Maxillofacial Trauma

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Etiology and Incidence
► Multisystem injury 20-50%
► Nasal and mandibular fractures most common in community ED’s
► Midface and zygomatic injuries most common in Trauma centers
► 25% of women with facial trauma result of domestic violence
► Incidence of concomitant cervical spine injuries with facial fractures

Etiology and Incidence
► Older age, MVC and TBI-higher incidence
► Facial fractures-a distracting injury?
► Carotid artery injury
► Blindness may occur with facial fractures

Maxillofacial Trauma
Emergency Management and Resuscitation

► Airway
  + Most urgent complication: Airway compromise
  + Simple interventions first
  + No mandible?
  + Flail Mandible – Flail Maxilla
  + Bilateral fractures

► Intubation
  + Avoid nasotracheal intubation
  + Be Prepared and Be Creative
  + Swelling, Bleeding, Suction!

► Airway Management Options
  + Awake intubation
  + Laryngeal Mask Airway
  + Fiberoptic intubation
  + Lateral or semi-prone position
  + Percutaneous transtracheal jet ventilation
  + Retrograde intubation
  + Cricothyroidotomy

Emergency Management and Resuscitation

► Hemorrhage Control
  + Rarely develop shock from facial bleeding alone
  + Direct Pressure
  + LeFort Fractures
  + Nasal hemorrhage may require A&P packing

► History
  + Vision
  + Teeth alignment
  + Abuse

Maxillofacial Trauma-Physical Exam

► Inspection
  + Facial elongation
    + High grade LeFort Fracture
  + Asymmetry
    + Deformities and cranial nerve injury

► Palpation
  + Tenderness
  + Step offs
  + Facial stability
  + Crepitus
  + Subcutaneous air
  + Cutaneous anesthesia

► ASSESS FUNCTION!
**Maxillofacial Trauma-Physical Exam**

► Periorbital and Orbital Exam
  - Perform early

► Bimanual Palpation Test

**Maxillofacial Trauma-Physical Exam**

► Periorbital and Orbital Exam
  - Look for exophthalmos or enophthalmos
  - Pupil shape
  - Hyphema
  - Visual acuity
  - Entrapment signs
  - Raccoon sign

**Maxillofacial Trauma-Physical Exam**

► Penetrating Injuries
  - Occult globe penetration
  - Eyelid lacerations

► Nose
  - Septal hematoma
  - CSF Rhinorrhea

► Ears
  - Subperichondral hematoma
  - Hemotympanum
  - Battle sign

**Maxillofacial Trauma-Physical Exam**

► Oral and Mandibular Exam
  - Mandible deviation
  - Floor of Mouth Ecchymosis
  - Teeth malocclusion
  - Paresthesia – Sensory Numbness
Maxillofacial Trauma-Imaging

- Head, chest and abdominal trauma takes precedence
- Plain Films
- CT
  - Orbital fractures
  - 3D images available

Maxillofacial Trauma-Specific Fractures

- Orbital Fractures
  - Usually through floor or medial wall
  - Enophthalmos
  - Anesthesia
  - Diplopia
  - Infraorbital stepoff deformity
  - Subcutaneous emphysema
  - Entrapment?

- Frontal Sinus/Bone Fractures
  - Direct blow
  - Frequent intracranial injuries – Posterior Table?
  - Mucopyoceles
  - Consult with NS for treatment, disposition and antibiotics

- Nasoethmoidal-Orbital Injuries
  - Lacrimal apparatus disruption
  - Bimanual palpation if medial canthus pain
  - CT face

Maxillofacial Trauma-Specific Fractures

- Orbital Fissure Syndrome
  - Fracture of the orbital canal
    - Extraocular motor palsies and blindness
    - If significant retrobulbar hemorrhage, may need cantholysis to save vision

- Zygomatic Fractures
  - Tripod fracture
    - Most serious
    - Lateral subconjunctival hemorrhage
    - Need ORIF

- Arch fracture
  - Most common
  - Outpatient repair
Maxillary Fractures

- High-energy injury
- Malocclusion
- Facial lengthening
- CSF rhinorrhea
- Periorbital ecchymosis

Tripod Fracture

LeFort Fractures
Maxillofacial Trauma-Specific Facial Fractures

▶ Mandibular Fractures
- Second most common facial fracture
- Often multiple
- Malocclusion
- Intraoral lacerations
- Sublingual ecchymosis
- Nerve injury
- Open Fractures
  - Pen G or Cleocin

Introduction
- Most common in young males (ages 18-30)
- Causes: assault, motor vehicle accidents, sports and gunshot wounds
- Most common Fractures Sites
  - Risks: impacted teeth, osteoporosis, edentulous areas, pathologic, lytic lesions

Classification by Site
- Symphyseal / Parasymphyseal
- Body
- Ramus
- Coronoid Process
- Condyle
- Alveolar
- Angle

<table>
<thead>
<tr>
<th>Site</th>
<th>Percentage</th>
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<tr>
<td>Body</td>
<td>33%</td>
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<tr>
<td>Angle</td>
<td>23.1%</td>
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<tr>
<td>Condyle</td>
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<tr>
<td>Symphysis</td>
<td>8.4%</td>
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<td>Ramus</td>
<td>4.8%</td>
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<tr>
<td>Alveolar</td>
<td>1.4%</td>
</tr>
<tr>
<td>Coronoid Process</td>
<td>4.8%</td>
</tr>
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</table>
Classification by Favorability

- Favorable
- Unfavorable

Anterior Muscles

- Weaker force
- Mylohyoid, geniohyoid, genioglossus, platysma, anterior digastric muscles
- Muscle action depresses and retracts (open mandible)
Posterior Muscles:

- Stronger force
- Temporalis Muscle
- Masseter Muscle
- Medial Pterygoid Muscles
- Lateral Pterygoid Muscles

Classification by Type of Fracture

- Open versus Closed
- Fracture Pattern: Communited, oblique, transverse, spiral, greenstick
- Pathologic: fractures secondary to bone disease (e.g., osteogenic tumors, osteoporosis)
**Management Concepts**

- Maintain Airway!
- Goals: restore occlusion, establish bony union & avoid TMJ pathology
- Repair within first week
- In general favorable fractures may only need closed reduction
- Postoperative Care

**Maxillo-Mandibular Fixation (MMF)**

**Closed Reduction**

- Indications
- Methods
- Requires an intact maxilla
- Typically MMF may be removed after 4-6 weeks
- Complications
Open Reduction & Internal Fixation (ORIF)

- Indications
- Approaches:
  1. Transoral
  2. External

Management by Type

- Coronoid, Greenstick, Unilateral Nondisplaced Fractures: observation with soft diet, analgesics, oral antibiotics and close follow-up, physiotherapy exercises for 3 months (may consider MMF for severely displaced coronoid fractures)

- Favorable, Minimally Displaced Noncondylar Fractures: may consider closed reduction and 4-6 weeks of MMF
Displaced Fractures

- Symphyseal and Parasymphysial fractures: tend to be vertically unfavorable.
- Body Fractures: almost always unfavorable.
- Angle fractures in general have the highest complication rate.
- Ramus Fractures: isolated ramus fractures are rare (protected by masseter muscle).

Surgical Complications

- Chin and Lip Numbness
- Osteomyelitis
- Malunion
- Nonunion
- Plate Exposure
- Marginal Mandibular Nerve Injury
- Necrosis of Condylar Head (Aseptic Necrosis)
- TMJ Ankylosis
- Dental Injury

MAXILLARY FRACTURES
Classification

Buttress System

Vertical Buttresses
1. Naso-Maxillary (NM)
2. Zygomatico-Maxillary (ZM)
3. Pterygo-Maxillary (PM)
4. Nasal Septum

Horizontal Beams

1. Frontal Bar
2. Inferior Orbital Rims
3. Maxillary Alveolus and Palate
4. Zygomatic Process
5. Greater Wing of the Sphenoid
6. Medial and Lateral Pterygoid Plates
7. Mandible
Le Fort Classification

- Based on patterns of fractures (lines of minimal resistance) classified according to the highest level of injury
- In many cases Le Fort classification is incomplete for maxillary fractures
- Le Fort fractures may present in many combinations or on one side (hemi-Le Fort)

Le Fort I (Low Maxillary)

- Transverse maxillary fracture
- Involves anterolateral maxillary wall, medial maxillary wall, pterygoid plates, septum at floor of nose
Le Fort II (Pyramidal)
- Caused typically from a superiorly directed force against the maxilla.
- Involves nasofrontal suture, orbital foramen, rim, and floor frontal process of lacrimal bone, zygomatic maxillary suture, lamina papyracea of ethmoid; pterygoid plate and high septum.

Le Fort III (Craniofacial Dysjunction)
- Separates facial skeleton from base of skull, typically caused by high velocity impacts.
- Involves nasofrontal suture, zygoma and zygomatic arch; pterygoid plates and nasal septum.
Management Principles

- Goals of Reconstruction
- Exposure/Approaches
- Timing
- Postoperative Care

Management by Le Fort Classification

- Le Fort I: reduced digitally, MMF, fixation of ZM
- Le Fort II: stabilization of the ZM buttress, MMF, nasofrontal process and inferior orbital rim.
- Le Fort III: usually requires coronal flap for adequate exposure for exploration and miniplate fixation

Techniques

- Plate Fixation (Miniplates)
- Interosseous Wire Fixation
- Bone Grafts
Surgical complications

- Malunion, Nonunion, Plate Exposure
- Palpable or Observable Plates
- Forehead or Cheek Hyposthesia
- Osteomyelitis
- Dental Injury

ZYGOMATI COMAXILLARY & ORBITAL FRACTURES

Zygomaticomaxillary Complex (Trimalar) Fractures

Introduction

Symptom:
- Subconjunctival & periorbital ecchymosis
- Eyelid edema
- Epistaxis
- Cheek hypothesia
- Diplopia
- Hypophthalmos
- Enophthalmos
- Trismus
Four sutures involved in Zygomaticomaxillary Complex Fractures

1. Zygomaticofrontal Suture
2. Zygomaticomaxillary Suture
3. Zygomaticotemporal Suture
4. Zygomaticosphenoid Suture

Management

- Stabilizing the zygomatic arch
- Minimum of 2points fixation
- Closed Reduction
- Open Reduction

Common Approaches to Zygoma

- Incisions
- Intraoral approach
- Coronal, Hemicoronal or Extended Pretragal Approaches
- Lateral Brow Approach
Management

- Indication for Surgical Intervention
- Contraindications for Surgical Intervention: hyphema, retinal tear, globe perforation
- Ophthalmological Evaluation - retinal edema?
- Technique

APPROACHES

- Subciliary Incision (Infraciliary)
- Transconjunctival Incision
- Lynch Incision (Frontoethmoidal)
- Brow Incision
- Subtarsal Incision
- Caldwell-Luc (Transantral) Approach
Surgical Complication

- Postoperative Blindness
- CSF Leak
- Persistent Enophthalmos and Diplopia
- Ectropion
- Entropion
- Cheek Hypesthesia
- Extrusion of Grafts
- Malunion, nonunion, Plate Exposure, Osteomyelitis
- Palpable or Observable Plates
FRONTAL SINUS FRACTURE
- Sign & Symptoms
- Risk

MANAGEMENT
Anterior Table Fractures
- Linear, Minimally Displaced
- Depressed Fractures
- Comminuted or Unstable Fractures

Posterior Table Fractures
- Isolated Nondisplaced Posterior Table Fracture
- Displaced Posterior Table Fracture
- Comminuted, Contaminated or through and Through Fractures--Cranialization
Surgical Complications

- Mucocele, Mucopyoceles
- Sinusitis
- Forehead Contour Deformity
- Intracranial Infections
- Osteomyelitis
- CSF leak
- Forehead Hypesthesia
- Forehead Paralysis
NASO-ORBITOMEOID (NOE) FRACTURES

Introduction
- NOE: frontal process of maxilla, nasal bones, and orbital space
- Sign & Symptoms
  - Pseudohypertelorism (Traumatic Telecanthus)

Anatomy
- Medial Canthal Ligament (MCL)
- Lacrimal Collecting System
  - Puncta
  - Canaliculi
  - Lacrimal Sac
  - Lacrimal Duct
Management

- First reconstruct medial orbital wall prior to repair of the MCL
- Must consider associated injuries
- May attempt closed reduction if MCL and lacrimal system is intact
- Telescoping Nasal Bones and Frontal Process of the Maxilla

Nasal Fractures

Introduction

- Most common
- Anterior impacts
- Lateral impacts
- Dislocated quadrangular cartilage inferiorly or "C-shaped"
- Children usually have dislocated or green stick fractures and have a higher risk of septal hematomas
- Comminutions are more common in adults
- Signs & Symptoms
- Diagnosis
Management

Initial Management
- Preoperative photographs/x-ray may be considered for medico-legal documentation
- Septal hematomas
- Open fractures must be cleaned then given antibiotics

Surgical Management
- Generally nasal bone depressed or deviation may undergo closed reduction
- Open Reduction with Internal Fixation (Septorhinoplasty)
- Pediatric Nasal Fractures: generally should be treated conservatively
Surgical Complications & Associated Injuries

- Persistent Deformity
- Nasal Obstruction
- Septal Hematoma
- Septal Perforation and Deviations
- Cribriform Plate Fracture