Management of Facial Trauma in the Emergency Department

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Background

• Trauma leading cause of death in individuals younger than 40 years of age

• Alcohol is a contributing factor in almost 50% of head/facial injuries

• 11% of all trauma patients sustain maxillofacial fractures requiring subspecialty intervention
Mechanisms of Injury

- Assault
  - Typically males between 18-25 years of age
  - 40% ER visits result from assault
    - 30% present with a fracture, 80% of these involve facial bones
    - Incidence: Nasal > mandible > zygoma > maxilla
  - Elevated blood alcohol reported in 50% of cases
Mechanisms of Injury

• Motor Vehicle Collision
  • Associated with more severe trauma
  • Frequently involves midface structures (nose, zygoma, maxilla)
  • With seatbelt laws, incidence of facial fractures reduced from 21% to 6% in 2 years
Mechanisms of Injury

- Falls
  - Bimodal age group
    - Toddlers
    - Elderly

- Sports
  - Relatively low incidence, secondary to mouth guards and protective head gear
Clinical Significance

- Face provides anterior protection for the cranium

- Facial appearance valued in most cultures

- In general, maxillofacial injuries are low priority in management of the polytrauma patient
  - Addressed in tertiary survey in ATLS protocol
  - **Exceptions**: 1. Life threatening hemorrhage
  2. Airway compromise
  3. C-spine injury
  4. Neurologic injury
Patient Evaluation

- History essentials:
  - Mechanism of injury
  - **Loss of consciousness**
  - **Neck pain/discomfort**
- Subjective complaints:
  - Double vision
  - Loss of vision
  - Hearing loss
  - Otorrhea or rhinorrhea
  - Malocclusion
  - Paresthesias (trigeminal nerve)
- Previous facial trauma
Patient Evaluation

• Identify potentially devastating injuries

1. Life threatening hemorrhage
   • Internal maxillary artery most common source associated with facial fractures
   • Management:
     • posterior nasal packing
     • Immediate reduction of fractures
     • Consideration of angiography and embolization for hemodynamically stable patient
Patient Evaluation

• Identify potentially devastating injuries

2. Loss of airway

• Facial trauma may result in massive edema or loss of anterior support of the tongue → obstruction at the level of the hypopharynx

PEARL: beware of airway risk in patient with multiple fractures of the anterior mandible
Patient Evaluation

• Identify potentially devastating injuries

3. Cervical spine injury
   • Spinal injury accounts for 6-8% of trauma admissions → 30% involve the c-spine
   • **15-20% of all c-spine injuries are associated with facial bone fractures**

PEARL: assume c-spine injury in patient with facial fractures until ruled out
Patient Evaluation

• Identify potentially devastating injuries

4. Neurologic injury

• Risk for intra-cranial injury:
  • Presence of skull fracture
  • Loss of consciousness
  • GCS<15
  • Closed head injury occurs in 17% of patients with facial fractures
  • Mid-facial fractures have more frequent association with closed head injury than mandible fractures
Key Points in Physical Examination

1. Cranial nerve examination
   • Assess CN II, EOM (CN III, IV, VI), sensation (V1-3) and CN VII
   • Document any abnormalities

2. Occlusion
   • Major indication for operative management
   • Subjective malocclusion does not always equate to displaced fracture
     • Trismus can cause significant alteration in occlusion without significant bony mal-alignment
Key Points in Physical Examination

3. C-spine examination
   • Rule out neck tenderness/pain
Diagnostic Imaging

- CT scans are gold standard for middle and upper facial fractures

- Reconstructed coronal images are not acceptable quality (CT head reformat)
  - Need dedicated facial bone cuts

- For mandible, a Panorex and Towne’s view are essential; mandibular series standard for evaluation of mandible fractures
Management of Fractures by Anatomic Location
Frontal Sinus Fractures
Frontal Sinus Fractures

• Frontal bone requires greatest force of any facial bone to fracture
  • Can withstand 800-1600 pounds of force

• Frontal sinus is contained within the frontal bone and drains into the middle meatus into the nasal cavity through nasofrontal ducts

• Sinus not present at birth; development begins at age 2; adult size at age 12
Frontal Sinus Fractures

• Clinical Presentation

  • Upper face edema and ecchymosis
  • Palpable deformity of frontal bone
  • +/- lacerations on forehead
  • CSF rhinorrhea
    • Occurs with dural laceration in region of cribiform plate or adjacent posterior table fracture
    • Confirm with β-transferrin test
Management

• Based on:
  • deformity secondary to displacement of anterior table
  • CSF leak
  • Likelihood of nasofrontal duct obstruction
  • Degree of displacement of posterior table
Management

- ORIF frontal sinus reserved for displaced anterior table fractures with no associated CSF leak

- Sinus obliteration indicated if nasofrontal duct involvement
  - sinus mucosa completely removed with rotary burs and ducts obstructed with graft (fat, pericranial flap, spontaneous osteogenesis or bone graft)

- Cranialization if displaced posterior table with CSF leak
  - Posterior table removed, remaining mucosa removed, ducts obliterated nasal cavity isolated from cranial cavity by interposition of pericranial flap along floor of anterior cranial fossa
Naso-orbital Ethmoid Fractures
Naso-orbital Ethmoid Fractures

- NOE fractures represent the most problematic fractures to repair and result in the most noticeable post-injury change in facial appearance.

- Fractures in this region alter the bony-soft tissue relationship of the nasal dorsum, naso-orbital valley.
NOE Fractures

- Clinical appearance
  - Telecanthus
  - Loss of dorsal nasal projection
  - Periorbital edema
  - Step-offs at orbital rims
  - Subconjunctival hemorrhage

- Radiographic evaluation
  - CT scan
  - Assess for comminution in region of medial canthi, degree of orbital involvement, possible frontal sinus involvement
NOE Fractures
NOE Fractures

- Management
  - Referal to Plastic Surgery for operative management of displaced fracture or laxity in medial canthal ligament on examination
NOE Fractures

- Detached medial canthal tendon = telecanthus

- Significant cosmetic deformity

- Recognition and appropriate referral essential to prevent this deformity
Nasal Fractures
Nasal Fractures

• Most common fractures of facial bones

• Often occur in isolation or as part of a complex fracture pattern
Nasal Fractures

• Assessment
  • Examine both external deformity as well as an intra-nasal examination
  • ** look for a septal hematoma** → needs to be drained if present
  
  • PEARL – during examination, it is important to determine whether a NOE component is present by testing for integrity of medial canthal ligament
Nasal Fractures

- Acute management in ED
  - If septal hematoma $\to$ drain and pack nose
  - Closed reduction can be attempted within first 3-5 days
Nasal Fractures

- Draining septal hematoma
  - **Essential to prevent degradation of septal cartilage and saddle nose deformity**
Nasal Fractures – Closed reduction

1. First, determine the direction of displacement and mark direction of correction with an arrow as this can be obscured once local anesthetic injected
Nasal Fractures – Closed reduction

2. Inject local to block nerves supplying the nose
   - Inject septum intranasally
   - Spray intranasally with local spray
   - can also pack nose with Otrivin soaked packing for hemostasis
Nasal Fractures – Closed reduction

3. Place instrument in the depressed side along the lateral wall of the nose below the nasal frontal angle.
   • Place a finger along the lateral side of the nose above the depressed area.
Nasal Fractures – Closed reduction

- Pearl: Do not insert elevator more superior to the level of the medial canthus
  - Can use finger as a stop to ensure elevator does not advance too superiorly
Nasal Fractures – Closed reduction

• With intra-nasal support using an elevator, apply constant, sustained pressure to reduce deformity
Nasal Fractures – Closed reduction

4. Apply nasal splint (more for a reminder for patient to not apply any pressure than actual protection)
Orbital Fractures
Orbital Fractures

• Orbit consists of 7 individual bones

• Most common fractures are medial wall and orbital floor (blow out fractures)

• Can occur with or without fracture of the orbital rim

• Without treatment, orbital fractures can result in dystopia (vertical globe malposition) or enopthalmos (posterior globe malposition)
Orbital Fractures

- Dystopia $\rightarrow$ results from loss of bony support maintaining globe position
Orbital Fractures

- Enopthalmos $\rightarrow$ results from 2 factors
  1. Increased intra-orbital volume secondary to fracture
  2. Healing can result in smaller volume
Orbital Fractures

• Imaging
  • CT scans are diagnostic

• Management →
  • Decision to operate based on size of defect, presence of enopthalmos, diplopia, or entrapment
  • ** in general, defects smaller than 1 cm do not require operative treatment unless enopthalmos or diplopia persists for 2 weeks**
  • Large defects should be treated regardless of symptoms because enopthalmos is likely to occur
Orbital Fractures

• Urgent referral to Plastic Surgery:
  • Orbital defect greater than 1 cm
  • Vertical dystopia
  • Enophthalmos
  • Entrapment

• Otherwise, can make referral for follow-up in clinic within 2 weeks of injury
Entrapment

- With orbital floor fractures, you can get a trap door effect whereby with the initial fracture displacement, the inferior rectus muscle becomes trapped within the orbital floor fracture (like a trap door)

- More likely with smaller orbital floor fractures

- **Surgical emergency**
  - Delay in treatment can lead to necrosis of inferior rectus muscle
Entrapment

• Diagnosis
  1. EOM → upper gaze will be restricted
  2. Forced duction test
Forced Duction Test

• Freeze inferior fornix with tetracaine drops
• Using forceps, grasp the inferior fornix and pull upwards
• If IR entrapped, will not be able to move globe upward
Zygomaticomaxillary Complex Fractures
Zygoma Complex Fractures (ZMC)

• Zygoma has 4 articulations
  1. Frontal
  2. Maxillary
  3. Sphenoid
  4. Temporal

• ZMC fractures typically disrupt all of these articulations (tetrapod fracture pattern)
ZMC Fractures

- Clinical presentation
  - Malar flattening
  - Step-offs at orbital rim, zygomatic arch
  - Enophthalmos
  - Infraorbital paresthesia
  - Trismus
  - Down sloping palpebral fissure

- Imaging
  - CT is diagnostic
ZMC Fractures

• Refer these fractures for Plastics assessment if:

  1. Significant displacement on CT
  2. Orbital floor involvement
  3. Malar flattening on clinical exam
  4. Malocclusion
      • with displaced zygomatic arch fractures, can get obstruction of movement of coronoid process of mandible
Maxillary Fractures
Maxillary Fractures

- Maxilla constitutes majority of midface skeleton
- Contains maxillary sinus and dentition
- 3 major buttresses provide support:
  1. Nasomaxillary
  2. Zygomatic
  3. Pterygomaxillary
Classification

- Le Fort classification of maxillary fractures
Maxillary Fractures

- Clinical presentation
  - Facial edema
  - Periorbital ecchymosis
  - Epistaxis
  - Malocclusion
  - Mobility of maxilla

- Imaging
  - CT diagnostic
Maxillary Fractures

• Management
  • Treatment indicated if occlusion abnormal
  • Patients with true Le Fort pattern fractures require ORIF

• **PEARL** – the maxillary sinus/antrum provides no structural support to the face → maxillary antrum/sinus fractures DO NOT require any treatment
Mandible Fractures
Mandible Fractures

• 2 most common causes:
  1. Assault
  2. MVC

• Other causes:
  • Gunshot wounds
  • Falls
  • Sports injuries
Mandible Fractures

- Classify by location:
  - Condyle
  - Coronoid
  - Ramus
  - Angle
  - Body
  - Symphysis

Incidence by location
- Angle > symphysis > body > condyle > coronoid > ramus
Mandible Fractures

• Patient evaluation
  1. Inspect occlusion
     • Evaluate for presence of anterior or posterior open bite
     • Evaluate for deviation of mandible during opening
  2. Perform bimanual examination of mandible to assess for mobility and tenderness
  3. Palpate condyles, both pre-auricularly and with finger in external auditory canal, during excursion to elicit tenderness
  4. ** inspect for loose or missing teeth**
     • Aspiration risk
  5. Mental nerve paresthesias
Mandible Fractures

- Imaging
  - Mandible series includes
    - PA skull
    - Lateral skull
    - Right and left lateral oblique
    - Towne projection
    - Submental vertex
  
- CT generally not necessary with good quality radiographs
  - May be necessary in patients with C-spine collars where adequate radiographs are not possible
Imaging

Towne view demonstrating right condyle fracture

Panorex demonstrating left parasymphysis fracture
Management

• ABCs
  • ATLS protocols
  • Treatment of mandible fractures can be delayed upto 2 weeks with appropriate antibiotic prophylaxis for critically injured patients

• Antibiotics
  • All patients with mandible fractures should receive prophylactic antibiotics treatment
    • Typically ancef+flagyl or clindamycin
    • Decreases infection rate from 50% to 6%
  • PEARL: Oral chlorhexidine useful for reducing bacterial counts in the presence of open fractures
Mangement

- Mandible fractures warrant referral for surgical evaluation

  - Typically, unilateral undisplaced parasymphyseal fractures can be managed with soft diet

  - Fractures at 2 anatomic locations are considered unstable and should undergo fixation of some time
    - Either ORIF or MMF

  - Fractures of the angle are associated with highest complication rate

  - Airway can be at risk secondary to swelling and loss of support of anterior mandible
Summary

• Patient presenting with facial fracture should be assessed as a trauma patient using ATLS protocols
  • Ensure airway is not at risk; especially for severe anterior mandible fractures

• Rule out c-spine and head injury

• Surgical referral warranted for displaced or unstable fractures

• Entrapment of inferior rectus muscle is a surgical emergency
Thank you