Maxillary and Periorbital Fractures

Michael E. Decherd, MD
Faculty Advisor: Shawn D. Newlands, MD, PhD
The University of Texas Medical Branch
Department of Otolaryngology
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Overview

• Classic tripod, orbital floor, LeFort fractures better thought of as orbitozygomaticomaxillary fractures
• Precise anatomic reduction is key
• Goal is functional and cosmetic rehabilitation
Epidemiology

• Males : Females -- 4:1
• Predominantly in 20’s or 30’s
• Cause
  – MVA > altercation > fall
• Site
  – Nasal > Zygoma > other
• In altercations left zygoma fractured more often
Anatomy
Anatomy of the Orbit

- Bones:
  Frontal, Zygomatic, Ethmoid, Lacrimal, Maxilla, Palatal, Sphenoid
Anatomy of the Orbit

• Four-sided pyramid or cone
Anatomy of the Orbit

- Maximum vertical dimension 1.5 cm behind rim
- Floor is concave and then convex
Anatomy of the Orbit

- Floor slopes into medial wall
- Optic nerve superomedial to true apex
Anatomy of Zygoma

- Four superficial and two deep articulations
- Intersection of arcs define malar prominence
Anatomy of the Maxilla

- Paired embryologically
- Functionally acts with palatine bone
Anatomy of the Maxilla
Vertical Buttresses

- Resist occlusal load
Horizontal Buttresses
Fracture Patterns
LeFort Fractures

• Experimentally determined weak points
• Can be in combinations bilaterally
• Useful descriptor
• Results from anterior forces
Le Fort I
Le Fort II
Le Fort III
Zygoma Fractures

- Results from lateral forces
Zygoma Fractures

• Impacted zygoma may mask orbital floor defect
Orbital Blowout Injury
Orbital Blowout Injury
Orbital Blowout Injury

- Usually inferior and/or medial wall
- Cone will become more spherical
- Leads to enophthalmos, inferior displacement
- Muscle entrapment causes diplopia
Patient Evaluation
Physical Exam

- Can be very difficult in traumatized patient
- Don’t forget trauma ABC’s (ATLS)
- Look for occlusion, trismus, stability, asymmetry, extraocular movements, V2 anesthesia, stepoffs, bowstring test, lacerations and ecchymosis
Physical Exam

- Midface asymmetry may indicate zygoma fracture
Physical Exam

• Palpate for midface instability
Physical Exam --

Ophthalmologic Considerations

• Ophthalmologic Minimums
  – Visual acuities (subjective and objective)
  – Pupillary function
  – Ocular motility
  – Anterior chamber for hyphema
  – Fundoscopic exam

• If in question ophthalmologic consultation is indicated
Eye Algorithm

• If obtunded, afferent pupillary defect may indicate visual loss
Afferent Pupillary Defect
Ophthalmologic Exam

[Image of an eye examination]

[Diagram of the eye showing various parts like Fovea, Macula, Optic disk, Arteriole, Vein]
Ophthalmologic Exam

- Hyphema is blood in anterior chamber
- Hx - vision worse supine, clears upright
- Can cause increased IOP
Ophthalmologic Exam

- Tonometer measures IOP
- Greatly increased IOP causes pulsatile optic disk
Ophthalmologic Exam

- Retinal detachment requires ophthalmologic attention
Ophthalmologic Exam

- Iridodialysis (torn iris)
- Opacified cornea
Ophthalmologic Exam

- Fluorescein reveals corneal abrasion
- Dislocated lens
Ophthalmologic Exam

- Subconjunctival ecchymosis may indicate orbital fracture
Forced Duction Testing
Physical Exam

- Often edema, swelling, or patient’s mental status make physical exam difficult
- CT is modality of choice -- axial and coronal
CT areas to evaluate

- Vertical buttresses
- Zygomatic arch
- Orbital walls
- Bony palate
- Mandibular condyles
Treatment
Treatment

- Goal is functional and cosmetic restoration
- Treatment must be individualized
- Various factors can affect management strategies
  - Multi-trauma
  - Concomitant mandible injury
  - Only-seeing eye
Order of Repairs

• Work from stable to unstable
• Use occlusion as guide
• Generally stabilize mandible, zygoma and palate before midface before orbit and NOE
Order of Repairs
Zygoma

- Ideally done between 5-7 days for resolution of edema
- Pre- or intra-operative steroids can help with edema
- After 10 days masseter begins to shorten
Zygoma

- Minimally displaced, non comminuted can be treated with reduction only
- Increasing amounts of displacement and comminution may require plating of lateral antrum, orbital rim, ZF suture, and even the zygomatic arch
- One can wire the ZF suture first to assist with reduction, then plate it after other areas stabilized
Zygoma Algorithm

CT Evaluation
- Axial
- Coronal

1. No comminution of external arcs of contour, and
2. Minimal displacement of zygoma
   “Closed” reduction by Gilles approach
   If Zygoma does not “pop into place”

1. Comminution of lateral antral wall, or
2. Moderate displacement of zygoma
   OR, RIF of lateral antral wall
   OR, RIF of zygomaticofrontal suture, lateral antral wall, inferior orbital rim
   If unsure of reduction of lateral antral wall, inferior orbital rim

Zygomatic arch with greenstick or single minimally displaced or angulated fracture
   OR zygomatic arch

Zygomatic arch comminuted
   OR, RIF zygomatic arch

OR, RIF lateral antral wall, inferior orbital rim
ORIF of Lateral Antral Wall
Gillies Reduction

- Incision through temporal fascia, superficial to mm
- Superficial temporal a.
- Lateral force on zygoma
Post-Gillies Reduction
Surgical Approaches

- Coronal
- Sublabial
- Transconjunctival
- Lateral Brow
Coronal Approach

Nasofrontal suture

Periosteum

Supra orbital artery & nerve
Coronal Approach

- Superficial temporal fat pad
- Supra orbital artery & nerve
- Periosteal incision
- Superficial temporal fat pad
- Frontalis nerve
- Auriculotemporal n.
- Superficial temporal art.
Coronal Approach

- Supraorbital nerve may be released for more exposure
Hemicoronal Approach
Lateral Brow Incision

- Avoid shaving brow hairs
- Goal is the ZF suture
Sublabial Approach

- Leave mucosa to sew to later
- Identify and preserve V2
Midface

- “Rigid” fixation misnomer with small plates and thin bones
- Semirigid fixation (wire) sometimes preferable
- Early function can be achieved with soft diet only
Vertical Buttress Algorithm

CT Evaluation
- Axial
- Coronal

Vertical buttresses non comminuted, minimally displaced
- Closed reduction, MMF
- OR, RIF vertical Buttress if 4-6 weeks of MMF unacceptable to patient

Vertical buttresses comminuted, displaced
- Mandible intact
- MMF
- OR, RIF mandible

Mandible not intact
- Low condylar neck, vertical ramus, body, or symphyseal fractures
- MMF
- OR, RIF mandible

Condylar head or high condylar neck fractures
- OR, RIF vertical buttresses

TMJs undisturbed, passive MMF obtained
- OR, RIF vertical buttresses
- Remove MMF, allow immediate function

TMJs injured (although not fractured), or MMF used to “pull into occlusion”
- OR, wire fixation of buttresses
- 4-6 weeks of MMF
Midface Disimpaction

- May be necessary to restore facial dimensions before fixation
Palate Fracture

- Wire can be placed posteriorly for stabilization before triangular reduction
ORIF of Midface
Orbital Floor

• When to explore? (Shumrick study)
  – Persistent diplopia with positive forced duction
  – Obvious enophthalmos
  – Comminuted orbital rim by CT
  – >50% floor disruption by CT
  – Combined floor/medial wall defects by CT
  – Fracture of zygoma body by CT
  – “Blow-in” fx with exophthalmos by PE or CT
Orbital Floor

- Best done 7-10 days
- Other indications
  - 1-2 sq.cm of floor disrupted
- Contraindications
  - hyphema, retinal tear, globe perforation
  - only seeing eye
  - medically unstable
Orbital Floor

- Dotted line shows anatomic goal of restoration
Orbital Rim Access

- A -- subciliary
- B -- lower eyelid
- C -- infraorbital
Transconjunctival Approach

- Lower border of tarsus
- Retractors
- Orbital septum
- Plane of dissection preseptal space
Transconjunctival Approach

- Conjunctiva is being used to protect globe
Lateral Canthotomy and Cantholysis

- Allows wider exposure
Orbital Floor Materials

- Marlex mesh
  - needs 360 degree support
  - better for concave anterior floor only
- Medpor
  - needs medial/ lateral support
  - can use for anterior/posterior defect
- Calvarial bone graft
- Titanium mesh
Synthetic Mesh
Orbital Floor
Bone Grafting

• Need to support floor full 4 cm
Orbital Metallic Mesh
Orbital Roof

• Uncommon due to high levels of force needed to fracture orbital roof
• Commonly with intracranial problems
Orbital Roof Repair

- Repair roof higher on frontal bar
Cutting Edge Topics

• Bioresorbable plates
• Intraoperative CT
• 3-D CT reconstruction
• Endoscopic assistance
Conclusion

• Goal is functional and cosmetic rehabilitation
• Precise anatomic restoration key
• Treatment tailored to each individual
• Knowledge of anatomy and techniques will lead to superior results
Case Presentation
• 30 yo WF
• MVA
• PMH unknown