Red Eye and Orbital Trauma in Children — Diagnosis and Treatment

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Orbital fractures are common in pediatrics and can be 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 computed tomography scan is usually sufficient in identifying the type of the orbital fracture and in 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, but a vigorous follow-up scheme should be used, and type 3 common pattern fractures are usually treated surgically in children.

Overview

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

- Pure orbital fractures/type 1 fractures. This includes an isolated fracture
of the orbital floor, the medial wall, the orbital roof, the lateral wall, or a combination of these.

- **Craniofacial fractures/type 2 fractures.** These are fractures that occur due to significant trauma to the face and are associated with the skull, facial and orbital fractures.
- **Orbital fractures associated with common fracture patterns/type 3 fractures.** This refers to an orbital fracture that is associated with fractures of the zygomaticomaxillary joint, the naso-orbitoethmoid, or fractures of the orbital floor combined with inferior orbital rim fracture.

### Epidemiology of Pediatric Orbital Fractures

In developed countries, trauma is the leading cause of death among children with pediatric facial fractures representing 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 the facial bones** in children and the high cranium: face ratio among them. Children younger than 5 years of age are prone to frontal bone and orbital floor fractures, while older children are more likely to have mid-face and mandible fractures after sustaining a facial trauma.

Orbital fractures occur in up to 25% of children who have a facial fracture due to facial trauma. A significant 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 to female ratio of 2:1. This can be attributed to the increased likelihood of participation in high-risk outdoor activities among young boys compared to girls.

The most common causes of facial and orbital trauma in children are **motor vehicle accidents** and **activities of daily living**. **Violence** and **fighting** might be the cause of facial trauma in older children.

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

### Classification of Pediatric Orbital Fractures

Orbital fractures can be classified into type 1 fractures, i.e. **pure orbital fractures**, type 2 fractures, i.e. **craniofacial fractures**, and type 3 fractures, i.e. **common pattern orbital fractures**. This classification system is very important for the clinician because of the correlation between the fracture’s type and the **risk of surgical intervention**.

In children, the most common type of orbital fractures is type 1 (40% of the cases) followed by type 2 (33%) and finally type 3 (27%). **Surgical intervention** is rarely needed in type 1 fractures (only 9% need a surgical intervention), whereas it is usually needed for the repair of type 3 fractures (up to 76% of type 3 fractures require some sort of surgical intervention).
Clinical Presentation of Pediatric Orbital Fractures

Children with orbital fractures usually present to the emergency department after sustaining a major trauma. While enophthalmos and entrapment can be considered as specific signs of a significant pure orbital fracture, they are rarely seen in children. In the case of acute enophthalmos or entrapment, the diagnosis of a significant orbital fracture should be made an urgent surgical intervention should not be delayed.

In a physical examination, the child 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 are reliably excluded by an experienced radiologist and a neurosurgeon. The worm’s eye view can enable us to better observe even mild degrees of enophthalmos in children.

After securing the airway, breathing and circulation, a more detailed history can be taken from any witnesses if possible. The exact mechanism of injury should be determined as early as possible because high-impact injuries due to motor vehicle accidents, for example, are more likely to be associated with significant non-facial injuries such as brain injuries, chest injuries, and abdominal injuries.

While a significant orbital fracture can be sight-threatening, these other associated injuries might be life-threatening and should take priority in the management of a trauma patient.

After the stabilization of the child, a complete physical examination should be performed to assess the degree of neurological injury. An ocular examination should be attempted to assess the eye movements and exclude ocular entrapment.

On physical examination, one should exclude any signs of facial trauma, such as facial lacerations or an open eye globe. Additionally, the nostrils and ears should be examined for any signs of basal skull fractures such as rhinorrhea and otorrhea.

Diagnostic Workup for Pediatric Orbital Fractures

After performing a thorough physical examination of the child, a computed tomography scan of the head and facial bones should be ordered. From the computed tomography scan, it should be easy to differentiate between type 1, 2 or 3 orbital fractures.

Children with type 1 fractures, who do not have enophthalmos or entrapment, should be evaluated for other cranial injuries such as an intracranial bleed which can be easily excluded by a non-contrast head computed tomography scan.

Children with type 2 fractures usually have an oblique facial fracture that extends to the orbit on their computed tomography scan. The fracture can involve the orbit from the beginning or can progress from a previously isolated facial fracture. Evolving facial fractures can be excluded by a repeat computed tomography scan and are known as growing skull fractures.

Type 3 fractures can also be easily diagnosed with an orbital view computed tomography scan. The most commonly involved bones in this type of fracture are the naso-orbitoethmoid and the zygomaticomaxillary bones.
Treatment of Pediatric Orbital Fractures

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

The determination of the classification of the orbital fracture is essential because the management plan is highly dependent on the type of fracture.

Children with type 1 fractures should be re-classified into significant pure orbital fractures and non-significant pure orbital fractures. A significant pure orbital fracture is defined as an orbital fracture 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 by a high-resolution computed tomography scan of the orbit.

Children with non-significant pure orbital fractures usually do well with conservative management alone, whereas those with significant pure orbital fractures should be closely monitored and followed up looking for any signs of acute enophthalmos. The risk of acute enophthalmos is higher in children with significant pure orbital fractures.

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

Type 2 orbital fractures in children should be closely monitored due to the risk of a growing skull fracture. Growing skull fractures usually present with ocular symptoms and might need surgical intervention. On the other hand, children with facial fractures and orbital fractures usually do well with conservative management alone unless they have acute ocular entrapment or enophthalmos.

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

References


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