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Case Report

White-eyed blowout fracture: Diagnostic pitfalls and review of literature

Ching Ching Yew [a,*], Ramizu Shaari [a], Shaifulizan Abdul Rahman [a], Mohammad Khursheed Alam [b]

[a] Oral and Maxillofacial Surgery Unit, School of Dental Science, Universiti Sains Malaysia, Kubang Kerian 16150, Kota Bharu, Kelantan, Malaysia
[b] Orthodontic Unit, School of Dental Science, Universiti Sains Malaysia, Kubang Kerian 16150, Kota Bharu, Kelantan, Malaysia

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ABSTRACT

White-eyed blowout fracture was first termed by Jordan et al. in individuals sustaining a blow to the periocular area and presenting with ocular symptoms, although with minimal soft tissue signs of trauma. It is often found in pure orbital floor blowout fractures among paediatric patients, and it could manifest as a linear or hinge-like trapdoor deformity. Unlike the more common open orbital blowout fractures with distinct diagnostic clinical signs, white-eyed blowout fractures are rarer and their diagnoses can be easily missed, subsequently costing an optimal time window for surgical intervention. This is critical as better outcomes are found with earlier release of entrapments. This report describes a case of a white-eyed blowout fracture in a 10-year-old child faced with its diagnostic challenges. The current literature review discusses the types of fracture pattern, signs and symptoms, mechanism of action, as well as timing of surgery. In view of the common complication of persistent diplopia, clinical pitfalls in achieving this diagnosis are emphasized to prevent any delay of treatment. Current literature evidences are weighted towards urgent surgical intervention, as positive outcomes are found to correlate with earlier release of entrapments.

Introduction

White-eyed blowout fracture was first termed by Jordan et al. in individuals sustaining a blow to the periocular area and presenting with ocular symptoms, although with minimal soft tissue signs of trauma [1]. It is often found in pure orbital floor blowout fractures among paediatric patients, and it could manifest as a linear or hinge-like trapdoor deformity.

Unlike the more common open orbital blowout fracture with distinct diagnostic clinical signs, white-eyed blowout fractures are rarer and their diagnoses can be easily missed, subsequently costing an optimal time window for surgical intervention. Accurate diagnosis is critical as better outcomes are found with earlier release of entrapments [2–4].

Case report

A healthy 10-year-old Malay boy allegedly fell hitting his face on a friend's knee while playing in school. The child did not lose consciousness, but he vomited twice at home and he was brought to the emergency department the same day.

The patient was clinically stable exhibiting a full Glasgow Coma Scale with borderline bradycardia. Upon presentation, the patient lacked external features of soft tissue signs of trauma. Ocular symptoms including periorbital haematoma, enophthalmos, dystopia and subconjunctival ecchymosis were absent (Fig. 1). It was only with further ophthalmology examination that the patient was revealed to have binocular diplopia on direct, upward and temporal gaze. He also had restriction in superior movement of the right eye, suggesting entrapment of the right inferior rectus muscle (Fig. 1).

Computed tomography (CT) confirmed an undisplaced linear fracture of the right orbital floor with minimal orbital content entrapment (Fig. 2). The diagnosis of white-eyed orbital blowout fracture was made. The patient was brought to the operating room on the third day after trauma, with consideration to starvation protocols for general anaesthesia. He underwent open reduction

* Corresponding author. Tel.: +60 124881564.
E-mail addresses: yewchingching@yahoo.com (C.C. Yew), miju55@hotmail.com (R. Shaari), shaifulrahman@lycos.com (S.A. Rahman), dralam@usm.my (M.K. Alam).

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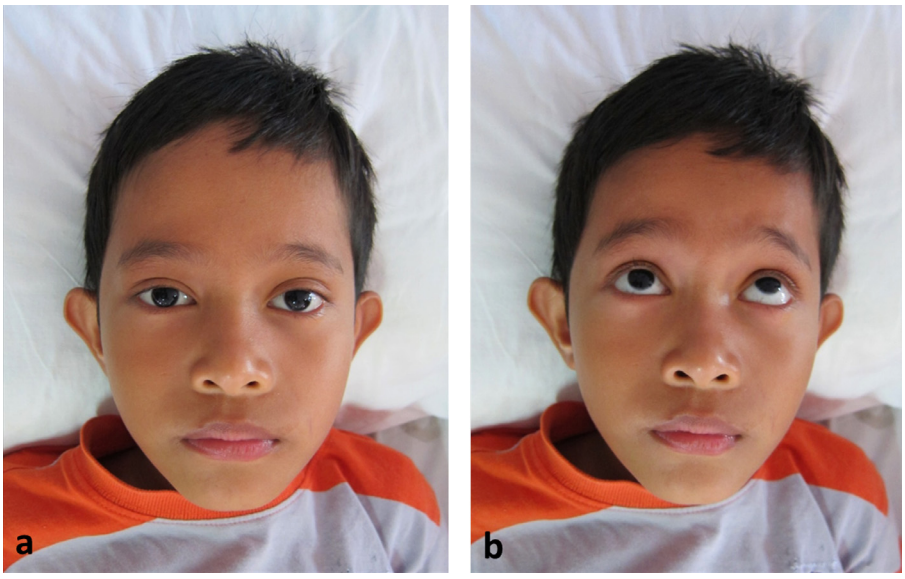

Fig. 1. Day one post-trauma of right white-eyed blowout fracture with no soft tissue clinical signs of injury: (a) primary gaze and (b) restriction in right superior gaze.

and release of orbital content entrapment via a transconjunctival approach. Intraoperative findings showed a stable and undisplaced linear fracture of the right orbital floor with tight adhesions of orbital contents to it. The adhesions were carefully released with two freers in alternating movements, where the fracture segment was gently depressed while the entrapment was relieved and repositioned superiorly onto the orbital floor. No reconstruction of the orbital floor was required. Postoperatively, the patient presented with mild binocular diplopia and with residual superior gaze restriction that fully recovered 6 months later (Fig. 3).

Discussion

Paediatric white-eyed blowout fractures are rare, and they present clinically different features from adult fractures due to the on-growing facial skeletal morphology. The elasticity of paediatric bone, incomplete fused suture lines, thicker periosteum and increased soft tissue padding over the malar eminence are some features that enable the paediatric orbital bone to absorb high impact yet sustain minimal bony structural damage [5,6]. Histologically, the growing paediatric bone consists of less calcified osseous tissue and is more cellular in nature, making it more pliable and less brittle.

Both the hydraulic and buckling theories are widely accepted, and they are believed to interact with one another to contribute to the mechanism of fracture in white-eyed blowout fracture [7,8]. Besides, the vulnerability of the inferior rectus muscle was described in CT morphology assessments by Neinstein et al. They found that the lack of periorbital fat for protection and the close proximity of the inferior rectus muscle to the orbital floor make the muscle susceptible to injuries [9]. Based on clinical and radiological features, orbital floor blowout fractures may present in two main patterns: the linear or hinged type, which carry different prognoses, respectively (Table 1) [10–13].

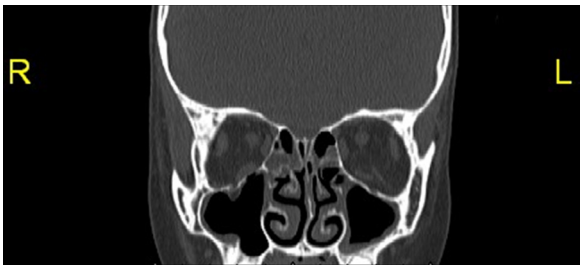

Fig. 2. Coronal section of CT scan showed an undisplaced linear fracture of the right orbital floor with minimal orbital content entrapment.

Diagnostic challenges in white-eyed blowout fracture exist because of the lack of external soft tissue injury presentation, such as in this case. Firstly, the mechanism of injury is often of low-velocity impact; hence, soft tissue response such as periorbital swelling and haematoma may be absent [9]. Secondly, without comminuted bony fractures, minimal tear of the periosteum leads to the absence of subconjunctival ecchymosis. Thirdly, enophthalmos is almost not expected in white-eyed blow out fractures as the minimal amount of orbital content entrapped below the orbital floor fracture is negligible. Besides, symptoms of oculocardiac reflex alone may mimic an intracranial injury, while proper eye examination may not be possible in an uncooperative child. All these give rise to diagnostic pitfalls in white-eyed blowout fractures. A high index of suspicion in clinicians, along with cross-sectional imaging (usually coronal cuts), is required to help confirm the diagnosis.

The positive symptoms in white-eyed blowout fracture are subtle, and they may present as binocular diplopia on primary and secondary gaze, orbital pain during superior gaze and oculocardiac reflex [1]. Restriction in superior gaze and positive forced duction test are usually observed upon further clinical examination. Oculocardiac reflex not only serves as a clue in arriving at a diagnosis but also can be an indication for surgery if the symptom is persistent, as it may lead to severe bradycardia and even heart block [14,15].

Most of the literature acknowledges white-eyed blowout fracture as a true surgical emergency and recommends urgent surgery within 24–48 h for release of the entrapment. This is supported by an extensive review article of 25 cases by Leslie and Durairaj, and many other reviews [1–4,6,10,11,16]. Conversely, in their study on 44 patients, Yang et al. found that there is no statistical difference in the operation success rate among groups operated upon within 24 h, between 24 and 72 h and after 72 h [17]. They emphasized the importance of appropriate surgical technique with complete removal of entrapments in the