Penetrating injury of orbital roof and brain sparing the eye ball in a pediatric patient: A rare occurrence

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Abstract

Blowout fractures are a common occurrence in traumatic brain injury patients. In pediatric age group, orbital floor fracture is a common occurrence. We report a case of 2-year-old male admitted to trauma center, with penetrating injury to the left eye by the clutch of motorbike which fell on the child. Noncontrast computed tomography scan revealed fracture of the roof of left orbit with left frontal contusion sparing the left eyeball. There was also the continuous leak of brain matter from the left eye which suggested tear of dura mater. Urgent left frontal craniotomy was done with the evacuation of contusion, reconstruction of orbital roof, and duroplasty under general anesthesia.

Key words: Duroplasty, orbit injury, pediatric trauma, penetrating injury

Introduction

The most common fracture of the orbital wall in the pediatric age group is involvement of floor.[1] The orbital roof is very strong with variable pneumatization by the frontal sinus. Fracture of the roof of the orbit is a rare occurrence. Possibly, because of the greater elasticity of the orbital bones in the pediatric population, they are more prone to fracture with less force of injury.[2] Dural tearing leads to herniation of brain content into the orbital socket. Entrapment of soft tissue and muscles can lead to oculocardiac reflex.[3] Many studies have indicated that early diagnosis and surgical repair can lead to better outcome.

Case Report

A 2-year old male who met with an injury to the left eye from the clutch of the motorbike was brought to trauma center. He had swelling over the left eye with the continuous leak of some fluid as complained by his mother. He was conscious but irritable. Right pupil was normal size and reactive to light, upper eyelid of the left eye was edematous and bulged out with the leaking of brain matter from the left eye [Figure 1a]. Urgent noncontrast computed tomography head and orbit was done which revealed fracture of the roof of left orbit with left frontal contusion [Figures 1b and 2]. The roof of orbit was displaced [Figure 3]. So urgent surgical intervention was planned. Ultrasound of eye was done to rule out associated ocular injuries. Other routine laboratory investigations were within normal limits. Blood grouping and cross matching were done and adequate amount of blood was arranged, and the patient was shifted to the operation room. Rapid sequence induction of anesthesia was done with propofol 2.5 mg/kg and fentanyl 1 mcg/kg.
Succinylcholine 15 mg was administered intravenously (IV). Anesthesia was maintained with oxygen and isoflurane with intermittent administration of injection vecuronium 0.01 mg/kg IV. Bicoronal incision was placed and left frontal craniotomy was performed. After raising of the bone flap, dural tear was present in the left frontal region from which contused brain leaked out. After the opening of dura evacuation of contusion and reconstruction of the roof of left orbit roof was done. As there was dural tear in basifrontal dura beyond the left orbital roof, duroplasty was done using periosteum graft. The patient maintained his all vitals and oxygenation throughout the procedure. He was given steroids (dexamethasone 1 mg and mannitol 10 g) IV. Postoperative pain management was done with paracetamol suppository per rectally and diclofenac sodium IV. The patient was extubated successfully.

**Discussion**

Orbital fractures represent 3–45% of all facial fractures in children. Orbital fractures may occur in children who have sustained blunt injury in traffic accidents, falls, or from other orbital trauma. The orbital roof is composed almost entirely of frontal bone with a tiny contribution from the lesser wing of sphenoid and these fractures usually result from severe frontal trauma and are often accompanied by intracranial injury. Incomplete ossification of bones is also an important consideration in pediatric age group. In our case, the cause of the injury was fall of the bike on the face of the patient, and this is a rare injury because the patient had left orbital roof fracture without injury to the globe of the eye. Orbital roof fractures present various challenges for the neurosurgeons as well as the anesthesics. On one hand, the nondisplaced or minimally displaced orbital roof fractures generally do not require surgical intervention and can usually be managed by observation alone. On the other hand, displaced orbital roof fractures require team management. Surgical treatment requires management by neurosurgeons, plastic surgeons, ophthalmologists, and anesthetists as it can result in significant neurologic, ophthalmologic as well as cosmetic morbidities, various complications include proptosis, blindness, globe rupture, eye immobility, anesthesia or paresthesia of the supraorbital and supratrochlear nerves, cerebrospinal fluid leakage, intracranial injury, enophthalmos, exophthalmos, entropion, infection, diplopia, restricted extraocular movements, blepharoptosis, orbital volume discrepancy, and those associated with the presence of foreign bodies. Studies advocate early surgical intervention of orbital roof fractures to prevent meningitis and brain abscess formation but surgical approach itself presents a significant risk of intracranial infection. Critical neurosurgical indications for early surgery are dural tears, intracranial hemorrhage or compound depressed fracture, in addition to ocular problems. Furthermore, large basifrontal duroplasty is difficult in this region due to the thin dura and limited space. Piotrowski et al. reported that about 80% of patients achieved good overall functional and cosmetic results with an early surgical intervention and 20% of patients showed an unsatisfactory result because of orbital problems. Delayed intervention led to prolonged operative time and difficult restoration of the fractured segment because of fibrosis, and markedly affected the esthetic outcome. The oculocardiac reflex may be activated in cases of severe orbital trauma. The reflex is a triad of bradycardia, nausea, and syncope. Transient bradycardia may be witnessed in the perioperative period during ocular manipulation for fracture reduction. Although this finding rarely has any clinical hemodynamic significance, fatal cardiac arrhythmia has been reported in the literature. Patients with traumatic brain injury requiring surgery will invariably require endotracheal intubation. The decision to perform endotracheal intubation is not only determined by the patient's respiratory status or the need for an operative procedure but more importantly by their Glasgow Coma Scale at the time of presentation. Small children are at an increased risk of posttraumatic seizures compared with adults, because of increased excitability of the developing brain. Management of intracranial pressure is of utmost importance during intracranial surgery. A lower limit of acceptability in the pediatric population has been set at a cerebral perfusion pressure of 40 mmHg.

**Conclusion**

In penetrating injury of the orbital roof with brain herniation, early surgical intervention is very important as the injury can lead to septic meningitis or brain abscess. Hence early craniotomy, debridement, and...
duroplasty are required to prevent morbidity and mortality of patient. Ocular motility restriction and diplopia were the most common manifestations of orbital fractures. The roof of orbit fracture may be associated with significant brain injury with an injury to the olfactory bulb. Early surgical intervention and repair lead to better postoperative recovery of ocular motility.

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**Conflicts of interest**
There are no conflicts of interest.

**References**


**Figures and Tables**

**Figure 1**
(a) Leaking of brain matter from eye. (b) Computed tomography showing left orbital roof fracture with herniation of brain into orbit

Figure 2

Computed tomography showing fractured roof of left orbit
Computed tomography showing fragmented orbit roof

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