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Ocular Injuries in Patients with Zygomaticomaxillary Complex (ZMC) Fractures at a Tertiary Care Hospital in Lahore

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ABSTRACT

Background: Ocular injuries are commonly linked with zygomatic-maxillary fractures, yet they can be easily overlooked. This study aimed to assess the severity of ocular injuries (impact on visual acuity) and potential risks associated with patients with ZMC fractures.

Methods: This retrospective observational study was conducted at the Department of Oral & Maxillofacial Surgery, King Edward Medical University/Mayo Hospital Lahore, from January 2023 to December 2023, which analyzed the records of 73 patients with zygomaticomaxillary complex fractures having ophthalmic consultations. Non-Probability Purposive sampling technique used. Data on age, gender, injury mechanism, zygomaticomaxillary fracture type, and associated ophthalmic injuries were extracted and analyzed using SPSS 21. Descriptive statistics, including frequency, percentage, and mean ± standard deviation, were calculated. Inferential statistics, such as chi-square tests (for categorical variables) and independent samples t-tests (for continuous variables), were used to identify significant associations. A p-value < 0.05 was considered statistically significant.

Results: The Maximum patients in this study were in the age range of 21-30, with a Mean age of 28.42 ± 7.516. Road traffic accidents were the main cause of trauma, comprising 52(71.2%). Mostly, patients had an inward and posterior displacement type of fracture (38.4%). Periorbital ecchymosis was seen in 59(80.8%) patients, subconjunctival hemorrhage in 54(74%), Diplopia in 30(41.1%), Enophthalmos in 16(21.9%), and Exophthalmos in 5(6.8%) patients, while one patient lost his vision after zygoma fracture in this study.

Conclusion: ZMC fractures often involve ocular complications; thorough eye evaluation is crucial in facial trauma cases to identify and treat associated injuries.

Keywords: Zygomatic Bone, Ocular Injury, Fracture Zygomatic, Zygomas, Cheek Bone, Eye Injuries.

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INTRODUCTION

The zygomatic bone is one of the strongest buttresses present at the lateral aspect of the middle third of the face. Because of its prominent position on the face, it is most fractured alone or along with other bones of the midface. Zygoma fractures include any injury to the five articulations of the zygomatic-maxillary complex, which are the zygomaticofrontal suture, infraorbital rim, zygomaticomaxillary buttress, the zygomatic arch, and the zygomatic-sphenoid suture[1,2]. Zygomatic bone fractures are one of the common fractures of the facial skeleton. Fractures occur largely due to assault (35.6%) or motor vehicle collision (20.7%)[1, 2, 3].

Clinical features of zygomatic bone fractures include hemorrhage, edema, subconjunctival and periorbital hemorrhage, hypoesthesia or anesthesia of branches of infraorbital nerves, zygomaticofacial and zygomaticotemporal nerve[3]. Because of the zygomatic sphenoid region and infraorbital region attachment with the zygomaticomaxillary complex, its fracture, along with its displacement, produces different symptoms and signs of ocular injury like exophthalmos, enophthalmos, diplopia, hypoglobus, etc[3, 4].

The incidence of ocular injuries associated with ZMC fractures ranges from 2.7 % to 90.6 % in patients with midfacial fractures[5, 6, 7, 8]. About 60% of zygoma fractures have an associated ocular injury which include subconjunctival hemorrhage (60 to 85%), corneal abrasion (15%), reduced visual acuity (11.5%), enophthalmos (10.5%), diplopia (10 to 20%), telecanthus (5%), and hypema (3.5%)[6, 8]. In another study, Zygomaticomaxillary complex fractures are associated with major ocular injuries which include globe rupture (2%), retinal hemorrhage (4%), retinal detachment (2%), hypema (2%) and minor ocular injuries which include subconjunctival hemorrhage (55%), iritis (2%), iris sphincter tear (2%), corneal abrasion (1%), microhypema (3%)[9]. Direct and indirect injury to the optic nerve in patients with zygomatic fractures results in loss of vision in 1-2 % of individuals[9,10, 11].

Enophthalmos is caused by orbital volume expansion, which mostly occurs in inferior and posterior displacement of the zygomaticomaxillary complex fracture[12,13]. Whitehouse et al. noted that enophthalmos was less pronounced than expected, based on orbital expansion, when measured within the first 20 days post-injury. However, after this initial period, the resolution of edema and hemorrhage allowed for a stronger correlation between orbital volume expansion and the severity of enophthalmos [14,15].

As there is a different range of ocular injuries in different parts of the world, there is a need for a local study to measure the frequency of ocular injuries and their impact on the final management plan. Prompt ophthalmological consultation, early detection of major ocular injuries, and emergency management of ocular injury alone or along with zygomatic fracture management can significantly reduce complications, i.e., entropion, ectropion, blindness, etc. The study aims to measure the frequency of minor and major ocular injuries associated with zygomatic bone fractures so that early ophthalmological consultation can be done for major ocular injuries. The objectives of this study were to assess the severity of ocular injuries (impact on visual acuity) and potential risks associated in patients with ZMC fractures.

METHODS

This retrospective observational study was conducted at the Department of Oral & Maxillofacial Surgery, King Edward Medical University/ Mayo Hospital, Lahore. Ethical approval from the institutional review board (No. 583/RC/KEMU Dated:19-09-2024) was received. The previous charts of patients with zygomaticomaxillary complex fractures from January 2023 to December 2023 were collected.

A total of 73 Patients with zygomaticomaxillary complex fractures and having ophthalmic complications were included in this study, Confidence level 85%, Margin of error 5%, Population proportion 12% [2]. Non-Probability Purposive Sampling Technique was used for data collection. The patients charts who fulfil the inclusion criteria were reviewed for following data; age, gender, method of injury, presentation at the hospital (Emergency or Outdoor), type of zygomaticomaxillary fracture (which was assessed clinically and confirmed by Computerized Tomography Scan or Paranasal Sinus view), subconjunctival hemorrhage, periorbital ecchymosis, corneal abrasion, reduced visual acuity, enophthalmos, exophthalmos, diplopia, telecanthus, loss of vision, hypema, microhypema, iritis, iris sphincter tear or any other ophthalmic injury. Patients who had ZMC fractures but did not have any ophthalmic consultation records were excluded from the study. The data was collected on a structured proforma.

All the data collected was entered into SPSS version 21, and the result was analyzed. The qualitative variables in data that is gender, method of injury, presentation at the hospital, type of fracture, subconjunctival hemorrhage, periorbital ecchymosis, exophthalmos, enophthalmos, diplopia, telecanthus, corneal abrasion, reduced visual acuity, hypema, microhypema, iritis, loss of vision, iris sphincter, was presented as frequency and percentage. Descriptive statistics, including

frequency, percentage, and mean ± standard deviation, was calculated. Inferential statistics, such as chi-square tests (for categorical variables) and independent samples t-tests (for continuous variables), were used to identify significant associations. A P-value < 0.05 was taken as significant.

RESULTS

The study population consisted of 73 individuals, with a male-to-female ratio of 61 (83.6%) to 12 (16.4%). The average age of the patients was 28.42 years, with a standard deviation of 7.516. The age range of the patients in this study was 11 to 50 years. Most of the patients in this study fell within the age range of 21-30 (42.46%) followed by 31-40 (34.24%) while only 12 patients (16.43%) were of age of 11-20 years and 5 patients (6.84%) were of the age of 41-50 years **(Figure 1).**

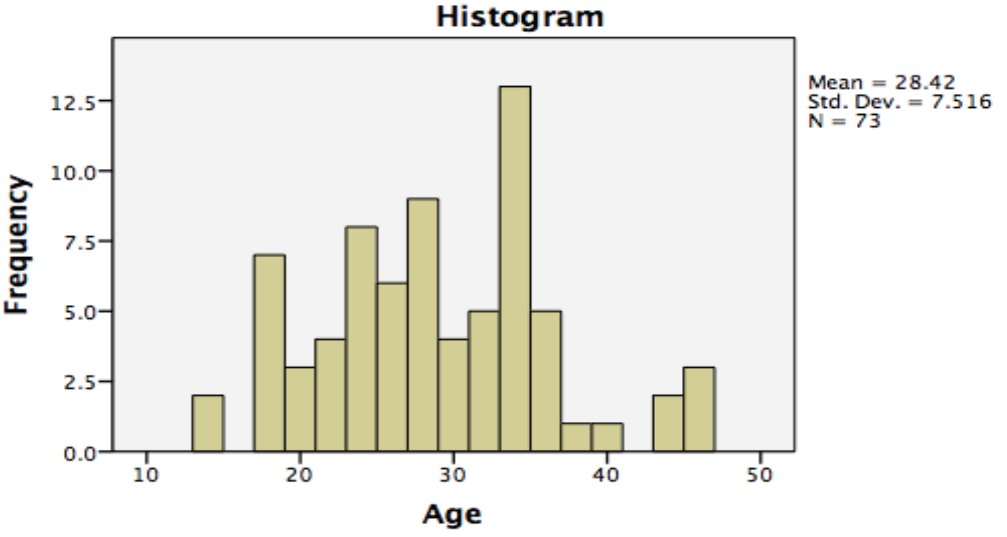

Figure 1: Age Distribution of the Patients

Table 1: Cause of Injury

Gender	Cause of Injury				
	Road Traffic Accident	Occupational Injury	Fall	Interpersonal Violence	Firearm Injury
Male	44	07	05	03	02
Female	08	00	00	02	02
Total	52	07	05	05	04

Road traffic accidents were the main cause of trauma, comprising 71.2% in this study, followed by occupational injury (9.6%), interpersonal violence (6.8%), fall (6.8%), and firearm injury (5.5%) (**Table 1)**.

Forty-eight patients (65.8%) presented in the outpatient department with zygoma fracture, while 25 patients (34.2%) presented in the Emergency department with zygoma fracture.

Most of the patients had an inward and posterior displacement type of fracture, 38.4% in this study, followed by an inward and downward displacement type of fracture (30.1%). 15.1% of patients had comminution of the complex type,13.7% of patients had outward displacement type, and 2.7% of patients had a minimal or no displacement type fracture were present in this study (**Figure 2)**.

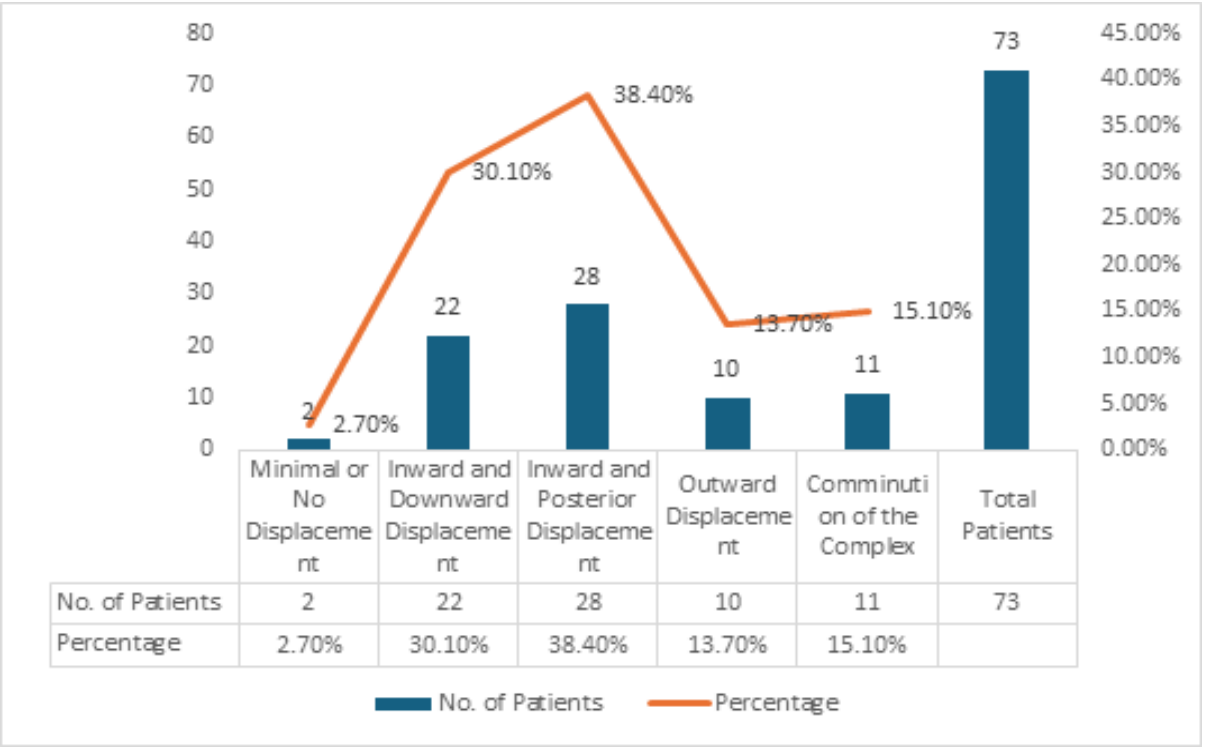

Figure 2: Type of Fracture

Table 3: Ocular Injuries Associated with ZMC Fracture

Ocular Injury		Frequency	Percent	Valid Percent	Cumulative Percent
Subconjunctival Hemorrhage	Absent	19	26	26	26
	Present	54	74	74	100
Periorbital Ecchymosis	Absent	14	19.2	19.2	19.2
	Present	59	80.8	80.8	100
Diplopia	Absent	43	58.9	58.9	58.9
	Present	30	41.1	41.1	100
Exophthalmos	Absent	68	93.2	93.2	93.2
	Present	5	6.8	6.8	100
Enophthalmos	Absent	57	78.1	78.1	78.1
	Present	16	21.9	21.9	100
Loss Of Vision	Absent	72	98.6	98.6	98.6
	Present	1	1.4	1.4	100
Hypema	Absent	68	93.2	93.2	93.2
	Present	5	6.8	6.8	100
Choroidal Rupture	Absent	68	93.2	93.2	93.2
	Present	5	6.8	6.8	100
Coronal Abrasion	Absent	70	95.9	95.9	95.9
	Present	3	4.1	4.1	100
Retinal Detachment	Absent	71	97.3	97.3	97.3
	Present	2	2.7	2.7	100
Canthal Laceration	Absent	70	95.9	95.9	95.9
	Present	3	4.1	4.1	100
Traumatic Mydriasis	Absent	66	90.4	90.4	90.4
	Present	7	9.6	9.6	100

There were 59 (80.8%) patients who had periorbital ecchymosis, and 54 patients (74%) had subconjunctival hemorrhage. Diplopia was seen in only 30 (41.1%) patients in this study. Enophthalmos was identified in 16 (21.9%) patients with zygoma fracture. One patient lost his vision after a zygoma fracture in this study. Exophthalmos was noticed in 5 (6.8%) patients in this study. Patients having traumatic mydriasis, Hypema, choradial rupture, corneal abrasion, retinal detachment, canthal laceration were noted in 05,05, 03, 02, and 03 patients respectively (**Table 3)**.

DISCUSSION

Subconjunctival hemorrhage and periorbital ecchymosis are most commonly found complications associated with ZMC fracture[5,6,7,12]. Injuries to the Midfacial region commonly result in damage to the orbital skeleton and often involve complex globe injuries[6,7,13]. Globe injuries may result in compromised ocular function and sometimes even loss of vision[9,11,14].

The predominance of ZMC fractures among males (83.6%) in our study aligns with findings from previous research[8,9,16,17]. The reason behind the males being more involved in outdoor activities compared to females. The mean age of the patient in our study was 28.42 ± 7.5, which is by a previous study[5,6,18]. The majority of patients in our study fell within the age bracket of 21-40 years. Young individuals' increased involvement in social activities, reckless driving habits, and propensity for interpersonal conflicts make them more prone to road traffic accidents and assaults[17,18,19,20].

Classically, road traffic accidents are found to be the main cause of facial fractures, followed by assault, fall, and sports injury[5,18,21]. Some studies have recognized assaults as the main cause of facial fractures[9, 17]. The major reason for zygoma fracture in this study was a road traffic accident (71.2%), which is in accordance with most of the local and international studies[5,17, 18,20,21].

Patients with facial fractures are 6.7 times more likely to suffer an ocular injury compared to those with major trauma but no facial fractures[16,22,23]. Many studies investigate the ocular complications associated with facial fractures[18,20,22]. The frequency of subconjunctival hemorrhage in our study (74%) falls within the range reported in previous studies (50-86%)[7, 8, 12, 13]. Diplopia was noticed in 41.1% of the patients, similar findings which align with previous studies that reported an incidence of 16-20% symptomatic diplopia in their studies[7, 9, 18,26].

Zygomatic displacement is a key factor in enophthalmos and exophthalmos. Enophthalmos or exophthalmos occurs in 2-7% of patients with zygomatic bone displacement, influenced by the displacement pattern[23,24,25]. In this study, Enophthalmos was present in 21.9% of the patients, which is higher compared with the previous studies (18%), (4.4%), respectively[8,18]. The higher incidence of enophthalmos might be due to a high number of patients with inward and posterior displacement type of fracture (38.4%) and inward and downward displacement type (30.1%) fracture in this study[25,26].

Medial zygoma displacement decreases orbital volume, causing exophthalmos [25,27]. Exophthalmos was noticed in 6.8% of the patients in this study, which is consistent with the previous study[12,15,26].Visual loss after midfacial fractures is rare and occurs in between 0.3 and 3.5% of cases[6, 9, 14] . Direct injury to the globe, optic nerve or the visual pathway is the main cause. There is a 10-50% reported incidence of blindness in patients with midfacial fractures due to retrobulbar hematoma[4, 11, 14]. Loss of vision was noticed in 1.4% of the patients in this study, which is comparable with a previous study in which blindness was noticed in 2% of the patients[9].

Hypema was present in 6.8%, choroidal rupture in 6.8%, corneal abrasion in 4.1%, retinal detachment in 2.7%, canthal laceration in 4.1%, and traumatic mydriasis in 9.6% of the patients; the same finding was reported by previous studies[9, 18, 20]. Many Previous Studies found that Zygomaticomaxillary Complex (ZMC) fractures have a higher rate of ocular complications, approximately 41%, compared to other types of fractures. However, Dubron et al. reported an even higher incidence of ocular injuries associated with ZMC fractures[7, 14, 24, 27].

LIMITATIONS OF STUDY

The study's retrospective design may be subject to biases, such as selection bias. The study was conducted at a single tertiary care hospital in Lahore, which may not be representative of other hospitals or populations, and it relied on medical records, which may be incomplete or inaccurate.

CONCLUSION

Ocular complications are frequently associated with ZMC fractures. Careful eye examination is necessary to diagnose minor and major ocular injuries in facial trauma patients. Care should be taken to ensure that all patients with ZMC fractures in whom ocular injuries are found should be managed appropriately to avoid blindness. This research emphasizes the importance of ocular examination and early involvement of a concerned specialist for management.

LIST OF ABBREVIATIONS

ZMC: (Zygomatic-Maxillary Complex)

CT scan: Computerized Tomography Scan
PNS: Para Nasal Sinus View
SPSS: Statistical Package for the Social Sciences

CONFLICT OF INTEREST
None

FUNDING
None

ETHICAL APPROVAL
The study received ethical approval from the institutional review board of King Edward Medical University Lahore under reference number (No. 583/RC/KEMU Dated:19-09-2024).

AUTHORS' CONTRIBUTIONS
MZAK: Conceptualization and methodology, Data Collection, **AA:** Manuscript writing, Data Analysis, Data Interpretation, **MAS:** Manuscript review, **NR**: Literature Review, **TS:** Data Analysis, **SAR:** Data Interpretation.

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