Blowout Fracture in a 3-Year-Old

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Abstract

A 3-year-old patient was referred to the oral and maxillofacial department with a fracture of the orbital floor. Due to the lack of clinical symptoms, a conservative approach was chosen. After 3 weeks, an enophthalmos developed. The orbital floor reconstruction was successfully performed through a transconjunctival approach. This case highlights the rarity of pure blowout fractures in young children. The specific presentation and diagnostics of orbital floor fractures in children and the related surgical planning and intervention are discussed.

Keywords

- blowout fracture
- child
- orbital floor
- orbital fracture
- trauma

In the past 42 years, only four cases of pure blowout fractures have been described in children below the age of 5, and a total of 13 below the age of 8.[1–3] The rarity of these fractures can be attributed to the often unpneumatized maxillary sinus (►**Fig. 1A**),[4–7] relatively larger forehead, and the other types of trauma in young children compared with adults (e.g., during sports or play).[1,5,6] Pure blowout fractures are isolated floor fractures without involvement of the orbital rim, whereas impure fractures involve the floor and the rim.[8] According to the hydraulic theory, the fracture is often the result of a sudden increase in intraorbital pressure caused by blunt trauma (►**Fig. 1A** and **B**). The buckling theory states that an anterior force on the rim, which buckles and transmits forces to the orbital walls, causes the orbital floor to fracture.[1,2,7]

Due to the pneumatization grade of the maxillary sinuses and the elasticity of the bone, children mostly present with so-called trapdoor fractures. This variation of the greenstick fracture causes entrapment of the inferior orbital tissues, which can include fat, the connective tissue septa, the inferior rectus muscle, and/or the inferior oblique muscle, leading to enophthalmos and/or diplopia.[2,5,7,9–11] The muscular entrapment leads to autonomic symptoms such as nausea and vomiting or even bradycardia and syncope. This triad of symptoms is also known as *oculocardiac reflex*.[2,5] Long-term entrapment of the muscle leads to necrosis and loss of function, resulting in an intractable diplopia.

Case Report

A 3-year and 10-month-old girl was referred from a regional hospital for a "second opinion" about an orbital fracture caused by a fall. An orbital computerized tomography (CT) scan made at the initial hospital showed a pure blowout fracture of the right orbital floor with dislocation of orbital contents (►**Fig. 2**). The size of the defect was 8.8 × 8.6 mm. There was no diplopia. The sensibility of the infraorbital nerve was undisturbed but possibly unreliable. The eye motility was normal. Hertel exophthalmometry values were: 10, 96, and 11. Due to periorbital edema and lack of clinical symptoms, the initial approach was conservative. Twenty days later an enophthalmos was noticed, without diplopia.

After 1 week, the inferiorly prolapsed tissue, due to rupture of the periorbit, was repositioned through a transconjunctival incision and the orbital floor defect was covered with Lyoplant (Braun Aesculap, Tuttlingen, Germany). Following closure of the conjunctival wound, a forced-duction test was performed,

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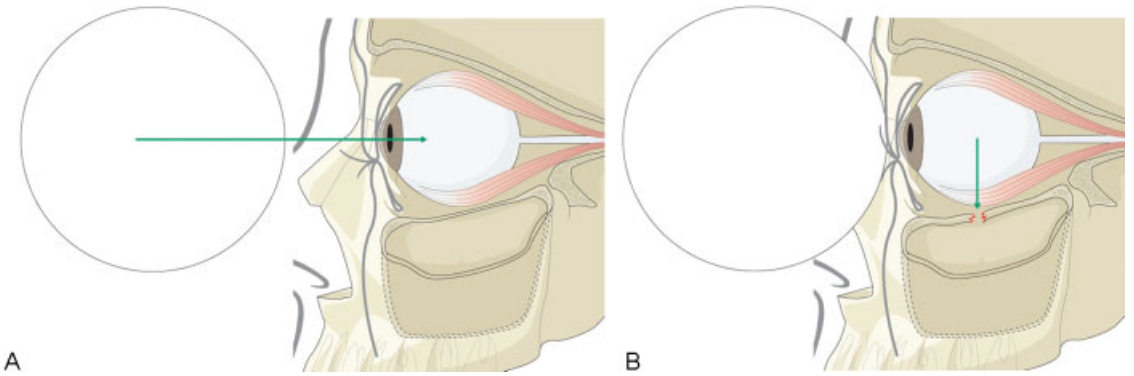


Figure 1 Schematic view of blow-out trauma in a young child with a blunt object. (A) (Left) Schematic, sagittal, view of the unaffected, incomplete pneumotized maxillary sinus of our patient at age of 3 years and 10 months. The dotted lines indicate the boundaries of the maxillary sinus at age of 20. The green arrow indicates the motion of the force of the ball. (B) (Right) The green arrow indicates the transferred force of the ball. Note the greenstick fracture of the orbital floor, the so-called trapdoor fracture.

which was negative. There were no complications and the patient was discharged 1 day after surgery.

At 12 months' follow-up, there were no complaints of diplopia. The ocular movements were normal and no enophthalmos was noted.

Discussion

Anatomy studies teach us that the maxillary sinuses are not fully developed in young children.[4,7] The youngest reported blowout-fracture patient was 11 months old.[12] Heteroanamnestic information should be obtained about the type of trauma and the interval between trauma and hospital visit. Restriction of gaze, extreme pain, and vomiting are signs of muscle entrapment, which may be followed by muscle infarction if left untreated. If the clinical symptoms are suggestive for an orbital fracture, even in the very young, additional radiological investigation is indicated.



Figure 2 Coronal orbital computed tomography scan of our 3-year-old patient after blunt orbital trauma, depicting a right-sided orbital (floor) blowout fracture with herniating orbital contents. Note the small lumen of the maxillary sinus associated with very young age.

Although the CT scan is the gold standard for the imaging of orbital fractures, there are questions concerning its use in pediatric orbital fractures.[13] Due to the radiation and the risk of cataract development, it is a less preferable diagnostic tool in children. In addition, the typical entrapment of soft tissue and muscle is better detected by magnetic resonance imaging (MRI). Furthermore, in the pediatric population, CT has been found to significantly underestimate extraocular muscle and soft tissue entrapment.[5] Therefore, MRI could be considered when there is clinical evidence of soft tissue entrapment that is not seen on a CT scan. MRI with a microscopy orbital coil is an alternative in pediatric orbital fractures.[13] Although a CT scan gives a more precise image of the bony structures, MRI should be considered in young children.

In case of poor patient compliance, as in the very young, an immediate forced-duction test under sedation is indicated. Surgical release of the entrapped or prolapsed tissues followed by reconstruction of the fracture should be performed within 24 hours if the forced-duction test is positive.[14]

Treatment depends on the severity of the clinical symptoms. Muscle entrapment should be surgically relieved as soon as possible. Indications for surgery are: persistent diplopia after the initial edema has resolved, vertical dystopia, defects larger than 50% of the floor, enophthalmos ($>$ 2 mm), oculocardiac reflex, and loss of cheek sensitivity (►**Fig. 3**).[5,6,14,15] The goal is to reestablish the orbital volume and reposition herniated soft tissue into the orbit. Infraorbital, subciliar, and transconjunctival incisions, with or without canthotomy, can be chosen. A transconjunctival route holds two advantages: it gives direct access to the orbital floor and does not give a visible scar. A transantral approach is contraindicated due to the small maxillary sinus in children.[5,16] The defect is often small in children, and therefore an auto- or heterogeneous graft is not always needed. Harvesting autogenous bone may have a negative influence on growth at the donor site.[5,6,11] Heterogeneous nonabsorbable alloplastic material may be displaced or change growth patterns and is *not* preferable in growing children. Lyoplant is

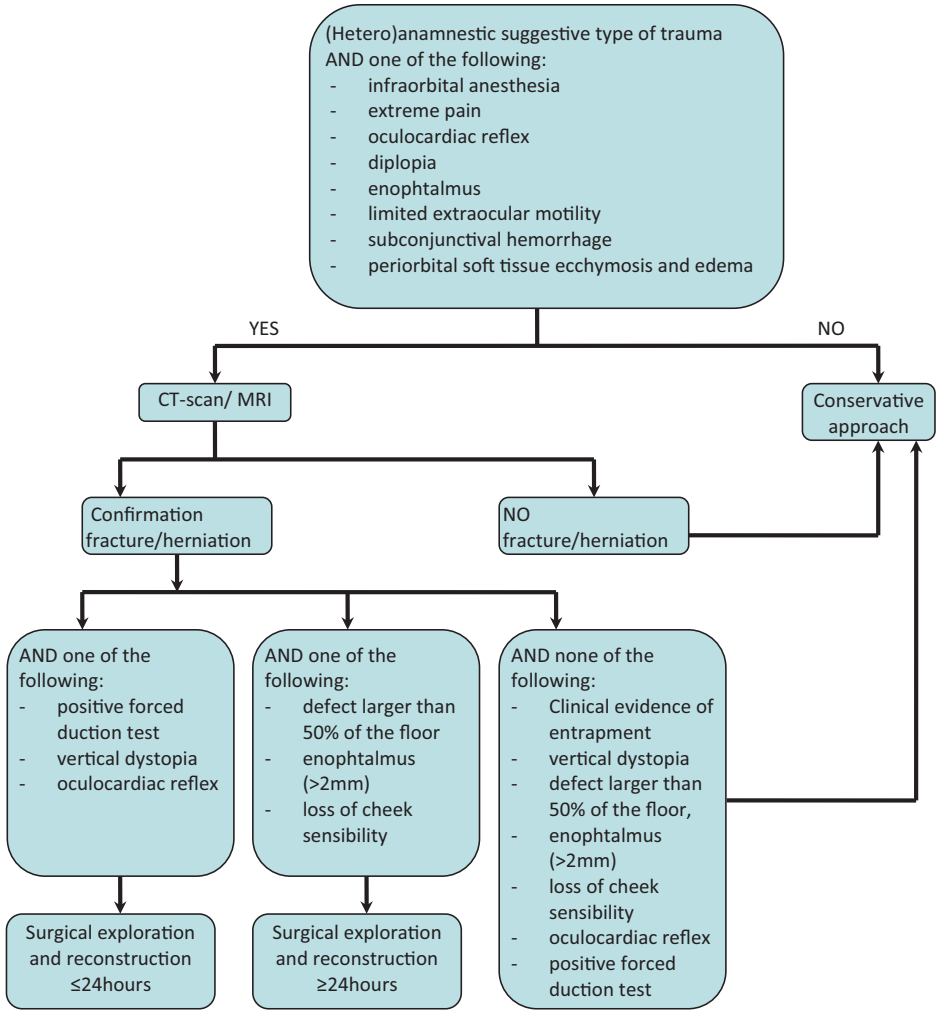


Figure 3 Algorithm for the diagnosis and management of the child with possible blowout fracture. Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging.

biocompatible, is easily placed, and adapts to the internal contours, therefore, we feel that alloplastic absorbable material is preferred in children.[6,15]

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