Orbital Floor Fractures

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Grand Rounds Presentation
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April 11, 2007
Important in the design of the orbit is its inherent ability to protect vital structures by allowing fractures to occur. Because the globe is surrounded by fat and the medial wall and floor of the orbit are thin, force that is transmitted to the globe allows fracture of the orbit without significant globe injury. This accounts for the significantly higher incidence of fractures of the orbit as compared to open globe injuries.
Pathophysicsiology

Bone conduction theory
“buckling”
- Less energy
- Small fractures limited anterior floor

Hydraulic theory
- More energy
- Larger fracture involving entire floor and medial wall
- Should suspect more extensive orbit involvement with associated injuries (globe rupture)
History

- Mechanism of injury
- Double vision, blurry vision
- Epistaxis
- V2 numbness
- Malocclusion
- Nausea and vomiting (especially in children)
- Abuse? Repeated falls? Frequent ER visits? (children)
Physical Exam

- Full Head and Neck exam
- Cardiac exam
  (Bradycardia, low BP)
- Facial asymmetry
- V2 exam
- Exam of canthal stability
  (Bowstring Test)
- Entrapment
- Pupillary exam
  (Marcus Gunn pupil)
- Retinal exam
- Hurtel exophthalmometry
Imaging

- C-Spine X-rays
- Plain Films of limited use
- MRI if retinal, optic nerve, or intracranial concerns
- CT Facial bones (most useful)
Indications for Repair

- Diplopia that persists beyond 7 to 10 days
- Obvious signs of entrapment
- Relative enophthalmos greater than 2mm
- Fracture that involves greater than 50% of the orbital floor (most of these will lead to significant enophthalmos when the edema resolves)
- Entrapment that causes an oculocardiac reflex with resultant bradycardia and cardiovascular instability
- Progressive V2 numbness
Immediate repair

- Nonresolving oculocardiac reflex with entrapment
  - Bradycardia, heart block, nausea, vomiting, syncope

- Early enophthalos or hypoglobus causing facial asymmetry

- “White-eyed” floor fracture with entrapment

Repair Within Two Weeks

- Symptomatic diplopia with positive forced duction test
- Large floor fracture causing latent enophthalmos
- Significant hypoglobus
- Progressive infraorbital hypesthesia

Observation

- Minimal diplopia
  - Not in primary or downgaze
- Good ocular motility
- No significant enophthalmos
- No significant hypoglobus

Trapdoor Fractures

- Trapdoor fractures with entrapment differ in children and adults
  - Children repaired within 5 days of injury do better that those repaired within 6-14 days or those repaired > 14 days
  - There is no difference in early timing of adults (1-5 days or 6-14 days)
  - Adults repaired less than 14 days from injury have less long term sequelae than those repaired greater than 14 days from injury

The Differences of Blowout Fracture of the Inferior Orbital Wall Between Children and Adults, Kwon et al. Archives Oto head & Neck.
Transconjunctival, Subciliary, Subtarsal Approaches

- Preseptal incision
  Transconjunctival approach

- Postseptal incision
  Transconjunctival approach

- Subciliary approach

- Capsulopalpebral fascia

- Orbital septum

- Orbicularis oculi muscle

- Inferior oblique muscle

- Orbital fat
Transconjunctival Approach

- Transconjunctival
  - No visible scar
  - Less incidence of ectropion and scleral show
  - Poorer exposure without lateral canthotomy and cantholysis
  - Better access to the medial orbital wall
  - Risk of entropion
Transconjunctival Approach
Subciliary Approach

- Subciliary advantages
  - Easier approach
  - Scar camouflage
  - Skin necrosis
  - Highest incidence of ectropion
  - Highest incidence of scleral show
Subtarsal Approach

- Subtarsal Advantages
  - Easiest approach
  - Direct access to floor
  - Good exposure
  - Postoperative edema the worst
  - Visible scar
Dissection

- Stay below orbital septum
- 24/12/6mm rule
- Remove entrapped inferior rectus muscle
- Slightly overcorrect if possible
- Avoid V2 injury

- Picture of dissection here
Materials for reconstruction

- **Autogenous tissues**
  - Avoid risk of infected implant
  - Additional operative time, donor site morbidity, graft absorption
  - Calvarial bone, iliac crest, rib, septal or auricular cartilage
Septal Cartilage repair

- Enophthalmos
- Maxillary sinus Ostia obstruction
- Deviated Septum
- Septoplasty, MMA, floor repair with septal cartilage
Septal Cartilage repair

- Floor reduced
- Maxillary Sinus Clear
- Septum Straighter
- Endophthalmos improved
Conchal cartilage repair

- Curve of concha can approximate curve of orbit
- Can place with concave surface down for overcorrection
- Two site surgery
- Entire concha needed for significant floor fractures
Materials for reconstruction

- Alloplastic implants
  - Decreased operative time, easily available, no donor site morbidity, can provide stable support
  - Risk of infection 0.4-7%
  - Gelfilm, polygalactin film, silastic, marlex mesh, teflon, prolene, polyethylene, titanium
Materials for reconstruction

- Ellis and Tan 2003
  - 58 patients, compared titanium mesh with cranial bone graft
  - Used postoperative CT to assess adequacy of reconstruction
  - Titanium mesh group subjectively had more accurate reconstruction
Endoscopic Balloon catheter repair

- Wide MMA
- Insert Foley and inflate
- Leave in place for 7-10 days
- Best for large trapdoor fractures without entrapment
- Broad spectrum antibiotics
Endoscopic Orbital Floor Repair

- Caudwell Luc approach
- Large MMA will allow larger working space
- Endoscopic reduction of floor contents
- May secure with antral wall bone, synthetic material, or Foley
Complications

- Blindness
- Orbital Hematoma
- Infection of hardware
- Entropion
- Endophthalmos
- Diplopia
Orbital Hematoma

- Poor Vascular perfusion of the optic nerve and retina
- Early recognition
- “Gray Vision”
- Proptosis
- Ecchymosis
- Subconjunctival hemorrhage
- Afferent pupil defect
- Hard globe
Orbital Hematoma

Treatment

- Lateral Canthotomy (immediately)
- Lateral canthal tendon lysis (immediately)
- IV acetazolamide 500mg
- IV mannitol 0.5 g/kg
- Surgical decompression of the orbit
Complications

- Abscess over implant
- Requires Implant removal
- More common with synthetic floor implants
Complications

- Pyogenic granuloma
- Entropion
Complications

- Late left proptosis
- Hemorrhage into implant
Lagniappe

- Medial orbital wall fractures
  - Most common orbital wall fracture
  - Weakest area of the orbit
  - Very commonly asymptomatic
  - Can have entrapment of medial rectus
  - Can get orbital emphysema with nose blowing
  - Approach through Lynch or Transcaruncular/Medial fornix incision
Lagniappe
**Orbital dystopia** - The bony orbital cavities do not lie in the same horizontal plane (**Horizontal Dystopia**) or the same vertical plane (**Vertical Dystopia**).
References


- Buckling and Hydraulic Mechanisms in orbital Blowout Fractures: Fact or Fiction?, Ahmad et al, *Journal of Craniofacial surgery*, vol 17, 438-441