Mandible Fractures

Jacques Peltier, MD
Faculty Advisor: Matthew Ryan, MD
The University of Texas Medical Branch
Department of Otolaryngology
Grand Rounds Presentation
May 2004
History

- Edwin Smith Papyrus 1650 described Hx, Phy, Diagnosis. Often fatal disease
- Hippocrates – Described monomaxillary dental fixation and binding
- Sulicetti – 1492 Described “tie teeth of jaw to teeth of uninjured jaw”
History

• Schede 1888 – Bone plate of steel secured with 4 screws
• Luhr 1960 – Developed mandibular compression plates
• Michelet and Champy 1970’s – Placement of small bendable non-compression plates
Mandibular Fractures

Anatomic Classification

- Condyle
- Ramus
- Angle
- Body
- Coronoid
- Alveolus
- Symphysis (parasymphysis)
Epidemiology

- Mandible most common after nasal fractures
- Mandible : Zygoma : Maxilla 6:2:1
- Ellis 4711 facial fractures, 45% with mandible fractures
- Assault > MVA > Fall > Sports
Epidemiology

- Sites of weakness
  - Third molar (esp. impacted)
  - Socket of canine tooth
  - Condylar neck
Epidemiology

- Boole et al (laryngoscope) 5196 fractures
  - Young military men
  - Angle 35%, Symphysis 20%, Body 12%, Condylar 9%, Subcondylar 4%, Ramus 4%, Alveolar 3%, Coronoid 1%
  - 70% 1 fracture, 30% 2 fractures, .2% more than 2
  - Facial lacs 30%, other facial fx. 16%, C-spine 0.8%
Haug et al
Fischer et al

<table>
<thead>
<tr>
<th>Region</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull</td>
<td>64</td>
<td>43.2</td>
</tr>
<tr>
<td>Face</td>
<td>78</td>
<td>52.7</td>
</tr>
<tr>
<td>Neck*</td>
<td>22</td>
<td>14.9</td>
</tr>
<tr>
<td>Chest</td>
<td>40</td>
<td>27</td>
</tr>
<tr>
<td>Abdomen</td>
<td>28</td>
<td>18.9</td>
</tr>
<tr>
<td>Upper extremity</td>
<td>41</td>
<td>27.7</td>
</tr>
<tr>
<td>Lower extremity</td>
<td>75</td>
<td>50.7</td>
</tr>
</tbody>
</table>

* Neck injury = cervical spinal injury.
Favorable vs. Unfavorable

- Masseter, Medial and Lateral Pterygoid, and Temporalis tend to draw fractures medial and superior
- Almost all fractures of angle unfavorable
Evaluation

- Stabilization via ATLS protocol
- Part of secondary survey
  - Pain, malocclusion, trismus, V3 sensory deficit
  - History of TMJ (earlier mobilization)
  - Blow to face favors parasympphyseal fracture and contralateral angle fracture
  - Fall to chin (bilateral condylar fractures)
Evaluation

- Previous occlusion (Class I-III)
- Psychiatric, nutritional, gastrointestinal, seizure disorders
- Previous facial trauma
- Other injuries (c-spine, intra-abdominal, likely prolonged intubation)
Physical Exam

- Complete Head and Neck exam
  - Palpable step off
  - Tenderness to palpation
  - Malocclusion
  - Trismus (35 mm or less)
  - FOM hematoma
  - Altered sensation of V3
  - Crepitus
Physical Exam

- Dental Exam
  - Lost, fractured, or unstable teeth
  - Dental Health
  - Relation to fracture
  - Quantity
Physical Exam

• Unilateral fractures of Condyle
  – Decreased translational movement, functional height of condyle
  – Deviation of chin away from fracture, open bite opposite side of fracture

Bilateral fractures of condyle
  - Anterior open bite
FIGURE 65.5. A fractured condyle usually is distracted anteromedially by the lateral pterygoid muscle. This produces a shortened functional height of the ramus as the masseter, medial pterygoid, and temporalis muscles draw the ramus closer to the skull base. The ipsilateral molar teeth act as a fulcrum to produce a slight contralateral anterior open bite.
FIGURE 65.4. A fractured condyle does not translate down the articular eminence on jaw opening. The unopposed translational movement of the opposite condyle deviates the chin toward the side of the fractured condyle.
Evaluation

- Panorex, mandible series
- CT scan
  - Not as diagnostic as plain films for nondisplaced fractures of mandible.
  - Most useful for coronoid and condylar fractures, associated midface fractures
Physiology

• Primary Healing
  – In rigid fixation techniques
  – Lag screws, compression plates, Recon plate, external fixation, Wire fixation, Miniplate fixation
  – No callus formation
  – Question of bone resorption
Physiology

- Secondary bone healing
  - Callus formation
  - Remodeling and strengthening
  - MMF, Wire fixation, Miniplate fixation
Closed Reduction

- Favorable, non-displaced fractures
- Grossly comminuted fractures when adequate stabilization unlikely
- Severely atrophic edentulous mandible
- Children with developing dentition
Closed Reduction

- **Length of MMF**
  - De Amaratuga – 75% of children under 15 healed by 2 weeks, 75% young adults 4 wks
  - Juniper and Awty – 82% had healed at 4 wks
  - Longer period for edentulous fractures 6-10wks
Closed Reduction

- Edentulous fractures
  - Bradley found absent inferior alveolar artery in 40% 60-80 yo’s
  - Periosteal blood supply disturbed by stripping
  - Up to 20% non-union despite type of treatment
  - May consider Gunning Splints
Open Reduction

- Displaced unfavorable fractures
- Mandible fractures with associated midface fractures
- When MMF contraindicated or not possible
- Patient comfort
- Facilitate return to work
Open Reduction

• Contraindications
  – General Anesthetic risk too high
  – Severe comminution and stabilization not possible
  – No soft tissue to cover fracture site
  – Bone at fracture site diffusely infected (controversial)
Open Reduction

- Associated condylar fracture
- Associated Midface fractures
- Psychiatric illness
- GI disorders involving severe N/V
- Severe malnutrition
- To avoid tracheostomy in patients who need postoperative intubation
Open Reduction

• Intraosseous wiring
  – Semirigid fixation
  – Cheap
  – Technically difficult
  – Primary and Secondary bone healing
Wire fixation

ALTERNATIVE TECHNIQUES
Open Reduction

• Lag Screws
  – Rigid fixation (Compression)
  – Good for anterior mandible fractures, Oblique body fractures, mandible angle fractures
  – Cheap
  – Technically difficult
  – Injury to inferior alveolar neurovascular bundle
Open reduction

- Ellis 41 patients with anterior lag screw technique
- 4.9% infection rate
- No malocclusion
- No Non-union
Lag Screw Technique
Lag Screw Technique
Lag Screw Technique
Rigid Fixation

• Compression plates
  – Rigid fixation
  – Allow primary bone healing
  – Difficult to bend
  – Operator dependent
  – No need for MMF
Rigid Fixation

• Miniplates
  – Semi-rigid fixation
  – Allows primary and secondary bone healing
  – Easily bendable
  – More forgiving
  – Short period MMF Recommended
Rigid Fixation

- Schierle et al studied experimental model, then applied in patients.
  - Model suggested two plates more stable
  - Patients divided into two groups with equal complication rates, equal functional results
Miniplates, Champy technique
Rigid Fixation

- Reconstruction Plates
  - Good for comminuted fractures
  - Bulky, palpable
  - Difficult to bend
  - Locking plates more forgiving
External Fixation

- Alternative form of rigid fixation
- Grossly comminuted fractures, contaminated fractures, non-union
- Often used when all else fails
Edentulous Fractures

• Chalmers and Lyons 1976 – Recommended closed reduction to preserve periosteal blood supply

• Chalmers and Lyons 1995
  – 167 fractures in edentulous mandibles
  – ORIF 82%
  – 15% complications
  – 12% Fibrous union
Edentulous Fractures

- ORIF
  - Inferior alveolar canal more superior in location
  - Vertical height 20mm compatible with standard plating systems
  - Vertical height 10mm or less, likely need rib graft
  - Plate removal after fracture healing if interferes with denture placement
Teeth in line of fracture

• Keep teeth if
  – Previously healthy
  – Peridontal plexus intact
  – No major structural injury
  – Tooth does not interfere with reduction of fracture
Teeth in line of fracture

- Neal and associates
  - 32% incidence of morbidity with teeth in line of fracture
  - No statistical difference if tooth was removed
Teeth in line of fracture

- Amaratunga
  - 16% complication rate in retained teeth
  - 13% in removed teeth
  - Retain teeth for 4-6 weeks if important for MMF
Condylar and Subcondylar

- Lindhal and Hollender
  - Closed reduction in children, teens, adults
  - Intracapsular fractures
  - Higher incidence of postoperative sequelae in adults
  - Children and Teens with less sequelae, more remodeling
Condylar and Subcondylar

- Norholt
  - Children 5-20 with intracapsular condylar fractures
  - Increased dysfunction with increasing age
Condylar and Subcondylar

- Closed reduction with arch bars MMF 2-3 weeks mainstay for youths
  - Ankylosis of TMJ and facial asymmetry most feared complication
  - Less effective for
    - increasing age
    - decreased ramus height
    - more displaced
Condylar and Subcondylar

• ORIF, Absolute indications
  – Displacement into middle cranial fossa
  – Inability to achieve occlusion with closed reduction
  – Foreign body in joint space
Condylar and Subcondylar

• Relative indications
  – Bilateral condylar fractures to preserve vertical height
  – Associated injuries that dictate earlier function
    • Soft tissue swelling causing airway compromise with MMF
    • Intracapsular fracture on opposite side where early mobilization important
Immediate Mobilization

- Kaplan et al.
  - Studied ORIF in two groups, one with MMF for 2 weeks, one with immediate mobilization
  - No statistical difference in rates of complications, postoperative pain, dental health, nutritional status
Bioabsorbable Plates

- Plating can relieve stress, no bone remodeling
- Bulky plates, thermal sensitivity, palpable
- Absorbable plates expensive
- Better in children?
- Use of poly-L-lactide in 69 fractures by Kim et al
  - 12% complication
  - 8% infection
  - No malunion
References


Spina and Marciani. Mandibular Fractures, pages 85 - 105

Mandible Fractures

Jacques Peltier, MD
Faculty Advisor: Matthew Ryan, MD
The University of Texas Medical Branch
Department of Otolaryngology
Grand Rounds Presentation
May 2004