Clinical study of orbital fractures

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Abstract

Objectives: To study different types, various clinical presentations, radiological findings, management and final outcome of orbital fractures. Materials and Methods: This prospective study recruited 21 patients with orbital fractures treated at a tertiary care medical college hospital for a two-year period. Results: Road traffic accident was the most common cause in 16 cases (76.19%) and involved only males. Fractures at workplace/home was seen in 5 cases (23.80%). Most of the patients were males, 19 (90.48%) and only 2 (9.52%) were females. The commonest age group was 3rd decade (38.09%). All the cases involved only one eye, 11 in Right eye and 10 in Left eye. 12 patients had complex combined fractures and 9 patients had single wall fractures. Medial and lateral walls were more commonly involved in both single wall and complex fractures. The most common symptoms were redness (71.42%) and periorbital swelling (71.42%), defective vision (38.09%) and pain (38.09%) followed by diplopia (23.82%). 9 patients were given IV Methyl Prednisolone followed by tapering oral steroids, 11 patients underwent surgical correction, mostly with polypropylene plate. 1 patient was referred to maxillofacial surgeon. In most of the patients with defective vision, there is a significant improvement in the final visual outcome. Conclusion: Road traffic accidents were the most common cause of orbital fractures and involves mostly male and in younger age group (3rd decade). Complex combined fractures were the common type and overall medial wall was most commonly involved. Surgery was needed in 57% of orbital fractures, whereas 43% were managed conservatively (medical management). Improved outcome was seen in majority of patients (90%).

Key Words: Orbital fractures, complex combined and single wall fractures, IV methyl prednisolone, polypropylene plate.

Introduction

In the present days of industrialization and increased incidence of road traffic accidents (RTA) and trauma at home or workplace, there is rise in the incidence of orbital trauma leading to fractures. Most often they come in acute stage, but can present in subacute or chronic stage especially when associated with polytrauma. There could be associated comorbidity which should be carefully looked into and managed. Defective vision and diplopia due to motility restriction are the commonest visual symptoms. Disfigurement of the face could be agonising and depressing for the patient and a challenging problem for the surgeon. The timing and treatment indications for orbital fractures are evolving. The goals of management include restoration of vision, ocular motility, binocular single vision (BSV) and cosmesis.

Material and Methods

It is a prospective interventional case series conducted on patients with orbital fractures attending the department of Ophthalmology at Maharajah’s Institute of Medical Sciences during May 2013 to August 2015.

Inclusion criteria: All cases of orbital fractures who first presented to the department of ophthalmology.

Exclusion criteria: Patients with co-morbid illness like globe injury or multi-trauma.

Clinical evaluation included detailed history and ocular examination like visual acuity, colour vision, anterior segment examination, ocular motility, fundus examination, IOP Measurement, Hertel’s Exophthalmometer, forced duction test, diplopia charting and CT scan was done wherever indicated. Hertel exophthalmometry is a useful indicator of the risk of enophthalmos, and in our experience, the presence of 1.5 mm or more of enophthalmos in the acute post-trauma period suggests that further enophthalmos may develop once swelling is reduced. Often, surgical repair of orbital fractures is delayed until a better examination can be performed. When the patients presented early with soft tissue edema, they were treated with systemic antibiotics and steroids. When the soft tissue edema subsided the ocular motility restriction was looked into. If persisted, FDT and CT images would decide
surgical intervention. The indications for surgery in orbital fracture included persistent diplopia with FDT positive and impacted extraocular muscle on imaging, enophthalmos or fracture more than 50% of the orbital floor.\textsuperscript{1} All the incarcerated tissue was retrieved from the sinus and the fracture covered with synthetic material (silicone/polypropylene plate and fixed with methyl acrylate glue). Associated traumatic optic neuropathy was treated with IV infusion of methyl prednisolone at a dose of 1000 mg daily for 3 days\textsuperscript{2}.

**Results:** Total number of cases - 21

Road traffic accident was the commonest cause in 16 cases (76.20%) of orbital fractures and it occurred only in males. Fractures at workplace/home was seen in 5 cases (23.80%). (Graph 1)

All cases had unilateral presentation with 11 in Right eye, 10 in Left eye. (Graph 4)

Of the 21 cases, 12 had complex combined fractures and remaining 9 had single wall fractures. Among complex fractures, medial wall was involved in 11, floor in 5, lateral wall in 8 and roof in 2. Among 9 patients of single wall fractures, 5 (55.56%) had medial wall fractures. Among 21 cases of orbital fractures, 16 had medial wall fractures. This can be explained due to the thin bone of medial wall. (Graph 5). (Figs 1-4)

Most of the orbital fractures occurred in males, 19 (90.48%) and very few in females, 2 (9.52%). (Graph 2)

Most common age group affected was 3\textsuperscript{rd} decade (38.09%). (Graph 3)

Figure 1: Axial view of plain CT scan of the orbit Red arrow showing fracture involving the medial wall of right orbit. Yellow arrow shows air in the right orbital space.
The most common complaints were redness and periorbital edema in 15 patients (71.42%), followed by defective vision and pain in 8 patients (38.09%) each. At the time of presentation the BCVA ranged from 6/6 to no PL. Among the 8 patients who had defective vision, 4 had vision of PL to 6/60 and 1 had no PL, 3 had 6/12 to 6/9.

Pain was complained by 8 patients and diplopia was present in 5. Binocular diplopia was due to fractures in which the extraocular muscle was entrapped, thereby resulting in ocular motility limitation as evidenced by Forced duction test. (Fig 5-6). The prevalence of binocular diplopia (5) was found to be less than ocular motility restriction (12). This was because diplopia in extreme gazes did not cause inconvenience to the patient which was ignored. These patients required surgical correction where the entrapped muscle was released and the fracture was covered with polypropylene mesh and the FDT was checked to make sure that it had become negative and the ocular motility was restored to normal which usually result in restoration of ocular motility and relief from binocular diplopia (Fig. 7 to13). Very rarely other mechanism like a fractured and displaced bone spicules can cause mechanical restriction of ocular motility and diplopia. (Figs 14 to 20). Enophthalmos was complained by 4 patients, proptosis by 2 and paresthesias by 2.
Figure 6: Forced Duction Test performed under general anaesthesia before surgery. Note that the globe could not be elevated, indicating restrictive pathology.

Figure 7: Fracture right orbit with restricted elevation of right eye (red arrow)

Figure 8: CT scan Coronal view of plain of the orbit showing fracture floor of orbit (white arrow) with entrapment of Inferior rectus muscle

Figure 9: Sagital section of CT scan orbit clearly demonstrating entrapment of the inferior rectus muscle in the fracture floor of the orbit. (red arrow)

Figure 10: Intra-operative photograph of swinging lower lid approach showing the polypropylene plate (green arrow) covering the fracture. The orbital rim of floor of the orbit can be seen clearly (yellow arrow)

Figure 11: Post-operative picture showing restoration of elevation of the right eye.

Figure 12: Complex combined fracture RE with yellow arrow showing deep superior sulcus, enophthalmos, hypoglobus.

Figure 13: One month postoperative photograph showing correction of enophthalmos as evidenced by normal superior sulcus (yellow arrow) and in hypoglobus.
Figure 14: Fracture left orbit with subconjunctival hemorrhage and gross defective elevation due to restrictive pathology (red arrow).

Figure 15: Coronal section of CT scan of orbit showing fracture lateral wall of the orbit (green arrow) with the displaced fragment of the bone impinging upon the globe.

Figure 16: Axial view of the CT scan of orbit showing the fracture frontal bone with the displaced bone impinging upon the globe (green arrow.)

Figure 17: Intraoperative photograph showing the fracture line on the frontal bone (green arrow)

Figure 18: The bone pieces that were displaced and causing mechanical obstruction to the elevation of the eye ball have been removed.

Figure 19: Intraoperative photograph of forced duction test done after removal of the fractured and displaced bone fragments demonstrating normal elevation. Compare the position of cornea (yellow arrow) with that in fig.6

Figure 20: Postoperative photograph showing complete restoration of elevation leading to total relief from the symptom of diplopia.

Graph 8: Modes of management

In 10 patients with orbital fractures were repaired by surgery with polypropylene/silicone plate as per indications. 1 patient with fracture impingement over globe was repaired by surgical exploration and removal of displaced fragments. 9 patients were given IV methyl prednisolone 1gm per day alternatively for 3 days followed by oral steroids 1mg/kg body weight in tapering doses and 1 patient was referred to maxillofacial surgeon. All patients who received steroids improved in vision and colour vision. All patients where orbital plating was done also improved their vision drastically. Post treatment, the vision improved in most of the patients such that 6 patients
had a vision of 6/12 or better. The maximum improvement occurred is from CF 2 mt to 6/6 following fracture floor repair and removing the bone speculum and from CF 3 mt to 6/6 following IV pulse steroids. One patient who had no PL and one who came two weeks after trauma did not improve with pulse steroids.

Surgery via repair of fractures with silicone or polypropylene plate was performed when indicated on 11 patients. Polypropylene plate was preferred over silicone plate since it was more malleable and also because it adds more volume. Patients were prescribed a course of systemic antibiotics and also oral prednisolone at a dose of 1mg/kg body wt. which was tapered over a period of 6 weeks. The post operative recovery was uneventful in all cases and there was significant improvement in vision, diplopia, and enophthalmos. (Table 1). No significant postoperative complications were noted in patients with early surgical treatment. 1 patient developed recurrent infections which could not be controlled with systemic antibiotics and the plate had to be removed.

Discussion

Degala et al\(^3\) reported that road traffic accidents was the commonest cause for orbital fractures which is similar to the present study (76.19%).

Boffano et al\(^4\) reported orbital blow out fractures and identified that floor was the commonest site followed by medial wall and lateral wall and 50.7% patients had evidence of diplopia. However, in the present study, medial wall was most commonly involved followed by lateral wall, floor, and roof. 34.7% cases had evidence of diplopia.

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<tr>
<th>Symptom/Sign</th>
<th>Improvement</th>
<th>%</th>
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<tr>
<td>Vision</td>
<td>6/8</td>
<td>75%</td>
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<tr>
<td>Colour vision</td>
<td>9/9</td>
<td>100%</td>
</tr>
<tr>
<td>RAPD</td>
<td>9/9</td>
<td>100%</td>
</tr>
<tr>
<td>Ocular motility</td>
<td>10/12</td>
<td>83.33%</td>
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<tr>
<td>Enophthalmos</td>
<td>6/7</td>
<td>85.71%</td>
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Minoru Furuta\(^6\) studied pure blow out orbital fractures with diplopia and concluded that the clinical manifestations and prognosis of patients were approximately predicted through the analysis of CT on fracture type and number of points of contact of an extraocular muscle to fracture edge. The present study focused mainly on the fracture type. Biege B\(^7\) studied orbital fractures and classified them into trap door type, floor fractures with incarcerated tissue and depressed floor fragment fractures. Fractures with incarcerated tissue were commonest followed by depressed floor fragment fractures and trap door. In the present study, classification was based on anatomical location and number of walls involved (simple and complex).

Degala et al\(^3\) opined that titanium mesh was the best material for repair of orbital floor fractures. But we have no experience with it. Polypropylene was the most common repair material used and found to be good. However, there was one case where after 4 months, the plate was infected which could not be controlled with antibiotics and hence removed.

In the present study, timing and treatment indications for orbital floor fractures were similar to those of Burnstine MA\(^8\). Surgery within 2 weeks is recommended in cases of symptomatic diplopia with positive forced ductions and evidence of orbital soft tissue entrapment on computed tomography examination or large orbital floor fractures that may cause latent enophthalmos or hypo-ophthalmos. Study by Brucoli.M in which the incidence of diplopia, enophthalmos, and infraorbital nerve dysfunction were improved by early surgical repair of the orbital blow-out fracture and low risk to develop post-operative complications if repaired within 2 weeks of trauma. In the present study patients who underwent surgery within 2 weeks of trauma had good outcome whereas those who underwent surgery after a longer interval and who had presented with very poor vision, the results were not satisfactory.

<table>
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<tr>
<th>Simple LOWF</th>
<th>Barta and Schubert</th>
<th>Our study</th>
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<tr>
<td>Comminuted LOWF</td>
<td>39.7%</td>
<td>37.5%</td>
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Conclusion

Road traffic accident was the commonest cause of orbital fractures and involved mostly male and the young (3rd decade). Complex combined fractures were the common type and medial wall most commonly involved. More than half the patients needed surgery whereas medical management also had a very significant role (42.86%). Significant improvement was noticed in diplopia, enophthalmos and defective vision.

Financial Disclosure

All the authors hereby declare that none of them have any financial interest to disclose regarding any of the products described/used in this study.

References