Maxillary and Periorbital Fractures

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Grand Rounds Presentation
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- Types
- Mechanisms
- Associated Injuries
- Anatomy
- Classification
- Evaluation
- Treatment
Types

- LeFort or Maxillary fractures
- Zygomaticomaxillary complex fractures
- Orbitozygomaticomaxillary complex fractures
Mechanisms

- Assault
- MVA
- Gunshot wounds
- Sports
- Falls
- Industrial accidents
Associated Injuries

- Brandt et al 1991
- 59% caused by MVA had intracranial injury
- 10% caused by fall/beating had intracranial injury
Associated injuries

- Haug et al 1990
- 402 patients
- Zygoma fractures:
  - Lacerations 43%
  - Orthopedic injuries 32%
  - Additional facial fractures 22%
  - Neurologic injury 27%
  - Pulmonary, abdominal, cardiac 7%, 4.1%, 1%
Maxillary fractures:

- Lacerations and abrasions 75%
- Orthopedic injury 51%
- Other facial fractures 42%
- Neurologic injury 51%
- Pulmonary 13%, abdominal 5.7%, cardiac 3.8%
Ocular injury

- Al-Qurainy et al 1991
- 363 patients with midface fractures
  - 63% minor or transient ocular injury
  - 16% moderately severe injury
  - 12% severe ocular injury (angle recession, retinal or vitreous injury, optic nerve damage)
  - 90.6% of patients had some ocular injury
  - 2.5% lost vision in the affected eye
Facial Skeleton

Facial Skeleton

Orbit

7 bones composing the orbit: frontal, sphenoid, zygoma, maxilla, palatine, lacrimal, ethmoid

Forces of mastication

Figure 1.3 Diagram showing the directions of distribution of the forces of mastication within the skeleton of the mid-face.

From: Banks P, Brown A. Fractures of the Facial Skeleton, Oxford, Wright 2001 pg.6
Facial Buttress system

FIGURE 66.1. The nasomaxillary and zygomaticomaxillary buttresses of the midfacial lattice are suspended from the frontal bar.

Facial Buttress system

Figure 101-2. A and B. Structural facial buttresses. Reconstruction of facial fractures incorporates fixation of individual fracture sites along the horizontal and vertical buttresses marked by the arrows.

Facial buttress system

LeFort fractures

- Rene LeFort 1901 in cadaver skulls
- Based on the most superior level
- Frequently different levels on either side
  - LeFort I
  - LeFort II
  - LeFort III
Figure 58A. The LeFort planes of weakness. Anteroposterior view.

Figure 58B. Lateral view.
Modified LeFort Classification

FIGURE 3. Superior face, frontal sinus, and zygoma fracture configurations.

Donat, Endress, Mathog classification

Evaluation

- ABC’s
- History
- Palpation of entire facial skeleton
- Occlusion
- Ophthalmological exam / consultation
- C-spine
- Imaging – CT
Imaging

- CT has surpassed plain film xray
- Allows precise diagnosis and surgical planning
- Axial and coronal cuts
FIGURE 7-16 Waters view (A) shows a Le Fort II fracture (arrows) that creates a pyramid-shaped fracture segment. Axial CT scan (B) shows a Le Fort II fracture. The midface fracture segment is clearly seen, and the zygomas are uninvolved. On more caudal scans the pterygoid plates were fractured, and on more cranial scans the ethmoid sinuses and orbital floors were fractured.
FIGURE 7-19 Axial CT scans show a Le Fort III fracture. The more caudal aspects of the fracture (A) are similar to those of a Le Fort II fracture. However, the more cranial fractures (B) separate the facial bones from the cranium.
Treatment of maxillary fractures

- Early repair
- Single-stage
- Extended access approaches
- Rigid fixation
- Immediate bone grafting
- Re-suspension of soft tissues
Maxillary fractures

- Steps of reconstruction-Rohrich and Shewmake
- Reestablish facial height and width
- IMF with ORIF of mandible
- Zygomatic arch reconstruction restores facial width and projection
- Reconstruction continues from stable bone to unstable and from lateral to medial
Internal fixation vs. traditional methods

- Klotch et al 1987
- 43 patients
- 22 treated with ORIF using AO miniplates
- 21 treated with combination of intermaxillary fixation, and/or interosseous wiring, and/or primary bone grafting
- Most severe injuries in rigid internal fixation group
- Shorter IMF, early return to diet, lower percentage of tracheotomy
- No plate infections
Haug et al 1995

134 patients treated by maxillomandibular fixation or rigid internal fixation

Postoperative problems in 60% vs 64%
Complication rates similar

Rigid fixation has benefits:
- Airway protection
- Enhanced nutrition
- More rapid return to pretraumatic function
Approaches

- Circumvestibular
- Facial degloving
- Bicoronal
- Transconjunctival
Figure 16. A. The circumvestibular incision is created 5 to 10 mm above the attached gingiva, transmucosally from first molar to first molar. B. Access to low-level maxillary fractures is provided by this intraoral approach.
Bicoronal approach

**FIG. 1.3.** Coronal view of the muscles and fascial planes of the face and scalp. (From Cheney ML. Facial Surgery: Plastic and Reconstructive. Baltimore: Williams & Wilkins, 1997, with permission.)
Figure 60-3  Reduction of a maxillary fracture using Rowe disimpaction forceps. (From Mathog RH. Atlas of craniofacial trauma. Philadelphia: WB Saunders, 1991:153. With permission.)
Treatment of Zygomaticomaxillary Complex fractures

- Restore pre-injury facial configuration
- Prevent cosmetic deformity
- Prevent delayed visual disturbances
- Repair within 5-7 days allows edema to decrease and avoids shortening of masseter with lateral and inferior rotation
- Soft diet and malar protection
- Closed reduction
- ORIF with plating of one to four buttresses
- Provide fixation as necessary for stable reduction
Ellis and Kittidumkerng 1996

48 patients

Reduced fracture with Carroll-Girard screw

- 4.2% closed reductions
- 31.2% one point fixation
- 27.1% two point fixation
- 27.1% three point fixation
- 10.4% four point fixation

Used exposure and fixation needed to provide stable reduction
Approaches to FZ buttress

Figure 5. Approaches to the frontozygomatic buttress: hemicoronal, brow, and upper blepharoplasty incisions.

Approaches to orbital floor

Figure 9. A1, A2: The frontozygomatic and zygomaticomaxillary suture lines provide information about zygomatico-maxillary complex displacement in the x and y planes. B: The lateral orbital wall exposure provides information about rotation of the zygomaticomaxillary complex in all three planes, as well as changes in orbital volume.
Orbital exploration

- Shumrick et al 1997
- 97 patient with either ZMC or midface fractures
- All explored had significant traumatic disruptions, no enopthalmos or diplopia in those not explored
- Based on their 7 criteria 22 ZMC and 11 midface underwent orbital exploration
Persistent diplopia which failed to improve in 7 or more days, positive forced duction testing, radiologic evidence of perimuscular tissue entrapment

Cosmetically significant and clinically apparent enophthalmos associated with abnormal radiological findings
Radiological evidence of significant comminution and or displacement of the orbital rim

Radiological evidence of significant displacement or comminution of greater than 50% of the orbital floor with herniation of soft tissue into maxillary sinus
- Combined orbital floor and medial wall defects with soft tissue displacement noted radiologically on CT scans
- Radiological evidence of a fracture or comminution of the body of the zygoma itself as determined by CT
- Physical or radiological evidence of exophthalmos or orbital content impingement caused by displaced periorbital fractures
Repair of the orbit

- Approaches
  - Transconjunctival with or without lateral canthotomy/cantholysis
  - Subciliary
  - Transconjunctival has lower incidence of ectropion/entropion
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
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
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
Soft tissue resuspension

- Wide exposure allows more accurate fracture reduction but may lead to problems in soft tissue covering of face.
- Need to close periosteum and provide suspension sutures to prevent descent of soft tissues.
Conclusions

- High index of suspicion for associated injuries - especially ocular
- Assessment of buttress system
- Wide exposure via cosmetically acceptable incisions
- Rigid fixation
- Soft tissue resuspension