Imaging Orbit/Periorbital Injury

9th Nordic Trauma Radiology Course 2016

Stuart E. Mirvis, M.D., FACR
Department of Radiology
University of Maryland School of Medicine
Topics to Cover

- Struts and buttresses
- Orbital fractures
- Periorbital injuries
- Orbital cranial nerves
- Soft tissue globe injury
Facial Struts

Anterior coronal struts consisting of frontal (1), zygomaticfrontal (2), nasofrontal (3), anterior maxillary (4), anterior alveolar (5) components.


Posterior coronal struts consisting of posterior wall of maxillary sinus (1) and pterygoid plates (2)

Horizontal struts superior (1), middle (2), and inferior (3) parts.

Sagittal struts consisting of median (1), parasagittal(2), and lateral (3) parts
**Concept of Facial Buttresses**

- Major support for facial skeleton to maintain form and function (I-beams)
- Attach directly or indirectly to skull base or cranium
- 3 vertical and 3 horizontal
- Buttresses accommodate screw fixation
- Maintain facial width and height
- Establish functional support (orbits and teeth)

Orbital sutures and thin orbital bony plates allow suture diastasis and fractures of thin bone to absorb impacting energy.

This anatomy plus orbital fat and muscles cushions the globe and preserves vision in high-energy impacts to the orbit.
Orbital Blow-out Fractures: Significant Imaging Features

- Evidence of muscle or fat entrapment (position/shape of muscle)
- Pure or impure fracture (?intact inferior orbit rim)
- Orbital hematoma (up to 24% orbital injuries)
- Complications: enopthalmous, diplopia, hypoesthesia
- Size (area) of floor defect or associated fractures
- Calculations of blow-out fractures of the orbital floor by 3D-CT and 2D-CT method are accurate for assessing the area of fracture

Orbital blow-out fracture
Orbit Blow-out Fracture
Orbit Blow-out Fracture
Herniated Inferior Rectus
Herniated and entrapped inferior rectus
Round inferior rectus – torn supportive tissues

Rounding of the inferior rectus muscle on initial coronal CT scan is predictive of the development of late enophthalmos.
Medial orbital wall fracture

- Isolated or associated 20-40% with floor fracture
- More common to cause orbital emphysema
- Rarely surgically repaired
- **Complications**: Horizontal gaze palsy, enopthalmous, epistaxis
Isolated or associated 20-40% with floor fracture

- More common to cause orbital emphysema
- Rarely surgically repaired

**Complications:** Horizontal gaze palsy, enophthalmous, epistaxis
Medial orbital wall fracture - emphysema
Medial blow-out with muscle herniation (entrapped?)
Orbital Blow-in fracture
Rare

Orbital roof fragments explode into frontal lobe

Typical – dural tears and CSF leak

Frontal sinus involvement common

Blow-up fracture
Orbital Blow-up fracture
Secondary acute trauma (Assault, MVC): demyelinating, inflammatory, ischemic causes

- Direct or indirect axon damage
- Impaired -- to loss of vision
- Avulsion, hemorrhage, emphysema, transection
- 0.5 to 5% closed head injury (forehead, supraorbital)
- Afferent pupillary defect
- Optic nerve atrophy 4-6 weeks
- Treatment – steroids (< 8 hrs. after injury)

FLAIR with fat & fluid suppression (CUBE): 3D FSE sequence used to perform whole-brain FLAIR T2-weighted imaging. Increased signal on diffusion.
Traumatic Optic Neuropathy

Case 1

Case 2
Superior Orbital Fissure Syndrome

- Sup. ophthalmic vein
- Lacrimal nerve
- Recurrent meningeal br. of ophthalmic artery
- Frontal nerve
- Trochlear nerve
- Sup. div. of oculomotor n.
- Nasociliary nerve
- Abducent nerve
- Inf. div. of oculomotor n.
- Inferior ophthalmic veins

Superior Orbital Fissure

- Optic canal
- Optic nerve
- Ophthalmic artery
- Tendinous ring

Inferior Orbital Fissure

- Zygomatic nerve
- Emissary veins
- Infraorbital vessels (They accompany the nerve into the infraorbital groove, canal and foramen)
- Maxillary nerve
- Infraorbital nerve
- Infraorbital groove
- Infraorbital canal
- Lower margin of orbit
- Infraorbital foramen
Orbital Apex Syndrome

- Optic neuropathy and ophthalmoplegia
- Loss of cranial nerves II, III, IV, ophthalmic division of V, and VI
- Blindness, fixed dilated pupils, proptosis, ptosis
- Causes: inflammatory, infectious neoplastic, iatrogenic/traumatic, and vascular conditions
LeFort Fracture Patterns

- Described as symmetric mid-face lines of weakness - experimental
- Often asymmetric clinically and combined with ZMC, NOE
- **Always** involves pterygoid plate fractures
- Higher energy usually leads to higher grade
- Any pattern of Lefort 1,2,3 fractures can occur
LeFort Fracture II
Lefort II and Naso-orbital- ethmoid
Combined LeFort Fracture Pattern - Smash
Manson Classification: medial support injury
3-wall orbital fracture and globe hemorrhage
Knife to right orbit - blind
- Traumatic exopthalmous – sudden reduced orbital volume, reduced vision. Hemorrhage, emphysema, loss afferent and efferent/direct pupillary responses
- Severe orbital tension, firm globe, limited ocular movement
- Globe tenting/stretching; acute proptosis; torn nerves, muscles; CCF
- Posterior globe angle < 120 degree with proptosis → surgery

Globe Extrusion

Globe angle < 130 degree
Stick in inferior orbit
“That’s All Folks”