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Epidemiology of zygomaticomaxillary complex fracture in oral and maxillofacial trauma patients

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ABSTRACT

Introduction: The current study is aimed at investigating the epidemiology of zygomaticomaxillary complex fracture in oral and maxillofacial trauma patients in a trauma hospital.

Materials and Methods: This cross-sectional descriptive-analytical study with 187 patients was conducted at Khatam al-Anbia Hospital in Zahedan from April 2018 to December 2021. All the data including etiology, gender, age, ethnicity, year and place of occurrence, and site of fracture were obtained from the medical records of all oral and maxillofacial trauma patients who were subjected to ZMC fracture. Chi-Square and Fisher's exact tests were used to analyze the data.

Results: Mean age of the patients was 29.53±14.13 years. Out of 187 patients, 87.2% (163 people) were male and 12.8% (24 people) were female. People between 20 and 40 years had more ZMC fractures than other age groups with 104 cases (55.7%). Baluch ethnic group with 111 people (59.3%) experienced more fractures than other ethnic groups. The highest fracture rate occurred in 2021 with 63 cases (33.7%). Street was the most prevalent place of occurrence for fractures with 134 cases (71.6%). Isolated cheek fracture was the most common with 95 cases (51%). The most common cause of fracture was traffic accidents with a prevalence of 71.1%.

Conclusion: The results revealed that traffic accident is the main cause of ZMC fractures in the studied population. Thus, public awareness and strict implementation of traffic policies are needed.

Keywords: Epidemiology; Fractures; Maxillofacial trauma; Zygomaticomaxillary complex fractures.

Introduction

Due to its direct exposure to trauma, the maxillofacial region is one of the body's most delicate areas [1]. Traffic accident and interpersonal assault are the main causes of face fractures. Other causes are falls from heights, sport accident, work accidents, and so on [2]. Accidents in head and neck area in addition to aesthetic problems cause serious neurological complications due to proximity to vital organs [3], Therefore, neurological impairments and mortality are frequently caused by head and neck trauma and its associated consequences [4]. The lower and upper portions of the face, respectively, experience the highest and lowest rates of facial bones fractures [5].

Fractures in the upper and middle part of the face are associated with more severe complications compared to the mandible fracture. Deformities and asymmetry are expected outcomes of these fractures if left untreated [6]. Fractures of the mid-face area can cause complications such as breathing problems, bleeding, maxillary sinus problems, vision problems, malocclusion, and numbness in the involved area which most often require secondary surgery [7]. The zygomaticomaxillary complex (ZMC) is a group of mid-face bones playing a vital role in the structure, function, and appearance of the facial skeleton. This complex participates in the formation of the floor and the external wall of the orbital cavity, malar eminence, and zygomatic arch.

Nasal fractures are the most frequent type of facial fracture, with ZMC fractures coming in second [8] and they are significant owing to their anatomical site and their relationship with the orbit and mandible. Damage to the mandible in some ZMC fractures prevents the coronoid processes from moving back easily and thus the patient cannot open the mouth [9]. Ocular complications may also occur following the ZMC fractures. It can cause tearing of the external muscles of the eye leading to diplopia [10]. Moreover, enophthalmos is another complication of these fractures [11]. Maxillofacial traumas can be prevented by identifying their etiology. Study on these fractures' epidemiology and etiology enables the authorities to develop the preventive measures [12]. Furthermore, it helps the medical staff to prepare themselves to cope with these traumas and helps the decision-makers to facilitate responding to the needs of these patients. Additionally, the significance of ZMC and its complications highlights the importance of investigating this issue. According to our search, a similar study had not been conducted in Zahedan and the southeast of Iran, so this study aimed to investigate the epidemiology of zygomaticomaxillary complex fracture in oral and maxillofacial trauma patients in a trauma hospital in the city of Zahedan.

Materials and Methods

This was a cross-sectional and descriptive-analytical study with 187 patients. It was conducted at Khatam al-Anbia Hospital, a trauma hospital in Zahedan, from April 2018 to December 2021 following acquiring the ethical clarification from the ethical board of the Zahedan University of Medical Sciences. All the data comprising etiology, gender, age, ethnicity, year and place of occurrence, and site of fracture were obtained from the medical records of all oral and maxillofacial trauma patients who were subjected to ZMC fracture. In this research, Census sampling method was used. Accordingly, 187 medical records were reviewed. SPSS 24 was used to analyze the data. Mean and SD deviation were calculated for age. Chi-Square and Fisher's exact tests were used to analyze the association between categorical variables. All statistical analyses were performed at a significance level of 5%.

Results

Patient's ages ranged from 4 to 84 years with a mean age of 29.53±14.13 years. Table 1 reports the etiological pattern. Based on this table, the most common cause of fractures was traffic accidents with a frequency of 71.1%. Other causes include falls from height, sports accidents, work accidents, and so on. The prevalence of ZMC fracture according to gender, age, ethnicity, year, and place of occurrence can be seen in Table 2. Other places of occurrence include field trips, sport centers, and so on.

According to Table 2, there was significant differences in the prevalence of ZMC fracture according to gender, age, ethnicity, year of occurrence, and place of occurrence ($P<0.05$). In other words, males had significantly more ZMC fractures than females, people between 20 and 40 years had more ZMC fractures than other age groups, the Baluch ethnic group had more ZMC fractures than other ethnic groups, and more ZMC fractures occurred in 2021 than in any other years and most of the ZMC fractures occurred on street. The prevalence of site of fracture can be seen in Table 3. Based on these results, solitary cheek fracture was the most common with 95 cases (51%). In Table 4 you can see the prevalence of causes of injury according to gender, age, ethnicity, year, and place of occurrence.

No significant differences in the prevalence of causes of injury according to gender, age, ethnicity, and year of occurrence were found ($P>0.05$). In other word, traffic accident was reported as the most frequent cause of fractures in both genders, in all age groups, in all ethnicities, and in all mentioned years. According to the place of occurrence and the result of Fisher's exact test, there was a significant difference in the prevalence of causes of injury ($P<0.05$). In another word, a traffic accident was the most common cause of injury on the street.

Table 1. Etiology of zygomaticomaxillary complex fracture.

Etiology	Number of patients	Percent
Traffic accident	133	71.1%
Interpersonal assaults	6	3.2%
Others	48	25.7%

Table 2. Prevalence of ZMC fracture according to gender, age, ethnicity, year and place of occurrence.

Variable	Gender		Age			Ethnicity			Year of occurrence				Place of occurrence			
No. of patients (percent)	M	F	<20	20-40	40<	Zaboli	Baluch	Others	2018	2019	2020	2021	Home	Street	Work	Others
	163 (87.2)	24 (12.8)	52 (27.8)	104 (55.6)	31 (16.6)	30 (16)	111 (59.4)	46 (24.6)	13 (6.9)	57 (30.5)	54 (28.9)	63 (33.7)	9 (4.8)	134 (71.7)	14 (7.5)	30 (16)

Table 3. Prevalence of site of fracture.

Site of fracture	Number of patients	Percent
Cheek	95	51%
Cheek+Mandible	32	17%
Cheek+Panfacial	23	2.12%
Cheek+Nose	22	12%
Cheek+Fracture of the medial or upper wall of the orbit on the same side	4	2%
Cheek+Lefort 1	3	6.1%
Cheek+Dentoalveolar	3	6.1%
Cheek+Mandible+Nose	3	6.1%
Cheek+Skull	2	1%

Table 4. Prevalence of causes of injury according to gender, age, ethnicity, year and place of occurrence.

Etiology Variable	Traffic accident (No. of Patients)	Interpersonal assault (No. of Patients)	Others (No. of Patients)
Gender			
Male	118	6	39
Female	15	0	9
Age			
<20	38	1	13
20-40	70	5	29
>40	25	0	6
Ethnicity			
Zaboli	23	1	6
Baluch	89	3	27
Others	29	2	15
Year of occurrence			
2018	8	0	5
2019	38	1	18
2020	39	3	12
2021	48	2	13
Place of occurrence			
Home	1	0	8
Street	115	6	13
Workplace	2	0	12
Others	15	0	15

Discussion

In the present study, males had significantly more ZMC fractures than females. In the literature of Yosefnia Pasha et al. in Babol, the prevalence of fracture was 81.4% in males and 18.6% in females that is consistent with the findings of the current literature [4]. The results of the study of Kazemiyan et al. in Khorasan Razavi [13] also demonstrated similar results to our study. In the research of Ruslin et al., the ratio of males to females was 2.2 to 1 [14]. Males tend to experience maxillofacial fractures more frequently than females do. This ratio varies from one society to the other, which may be the result of variations in countries' social, cultural, and economic structures. The greater involvement of males, especially in developing countries, is due to the social nature of societies and the primary role of males in providing for the family's livelihood and their extensive presence outside the home and hard jobs. Therefore, they are at greater risk of accidents, assaults, and occupational incidents compared to females. Due to the existence of appropriate conditions for working outside home for women in developed countries, this ratio is much less in the societies like Canada, New Zealand, and Australia. However, this ratio can change over time in the same place according to the study of Taghavei and Jalilimanesh, which demonstrated this change in the city of Yazd [15]. Subsequently, this ratio varies from one year to another year in a city as more women get independent over time and get more roles in the society.

Based on the obtained results, Traffic accident was the most frequent cause of fractures, followed by other reasons (falling from a height, sports injuries, and non-specified causes) and interpersonal assault. In a research done by Zahedi et al., results showed that traffic accident was the most common cause of maxillofacial fractures [16]. In a research done by Hasnat et al., the findings proved that males are the most common victims of head and neck trauma, and traffic accident is the major cause of these injuries [17]. In the study of Kazemiyan et al. in Khorasan Razavi, traffic accident was reported as the primary cause of trauma (75.4%), which can have various reasons, including engineering problems related to the road, vehicles safety, human errors, and illegal speed [13]. In the study of Akrami et al. l. the most common cause of fractures was traffic accidents (61.2%), of which 63.24% were motorcycle accidents, 36.76% were car accidents [18]. World Health Organization's strategy for minimizing traffic accident injury includes the use of seat belts, safety helmets, and childcare seats, restricting mobile phone usage while driving, and improving the safety of roads and vehicles [19]. In the present study, people aged between 20 and 40 years have more ZMC fractures than other age groups. According to Bali et al.'s study, traffic accident was the main cause of the majority of injuries among people aged 20 to 24. Additionally, it was noted that the jaw was the most often broken bone [20]. The findings of a study by Arangio et al. showed that the age range of 18 to 39 years suffered the most from maxillofacial injuries, with traffic accident being the most common cause of these fractures [21]. The second and third decades of life are the most active in terms of job searching and other activities outside home, according to the studies by Weihsin et al. [22] and Jalali et al. [23]. As a result, individuals are more likely to be exposed to more risky events like road accidents. Traffic accident was shown to be the most frequent cause of fracture in all three age groups when the cause of fracture was investigated in the current study.

Our study showed that solitary cheek fracture was the most frequent bone fracture among ZMC (51%). In the study of Manodh et al., it was demonstrated that traffic accident was the most common cause and mandible was the most frequently damaged bone [24]. In the study of Akrami Abargouei, the most common fracture site was the nasal bone (67.4%), followed by a single mandible fracture (18.7%). The least common fracture site was the frontal bone (0.4%). The most common fracture site in the mandible was condyle (31.47%) [17]. Nose (37.7%) and mandible were the two most common fracture sites in Hwang and You's investigation (30%) [25]. One study reported that the bones of the middle area of the face are the most common site of injury [26]. This difference in fracture pattern indicates the differences in mechanisms of injury. However, the association between etiology and type of trauma may be impacted by variables like age, gender, and cultural traits [27].

The most prominent feature of the face is nose. As a result, it is the face bone that fractures most frequently [28]. The mandible is the only mobile bone of the face. Thus, it is at a greater risk of fracture than the bones of the middle region of the face [29]. Fracture of the mandible, especially the condyle region, can be considered a defense mechanism, as it prevents the transmission of severe trauma to the upper sensitive areas such as the brain and skull [30]. In the study of Ho et al. in 2017 most ZMC fractures were in the form of solitary cheek fractures, followed by simultaneous fractures of the cheek and mandible [31].

Conclusion

The results revealed that traffic accident is the main cause of ZMC fractures in the studied population and interpersonal assault in Zahedan is not the primary cause. Thus, public awareness and strict implementation of traffic policies are needed. Wearing a helmet and fastening a seatbelt should be taken more seriously not only in Zahedan but also in Iran as these traffic policies are not obeyed by numerous drivers.

Conflict of Interest

There is no conflict of interest to declare.

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