A Study Assessing Surgical Management of Traumatic Orbital Fractures with Delayed Presentation at Tertiary Care Institutions: An Experience of 1 Year

Sourabh Dixit[1] Manpreet Singh Banga[1] Suniti Kumar Saha[1] Kaushik Roy[1] Partha Ghosh[1] Sandeep B.V[1]

[1]Department of Neurosurgery, NRS Medical College, Kolkata, West Bengal, India

Address for correspondence Dr. Sourabh Dixit, MS Department of Neurosurgery, NRS Medical College 138 AJC Bose Road, Kolkata, West Bengal 700014 India (e-mail: sourabhdixit1011@gmail.com).

Indian J Neurotrauma 2017;14:65–69

Abstract

Background Orbital and periorbital injuries are significant contributors to traumatic facial injuries. Orbital fractures can occur either alone or in conjugation with other facial bone fractures and cranial and maxillofacial injuries.

Objectives The study aims to find out the incidence of various types of fractures occurring in patients, mode of trauma, clinical presentation, and results of delayed surgical repair in cases of orbital fractures.

Materials and Methods This is a “prospective observational study” including 12 patients. Surgical repair of orbital fractures was considered for suspected muscle entrapment in fractures, restricted ocular motility, symptomatic diplopia not improving for over 2-week period, or if enophthalmos greater than 2 mm was present.

Results Regarding age incidence, the maximum number of cases, that is 41.66%, were aged between 21and 30 years. The main modes of trauma in most cases, that is, 50%, were due to road traffic accidents followed by fall from height, that is, 25%. The majority of cases presented to us with complex fractures involved one or more orbital bones, that is 33.33%. Postsurgery outcomes were good and fair in 75% and 25% patients, respectively.

Conclusion Proper orbital fracture stabilization is crucial to bring out good cosmetic as well as ocular outcome.

Keywords
- orbital fractures
- diplopia
- enophthalmos

Introduction

Orbital and periorbital injuries are significant contributors to traumatic facial injuries. Orbital fractures can occur either alone or in conjugation with other facial bone fractures in open and closed cranial and maxillofacial injuries. Studies have estimated that orbital fractures account for roughly 10 to 25% of all cases of facial fractures.[1–5] They are most commonly seen in conjunction with road traffic accidents (RTAs), assaults, falls, sports injuries, etc.[6] High-velocity trauma as in RTA and fall from height, in particular, tend to be more destructive and are associated with more concomitant organ injuries, zygoma fractures, and multiple orbital wall fractures than the other common causes of assault, sports-related, falls, and so forth.[7] Penetrating orbital injuries occur less frequently but are associated with a greater than 10% incidence of death or subsequent vegetative state, mostly due to adjacent intracranial injuries.[8] In addition, damage to the globe, optic nerve, and extraocular muscles is always a concern.[9]

The most common clinical signs seen with adult orbital fractures are periorbital ecchymoses and subconjunctival hemorrhages; however, absence of such signs does not rule out an orbital floor fracture, particularly in the pediatric population. Clinical findings as well as consistent mechanisms of injury should prompt a suspicion for an orbital fracture.[5,10]

received
November 28, 2016
accepted
June 19, 2017

DOI https://doi.org/10.1055/s-0037-1606211.
ISSN 0973-0508.

Objectives

1. To study the incidence of various orbital fractures and mode of trauma and clinical presentation in patients.
2. To study the outcome of delayed surgical repair among patients.

Materials and Methods

The present "prospective observational study" was performed in 12 patients admitted to the Department of Neurosurgery, NRSMCH, Kolkata, with a history of trauma including the cranial and maxillofacial injuries between March 2015 and February 2016.

Indications for surgery: Surgical repair of orbital fractures was considered for suspected muscle entrapment in fractures, restricted ocular motility, symptomatic diplopia not improving for over 2-week period, or if enophthalmos greater than 2 mm is present, in cases of frontal and facial fractures for proper alignment and stabilization of facial bones.

Inclusion criteria: The study included all patients admitted in neurosurgery ward with confirmed orbital fractures with or without other cranial and maxillofacial injuries between March 2015 and February 2016.

Exclusion criteria: Patients having any signs of field cuts, optic nerve injury, blow-out fractures to the orbit.

All the patients who sustained concurrent maxillofacial and orbital trauma were subjected to examination by ophthalmologists, otorhinolaryngologists, and maxillofacial surgeons. The patients' information was obtained, which included history of mode of trauma, previous treatments, associated relevant information, and thorough examination including the full neurologic examination, ophthalmic examination performed during ophthalmologic consultation, and other pertinent examinations and consultations were also done.

All patients were subjected to computed tomography (CT) of the facial bones including paranasal sinus (PNS) and orbit with three-dimensional (3D) reconstruction.

Patients with orbital fracture with concomitant skull fractures and facial bone fractures were operated upon in same settings.

For fractures involving the frontal bone, frontal sinus, and orbital roof, a bicoronal scalp flap was raised (►**Fig. 1a**) and fractures were exposed and fixed. For fractures involving the lateral wall, floor and zygomaticomaxillary complex (ZMC) approaches such as infraorbital, transconjunctival, or midfacial degloving (MFD) via maxillary sublabial incision (►**Fig. 1b**) were used. In this study, the implants used for orbital fixation were titanium mini and micro plates, and orbital plate was used in one patient with rim fracture (►**Figs. 2–4**).

Postsurgery, each patient had follow-up of 6 months. All the patients were subjected to 3D CT scan of the skull in postoperative assessment. To assess the cosmetic outcome of the patients, visual analogue scale (VAS) (►**Fig. 1c**) was used.[11] Complete data of the patients were recorded and analyzed in tabulated formations.

Observations and Results

In this study, 12 patients with confirmed orbital fractures were included, and the following results were obtained:

Regarding age incidence (►**Table 1**), the maximum number of cases, that is, 41.66% ($n = 5$) were of 21 to 30 years of age, followed by 25% incidence in 41- to 50-year age group. This was followed by incidence of 16% in two age groups: 11 to 20 and 41 to 50 years. The age distribution clearly shows that the majority of cases occurred in younger population.

Regarding the mode of trauma (►**Table 2**), the most cases, that is 50% ($n = 6$), were due to RTAs. The next most common mode of injury was fall from height, that is, 25% of total cases.

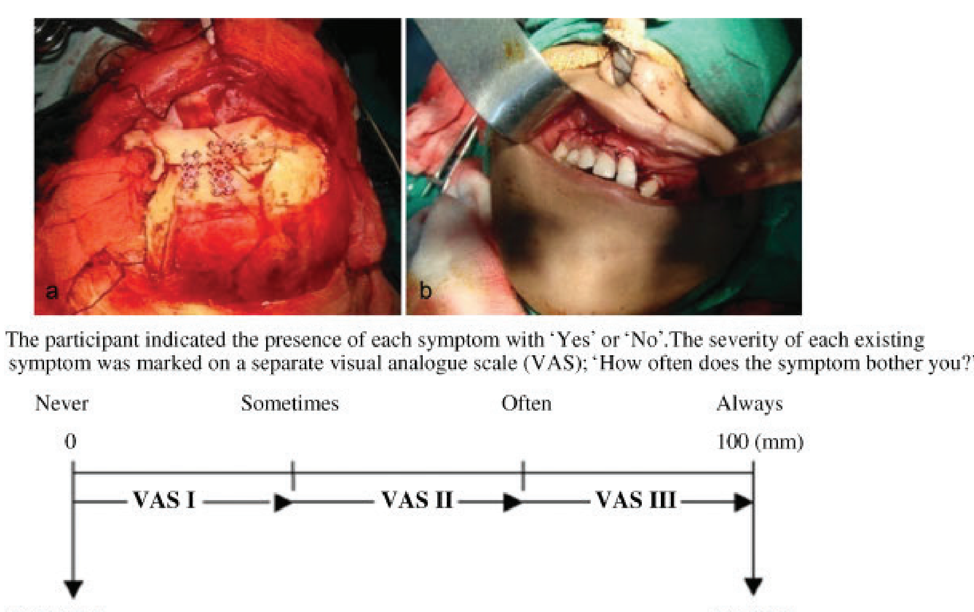

Fig. 1 (**a**) Fracture fixation by bicoronal flap and titanium plates. (**b**) Sublabial approach. (**c**) Visual analogue scale (VAS).

Fig. 2 (**a**) CT scan showing fracture of superior orbital rim, lateral wall of orbit and zygomatic arch. (**b**) Coronal image. (**c**) Postreconstruction with titanium mini plates.

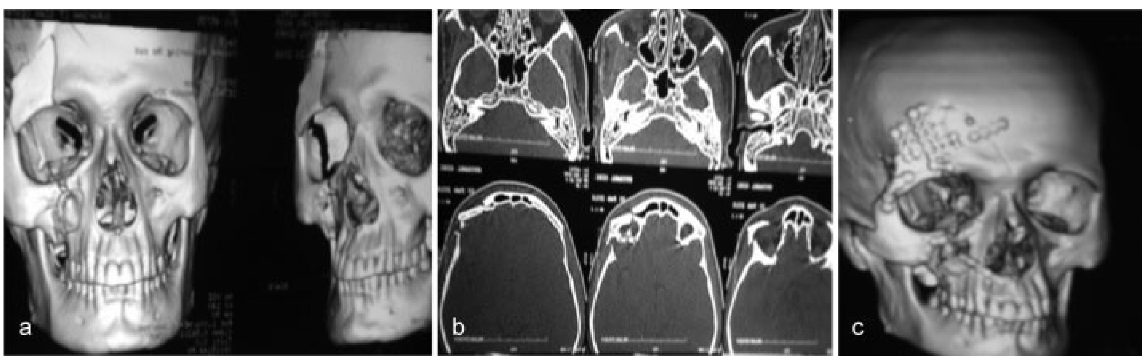

Fig. 3 (**a**) CT scan showing fracture of superior orbital rim, lateral wall of orbit and zygomatic arch and floor and maxilla. (**b**) Coronal image. (**c**) Postreconstruction with titanium mini plates and L-shaped plates.

Fig. 4 (**a**) CT scan showing loss of frontal bone with superior orbital rim. (**b**) Coronal image. (**c**) Postreconstruction with titanium mesh and orbital plate.

This was followed by assault in 16.66% cases. One case had trauma from metallic object.

Most cases (►**Table 3**) presented to us were with complex fractures involving one or more orbital bones, that is 33.33%, and also the same number of patients had fracture involving the lateral orbital wall and ZMC (►**Figs. 2, 3**). This was followed by fractures involving the orbital roof, that is, 16.66%. One patient had superior orbital rim fracture involving the frontal bone and another had orbital floor fracture.

All the patients had delayed presentation to us, mostly after 2 weeks of trauma so almost all of them had subsided features of ocular trauma (►**Table 4**). Almost 33.33% patients underwent operation for complaints of diplopia, especially in lateral gaze, and 41.77% had complaints of enophthalmos. Diplopia was improved in 75% patients in postoperative period, and only one patient had persistent diplopia in postoperative follow-up. Enophthalmos was improved in 80% patients in postoperative period (►**Fig. 5**), and only one patient had residual enophthalmos in postoperative follow up.

Among the associated injuries (►**Table 5**), the maximum number of patients, that is, 75% ($n = 8$), had concomitant head injury with skull bone fracture. Almost 25% patients had fracture involving the peripheral nasal sinuses mostly the frontal sinus, and 16.66% patients had fractures involving the ZMC. Nasal and isolated facial bone fractures were present in one patient.

Cosmetic improvement on VAS showed nine patients in VAS I, 2 patients in VAS II, and no patient in VAS III.

Table 1 Age-wise distribution of orbital fractures

	Males	Females
0–1 y	0	0
1–10 y	0	0
11–20 y	2	0
21–30 y	5	0
31–40 y	2	0
41–50 y	3	0
51–60 y	0	0
> 60 y	0	0

Table 2 Etiology-wise distribution of orbital fractures

Mode of trauma	No.
Road traffic accidents	6
Falls	2
Assault	3
Sports injury	0
Others	1

Table 3 Site-wise distribution of orbital fractures

Site of orbital fracture	No.
Roof	2
Floor	1
Medial wall	0
Lateral wall and ZMC	4
Orbital rim	1
More than one bone or site	4

Abbreviation: ZMC, zygomaticomaxillary complex.

Table 4 Time interval between trauma and surgery of orbital fractures and occurrence of symptoms

Time interval between trauma and surgery	Total No. of cases	Diplopia	Enophthalmos
> 2–4 wk	6	3	3
> 4–8 wk	4	0	0
> 8 wk	2	1	2

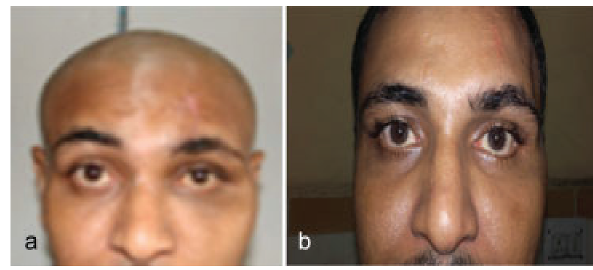

Fig. 5 (**a**) Enophthalmos in patient with orbital fracture. (**b**) Postoperative image with enophthalmos correction.

Table 5 Incidence of associated injuries among case

Associated injuries	No.
Head injuries	8
Skull bone fractures	8
Nasal fractures and epistaxis	1
PNS fractures	3
Zygomaticomaxillary complex fractures	2
Isolated facial bone fractures	1

Abbreviation: PNS, paranasal sinus.

Discussion

The injuries to the globe and adnexal structures occur frequently during blunt facial trauma.[10] In this study, the maximum number of cases, that is, 41.66% (n=5), were of 21 to 30 years of age. This was followed by 25% incidence in 41- to 50-year age group. The age distribution clearly shows that the maximum number of cases occurred in younger population. Similar age incidence was reported by Mittal et al,[6] with the maximum number of cases being between the ages of 10 and 50 years with the peak incidence in the 20- to 30-year age group.

The maximum number of cases, that is, 50% (n=6), were due to RTAs. The next most common mode of injury was fall from height, that is, 25% of total cases. This was followed by assault in 16.66% cases. Mittal et al[6] obtained similar results and reported RTAs as cause of trauma in 71.3% patients. The second most common cause was falls (15.4%), followed by assault in 5.8% cases.

One-third of cases presented to us with complex fractures involving one or more the orbital bone, and also the same number of patients had fracture involving the lateral orbital wall. This was followed by fractures involving the orbital roof, that is, 16.66%. One patient had orbital rim fracture and another had orbital floor fracture. Among the associated injuries, 75% of patients had concomitant head injury. Skull bone fracture was present in the same number of patients. Almost 25% patients had fracture involving the peripheral nasal sinuses mostly the frontal sinus, and 16.66% had fractures involving ZMC complex. Nasal and isolated facial bone fractures were present in one patient.

Hwang et al[12] also reported similar results in their series of facial trauma. Head and neck injuries were the most common isolated injuries associated with facial fractures (13.3%). Among the patients with injuries to the head and neck area, most had intracranial injuries with altered levels of consciousness, cervical spine injuries, or optic nerve injury. The most common isolated fracture associated with facial fractures was a skull fracture (22.2%).

Almost 33.33% patients underwent operation for complaints of diplopia, especially in lateral gaze, and 41.66% had complaints of enophthalmos. Three patients underwent orbital fracture fixation as a part of frontal bone and orbitozygomatic repair.

In this study, diplopia was improved in 75% patients in postoperative period and only one patient had persistent diplopia in postoperative follow-up. Three patients who had improvement in diplopia presented to us within 4 weeks of trauma whereas the patient who had no improvement in diplopia following surgery presented late. Diplopia may be present after trauma due to injury and can resolve spontaneously as orbital edema and hemorrhage subsides. If diplopia is present 10 to 14 days after trauma associated with limitation of ocular motility and radiologic conformation of an orbital fracture, entrapment of the ocular muscle or perimuscular tissues is suspected and intervention is required.[13] In this series, two patients had lateral rectus entrapment and associated fracture of the lateral wall and zygomatic complex, one patient had orbital roof fracture and superior rectus involvement, and one patient had inferior rectus entrapment and orbital floor fracture. The first three case patients presented within 4 weeks of trauma and had improvement in postoperative period whereas the patient with inferior rectus involvement had late presentation after incidence (> 8 weeks) and had postoperative residual diplopia.

Trauma to the soft tissue can cause nerve paresis, inferior rectus contusion, and local edema, all of which may mimic inferior rectus entrapment. However, decreased eye movement in one gaze meridian or axis is highly suggestive of extraocular muscle dysfunction, especially if the movement deficit is vertical. Forced duction testing, CT imaging, and pain on eye movement can all be helpful, but none are 100% sensitive or specific. Muscle and neurovascular compromise may accompany muscle entrapment, especially with the inferior rectus.[5] Folkestad et al[11] reported diplopia in 9.5% patients in their series in final checkup postoperatively. However, they did not find any significant disability with diplopia because most of the patients noticed it in far lateral gaze and had showed improvements in postoperative follow-up.

Enophthalmos was improved in 80% patients in postoperative period, and only one patient had residual enophthalmos in postoperative follow-up. Out of five patients, three were operated within 4 weeks of trauma (►**Fig. 2**), one was operated after 6 weeks, and one was operated after 8 weeks and had residual enophthalmos. Chen et al[14] also reported enophthalmos in 56% patients and 80% improvement in patients after surgery and final residual enophthalmos in 14.3% patients. They emphasized on timing of surgery and found that the maximum correction was in patients operated in less than 4-week duration whereas no significant difference was seen in patients operated within 2 weeks and between 2 weeks and 4 weeks. Folkestad et al[11] reported enophthalmos in 19% patients in their series in final checkup postoperatively.

Postoperative cosmetic outcome was VAS I in 75% patients, and 25% had regarded the cosmetic outcome as VAS II. Folkestad et al[11] reported that 25% patients rated their facial aesthetics highly dissatisfying (VAS IV) preoperatively; 16% kept scoring VAS IV for this item until the final postoperative assessment, when 6% still reported themselves distressed by altered looks. The main complaint at the final checkup was dissatisfaction with the operation scar.

Conclusion

Orbital fractures and ocular injuries require proper redressal in patients with facial trauma. Proper orbital fracture stabilization is crucial to bringing out good cosmetic as well as ocular outcome. Planned surgical interventions at the time of dealing of facial fractures and orbital fractures in same settings can bring out good postoperative recovery as well as cosmetic improvements.

Funding
None.

Conflict of Interest
None.

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