ORIGINAL ARTICLE

Epidemiological Profile of Zygomatic Complex Fractures, Including Frequency, Etiology, Patterns, and Treatment Modalities for Patients

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OBJECTIVE: The study is aimed to determine zygomatic fracture frequency, etiology, and treatment patterns.

METHODOLOGY: This descriptive cross-sectional study, conducted at Chaudhry Muhammad Akram Dental Hospital, Lahore, from January 2022- June 2023 after ethical Approval vide no. ANDC/RAC/2021/15. The sample was selected using a non-probability convenience sampling technique, and data was collected on various factors including age, associated fractures, gender, cause of injury, and treatment modalities. The use of both categorical and quantitative data, along with the chi-square test for comparison.

RESULTS: There were 12 females and 55 males, and the affected male-to-female ratio was 4.5:1. The mean age of patients was 30.69± 10.83SD, with peak frequency occurring in the age range of 16-25 years. The frequency of zygomatic right sided bone fracture was 37(55.22%), left sided 24(35.82%) and bilateral 6(8.96%). The common cause of zygomatic complex fracture was road traffic accidents in 64(95.5%) patients, fall 1(1.5%), and assault 2(3%) patients. There was a significant association between etiology with age (P=0.03) and age with gender (P=0.04). There was also a significant association of age with zygomatic-maxilla bone (P=0.03), zygomatic-nose (P=0.00), and orbital floor-zygomatic bone (P=0.00). Open reduction and internal fixation (ORIF) were performed in 64 (95.5%) patients, and 3(4.5%) patients received Arch bar elastics (ABE-ORIF).

CONCLUSION: There was male predominance in road traffic accident and right-sided zygomatic bone being the most commonly affected. There was significant associations of etiology with age and gender, as well as age with associated fractures of the maxilla bone, nose, and orbital floor.

KEYWORDS: Zygomatic fractures, internal fracture fixation, maxillomandibular fixation

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INTRODUCTION

Zygomatic complex fractures are the second most prevalent type after mandibular fractures. This bone is commonly fractured in road traffic accidents due to its prominence. It absorbs the burden of facial injury.[1-5] A study concluded a prevalence of 33.6% of zygomatic fractures.[6] They are involved in 42% of facial fractures.[7] They cause skeletal and soft tissue injuries on the face. These injuries are life-threatening and cause aesthetic, functional, and psychological complications.[8] Traffic accidents are the most common cause of zygomatic complex fractures.[1,8,9] Assault in adults falls in the younger population, and work-related and sports injuries are other causes of facial injuries.[2,4,7,8,10] These injuries' severity increases due to heavy traffic and interpersonal violence.[11] Literature has reported 57.6% of zygomatic bone fractures following road traffic accidents.[12] They are common in males aged 20-29 years.[2,3,7,10,12] Zygomatic bone provides contour, shape to the face, and orbital integrity.[1-3] Zygomatic bone is strong

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skeletal support to the lateral portion of the middle third of the face. It's part of the inferior and lateral portion of the orbital floor and rim.[11] Zygoma is attached through sutures with the frontal, maxillary, temporal, and sphenoid bones. These sutures are common sites for fractures leading to zygomatic complex fractures. The orbital floor comprises an inferior Zygoma connected to the maxilla and sphenoid bone. Zygomatic bone also forms a lateral orbital margin with the frontal bone. So, an orbital defect is present in zygomatic complex fractures.[3] Zygomatic fractures are common with fractures of the nose and maxilla.[11] Pain with sensory disturbance is a common symptom. There may be a flattened arch, mid-face deformity, restrictive eye movements, disrupted mandibular function, trismus, periorbital edema, diplopia, restrictive mouth opening, and enophthalmosis.[1-3,11,13] Treatment options for zygomatic complex bone fractures are closed reduction without fixation and open reduction with fixation.[10] The primary goal of surgical treatment is to provide optimal aesthetics, utmost reduction and stability, optimal functional status, and prevent further complications.[10] The recent literature stated that 96% of such factures are dealt with use of ORIF under general anesthesia.[14] The visualization of fractured sites is limited. Standard internal fixation is done using titanium plates and screws.[10]

This study aims to ascertain the relative incidence of different etiological variables, patterns, and the most effective treatment technique used in the Oral & Maxillofacial Surgery department at Chaudhry Muhammad Akram Dental Hospital, ANDC, Lahore, for the management of maxillofacial fractures. Consequently, this will assist us in setting clinical priorities for the efficient management and prophylactic measures of these injuries.

METHODOLOGY

This Cross-sectional study aimed to determine the incidence of zygomatic bone fractures. The study was conducted in the department of Oral & Maxillofacial Surgery, Chaudhry Muhammad Akram Dental Hospital, Azra Naheed Dental College, Lahore from January 2022 to June 2023, after approval from the ethical review board. Sample size was 67 using formula n = [DEFF*Np(1-p)]/ [(d^2/$Z^2$1-$\alpha/2$*(N-1)+p*(1-p)] from Open epi, where confidence level is 80%, population size N for infinite population is is 1000000, p is 89%, Z is 1.96, d is 0.05.

A total of 67 patients were taken using a non-probability convenient sampling technique. Patients aged 16-62 years from both genders with zygomatic complex fractures resulting from acute trauma were included. Patients with blast or gunshot injuries, metabolic, inflammatory, neoplastic diseases, immunocompromised patients, and pathological fractures were excluded from the study. Data collection began after taking informed consent from the patients. All the patients were subjected to extraoral and intraoral clinical examination followed by radiographic assessment. CT scan of the face with 3D reconstruction was used as a standardized tool to confirm fractures. All the data included age, gender, etiological factors, site of fracture, and treatment method used was recorded. Etiological factors included road traffic accidents, falls, and assaults. Treatment methods included open reduction and internal fixation (ORIF) using titanium bars and screws, and arch bar elastics. Data was analysed using IBM SPSS 26. Mean and standard deviation were calculated for age. Categorical data on gender, categories of age, side of fracture, etiological factors, and treatment methods were presented through percentages and frequencies. The Chi-square test was used to compare qualitative variables. A value of P>0.05 was considered significant.

RESULTS

Out of 67 patients having zygomatic fracture complex, 55(82.09%) males and 12(17.91%) females were affected. The male-to-female ratio is 4.5:1. Major zygomatic fractures, 26(38.8%), were seen in the age range of 16-25 years. The mean age was found to be 30.69± 10.83SD. The common cause of zygomatic complex fracture was road traffic accidents in 64(95.5%) patients, fall 1(1.5%), and assault 2(3%) patients. The frequency of zygomatic right sided bone fracture was 37(55.22%), left sided 24(35.82%) and bilateral 6(8.96%). Most patients got open reduction internal fixation, 64(95.5%) and others got arch bar elastics (ABE-ORIF). The frequency of associated fractures with zygomatic bone was highest with the fractured maxilla, followed by the

Table 1: Characteristics of patients with zygomatic bone fracture

Characteristics	Categories	Frequency	Percentage (%)
Gender	Male	55	82.09
	Female	12	17.91
Age	16-25	26	38.3
	26-35	21	31.3
	36-45	14	20.9
	46-55	4	6.0
	56-65	2	3.0
Side of fracture	Right	37	55.2
	Left	24	35.8
	Bilateral	6	9
Etiology	Road traffic accident	64	95.5
	Fall	1	1.5
	Assault	2	3
Treatment	ORIF	64	95.5
	ABE -ORIF	3	4.5
Associated fractures	Maxilla	37	55.2%
	Mandible	29	43.3%
	Orbital floor	8	11.9%
	Nose	6	9%
	Mid upper face	3	4.5%

mandible, orbital floor, nose, and mid-upper face. Table 1 shows all the characteristics of the patients with zygomatic bone fractures.

There was a significant association of age with associated fractures of zygomatic bone in the maxilla (P=0.03), nose (P=0.00), and orbital floor (P=0.00). There was no significant association of age with the mandible-zygomatic complex (P= 0.71) and mid-upper face (P= 0.71). Table 2 shows the frequency and association of age with associated zygomatic complex fractures.

The peak frequency of 26(38.8%) is found in the age range of 16-25 years. There was a significant association between age and gender (P=0.04), shown in Table 3.

Table 2: Frequency and Association of Age with Zygomatic Complex

Age (years)	Bone	None	L-Ipsi	Ipsi-R	L-Bi	Bi-L	Bi-R	R-Bi	Bi-bi	RL-Cont	Cont-LR	Total	P-Value
16-25	Zyg-max	15	3	6	1	-	-	1	0	-	-	26	0.03
26-35		10	5	4	2	-	-	0	0	-	-	21	
36-45		5	4	3	0	-	-	1	1	-	-	14	
46-55		0	2	1	0	-	-	1	0	-	-	4	
56-65		0	1	0	0	-	-	0	1	-	-	2	
Total		30	15	14	3	-	-	3	2	-	-	67	
16-25	zyg-nose	23	2	1	-	0	-	-	-	-	-	26	0.00
26-35		20	1	0	-	0	-	-	-	-	-	21	
36-45		13	1	0	-	0	-	-	-	-	-	14	
46-55		4	0	0	-	0	-	-	-	-	-	4	
56-65		1	0	0	-	1	-	-	-	-	-	2	
Total		61	4	1	-	1	-	-	-	-	-	67	
16-25	orb-zyg	22	2	2	0	-	-	-	-	-	-	26	0.00
26-35		19	1	1	0	-	-	-	-	-	-	21	
36-45		13	1	0	0	-	-	-	-	-	-	14	
46-55		4	0	0	0	-	-	-	-	-	-	4	
56-65		1	0	0	1	-	-	-	-	-	-	2	
Total		59	4	3	1	-	-	-	-	-	-	67	
16-25	Mand-zyg	14	5	3	-	1	0	-	-	1	2	26	0.71
26-35		15	2	1	-	0	3	-	-	0	0	21	
36-45		4	3	1	-	1	4	-	-	0	1	14	
46-55		3	1	0	-	0	0	-	-	0	0	4	
56-65		2	0	0	-	0	0	-	-	0	0	2	
Total		38	11	5	-	2	7	-	-	1	3	67	
16-25	mid-upper face	24	2	-	-	-	-	-	-	-	-	26	0.71
26-35		21	0	-	-	-	-	-	-	-	-	21	
36-45		13	1	-	-	-	-	-	-	-	-	14	
46-55		4	0	-	-	-	-	-	-	-	-	4	
56-65		2	0	-	-	-	-	-	-	-	-	2	
Total		64	3	-	-	-	-	-	-	-	-	67	

**Chi square test was used, P <0.05 significant, *Zyg-Zygomatic bone, mand-mandibe, max-maxilla, orb-orbital, L-left, R-right, Bi-bilateral, Ipsi- ipsilateral, contra-contralateral*

Table 3: Age and Gender Cross Tabulation

Age and gender cross-tabulation				*P- value
Age (years)	Gender			
	Male	Female	Total	
16-25	23	3	26	0.04
26-35	15	6	21	
36-45	14	0	14	
46-55	2	2	4	
56-55	1	1	2	
Total	55	12	67	

**Chi square test was used, P <0.05 significant*

Table 4: Age and Etiology cross-tabulation

Age and etiology cross-tabulation					*P- value
Age(years)	Etiology				
	RTA	Fall	Assault	Total	
16-25	25	0	1	26	0.03
26-35	20	0	1	21	
36-45	14	0	0	14	
46-55	3	1	0	4	
56-55	2	0	0	2	
Total	64	1	2	67	

**Chi square test was used, P <0.05 significant*

DISCUSSION

The present study revealed a higher prevalence of zygomatic fractures in males compared to females, with a male-to-female ratio of 4.5:1. Previous study conducted by Shaukat et al conducted in Multan show that males are more affected than females, with a ratio of 3.8: 1, respectively.[12] Another International study conducted in Romania by Tent and Juncar found a male-to-female ratio of 6.8:1.[15] The most common etiology of zygomatic fracture, according to the current, study is road traffic accidents. It's also in line with the results of previous studies.[1,12] A study conducted in Romania concluded that the most common cause of zygomatic fractures was interpersonal violence, followed by falls and road traffic accidents.[15] Another European study conducted by Brucoli et al concluded that the most common causes for zygomatic fractures were assaults followed by falls.[16] These results differ from the current study due to geographical differences. In Asian countries road traffic accidents are common cause of zygomatic fractures, while in European countries assaults are major reason for these fractures. The most common age group in the current study is 16-25 years. Another study concluded that the most common age of fracture was 20-29 years.[15] This age group is most vulnerable to zygomatic fractures because they are most active in this age group both culturally, socially, and physically. They are more prone to road traffic accidents, assaults, falls, and personal violence. Open reduction and internal fixation are the most common methods of treatment. The current study has preferred ORIF as a method of treatment. A recent study by Mehmet and Erkin concluded that open reduction is the most common step, and internal fixation should be done when stability is required.[17] The current study concluded that the most commonly associated fractures with zygomatic bone were the maxilla, the mandible, the mid-upper face, the nose, orbital floor. Another study found that the most commonly associated fractures were the orbital floor, nasal and mandibular fractures, and the zygomatic bone.[16] A similar study by Shahzad and Marath found that mandible fractures are followed by zygomatic and intervention was ORIF as reasonable for its management.[18] The orbital rim is mostly affected because zygomatic bone forms the lateral part of the inferior orbital wall.[19] Another study found that the most common fracture site, along with the zygomatic bone, was the orbital rim, followed by the maxilla. Maxilla is mostly affected when

enough force hits the bone, like a road traffic accident.[20] The most common etiology in the current study is road traffic accidents, so the maxilla is most commonly affected by associated fractures in this study.

These findings not only provide valuable insights for future treatment strategies but also emphasize the significant impact of zygomatic complex fractures on patients and the importance of continued research in this area. The study's limitation is that the sample size is small, which can limit the generalizability of the findings. Further, the data was collected from single settings and limited variables. This study has no comparison group for ORIF. This study was observational, but further studies with analytical study design and clinical trials regarding intervention can provide a clearer picture of the variables of interest.

CONCLUSION

The study's findings underscore the male predominance in road traffic accident-related zygomatic complex fractures, with the right-sided zygomatic bone being the most commonly affected. The significant associations of etiology with age and gender, as well as age with associated fractures of the maxilla, nose, and orbital floor, further highlight the importance of this research. Open reduction and internal fixation are the most common interventions that provide valuable insights for future treatment strategies.

CONFLICT OF INTEREST

None declared

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