Delayed Management of White Eye Blowout Fracture: It's Never Too Late

Anas Imran Arshad1,2, Jawaad Ahmed Asif3, Tahir Yusuf Noorani4, Nafij Bin Jamayet5, Zuliani Mahmood1, Mohammad Khursheed Alam6

ABSTRACT

Background: A classic presentation of a pediatric facial trauma resulting in an orbital blowout fracture is an absence of subconjunctival haemorrhage, an upgaze diplopia, and general malaise caused by the oculocardiac reflex (OCR). This clinical presentation is termed as a white eye blow out fracture. These fractures in pediatric patients tend to entrap soft tissues including extraocular muscles leading to limitation in ocular movement. Besides clinical and radiographic evaluations, the motility evaluation is a primary diagnostic tool in such injuries. To prevent a neurocranial injury, early surgical intervention is highly advised in symptomatic cases.

Case Presentation: This case report presents a pediatric patient who was involved in a motor vehicle accident and sustained a head injury and an orbital roof fracture. Limitation of extraocular movement, vertical dystopia, OCR and diplopia were observed which suggested a trap door type fracture. To access the surgical site, a coronal approach was performed which facilitated the release of soft tissues entrapped into the orbital roof.

Outcomes: Presence of clinical signs and symptoms like limitation of extraocular movement, vertical dystopia, OCR and diplopia are indicative of immediate surgery but concomitant head injury may hinder the urgency of the orbital fracture repair. Although, the surgical correction was delayed satisfactory post-surgical outcomes were achieved with immediate improvement in extraocular movement, diplopia and resolution of OCR.

Conclusion: Management of orbital roof fractures is a multidisciplinary approach which requires a prompt execution of treatment plan, good understanding and co-operation between neurosurgery, ophthalmology and maxillofacial team is a necessity for successful outcomes.

KEY WORDS

orbital roof fracture, trapdoor fracture, muscle entrapment, pediatric, trauma, diplopia, white eye blowout fracture

INTRODUCTION

Orbital fractures may occur in a range of patients who present with blunt trauma to the face and skull. The management of orbital fractures in adult patients has been widely debated in the literature but there are relatively few published studies evaluating the characteristics and management of orbital fractures in the pediatric population1,2. The incidence of such fractures as a result of facial injury is very common in adult population however, it is much lower (5-15%) in children because of differences in the anatomical and physiological characteristics of facial development3-6. The main causes of these facial fractures include fall, sporting injuries, child abuse and road traffic accidents6. The nature of injury, clinical symptoms, type of fracture, and treatment indications of isolated orbital wall fractures are different in the children from those in the adults.

Children are particularly susceptible to pure orbital fractures of the trapdoor variety. Trapdoor fracture, defined by the lack of displacement of the involved bones, occurs when a circular segment of the bony orbit fractures and becomes displaced, however, remains attached on one side6. The orbital contents are herniated and entrapped at the fracture site. Because of the greater elasticity of the orbital bones in children, there is a higher incidence for the development of trapdoor type fractures in pediatric patients.

Pediatric orbital roof fractures can have a different disposition as compared to adult orbital floor fractures and can have adverse long-term consequences if not detected and treated early. Here is the case report of a pediatric patient who sustained head injury and fracture of the orbital
CASE PRESENTATION

Diagnosis

A five-year-old boy presented to Hospital Universiti Sains Malaysia following a motor vehicle accident. Upon examination, the Glasgow coma scale (GCS) of 3/15 was noted, which warranted intubation followed by admission to the neurosurgical intensive care unit. The neurosurgery team conservatively managed patient for 10 days, and endotracheal intubation and sedation hindered thorough facial and ophthalmological examinations. After extubating, the patient was shifted to the pediatric ward on the 16th day post-trauma. Following ophthalmology review a restriction in the movement of right globe was noted. A surgical consultation was requested the following morning for assessment of facial fractures and orbital.

Investigations

CT scan revealed pneumocranium at frontal area, intra-parasellar bleed in right frontal area, right temporal contusion and extradural hematoma. Bone window displayed fractures at right frontal, petrous part of temporal and facial bones. The mid-face included fracture of right supra-orbital margin and nasal bone along with Lefort II. Three dimensional (3D) CT scan showed linear fracture of the frontal bone on right side extending down towards the right supra-orbital bone which had caused buckling of the right orbital roof. Associated fractures of right lacrimal bone and nasal bone were also detected. Coronal and sagittal planes of temporal and facial bones. The mid-face included fracture of right supra-orbital margin and nasal bone along with Lefort II. Three dimensional (3D) CT scan showed linear fracture of the frontal bone on right side extending down towards the right supra-orbital bone which had caused buckling of the right orbital roof (Figure 1). Bilateral infra-orbital undisplaced fractures were also noted.

Preliminary ophthalmic examination revealed bilateral periorbital hematoma, hypoglobus right eye with deviation downwards and outwards. Mild chemosis was also detected in the right eye. Mild restriction upon infraduction with diplopia, vertical dystopia and oculocardiac reflex was noted (Figure 2 A). On palpation, a step deformity was noted over the right frontal area and right supra-orbital margin. A bony spike projecting over the left lateral aspect of nasal bone was palpable. Infraorbital margins on either side did not exhibit any step deformity or any signs of infra-orbital paresthesia on the face bilaterally.

Treatment Plan

Considering the clinical (Figure 2 A) and radiographic findings (Figure 2 B), surgery was planned to release the soft tissue entrapment and fix the medial aspect of the right orbit and the left lateral nasal bone. 3D reconstruction of fractures facilitated the determination of microplate and screw placement3. Bilateral infraorbital fractures were planned to be managed conservatively.

As the area of concern was right frontal bone, right orbital roof and the orbito-nasal complex, a coronal approach was planned. Intraoperatively, the soft tissue entrapment at the right orbital roof was detected and released (Figure 1 B). Concurrently the medial canthus of the left eye was also stabilized using non-absorbable 4/0 Prolene suture and anchored to the titanium microplate at the left lateral nasal bone.

The step deformity at the linear frontal bone fracture was reduced and stabilized with 1.3 mm thick micro titanium plates and 4 mm screws. The nasal bones over both the sides were anatomically reduced. They were fixed with micro titanium plates and screws. The coronal flap was re-approximated and sutured with a drain over the right side.

Post-surgical plan

Two days post-operatively, drains were removed. Post-operative recovery was uneventful. Ophthalmic examinations were repeated and shows satisfactory results with immediate improvement in extraocular movement and diplopia. Post-operatively, patient was reviewed after a week, 10th day for suture removal, 1 month, 3 months and a year later (Figure 2 C). Post-op 3D CT showed the titanium microplates in place (Figure 2 D). Patient has shown marked improvement and is able to attend school and participate in sports activities. CT scan will be repeated to monitor the cranial migration of the micro titanium plates and to plan its removal if deemed necessary.

DISCUSSION

The forehead prominence and thinness of the bone in children makes frontal bone fractures, supraorbital rim, and orbital roof possible with direct impact type injuries. With significant force, intracranial injury (pneumocephalus, epidural and subdural hematomas, and cerebral contusion) are seen. Posterior displacement of the frontal and supraorbital rim or inferior displacement of the orbital roof requires open surgical reduction. Head injury may necessitate postponement of orbital fracture repair to allow the brain to recover. As such, in this case, definitive surgical management of orbital roof fracture was delayed due to the presence of head injury.

It is widely reported in children that due to high rate of misdiagnosis and under recognition of orbital floor fractures with entrapment, there is a permanent loss of muscle function. Review of the literature concerning initial evaluation and management of pediatric orbital floor fractures in the emergency department has shown that white-eyed blow-out fractures and orbital floor fractures presenting with OCR symptoms are unrecognized and uninvestigated as in many as one third of pediatric facial trauma patients because the symptoms are attributed to concussion. OCR, also called Aschner phenomenon, is characterized by decrease in pulse rate due to entrapment of extraocular muscles and their traction during eye movement.

Fixation of orbital fractures in children is still debated and evolving. Previous management philosophies have ranged from immediate surgery on all blowout fractures to surgery or none. Currently, indications for surgical repair after an internal orbital fracture are muscle entrap-
ment resulting in ocular motility restriction, early enophthalmos (> 2 mm), and orbital defects involving more than 50% of the floor or medial wall\(^{18}\). Reports evaluating the pediatric population have suggested an increased potential for trapdoor type fractures which may require expedient repair to restore motility and reduce the possibility of tissue ischemia and necrosis\(^{14-16}\).

In the case discussed, symptoms like limitation of extraocular movement, vertical dystopia, OCR and diplopia were present that requires immediate surgery to release the soft tissue entrapment. However, the presence of severe head injury with GCS 3/15, the surgery was delayed. The surgery was carried out 18 days following trauma, which is considered late repair\(^{13,16}\). Yoon et al. proposed that surgical repair carried out more than 15 days following trauma is not expected to have good post-operative results\(^{10}\). However, in this case, although the surgical repair was delayed, the patient showed good recovery and returned to premorbid state. There was no limitation in extraocular movements and no diplopia was observed immediately following surgical repair.

Coronal incisional approach was used to release the muscle entrapment from the trapdoor fracture as recommended by Eppley\(^{6}\). Resorbable fixation plating system is more advantageous and the preferred one but due to its cost and availability issues, titanium microplating system is commonly used. The metallic osteosynthesis system is advantageous as it is readily available, cost effective, and bio-compatible. However, the risk of infection and migration of these systems is a genuine issue. The metallic micro plates applied at the frontal area may migrate intra-cranially due to the bone developmental pattern. Therefore, regular monitoring is advocated and titanium microplate might be removed if deemed necessary.

**CONCLUSION**

Orbital Trapdoor fractures are common in paediatric population of age less than 7 years. Presence of clinical signs and symptoms like limitation of duction, vertical dystopia, oculo-cardiac reflex and diplopia are indicative of immediate surgery but concomitant head injury may hinder the urgency of the orbital fracture repair. Although, the surgical repair of the orbital roof fracture was delayed, the results were satisfactory with immediate improvement in extraocular movement and diplopia. Management of orbital roof fractures in paediatric patients mandates a multidisciplinary approach which requires co-operation between neurosurgery, ophthalmology, paediatric dentists and maxillofacial team.

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**REFERENCES**