

PATTERN OF ZYGOMATIC BONE FRACTURES AND TREATMENT MODALITIES: A STUDY

¹ATTA-UR-REHMAN, BDS, FCPS (Oral Surgery)

²SHUJA RIAZ ANSARI, MDSc (Leeds)

³SYED MURAD ALI SHAH, ⁴BASHEER REHMAN

ABSTRACT

This study was designed to determine the pattern of zygomatic bone fracture, etiology and treatment options. The term pattern in this study was used for the sites/processes of zygomatic bone fracture. The variables evaluated were age, gender, sites of fracture and treatment options. A total of 81 patients with zygomatic bone fracture were treated in Oral and Maxillofacial Surgery unit, Khyber College of Dentistry, Peshawar for a period of one year from July 2007 to June 2008. Majority of patients were young males in 3rd and 4th decade. Male to female ratio was 12.5:1. Road traffic accidents (76.5%) were the most common and interpersonal violence 2.5% as the least common etiology of zygomatic bone fracture. In 28.4% patients, zygomatic bone was fractured at single site while in 71.6% it was fractured at more than one. Fracture at zygomatic buttress and infraorbital rim (27.2%) in combination was most common finding. Twenty three percent patients did not require treatment, 32.1% zygomatic bone fractures were reduced indirectly and 44.4% were reduced directly by open reduction and internal fixation.

Key words: Zygoma, Zygomatic bone fracture, Khyber College of Dentistry

INTRODUCTION

The face occupies the most prominent position in the human body and rendering it vulnerable to injuries quite commonly.¹ The zygomatic bone or zygoma is a strong buttress of lateral portion of middle third of facial skeleton² and is responsible for midface contour and protection of orbital contents.³ The prominence of zygomatic bone predisposes it to bear the brunt of facial injuries¹. Fractures of zygomatic complex are among the most frequent in maxillofacial trauma.^{4,5} The incidence of zygomatic complex fracture has a proportionate increase with rise in the facial bone fractures associated with the ever escalating hazards of modern transportation.⁴ Zygomatic region is involved in 42% of facial fractures⁶ and accounts for 64% of all middle third fractures.⁷

The etiology of zygomatic bone fracture varies from country to country due to social, cultural and environmental factors⁸, which include road traffic accidents, assault, fall, sports and missile injuries. The relative contributions of these factors varies from region to region.⁹ The role of RTA as an etiologic factor

in zygomatic complex fractures is identified in many studies.^{5,10,11} Fractures of zygomatic complex appear common in young adult males.^{9,12,13} They can occur as isolated fractures or associated with other maxillofacial injuries.^{14,15} Zygomatic bone has four bony attachments to the skull through its processes, which if fractured all together called tetrapod fracture, or can occur as isolated process fracture. Common clinical features of zygomatic complex fractures include swelling of face, flattening of cheek, subconjunctival ecchymosis, sensory disturbance, enophthalmos, diplopia and gagging of occlusion.^{16,17} Diagnosis of zygomatic bone fracture is by history and physical examination and confirmed by radiography. CT scan of face in axial and coronal plane is standard for all patients with suspected zygomatic bone fracture.¹⁸ The treatment of zygomatic bone fracture varies from none to open reduction and internal fixation at three or four sites depending upon type of fracture.

METHODOLOGY

This study was conducted on patients with zygomatic bone fracture attending OPD of Oral and Dental

¹ Senior Registrar, Department of Oral and Maxillofacial Surgery, Khyber College of Dentistry, Peshawar

² Associate Professor, Department of Oral & Maxillofacial Surgery

³ Demonstrator, Department of Oral Pathology

⁴ Junior Registrar, Department of Oral & Maxillofacial Surgery

Hospital, Khyber College of Dentistry, Peshawar, Pakistan from July 2008 to June 2009. The purpose of this study was to determine the pattern and aetiology of zygomatic bone and the treatment options for its management. Pattern means the different sites/processes of zygomatic bone fracture. History was taken from the patient to determine the cause of fracture. Complete physical examination of zygomatic bone was carried out to know sites of fracture and confirmed by radiography including plain and specialized imaging. The sites of fracture were determined using PNS, OM view, Jug handle view and CT scan when required. All cases requiring treatment were carried out under general anesthesia using nasal endotracheal intubations. Different types of approaches were used for treatment depending upon type and location of fracture including intraoral maxillary vestibular incision, lateral eyebrow incision and infraorbital rim incision. Fractures of zygomatic bone were reduced either indirectly by elevation only, elevation and support with antibiotic moistened antral pack or directly by exposing fracture sites and fixation with transosseous wiring or 1.5mm osteosynthesis plating system. Nondisplaced fractures were left as such and followed up for variable period of time. Postoperative radiographs were taken in selective cases. The data were put in a designed Proforma.

RESULTS

A total of 81 patients with zygomatic bone fracture were attended in Oral and Dental Hospital, Khyber College of Dentistry, Peshawar during one year from July 2007 to June 2008. Out of these, 92.6% were male and only 7.4% were females with male to female ratio was 12.5:1 (Fig 1). This study showed, that zygomatic bone fracture occur over wide age ranging from 9 years to 65 years with mean age of 29.6 years. Most of the cases in this study were found in 3rd decade, followed by 4th and 2nd decade, (Table 1) Road traffic accident was found to be the most common etiology of zygomatic bone fracture accounting for 76.5% followed by other causes 11.1%, fall 9.8% and inter personal violence 2.5%. In other causes of zygomatic fracture, 6 were due to fire arm injury, 2 were due to work related accidents and one due to CNG blast. (Table 2) Left side of zygomatic bone fracture accounted for 51.9% (n = 42) and right side 48.1% (n = 39).

This study showed that zygomatic bone was fractured at single process in 28.38% (n = 23) patients, in 71.6% (n = 58) patients more than one process was involved. In patients with single processes fracture,

the zygomatic buttress was most commonly involved accounting 23.5% followed by infra orbital rim 3% and frontozygomatic suture 1.2%. None of isolated zygomatic arch fracture was found. When zygomatic bone was fractured at more than one process, fracture at two

TABLE 1: AGE DISTRIBUTION

| Age (years) | n | % | Mean | Age |
|-------------|----|-------|------|------|
| 1 – 10 | 1 | 1.23 | | |
| 11 – 20 | 14 | 17.28 | | |
| 21 – 30 | 38 | 46.91 | | |
| 31 – 40 | 17 | 20.98 | 29.6 | 9-65 |
| 41 – 50 | 5 | 6.17 | | |
| 51 – 60 | 5 | 6.17 | | |
| 61 – 65 | 1 | 1.23 | | |
| Total | 81 | 100 | | |

TABLE 2: ETIOLOGY OF ZYGOMATIC BONE FRACTURE

| Factors | n | % |
|---------|----|------|
| RTA | 62 | 76.5 |
| Others | 9 | 11.1 |
| Fall | 8 | 9.8 |
| IPV | 2 | 2.5 |
| Total | 81 | 100 |

TABLE 3: SITES OF FRACTURE

| Site of fracture | n | % |
|--|----|------|
| Infra orbital rim + Zygomatic buttress | 22 | 27.2 |
| Frontozygomatic process + Infra orbital + Zygomatic buttress | 21 | 25.9 |
| Zygomatic buttress | 19 | 23.5 |
| Frontozygomatic process + Zygomatic buttress | 7 | 8.6 |
| Zygomatic buttress + zygomatic arch | 6 | 7.4 |
| Infra orbital rim | 3 | 3.7 |
| Frontozygomatic process | 1 | 1.2 |
| Frontozygomatic process + Infra orbital rim | 1 | 1.2 |
| Frontozygomatic process + Infra orbital rim + Zygomatic arch | 1 | 1.2 |
| Total | 81 | 100 |

TABLE 4: TREATMENT OPTIONS

| Treatment option | n | % |
|--------------------------------------|----|------|
| No treatment | 19 | 23.4 |
| Elevation | 15 | 18.5 |
| Elevation and antral packing | 11 | 13.5 |
| Open reduction and internal fixation | 36 | 44.4 |
| Total | 81 | 100 |

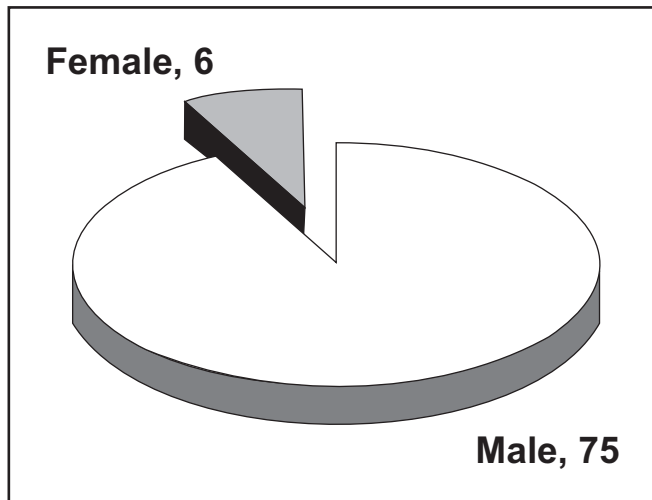


Fig 1: Gender distribution (M:F = 12.5:1)

processes was found in 44.4% patients. Three processes fracture is called tripod fracture was seen in 27.2% patients. In patients with two process fracture, the infra orbital rim and zygomatic buttress were the most common sites of fracture accounting 27.2%, followed by frontozygomatic and zygomatic buttress 8.6%, zygomatic buttress and zygomatic arch 7.4% and frontozygomatic and infra orbital rim 1.2%. In patients with three processes fracture, the combination of frontozygomatic suture, infra orbital rim and zygomatic buttress was found in 25.9% patients followed by combination of frontozygomatic, infra orbital rim and zygomatic buttress 1.2%. (Table 3)

Out of the total patients, 23.4% did not require treatment and were assessed for variable period after initial presentation. In 32.1% patients the fracture was reduced indirectly. Out of these 26, 18.5% were reduced only by elevation through intraoral approach and 13.5% were reduced and then supported with antral packing. In 44.4% patients open reduction and internal fixation with transosseous wiring and 1.5mm miniplates system were carried out using the different approaches depending upon site, degree of displacement and stabilization required after reduction. (Table 4)

DISCUSSION

The Oral and Maxillofacial Surgical Unit, Khyber College of Dentistry is a tertiary care centre having 23 beds for management of Orofacial conditions and dedicated to the teaching of undergraduate students and residents. It is a major trauma centre.

This study recorded that more males than females (12.5:1) sustained zygomatic complex fractures. Similar findings were found in other studies however, the relative ratio of male to female (12.5:1) is higher in the present study. Some of the reported males to female ratio are given below;

| | |
|-----------------------------------|--------|
| Ozemene et al ¹⁵ | 3.2:1 |
| Ajabe HA et al ¹⁹ | 4.7:1 |
| Chowdhury LCSR et al ¹ | 5.2:1 |
| Kovacs FA et al ²⁰ | 6.42:1 |
| Sullivan STO et al ²¹ | 8.9:1 |
| Bouguila J et al ²² | 9.1 |
| Adekeye ³ | 23.1:1 |

The reason could be greater social and economic involvement of young adult males. The age group most commonly involved in this study was from 3rd decade followed by 4th decade and 2nd decade. The lowest incidence was found in 1st and 7th decade. Maxillofacial trauma is common world wide in 3rd and 4th decade, so is the case with zygomatic bone fractures. Studies reported by Chowdhury et al¹, Motamedi MH⁹, Ozemene et al²⁵, AL Ahmad HE et al²⁶ and Fasola et al⁴ showed that zygomatic bone fracture are common in 3rd decade.

The etiology of facial fractures has changed over decades and they continue to do so.²⁷ The developed countries show a striking reduction in broad category of road traffic accidents and increasing influence of interpersonal violence²⁷ however, road traffic accidents were the most common cause of zygomatic bone fracture in present study and inter personal violence was the lowest cause. Similar high percentages of road traffic accidents were reported by Chowdhury and Menon¹ 86.20%, Fasola et al⁴ 81.6%, Ozemene²⁵ 81% and Qayyum Z²⁸ 52.5%. However, Kovacs et al²⁰ 46.2%, Zingg et al²⁹ 29% reported Inter personal violence as leading cause of zygomatic bone fractures. Interestingly Sullivan STO et al²¹ reported sports 27.5% and Gomes PP et al²⁴ reported fall 21.83% as most common cause of zygomatic complex fractures. The reason may be the groups in which the study was carried out.

Left side zygomatic bone was fractured in 51.85% (n = 42) and right side in 48.15% (n = 39) in this study. Similarly high percentage of left side zygomatic bone fracture were reported by Chowdhury et al¹ 59.77%, Kovacs et al⁴ 61.5% and Ugoboki et al³⁰ 63%. Zygomatic bone fractures are also known as isolated zygomatic fracture, molar fracture or classic tripod fracture.³¹ However, the terms tripod fracture and trimolar fracture are inaccurate and should be avoided because zygoma has four processes rather than three and it can be fractured at single process only.²⁴ In this study 88% of the zygomatic bone fractures were diagnosed and confirmed using occipitomenal view. The rest required additional views including submentovertex view and posteroanterior view of face. Only in 3% cases CT scan was advised where orbital signs were positive. This study showed isolated processes fracture in 28.38% patients, two process fracture in 44.43% and tripod fracture in 27.15%. Zingg et al²⁹ reported single process fracture in 31% cases and tripod fracture in 51% cases which is high as compare to this study. Isolated frontozygomatic process fracture was found in 1.23% cases, and zygomaticomaxillary buttress in 23.45%, however, Obuekwe et al²⁵ reported 28.4% isolated frontozygomatic process fractures and zygomaticomaxillary buttress in 22.4%. The interesting finding in this study was that no isolated fracture of zygomatic arch was seen. Some studies that reported isolated zygomatic arch fracture are given below;

| | |
|----------------------------------|--------|
| Obuekwe O et al ²⁵ | 8.25% |
| Gomes PP et al ²⁴ | 10.51% |
| Czerwinski M et al ³² | 19.0% |
| Bouguila et al ²² | 34.53% |

In the present study combination of frontozygomatic process and zygomaticomaxillary buttress was fractured in 8.64% cases, however, Obuekwe et al²⁵ reported 38.8%. Tripod fracture in the present study were found in 25.92% as compared to study by Bouguila et al²² who reported tripod fracture in 43.7% patients.

The time elapsed from trauma to first examination and surgical treatment varied in this study. Factors that influenced the treatment modalities included timing of presentation, age of the patient, function loss, aesthetics concern, finances and associated systemic diseases. There are a number of methods and approaches to treatment of zygomatic bone fracture including temporal approach, lateral orbital approach, intraoral approach, percutaneous approach for elevation with bone hook and external fixation, antral

packing with gauze or balloon, intraosseous wiring and bone plating and recently endoscopic assisted reduction and fixation.³³ In the present study, 23.3% patients did not require any treatment. Eighty five percent of those untreated patients had fracture only at zygomatic buttress and the rest involved zygomatic buttress and infraorbital rim in combination. They were followed up for variable period of time. Similar results were reported by Larsen and Thompson et al³⁴ and Ellis et al.³⁵ Gomes PP et al²⁴ reported a high number of zygomatic bone fractures (56.6%) that did not require treatment. In the present study 18.5% fractures were reduced only by elevation through intraoral and extraoral approaches and 13.5% cases were reduced and supported by antral packing with antibiotic moistened gauze in comminuted fractures and sometime to supplement intraosseous wiring. The results with antral packing were satisfactory. Chronic sinusitis was found in few 2% cases.

In this study 44.4% cases were treated by open reduction and internal fixation with wires, miniplates or combination. In 1970 the introduction of miniplate osteosynthesis for treatment of zygomatic complex fracture revolutionized the treatment³⁶ and recommendations for fixation have varied from none to placement of 3 or 4 miniplates at different sites.^{35,37} Recently trend in treatment of zygomatic bone fracture is changing to open reduction and internal fixation.³³ Upper eyebrow incision, infraorbital rim incision and intraoral vestibular incision were used to expose the fracture segments. Fixation with plates at frontozygomatic suture was commonly used in this study and taken as guide for use of additional plates and wires at other sites as required in each case. The advantages were anatomical reduction of fracture segments intraoperatively, reliable method of fixation and provide three dimensional stability. The increased cost, facial scars and occasionally the necessity to remove the miniplates are the main disadvantages of this method.

CONCLUSION

This study on zygomatic bone fractures showed that the majority of patients were young adult men. RTA was leading factor causing zygomatic bone fracture. Zygomatic bone can be fractured as isolated, two or three processes fracture. Fracture at two processes was most common finding in this study. No isolated zygomatic arch fracture was found in this study. Treatment modalities for zygomatic bone fracture depends on characteristics of the fracture and open reduction

and internal fixation with miniplates is most reliable modality providing three dimension stability.

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