Orbital Fractures
A Radiological Perspective

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Agenda

• Orbital Anatomy
• Patient A.D.
  – Clinical Presentation
  – Radiological Work-Up
• Imaging of the eye
• Orbital Blow-Out Fractures
• Orbital Blow-In Fractures
• Le Fort Fractures
• Treatment
Orbital Anatomy

• Orbital Bones
  – Maxilla
  – Zygoma
  – Lacrimal
  – Ethmoid (lamina papyracea)
  – Sphenoid
  – Palatine
  – Frontal

• Associated Sinuses
  – Frontal
  – Maxillary
  – Ethmoidal
  – Sphenoid
Patient A.D.

- 46 yo male s/p assault (punch to L eye)
- Presents c/o pain in L eye, pain abducting L eye
- PE
  - Periorbital hematoma, tender laterally/medially/inferiorly, L enophthalmos, mildly injected conjunctiva
  - EOMI, PERRL, no step-off, no infraorbital numbness, normal fundus exam, grossly intact visual acuity
Radiological Work-Up

- **C-spine films**
  - No evidence of cervical spine fracture

- **CT Head w/o contrast**
  - No evidence of intracranial hemorrhage
  - Left blow-out fracture

- **CT Orbit**
  - Axial images (best for medial/lateral wall)
  - Coronal images (best for orbital floor and roof)
Head CT

- Evidence for orbital wall blow-out fracture
  - Obtain CT of Orbits for closer analysis
Axial CT of Orbits

- Fracture in ethmoid bone (lamina papyracea)
- Hemorrhage into ethmoid sinus and maxillary sinus
- Intact EOM and optic nerve
Axial CT of Orbits (cont.)

• Orbital Empysema
  – Anterior
  – Medial to Rectus Muscle

• Increased density of L ethmoid sinus
Coronal CT of Orbits

- Blow-out Fracture of orbital floor and medial wall
- Hemorrhage into maxillary sinus and ethmoid sinus
Orbital Blow-Out Fracture

• Trauma leading to displacement of bone outwards from orbit
  – Inferior displacement of orbital floor
  – Medial displacement of medial orbital wall
• Orbital rim intact
• Expand orbital volume
  – Herniation of orbital fat, EOM, into adjacent sinus
• PE
  – Triad of enophthalmos, restrictive strabismus, infraorbital numbness
Pathogenesis

• Hydraulic Theory
  – Increased IOP leads to fracture

• Buckling Theory
  – Direct transmission of force through orbital bones

• Blow-out fracture is a protective process

www.universityoralsurgery.com/media/proc/ex8.jpg
Complications

- Muscle entrapment
- Optic nerve injury
- Globe rupture
- Peripheral nerve injury

Imaging

• Plain x-ray
  – Caldwell (PA), Waters (PA, occipitomental)
  – High false negative rate of 50%¹
• Ultrasound
  – Sensitivity 85%²
• CT
  – Extremely effective
  – No contrast necessary
  – Conventional CT, High Resolution CT, Spiral CT
• MRI
  – Poor bone imaging
  – Risk of foreign body

²-Clinical Radiology 1997; 52:708-711
Radiological Findings

- Floor disruption
  - Absent bony fragment
  - Bowing into sinus
- Sinus opacification
- Air-Fluid level
- Orbital emphysema
- Asymmetry
- Soft tissue swelling
Plain Film: Waters View

NORMAL WATERS VIEW

• m: maxillary sinus
• lwm: lateral wall of maxillary sinus
• ior: inferior orbital rim
• of: orbital floor z: zygoma
• za: zygomatic arch
• f: frontal sinus
• n: nasal bones

ADDITONAL PATIENT #1

• Medial/Inferior orbital wall blow-out
  – Depressed right orbital floor
  – Opacification of right maxillary sinus
  – Opacification of right ethmoid sinus
• “Hanging tear drop”: herniation of orbital fat into maxillary sinus (not seen here)
Blow-Out Fracture of Medial/Inferior Wall

- Similar to patient AD
- Herniation of orbital fat into ethmoid and maxillary sinus
- Hemorrhage into retrobulbar region (open black arrow)
- Intact inferior rectus muscle

ADDITIONAL PATIENT #2
Orbital Blow-In Fracture

- Trauma leads to displacement of orbital fragments towards orbital space
- Decreased orbital volume
  - Associated proptosis
- Considered more severe than blow-out fractures
- Rare
- Commonly “impure” vs. “pure” blow-out fractures
  - Orbital rim no longer intact
Superior Orbital Blow-In Fracture

- CT Coronal Image
- Lateral Bony Fragments
- Depression of globe
Superior Orbital Blow-In Fracture (same patient)

- Frontal/Oblique 3-D Reformatted Spiral CT Images
  - Localized orbital rim + roof fracture
  - Decreased orbital volume
Le Fort Fractures

- Transversely oriented fractures that involve maxilla bilaterally
- Le Fort I: spares the orbit
- Le Fort II and III: complex orbital fractures
Le Fort II

- Naso-frontal suture fracture
- Medial orbital wall fracture
- Inferior orbital rim fracture
- Lateral/Inferior walls of maxillary sinus fracture
- Posterior image would show orbital floor fracture

Coronal Image (anterior slice)

Coronal Image (more posterior slice)

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Treatment

• Orbital Blow-Out fracture
  – Surgical vs. non-surgical (Patient AD)
  – Persistent diplopia, EOM entrapment

• Orbital Blow-In fracture
  – Usually more severe
  – Surgical decompression/fracture repair often necessary

• Le Fort fractures
  – Commonly multisystem trauma
  – Resuscitation
  – Surgical repair
Key Points

- CT = best study for orbital fractures
  - Plain Film, Ultrasound, MRI also used
- Medial and inferior orbital wall most prone
- Blow-out fractures vs. Blow-in fractures
- Complex fractures (Le Fort II and III) involve orbit
- Surgical repair not always necessary
References

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