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CASE REPORT

White-eyed blowout fracture, child in danger: A case report

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Abstract

A white-eyed blowout fracture is an orbital floor fracture associated with restriction of ocular motility (suggestive of orbital content entrapment) but with minimal or absence of signs of soft tissue trauma. It can lead to significant patient morbidity. This case involved an 8-year-old boy with a white-eyed blowout fracture following facial trauma. He presented with binocular diplopia and a history of recurrent episodes of vomiting after the trauma and was referred to our centre for a suspected head injury. Visual acuity in both eyes was 6/9. Examination showed minimal left periorbital haematoma with left eye motility restriction on superior and medial gaze associated with pain. CT scan of the orbit showed left orbital floor fracture with minimal soft tissue entrapment. He underwent urgent open exploration of the left orbit and release of orbital tissue entrapment. Post-operatively, the left eye motility restriction improved significantly with resolution of diplopia. In conclusion, a high index of suspicion is crucial in diagnosing paediatric white-eyed blowout fractures due to lack of external ocular signs.

Introduction

Smith and Regan et al. first described a blowout fracture – an isolated fracture of the orbital floor with an intact orbital rim – in 1957.[1] In 1998, Jordan et al. introduced the term white-eyed blowout fracture, referring to individuals presenting with ocular symptoms following a blow to the periocular area, although with minimal signs of soft tissue trauma.[2,3] Paediatric white-eyed blowout fractures are rare and can present differently, thus offering potential for long-term complications if not recognised and treated properly.[4] This article reports the case of a young boy with a white-eyed blowout fracture following facial trauma.

Case history

A healthy 8-year-old boy allegedly fell into a drain with the left side of his face hitting the drain's edge. There was no loss of consciousness. However, he had binocular diplopia and several episodes of vomiting after the trauma. There was no history of headache, drooping of the eyelid or sunken globe. He was referred to our emergency department for suspected head injury due to persistent vomiting.

His Glasgow Coma Scale remained full throughout admission, and he was haemodynamically stable. His visual acuity was 6/9 in both eyes. Pupillary reaction was normal in both eyes. Relative afferent pupillary defect was absent. Ocular examination revealed minimal left periorbital haematoma with white conjunctiva and superficial abrasion wound on the left cheek. There was no ptosis, proptosis or enophthalmos of the left eye. Left eye hypotropia was present upon primary gaze. Extraocular muscle examination showed restriction in the left eye superior and medial gaze (**Figure 1A**), associated with diplopia and ocular pain on ocular movement. No tenderness or deformity of the left orbital rim was present. Both anterior segments were unremarkable. Fundoscopy revealed normal optic discs and retinas in both eyes. Hess chart test demonstrated left eye hypotropia with limited elevation. A forced duction test was not performed because the child was not cooperative.

A CT scan of the orbit and brain revealed left orbital floor fracture with extraconal fat herniation into the left maxillary sinus (**Figure 2**). No inferior rectus entrapment or retrobulbar haemorrhage was noted, nor was intracranial haemorrhage. He underwent urgent open exploration of the left orbit via a transconjunctival approach by the Oral and Maxillofacial team. Intra-operatively, exploration revealed an undisplaced fracture line near the infraorbital groove with minimal soft tissue entrapment. There was no rectus muscle entrapment. A forced duction test showed minimal mechanical restriction. The tissue entrapment was successfully released, as

evidenced by the free movement of the globe during the forced duction test at the end of the operation. No implant was placed. He also received a five-day course of oral Cefuroxime. Post-operatively, the left eye's range of movement has improved significantly. Minimal superior gaze restriction was observed with resolution of diplopia and pain (**Figure 1B**). The restriction was fully resolved after three months.

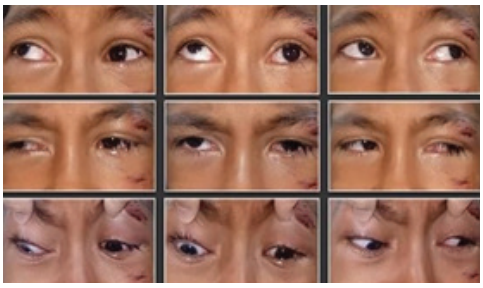

Figure 1A: Picture showing left eye hypotropia on primary gaze. There was restriction of superior and medial gaze over the left eye

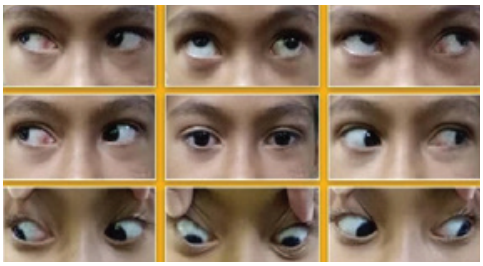

Figure 1B: Picture showing significant improvement of extraocular movement post-operatively. There was minimal restriction of superior gaze over the left eye.

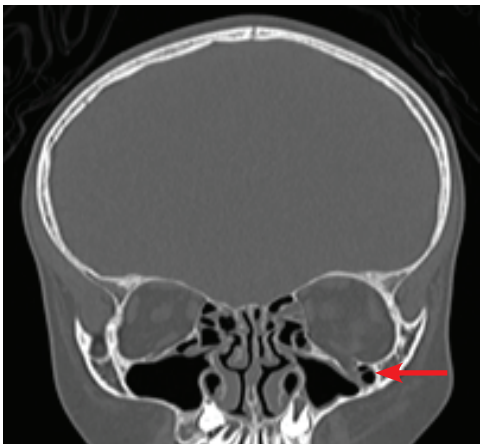

Figure 2: Coronal section of CT scan showed left orbital floor fracture with minimal soft tissue entrapment (arrow).

Discussion

The hydraulic and buckling mechanisms are two widely accepted theories explaining the mechanism of a blowout fracture.[1,3-5] In the hydraulic mechanism, an increased intraorbital pressure results in direct compression and fracture of the bony floor. The buckling mechanism describes any force transmitted posteriorly through the orbital rim transiently buckling and then fracturing the thin orbital floor.[4]

White-eyed blowout fractures are likely to occur in children over age 7.[6] Younger children have thicker sinus walls, greater bone elasticity, and a thicker padding of cheek fat with a smaller and flat midface. These features are thought to be protective of the orbital floor.[4] Commonly, paediatric white-eyed blowout fractures are caused by low-velocity, high-force crush injuries,[4] including sport-related injuries, accidents while playing, falling, motor vehicle accidents or assault.[4-5,7]

These fractures lead to diagnostic challenges due to a lack of clinical evidence of soft tissue injury. Even when entrapment is present, other features such as periorbital haematoma, subconjunctival haemorrhage or enophthalmos may be mild or absent.[3,6] Common presentation of white-eyed blowout fractures includes binocular diplopia, orbital pain during superior gaze, limited extraocular motility and oculocardiac reflex.[3-4,8,12] The symptoms of oculocardiac reflex, a potentially life-threatening condition, consist of nausea/vomiting, bradycardia, hypotension or cardiac arrest. This reflex is mediated by communication between the ophthalmic division of the trigeminal nerve and the visceral motor nucleus of the vagus nerve via the reticular formation.[4,12] Presenting symptoms such as nausea and vomiting may lead to a head injury misdiagnosis, potentially distracting the clinician from the true aetiology. Hence, oculocardiac reflex must be considered as a cause of nausea and vomiting in patients with white-eyed blowout fractures.[8]

A CT scan of the orbital is the gold standard of imaging for a suspected orbital floor fracture.[4] However, assessing the muscle/soft tissue entrapment clinically rather than relying on a radiologic diagnosis is vital because it is sometimes difficult in acute trauma to differentiate the entrapment from soft tissue swelling, fat stranding or haematoma.[6] In blowout fractures, a CT scan usually shows features of trapdoor fractures, meaning a linear floor fracture with minimal displacement and little or no soft tissue herniation into the maxillary antrum.[6] A forced duction test is

useful to assess the presence of ocular motility mechanical restriction. Mechanical gaze restriction along with a positive forced duction test and CT evidence of muscle/soft tissue entrapment are considered indications for surgical repair.[9-10] At the end of surgery, a forced duction test should be performed to evaluate the globe mobility to confirm the complete release of the entrapped tissue.[9]

A white-eyed blowout fracture is recognised as a true surgical emergency. Urgent surgery within 24-48 hours to release the entrapment is recommended for a positive outcome.[2-8] Early intervention can avoid ischaemic necrosis, fibrosis and scarring of entrapped muscle/ soft tissue, which can otherwise lead to permanent gaze restriction with consequent diplopia.[5,7,12] Rather than a subciliary or lower fornix approach, a transconjunctival approach has been preferred, allowing adequate visualisation of the orbital floor and reducing the risk of postoperative ectropion and scar hyperplasia.[10-11] Implant materials vary, including autogenous materials (bone and cartilage) and alloplastic materials (titanium mesh, porous polyethylene and resorbable sheeting). The selection is determined by the patient's fracture, age and location.[11] In this case, the attending surgeon's decision not to place an implant was likely due to the intraoperative findings of an undisplaced fracture line over the orbital floor.

Although prescribing prophylactic antibiotics in orbital fracture has become very common, no strong evidence supports their use. A review by Reiss et al. (2017) found that the most common reasons for using antibiotics in orbital fractures included the presence of sinusitis, recommendations by otolaryngology/ ophthalmology, and presence of floor fracture. They suggested withholding antibiotics for low-risk patients (those without an upper respiratory infection and not using steroids) and recommended shorter five- to seven-day courses of an oral antibiotic, if prescribed.[13]

Persistent diplopia is the most common complication in children with white-eyed blowout fractures,[3,4] resulting from a unique paediatric trapdoor fracture pattern that directly damages the extraocular muscle, leading to restricted motility. Another rare but devastating complication is orbital cellulitis.[14]

Conclusion

A high index of suspicion is crucial in diagnosing paediatric white-eyed blowout fractures due to a lack of external ocular signs. This case also highlighted a rare presentation of a white-eyed blowout fracture mimicking a head injury presentation. Notably, a delay in diagnosis can potentially lead to a life-threatening condition and delay surgical intervention.

Acknowledgement

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Conflicts of Interest

All authors declare no conflicts of interest.

Patients' consent for the use of images and content for publication

The patient and parents have provided verbal consent for the publication.

What is new in this case report compared to the previous literature?

- This paper highlights the importance of clinicians, especially those involved in the acute management of children with orbital trauma, in detecting and diagnosing a white-eyed blowout fracture.
- Due to a lack of external ocular signs, a white-eyed blowout fracture can easily be misdiagnosed as a head injury due to similar presentation, such as nausea and vomiting post-trauma, as initially happened in this case.
- We hope this paper will benefit all clinicians, especially those in primary care, such as those practising in a health clinic setting, general practitioners and emergency units. Early diagnosis and timely surgical intervention are crucial for a positive outcome and to prevent sequelae.

What is the implication to patients?

In the case of a white-eyed blowout fracture, any delay in surgical intervention can be life-threatening due to the risk of oculocardiac reflex. Furthermore, entrapped muscle/soft tissue ischaemia can lead to permanent gaze restriction with consequent diplopia in the child.

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