results

Zygomatic maxillary complex fracture was prevalent in third decayed of life with mean age of 28.45 years. Male (286) were more affected. Road traffic accident is primary cause of the fracture in our study. Type III fracture (31.35%) on Knights classification is commonest pattern followed by type VI (18.65%), type V (13.99%) and type II (14.77%). On Zing classification type B (53.89%) of Zing classifications is more prevalent followed by type C (19.69%) and type A2 (17.36%).

Conclusions

The study describes the demographic distribution, aetiology and pattern of Zygomatic complex fracture in a tertiary hospital.

Keywords: etiology; pattern; prevalence; zygomatic complex fracture.

INTRODUCTION

Zygomatic bone, malar bone, is prominent facial bone two in number and contributes to strength and stability of mid face.[1] It not only is a strong pillar for the middle third of the face but also is key for esthetics and function.[2] Intricate anatomical architecture of zygoma helps to bear impact to considerable magnitude yet its fracture is not uncommon.[3] Zygoma articulates with frontal, temporal and maxillary bone was initially considered it to be tripod bone and its fracture as tripod fractures. However, fourth process that forms the floor of the orbit by the fusion to sphenoid bone marks it as a tetrapod. This complicated articulation makes the Zygomatico-Maxillary complex (ZMC).[4] Various studies on ZMC fractures were carried out to describe incidence and distribution on age, gender, society and aetiology.[5-8] However, study on the pattern of the zygomatic bone fracture is ill defined. This may be due to various classification systems secondary to the complex anatomy.[9-12] Knight and North classification system and Zing classification system are more common classification system used to illustrate ZMC fracture.[10, 12] This study aimed to assess the prevalence and pattern of zygomatic

complex fracture and see the variability of common classification system.

METHODS

This was a prospective observational study conducted in the Department of Oral and Maxillofacial surgery of College of Medical Sciences, Teaching Hospital (COMS-TH), Chitwan, Nepal. After approval from institutional review committee (Ref No.COMSTH-IRC/2021-137) all cases of facial injury reported to emergency and OPD of College of medical sciences from September2021 to September 2023 with clinical suspicion of zygomatic complex fracture was considered for the study.

Sample size was calculated based on the previous

$$n = Z^2 \frac{pq}{e^2}$$

For 95% confidence interval Z =1.96 and p=27.08 and q= (100-p) =(100-27.08)=72.92 and allowable error is 5%.so number of sample size will be

$$n = 1.96^2 \frac{27.08 \times 72.92}{5^2}$$

$$n = 303.44$$

Based on the calculation number of sample size is 304. We have taken 371 cases for our study. All study cases under went Computer tomography scan (CT scan) with axial and coronal cuts with 3D reconstruction. Fracture in three processes namely frontal, temporal and Maxillary process were included while the fracture at floor of the orbit was excluded from the study. This exclusion is because both Knight and North classification and Zing Classification only considered these processes. All CT scan was checked by Oral and Maxillofacial surgeon with more than 3 years' experience. The fracture was studied in 3D reconstructed format first. Presence of fracture line in frontal, infraorbital and zygomatic arch and zygoma were recorded. Fracture lines only in frontal process was marked as isolated lateral orbital wall fractures. Similarly fracture line in the temporal process was isolated zygomatic arch and fracture line in the infraorbital rim was isolated infraorbital wall fractures. Presence of fracture line in all three processes and additional fracture lines were also noted. Further in

CT scan distance between the fracture fragments was closely observed and was measured using calibrated computer scale. Fragments less than 5 mm apart were considered as undisplaced and those, more than 5 mm were marked as displaced. If the lateral orbital wall tilted medially and infraorbital rim went inferiorly it was considered to be medially rotated. The lateral rotation of the zygoma was considered when the infra orbital rim was above its counterpart and lateral orbital wall was outside to its counterpart. All the data was recorded in the preformed proforma and was transferred to MS excel and was analysed using SPSS 20 version. Table, Bar diagram were used to express the results.

RESULTS

In 372 cases of our study, 286(76.9 %) were male and 86(23.1%) were female. The mean age of the population was 28.45 ± 8.82 years. The distribution of age range is given in (Table 1).

Table 1. Distribution on Age range. (n=286)	
Age range	Frequency (%)
<20 years	45 (12.1)
21-30 years	211 (56.72)
31-40 years	75 (20.16)
41-50 years	32 (8.6)
>51 years	9 (2.42)

In our study we observed left side 198(53.2%) is prevalent and 14(3.8%) is bilateral. Distribution of side is given in (Table 2).

Table 2. Distribution on Side. (n=372)	
Side	Frequency (%)
Left	198(53.2)
Right	160 (43)
Bilateral	14 (3.8)

In our study we observed RTA is commonest cause of the ZMC fracture 188(50.5 %) followed by fall and assault. Different causes of ZMC fracture is shown in the (Figure 1).

Out of 372 cases 386 zmc were found to be fractured. All 3 process of ZMC was most prevalent with 208 (53.89%) out of which 102(26.42%) were displaced. 54(13.99%) were laterally rotated while 32 (8.29%)
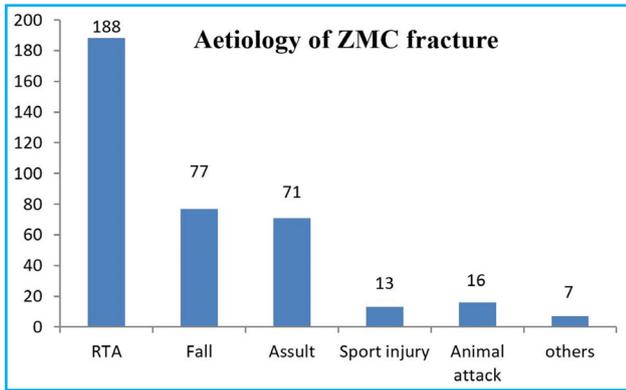
Figure 1. Distribution on the aetiology.

were medially rotated. Isolated arch fracture in our study was 67(17.36%) out of which 10 (2.59%) showed no displacement. Different pattern of ZMC fractures are tabulated in (Table 3).

fracture was given by Schjelderup in 1950.[11] Knight and North classification and Zing classification are commonest in use. [10-12, 15] For surgeons it always has been a challenge to manage this complex structure as it not only directly impacts the facial aesthetics but also plays a pivotal role in structural balance.[3,16,17] ZMC fracture is more prevalent in third decayed of life in previous studies.[18, 19] This might be because these age groups are bread earner and are involved in extra household activities. This finding coincides with findings of our study where mean age is 28.45 $\pm$ 8.82 years. This study also supports other study conducted in gender based population showing male being more affected.[7, 20] This may be because of male involved in physical activities, traveling and also practice drink and

Table 3: Various pattern of ZMC Fracture. (n=372)

Knight and North classification	Zing Classification				
	Isolated zygomatic arch (Type A1)	Isolated lateral orbital wall (Type A2)	Isolated infraorbital wall (Type A3)	Fracture of all 3 processes (Type B)	Fracture with multiple lines (Type C)
Undisplaced fracture (Type I)	10(2.59%)	4(1.04%)	12(3.11%)	20(5.18%)	4(1.04%)
Isolated zygomatic arch fracture (Type II)	57(14.77%)	0	0	0	0
Displaced fracture (Type III)	0	15(3.89%)	4(1.04%)	102(26.42%)	0
Medially rotated (Type IV)	0	0	0	32(8.29%)	0
Laterally rotated (Type V)	0	0	0	54(13.99%)	0
Additional fracture line (Type VI)	0	0	0	0	72(18.65%)

DISCUSSION

Zygomatic bone is a amalgamated bone that has articulation with frontal, temporal and maxillary bone facially and sphenoid bone in the floor of the orbit.[2] This multipart anatomy results its name to zygomaticomaxillary complex and also make it able to stand forces of impact resisting fracture to certain extent.[14] Despite structural resistance to fracture because of its prominence, fracture of zygomaticomaxillary complex is not uncommon. High prevalence of the fracture, complex anatomy made large variants of the classification system. Oldest known description of ZMC fracture was by Daverney in 1751 but classification of

drive. Previous studies show left side is predominantly affected in facial trauma which also favours our study.[19, 20] This predominance of the side might be because most people are right hand and try to protect themselves from injury using their dominant hand. Also in the physical assault there will be more blows in the same direction of the opponent strong arm. In our study the left side is slightly more involved than the right by small margin. This might be because of the difference of aetiology of the trauma. RTA is one of the prime causes of the ZMC fracture in our study followed by fall and physical violence. This result favours the study carried out previously in Chitwan.[13] Since the city is located in mid

Nepal and large number of vehicles cross the city every day along with multiple cross roads within city may be contributing factor for the accident prone injuries. High hills and farming based occupation and our centre being tertiary centre for management of facial injuries, fall injury is substantial in number. Mixed community, high illiteracy rate and abundance of alcohol consumption in the area makes physical violence and its consequences as third reason for ZMC fracture in our study.[18, 21-23] This is similar to study conducted in developing world while contradicts the study conducted in developed world as road safety is given pivotal importance in those worlds. Based on Zing classification type B, fracture of all three processes, is most common 53.89% in our study. The prevalence of this type of fracture was also highly reported ranging from 57.27% to 62.7%.[24] Type C or multifragments zygoma in our study is 19.69% which is second commonly seen type of fracture that supports the study by Zing et al. Type A1 or isolated fracture is third prevalent in our study similar to study of Zing. However this finding is not in accordance to study conducted by Dubron as they observed type A1 (12.2%) to be more prevalent than type C (6.1%).[24] Type A2 and A3 are less prevalent in previous studies similar to ours though there is difference in percentage of prevalence. This difference of pattern in studies, our and Dubron, can be attributed to aetiology of fracture. Our study has RTA as prime role for the fracture while in theirs, they observed fall to be pivotal.[24] This difference of aetiology might lead to altered direction and intensity of impacted force. While on comparing the pattern of ZMC fracture with Knight and North classification, our study is in accordance to theirs as type III fracture was more prevalent 33% vs 31.35%. [10] Also, type V was more than type IV in both studies which is against the

finding of Senthilkumar et al. [25] Sardar et al. observed the type IV to be more prevalent followed by type V and type III to be more prevalent.[23] This difference of pattern may be attributed to only one type of motorbike accident was considered in his study. In our study type VI ZMC fracture is fourth most prevalent pattern which again contrasts the study by Senthilkumar where they observed this type to be second most prevalent.[25] Type II and type I are least common pattern of ZMC fracture in all studies which again is supported by our study.[10, 23, 25] Though this study observed the classical pattern of ZMC fractures described as they still are the determinants for the treatments.[3, 5, 14] With advancement and use of fast vehicles the pattern of ZMC is more atypical now-a-days.[26] RTA initially was prime cause of the maxillofacial trauma is now in decreasing trend in developed country and in urban areas.[27] This study is a single centred study where cases from neighbouring areas and high way accidents are referred. Presence of other four tertiary hospitals nearby may hamper the common pattern prevalence. Hence more studies involving multi-centre study for the maxillofacial injuries are suggested.

CONCLUSIONS

Zygomatic bone provides the prominent facial look and is important for the aesthetics. Fracture of the zygoma along with its neighbouring bone is not uncommon. RTA is the most common cause of the fracture affecting mostly young people. A displaced fracture involving three processes is more prevalent and is always the challenge to the operating surgeons. Hence knowledge of epidemiology and pattern guides operative team for adequate patient counselling and treatment.

Conflict of interest: None

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