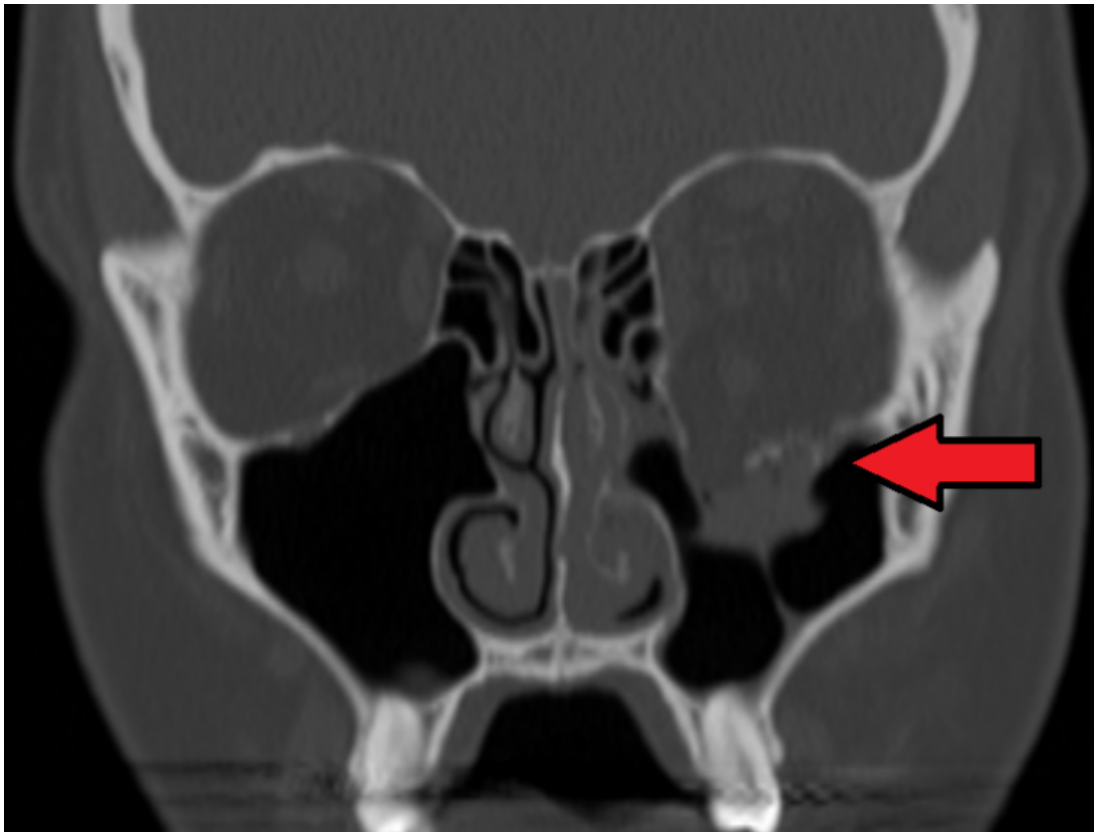
Red Eye and Orbital Trauma in Children — Diagnosis and Treatment

See online here

Orbital fractures are common in children and can be either isolated or combined with craniofacial fractures. Associated injuries are usually evident and should be excluded in any child who presents with an orbital fracture. A CT scan is usually sufficient in identifying the type of orbital fracture and excluding urgent neurological injuries such as intracranial bleeding. Type 1 (pure orbital) fractures should be treated conservatively. Type 2 (craniofacial) fractures can be treated conservatively; however, a rigorous follow-up scheme should be used. Type 3 (common pattern) fractures are usually treated surgically in children.



Overview

Orbital fractures are common in children and usually associated with **significant trauma to the face or orbit**. They can be isolated or associated with other craniofacial fractures and can be classified into the following types:

- **Pure orbital (type 1) fractures:** These include isolated fractures of the

orbital floor, medial wall, orbital roof, lateral wall, or include a combination of these variants.
- **Craniofacial (type 2) fractures:** These occur due to significant trauma to the face and include skull, facial, and orbital fractures.
- **Common pattern orbital fractures (type 3) fractures:** These include orbital fractures associated with the zygomaticomaxillary joint, naso-orbitoethmoid complex, or fractures of the orbital floor combined with that of the inferior orbital rim.

Epidemiology of Pediatric Orbital Fractures

In developed countries, trauma is the leading cause of death among children with pediatric facial fractures and represents 4.6% of all pediatric trauma admissions.

Facial fractures due to trauma are rarer in children compared to adults, which might be attributed to the increased **elasticity of facial bones** and the high cranium: face ratio in the former. Children younger than 5 years of age are prone to frontal bone and orbital floor fractures, while those older are more prone to midface and mandibular fractures after sustaining facial trauma.

Orbital fractures occur in up to 25% of children who sustain facial fractures due to facial trauma. A notable proportion of these children also have a significant **brain injury**.

There is a **slight male predominance** in the distribution of the frequency of orbital fractures in children with an estimated male:female ratio of 2:1. This can be attributed to the increased likelihood of young boys, as opposed to girls, participating in high-risk outdoor activities.

The most common causes of facial and orbital trauma in children include accidents involving **motor vehicles** and those **related to daily activities**. **Violence** and **physical fights** may be the causes of facial trauma in older children.

The prognosis of pediatric orbital fractures is dependent on the presence of **eye globe injury**, associated neurological injuries, and other injuries such as **lung contusions**. Approximately 43% of children who sustain facial trauma strong enough to cause an orbital fracture also display **neurological injury** that can range from a **simple concussion** to **intracranial bleeding**.

Classification of Pediatric Orbital Fractures

Orbital fractures can be classified into **pure orbital** (type 1), **craniofacial** (type 2), and **common pattern orbital** (type 3) **fractures**. This classification system is important for clinicians because it indicates the correlation between fracture type and **the risk of surgical intervention**.

Type 1 is most common in children (40% of all cases), followed by type 2 (33%) and type 3 (27%) fractures. **Surgical intervention** is rarely needed in type 1 fractures (9%), whereas it is often needed in type 3 fractures (up to 76%).

Clinical Presentation of Pediatric Orbital Fractures

Children with orbital fractures present to the emergency department after sustaining **major trauma**. While **enophthalmos** and **entrapment** can be considered specific signs

of a significant pure orbital fracture, these are rarely seen in children. In the case of acute enophthalmos or entrapment, significant orbital fractures should be diagnosed promptly and surgical intervention should not be delayed.

During a physical examination, the patient should be instructed to fully extend the neck and look upwards, i.e. a **worm's eye view**. This approach should be used **only if cervical fractures have been conclusively excluded** by an experienced radiologist or neurosurgeon. The worm's eye view can help detect even mild degrees of enophthalmos in children.

After **securing the airway, breathing, and circulation**, a detailed history should be taken if possible. The **exact mechanism of injury** should be promptly determined because high-impact injuries due to motor vehicle accidents, for example, are more likely to be associated with significant non-facial injuries involving the brain, chest, and abdomen.

While orbital fractures may **threaten the patient's vision**, associated injuries could be **life-threatening** and should, therefore, be prioritized in the management of trauma patients.

Once the patient is stable, a **complete physical examination** should be performed to assess the degree of neurological injury and exclude any signs of facial trauma such as **facial lacerations** or **open-globe injuries**. Additionally, the nostrils and ears should be examined for signs of **basal skull fractures** such as **rhinorrhea** and **otorrhea**, respectively. An **ocular examination** should be conducted to assess eye movement and exclude ocular entrapment.

Diagnostic Workup for Pediatric Orbital Fractures

After a thorough physical examination, a **computed tomography (CT) scan** of the head and facial bones should be ordered, which would help identify the type of orbital fracture.

Children with type 1 fractures who do not have enophthalmos or entrapment should be evaluated for cranial injuries such as an **intracranial bleed** using a non-contrast CT scan of the head.

In children with type 2 fractures, a CT scan should reveal an oblique facial fracture that extends to the orbit. The fracture can involve the orbit from the beginning or progress from a previously isolated facial fracture. Evolving facial fractures or **growing skull fractures** can be excluded by **repeating the CT scan** during a follow-up.

CT scan of the orbit is useful in detecting type 3 fractures in which the **naso-orbitoethmoid and zygomaticomaxillary bones** are most commonly involved.

Treatment of Pediatric Orbital Fractures

Orbital trauma is an ophthalmic emergency and care must be taken to allow for the initial stabilization of the patient by means of fluid administration, pain control, and wound dressing to avoid infection. Definitive management depends on the determination of the type of orbital fracture.

Type 1 fractures in children should be further classified into **significant** and **non-significant subtypes**. A significant pure orbital fracture is defined as one that involves more than 50% of the orbital wall length or width, or a fracture that has significant and

severe displacement. These variables can be assessed using a high-resolution CT scan of the orbit. Significant pure orbital fractures should be closely monitored and followed up for signs of **acute enophthalmos** as they **pose a higher risk.**

Children with non-significant pure orbital fractures usually recover with **conservative management**.

Acute surgical intervention for significant pure orbital fractures is controversial as recent studies show that conservative management is as effective as surgical intervention.

Type 2 orbital fractures in children should be **closely monitored** owing to the **risk of growing skull fractures**. These fractures usually present with **ocular symptoms** and might need **surgical intervention**. On the other hand, children with facial fractures and orbital fractures usually respond to conservative management unless they have **acute ocular entrapment** or **enophthalmos**.

Type 3 orbital fractures are usually associated with **severe displacement**, **enophthalmos,** and **telorbitism**; therefore, **surgical intervention** to repair the involved bones should be considered in all children who present with such fractures. It should be noted that **growing skull fractures can evolve into type 3 orbital fractures with zygomatic bone involvement**.

References

Losee J, Afifi A, Jiang S et al. **Pediatric Orbital Fractures: Classification, Management, and Early Follow-Up**. Plastic and Reconstructive Surgery. 2008;122(3):886-897. doi:10.1097/prs.0b013e3181811e48.

Notes