Print ISSN: 2321-6379
Online ISSN: 2321-595X
DOI: 10.17354/ijss/2017/426

Original Article

# Analysis of Outcome of Zygomatic Fracture Management

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## Abstract

**Introduction:** The zygomaticomaxillary complex is an important functional and esthetic landmark of midface, and it provides prominence to the cheek.

**Aim:** The aim of this study is to evaluate the clinical and radiological features of zygoma fractures and to analyze the functional and esthetic outcome of zygoma fracture management.

**Materials and Methods:** This study includes 37 cases undergone zygomaticomaxillary complex fractures. Patients were divided into six groups according to Knight and North classification. Functional sequelae, namely, trismus and infraorbital anesthesia and esthetic sequelae, namely, malar asymmetry and orbital dystopia were recorded, and computed tomography (CT) scan of facial bones was done.

**Results:** Trismus was the most common symptom (67%). Malar asymmetry was the most common esthetic abnormality (83%). The predominant fracture type based on Knight and North was Group III (displaced but unrotated fracture) in 35% of patients. The most common procedure was 2-point fixation (35%). Post-operatively, trismus improved in 80%, infraorbital anesthesia in 63%, malar asymmetry in 64%, and orbital dystopia in 50%. The most common complication was plate extrusion.

**Conclusion:** Zygoma fractures result in significant functional and esthetic sequelae. Mode of management depends on clinical and radiological features. CT scan axial and coronal section of facial bones shows the severity of fractures not all patients need operative intervention.

**Key words:** Fracture Zygoma, Rigid internal fixation, Enophthoimos, Vertical dystopia

## INTRODUCTION

The zygomaticomaxillary complex is an important functional and esthetic landmark of the midface, and it provides prominence to the cheek.[1] However, unfortunately, it is very vulnerable to injury because of its intrinsically prominent convexity. It forms an important junction between the skull and midface.[2] There are four bony attachments between zygoma and other facial bones: A superior attachment to frontal bone (frontozygomatic suture), a medial attachment to maxilla (zygomaticomaxillary suture), a lateral attachment to temporal bone (zygomaticotemporal suture), and a deep attachment to greater wing of sphenoid (zygomaticosphenoidal suture). When trauma occurs to the zygoma and results in fracture of all four suture lines, it is called as a tetrapod fracture.[3] Based on the clinical features and X-rays and computed tomography (CT) scan of facial bones, the zygoma fractures are managed in different ways ranging from conservative management to internal fixation and bone grafts.[4] Zygoma fractures result in a range of deformities from cosmetic to functional disabilities. Cosmetic deformities being a loss of malar protrusion (malar flattening), orbital dystopia, ectropion, enophthalmos, exophthalmos, and decreased anterior facial width. Functional deformities range from difficulty in the mouth opening (trismus), infraorbital anesthesia, and diplopia.[5]

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www.ijss-sn.com

Month of Submission : 06-2017
Month of Peer Review : 07-2017
Month of Acceptance : 08-2017
Month of Publishing : 08-2017

### Aim

The aim of this study is to evaluate the clinical and radiological features of zygoma fractures and to analyze

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the functional and esthetic outcome of zygoma fracture management.

## MATERIALS AND METHODS

Patients with zygoma fractures who were admitted in trauma ward and then transferred to plastic surgery department after ruling out head injury and other major injuries were included in the study. X-ray skull anteroposterior, lateral, and sinus view before and after surgery. CT facial bones - coronal and axial sections. Exclusion criteria: Patients with major head injuries, multiple organ injuries. Pre-operative assessment: Patients admitted with facial injuries were evaluated clinically. The following clinical features were specifically sought to identify zygoma fractures. Clinical evaluation: Ocular findings, periocular ecchymosis extent, noted. Subconjunctival hemorrhage, particularly, lateral extent noted visual acuity, light reflex, field of vision, and ocular movements such as diplopia, ptosis, eye opening and closure, orbital dystopia, and ectropion. Presence of infraorbital anesthesia was noted. Mouth opening was examined by scale and recorded in mms. Orbital rim was palpated specifically at frontozygomatic suture and infraorbital rim at maxillozygomatic suture for stepping. Maxillary Buttress fracture is ruled out by per oral examination. Malar projection was assessed by looking downward the face of the patient from the head end. This finding was recorded after 5 days if there is periorbital edema. Ophthalmological evaluation was done at the ophthalmological department and clearance obtained before surgery. Neurosurgical opinion obtained and major neurological injury was ruled out before taking up for surgery.

Based on radiological findings, patients were grouped according to Knight and North classification. Group I - No significant displacement, fractures visualized on radiographs/CT scan. Group II - Arch fractures; inward buckling of the arch, no orbital or antral involvement. Group III - Unrotated body fractures; downward and inward displacement but no rotation. Group IV -medially rotated body fractures; downward, inward, and backward displacement with medial rotation (Figure 3). Group V - Laterally rotated body fractures; downward, inward, and backward with laterally rotated zygoma. Group VI - Complex additional fracture lines cross the main fragment (Figure 4). Based on clinical and radiological features, patients were assigned for surgery or conservative management. Conservative management was used in patients with no functional abnormalities, esthetically no significant deformity, Knight and North Type I, medically unfit cases for surgery. Indications for surgery include trismus, infraorbital anesthesia, significant malar flattening, orbital stepping, orbital dystopia, diplopia, increased facial width, and malocclusion due to associated fractures such as Knight and North Type II, IV, V, and VI.

## RESULTS

In 37 patients studied, males were commonly affected (94%). The most common age group being 20-30 years (43%). Road traffic accident being the predominant cause. Most common symptom noted was trismus (67%). The most common sign was subconjunctival hemorrhage (100%). Most common esthetic abnormality noted was malar asymmetry (83%). The predominant fracture type in our patients was Group III (35%) of Knight and North. Least common type was Group II (5%) (Figure 1). Trismus occurred in all patients of Group II and Group V (100%). Infraorbital anesthesia commonly occurred in all Type IV patients (100%). Orbital dystopia was most commonly noted in Type VI (100%). Malar asymmetry commonly occurred in Type III, IV, V, and VI (100%).

Most common procedure performed was 2-point fixation with plate and screws (Figure 2). Post-operatively, malar asymmetry improved in 64% of patients (Table 1). Maximum improvement occurred in Type III (91%) and

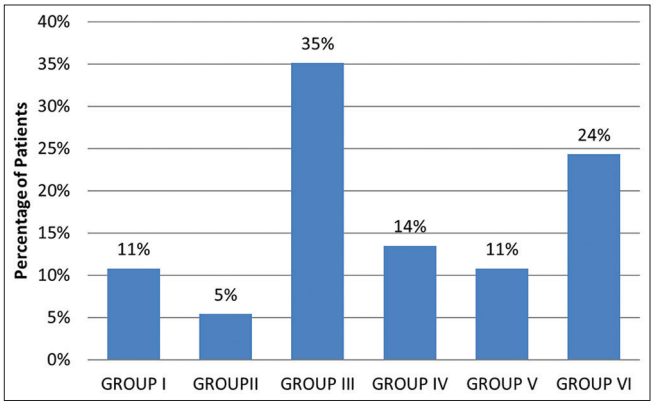


**Figure 1: Knight and North classification**

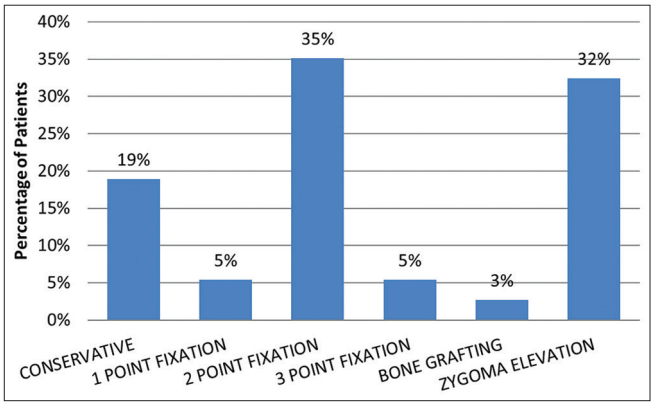


**Figure 2: Procedure performed**

least improvement in Type VI (50%). Infraorbital anesthesia improved in 63% of cases at of 5-month follow-up. Maximum improvement occurred in Type VI (83%) and least in Type IV (40%). Trismus improved in 80% of cases. Maximum improvement occurred in Type II, III, and IV (100%), and least improvement occurred in Type V (25%). Orbital dystopia is the least improved sign (50%) of our cases (Table 2). The early complication was infection noted in 2 cases, late complication being malar asymmetry (36%), and plate extrusion in 2 cases. From the Tables 3 and 4, it is observed that the overall outcome is good in Type III and IV and moderate in Type V and VI which had severe injuries.

## DISCUSSION

The outcome of zygomatic fractures after management is based on the recovery of functions, namely, adequate mouth opening, correction of diplopia, recovery of infraorbital anesthesia, and achieving an esthetically normal face by correction of malar asymmetry. In our study, over a period of 22 months, the above said functional and esthetic features have been analyzed following zygomatic fracture management. The assessment of outcome helps in forming a protocol for the management of zygoma fractures and pinpoints the deficiencies existing in the management and the need to improve the already evolving management techniques.

**Table 1: Post-operative outcome**

| Functional sequelae | Total | Improved |
|---|---|---|
| Trismus | 25 | 20 |
| Infraorbital anesthesia | 22 | 14 |
| Malar asymmetry | 31 | 16 |
| Orbital dystopia | 14 | 7 |

**Table 2: Procedure versus outcome**

| Procedure | Total cases | Malar protection improved (%) | Trismus improved (%) | Infraorbital anesthesia improved (%) |
|---|---|---|---|---|
| Elevation | 12 | 9/10 (90) | 9/9 (100) | 3/6 (50) |
| 1P fixation | 2 | 1/2 (50) | 2/2 (100) | 2/2 (100) |
| 2P fixation | 13 | 6/13 (46) | 7/13 (53) | 8/11 (72) |
| 3P fixation | 2 | 1/2 (50) | 1/2 (50) | 1/2 (50) |

**Table 3: Post-operative outcome of dystopia**

| Group | Pre-operative | Improved | Percentage |
|---|---|---|---|
| I | 0 | 0 | - |
| II | 0 | 0 | - |
| III | 3 | 3 | 100 |
| IV | 1 | 1 | 50 |
| V | 2 | 1 | 50 |
| VI | 8 | 3 | 37 |

**Table 4: Outcome based on Groups I-VI of Knight and North**

| Group | Trismus | IOA | Malar symmetry | Orbital dystopia (%) |
|---|---|---|---|---|
| I | - | - | - | - |
| II | 100 | - | - | - |
| III | 100 | 71 | 91 | 100 |
| IV | 100 | 40 | 60 | 50 |
| V | 25 | 50 | 25 | 50 |
| VI | 75 | 83 | 50 | 37 |

IOA: Infraorbital Anaesthesia

Rowe and Killey (1955) in an analysis of 629 cases of facial fracture noted 19.6% did not require surgery in our study conservatively managed cases were 10%.[6]

Holt *et al.* reviewed about associated ophthalmic injuries and concluded that serious ophthalmic injuries resulting in blindness occurred in 3% of cases and incidence of blindness in our study was 5%.[7]

Zingg *et al.*, in their studies on orbital floor fractures after treatment with orbital floor implant, stated that diplopia persisted in 17% of cases and enophthalmos in 11% of cases. In our study, persistent diplopia was noted in 2 cases (5%).[8]

Taicher *et al.,* in their study, on infraorbital anesthesia, showed postoperatively 43% recovered sensation in 2-3 months, 70% in 3-5 months, and 90% in 7-9 months. 10% had residual numbness. In our study, over a mean follow-up of 6 months, 63% fully recovered from infraorbital anesthesia.[9]

The separation at frontozygomatic suture was an important decisive factor in deciding about open reduction and internal fixation (ORIF).[6] If separation was more than 2-3 mm, ORIF was carried out. Hence the pre operative Axial and Coronary CT of the facial bones required to decide about the line of management.[10]

Rinehart *et al.*,[11] neither single miniplate nor triple wire fixation was enough to stabilize zygoma against masseter muscle forces, recommended 2-point fixation using double miniplate across zygomaticofrontal and zygomaticomaxillary fracture lines that are sufficient to resist masticatory muscle forces.

Hence, in our study, we used 2-point fixation as the most common type of fixation and 3-point fixation for grossly comminuted Type VI fractures.[12]

In our study, residual malar asymmetry was present in 36% of cases which clearly shows that more intraoperative imaging of fracture reduction is needed to ensure appropriate reduction and good malar symmetry. This can be done by intraoperative fluoroscopy[13] or intraoperative

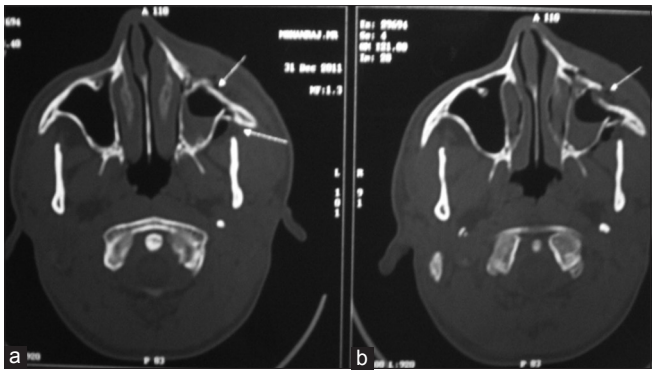

**Figure 3: (a and b) Group V fracture zygoma**

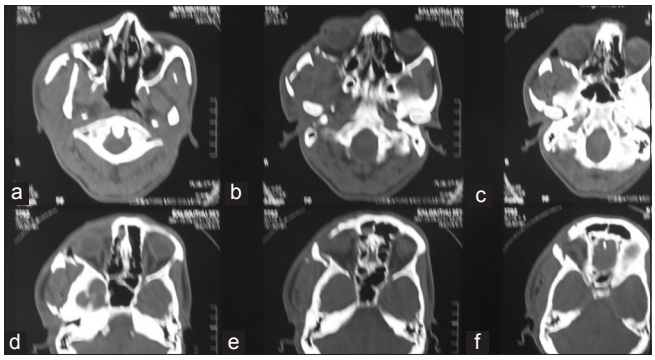

**Figure 4: (a-f) Group VI fracture zygoma**

CT,[10] which we did not have in our institution. Stanley,[14] in his study, on the use of intraoperative CT during repair of orbit zygomatic fractures, intraoperative scanning allows correction of discrepancies in malar prominences and orbital wall during repair.

In our study, persistent infraorbital anesthesia was noted in 37% of patients at the end of 5 months.[15] Most of the studies show that maximum improvement in anesthesia occurs by 1 year. The results show that a more prolonged follow-up is needed, and in patients with anesthesia, a thorough exploration of infraorbital floor is needed to disimpact the compressed infraorbital nerve.[9,16]

The persistent orbital dystopia[17] in 50% of patients again stresses the need for intraoperative CT and more points of fixation particularly the zygomaticomaxillary buttress and zygomaticosphenoid junction in lateral orbital wall.[10]

Thus, this study shows the importance of analysis of the outcome of zygoma fracture management, thereby critically evaluating and helping us to adopt methods of management of zygoma fractures which is still evolving[18] to improve and prognosticate our results.

## CONCLUSION

From our study, it is concluded that zygoma fractures are the most common facial fractures next only to nasal and mandibular fractures. Males are commonly affected and occur most commonly in the third decade. Pre-operative CT scan helps in classifying the zygoma fractures and deciding about the mode of management. Pre-operative ophthalmological, ear, nose, and throat, and neurosurgical opinion greatly facilitated the management. Not all patients require operative management.

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**How to cite this article:** Senthilkumar R, Prakash S, Anandan H. Analysis of Outcome of Zygomatic Fracture Management. Int J Sci Stud 2017;5(5):216-219.

**Source of Support:** Nil, **Conflict of Interest:** None declared.