Facial Trauma

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Disclosures:
- None

Objectives
- Briefly review role of facial bones and structural pillars
- Discuss diagnosis of facial trauma (Multi-detector CT)
- Review key points of "simple" midface fractures: nasal bone, maxilla/palate, zygoma and orbit
- Identify complex midface fracture patterns, relevant classification systems & commonly associated complications
  - Le Fort (I, II, & III)
  - Zygomaticomaxillary Complex Fractures
  - Nasoethmoidal

Facial Buttresses
- Distribution of forces along thickened skeletal buttresses
- Evolved in part to resist vertical and axial (grinding) masticatory forces

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<thead>
<tr>
<th>Sagittal</th>
<th>Axial</th>
<th>Coronal</th>
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</thead>
<tbody>
<tr>
<td>Nasomaxillary (medial)</td>
<td>Frontal bar</td>
<td>Anterior plane</td>
</tr>
<tr>
<td>Zygomaticomaxillary (lateral)</td>
<td>Upper maxillary</td>
<td>Pterygoid plane</td>
</tr>
<tr>
<td>Maxillary (incisor)</td>
<td>Lower maxillary</td>
<td></td>
</tr>
<tr>
<td>+/− Vertical maxilla</td>
<td>+/− Skull base</td>
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Facial Bones
- Societal importance, perception
- Communication
- Nutrition
- Housing and protection of proximal airway and organs of special sense
- "Cushion" for the neurocranium and cervical spine
- Multi-detector CT is imaging of choice
  - Thin section axial bone algorithm images with reformations.
  - Three-dimensional images in assessment of complex facial deformities, preoperative planning, and patient consultation
  - Demonstrates soft tissue injury, hemosinus, foreign bodies
- Clinical examination and routine radiographs are inferior
  - Clinically, fractures are obscured by soft tissue injury, altered level of consciousness, and life threatening injuries to remainder of body
The most common central midface fracture, likely underrepresented.

Involvement of bony vs. cartilaginous structures.

Manifestation dependent on direction and degree of injury force:
- Lateral impact mechanism (2/3rd) > frontal injury.

Look for/report on nasal septal hematoma—potential complications include infection and/or necrosis.

Alveolar fracture is the most common isolated maxillary fracture:
- Mechanism = blow to mandible, pushing teeth upward/outward.
- Associated displacement/destabilization of teeth.

Partial maxillary fractures:
- Mechanism = direct blow to anterior maxilla.

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## Indications for surgery:
- Muscle entrapment and acute enophthalmos (fracture fragments > 1 cm in size)
- Proptosis resulting in posterior globe tenting is an ophthalmologic emergency
- Chronic enophthalmos is related to stable fracture defect with fat herniation. Identify prospectively!
- Alloplasts reconstruct orbital floor

## Orbital “Blow-out” Fracture

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<td>Orbital Floor</td>
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<tr>
<td>Rare. Fracture fragments may impinge on extracranial musculature or globe</td>
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<td>Risk of globe laceration</td>
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## Orbital “Blow-in” Fracture

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<td>Supraorbital roof</td>
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<td>Mechanism: Direct blow to forehead, with fracture fragments displaced inward</td>
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<td>Association with skull and frontal sinus fractures, intracranial hemorrhage</td>
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<tr>
<td>Depressed fracture +/- subperiosteal hematoma can impinge on upper globe, clinically mimicking upward gaze palsy</td>
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<tr>
<td>Unique complications: proptosis, dural tear with CSF leak or cephalocele, extension of fracture into orbital apex</td>
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## Orbital Apex Fracture Extension

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<td>Can be seen in:</td>
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<td>Orbital fractures, or</td>
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<td>APPLY fracture patterns extending upward from the site of pterygoid maxillary separation in complex facial fractures (Le Fort type injury)</td>
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<td>In complex patients in whom vision cannot be assessed, detection of orbital apex fracture by MDCT is crucial</td>
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<td>May be the only method to diagnose potential vision compromising injury</td>
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<td>May extend through the optic canal and/or superior orbital fissure, resulting in clinical syndromes:</td>
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<tr>
<td>Superior orbital fissure (SOF) syndrome: injury to CN III, IV, V1, and VI, resulting in ophthalmoplegia, diplopia and ptosis</td>
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<tr>
<td>Orbital apex syndrome: SOF syndrome + monocular vision loss</td>
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<td>Emergency prompting high dose steroid therapy or surgical decompression</td>
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## Le Fort Fractures

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<td>René Le Fort. French army surgeon described “lines of least resistance” through which midfacial fractures occur.</td>
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<td>Though the 3 types of complex fractures patterns were originally characterized separately and symmetrically across the midface, any 3 fracture types can exist in combination with another, either on the ipsilateral or contralateral side</td>
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<tr>
<td>Disruption of the pterygoid maxillary junction is the commonality shared by the 3 patterns, and must be present to characterize a fracture pattern as a Le Fort type fracture</td>
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## Le Fort Type I Fracture

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<td>“Floating Palate”</td>
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<td>Mechanism: Blow to upper lip/ maxilla</td>
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<tr>
<td>Detaches the upper jaw from the maxillary sinuses and lower nasal septum</td>
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<tr>
<td>Involves all walls of maxillary sinus in axial plane</td>
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<tr>
<td>“Unique feature” is involvement of the lateral margin of the nasal fossa and inferior nasal septum</td>
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</table>
Le Fort Type II Fracture
- **Pyramidal**
  - Mechanism: Blow to high central midface
- Further classification:
  - Wassmund I: Nasal bone sparing
  - Wassmund II: Nasal bone extension
- "Unique feature" is involvement of the inferior orbital rim
- High (80%) rate of V2 nerve injury

Le Fort Type III Fracture
- Craniofacial separation
- Centrolateral midface fractures
- Further classification:
  - Wassmund III: Nasal bone sparing (separation at nasomaxillary suture)
  - Wassmund IV: Nasal bone extension
- "Unique feature" is involvement of the lateral orbital rim and zygomatic arch

Zygomaticomaxillary Fracture
- "Trimalar", "tripod"
- 2nd most common midface fracture after nasal bone
  - Mechanism: Direct traumatic blow to malar eminence
  - Centrolateral midface fractures resulting in disruption of the 4 sutures that attach the zygoma to the remaining face and calvarium
- Intraorbital volume can be increased or decreased depending on direction and rotation of fracture fragments.

Nasoethmoidal Fracture
- Markowitz and Manson classification:
  - Type I: Medial canthal structures insert on bony fragment large enough to be fixed to adjacent bone
  - Type II: Comminuted fracture with medial canthal structure attachment to central fragment
  - Type III: Severely comminuted fracture with avulsion of medial canthal tendon from bone

Nasoethmoidal Fracture
- "Nasoorbitoethmoid" (NOE) or "Nasofrontoethmoid" (NFE)
  - Mechanism: Blow to nasal region with transmission through the nasal cavity, medial orbital walls and ethmoid sinuses.
- Clinical
  - Proptosis, hypertelorism, telecanthus, damage to nasolacrimal apparatus and medial canthal tendon
- High association with severe nonfacial injuries (Intracranial hemorrhage, CSF rhinorrhea)

Objectives
- Briefly review role of facial bones and structural pillars
- Discuss diagnosis of facial trauma (Multi-detector CT)
- Review key points of "simple" midface fractures: nasal bone, maxilla/palate, zygoma and orbit
- Identify complex midface fracture patterns, relevant classification systems & commonly associated complications
  - Le Fort (I, II, & III)
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