Management of Mandible Fractures

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Overview

- Case Presentation
- Anatomy of the mandible
- Biomechanics of the mandible
- Principles of Wound Healing
- AO Principles and Plating
- Multiple Fractures
- Antibiotics and Infections
- Conclusion
Case Presentation

- **CC:** Jaw pain
- **HPI:**
  - 32 yo M, struck in jaw 18 hrs prior to ED arrival
  - No pain initially, but increasing pain and swelling throughout the day
  - No LOC
  - Denies occlusal abnormality, although visibly poorly aligned
  - Reports no other injuries
Case Presentation

- PMH: None
- PSH: None
- Medications: No home medications
- Allergies: NKDA
- FH: No bleeding disorders. No known FH
- SH: smokes ½ PPD cigaretters, 4 beers a day
- ROS: No h/o CV, resp, hematologic sxs
Case Presentation

Physical Exam

- AF VSS. No difficulty breathing
- Head/Face/Neck:
  - 2 cm Submental laceration
  - Edema overlying the left angle, ramus, and body of mandible
Case Presentation

- **Mouth:**
  - No trimus. Teeth in fair condition. Missing right mandibular molars
  - Open fracture line between the left lower 2nd and 3rd molar with exposed bone and crepitance to palpation
  - Malocclusion with underbite and leftward displacement of the mandibular dentition

- **Neuro:**
  - Facial strength equal and normal bilaterally
  - No decrease in sensation, specifically denies V3 weakness
Imaging
Imaging

- Acute, minimally displaced and comminuted fracture involving the left inferior mandibular ramus with extension to the left third, posterior most, molar tooth.
- Significant soft tissue hematoma and edema is seen involving the left masseter muscle and left submandibular space, with a moderate amount of soft tissue emphysema adjacent to the fracture site.
What next?
- When would you repair?
- What approaches could be used?
- Would you discharge the patient from the ED on antibiotics?
Anatomy

http://dict.space.4goo.net/dict?q=mandible
Anatomy

- The nerve that innervates the mandible exits from which skull base foramen?

  A. Foramen Spinosum
  B. Jugular Foramen
  C. Foramen Ovale
  D. Foramen Rotundum
  E. Foramen Lacerum
Anatomy

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Anatomy

- The nerve that innervates the mandible exits from which skull base foramen?

  A. Foramen Spinosum – Middle meningeal artery
  B. Jugular Foramen – Jugular vein. IX, X, XI
  C. Foramen Ovale – V3
  D. Foramen Rotundum – V2
  E. Foramen Lacerum – Nerve of the pterygoid canal (Greater and deep petrosal nerves)
Biomechanics
Biomechanics

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Biomechanics

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Classification of Mandible Fractures

Mandible Fractures

Mandibular fractures
Frequency by location

- Coronoïd process: 2%
- Condyle: 30%
- Ramus: 3%
- Angle: 25%
- Body: 25%
- Parasymphyseal / Mental: 15%
Bone Healing Principles

Indirect/secondary:

- Day 1-5: fracture hematoma: ingrowth of vessels bring fibroblasts and other progenitors
- Day 5-21: callus: formation of fibrocartilage and chondroid by chondroblasts & deposition of osteoid by osteoblasts – fracture is somewhat stable
Bone Healing Principles

Indirect/secondary:

- Day 21-60: remodeling – restructuring of callus and reconstitution of medullary canal and medullary fat, fracture is stable
Bone Healing Principles

Direct/primary Healing
- No callus formation
- Question of bone resorption
Bone Healing Principles

Direct/primary Healing
- AO foundation - 1958
- Arbeitsgemeinschaft für Osteosynthesefragen
  - Restoration of anatomy
  - Stable fracture fixation
  - Preservation of blood supply
  - Early mobilization
Load-bearing v Load-sharing
Load-bearing v Load-sharing

- Bicortical screws
- Locking recon plate bears the forces through the area
- Comminuted fractures, defects, atrophic edentulous fractures, post infection
- Internal external fixator
Load-bearing v Load-sharing

- Stability from the frictional resistance between fragments
- Simple fractures
- Champy
  - “Ideal lines of osteosynthesis”
  - Semi-rigid fixation
- Other eg: Lag screw and compression plating
“Special Considerations” of Mandible Fractures

- Multiple fractures
- Antibiotics
- Infection
Case #1

- 24 y M referred to your clinic from the ER after being assaulted by “two dudes.”
  - Bilateral open mandible fracture
    - Angle and parasymphysial

- What is the way that you are wanting to repair the fractures?

- He asks you about repair and about the risk of infection.
  - Perioperative antibiotics?
    - Which route?

- Would his infection rate be different if the fractures were in the ramus/condyle instead?
Bilateral Mandible Fractures
Bilateral Mandible Fractures
Bilateral Mandible Fractures

- How would you repair the fractures?
- Which fracture would you plate first?
- What would be your approach?
- What type of plates would you use?
Bilateral Mandible Fracture
Infection

- When should antibiotics be administered?
- How long should antibiotics be given?
- Which antibiotic should be given?
Infection

- Maxillomandibular infection rate
  - 10-15%

- Open mandible infection rate
  - 6.25%

- Angle fractures (3rd molar) have the highest rate of infection

- Higher rate of infection with open fractures compared to closed fractures (condyle/ramus)


Infection

Antibiotic Duration and Postoperative Infection Rates in Mandibular Fractures

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Mandible infection 2001-06

- 197 patients
- 4.5% infection rate (9 patients)
- Only age (older patients) correlated with increased risk of infection
- No difference in infection rate on antibiotic length

Infection

Prescribed Antibiotics

Duration of Systemic Antibiotics

Length of Prescription
Only looked at RCT (4)
Recommended a “1 shot” administration may be as effective as a 7-day course
No specific antibiotic recommended
Abx may not be needed in condyle fractures.

A second Systematic Review in 2011 concluded there were not enough adequate RCT to comment on antibiotic usage in mandibular fractures.

- No data sufficient for NNT, type of antibiotic, route of administration, dose.
Infection

Which of the following does NOT increase the risk of infection?

A. Infected tooth
B. Devitalized bone
C. Mobile bone fragments
D. All of the above will increase the risk of infection
Infection

Which of the following does NOT increase the risk of infection?

A. Infected tooth
B. Devitalized bone
C. Mobile bone fragments
D. All of the above will increase the risk of infection
Infection

- Instability produces and can propagate infection

- Signs/symptoms of infection
  - Erythema
  - Persistent pain
  - Pus
  - Continued induration
  - Warmth
Infection

- Risk Factors for Infection
  - Alcohol/Drug abuse
  - Noncompliance
  - Imprisonment
  - Dementia
  - Self-neglect

Immunosuppression
DM

https://www2.aofoundation.org/wps/portal/lut/p/c1/04_S88K8vILM9MSSzPy8vBz9CP0os3hngq7BARydDRwN3Q1dDA08XN59Qz8AAwMDA6B8JK8hagFg8Ffnqkezn7GTH1DahIBuP4_83FT9gty1cgBttn3y/dI2/d1/L2dJQSEVUUt3QS9ZQn3IzZqzBWUUECMUEwRzFFMTBJREZMVUIRUDewMDAI/?showPage=redfix&bone=CMF&segment=Mandible&classification=91-Special%20considerations&treatment=&method=Special%20considerations&implantstype=hidden&approach=&redfix_url=1285234127954
Infection

Which area has the highest rate of infection?
Infection

- Angle Fractures
  - ~20% infection rate
  - Thought to be related to impacted or involved third molars

Case #2

- 67 y F undergoes removal of an impacted 3rd molar, with subsequent dry socket, chronic infection, and pathologic fracture presents to your clinic.

- What causes infections?
- Next Step?

Infection

- Rigid Fixation
  - Internal or External
- Expose and debride the infected area
  - Devitalized bone to bleeding bone
  - Remove infected tooth

Infection

- Application of a locking recon plate
- Harvest bone graft
  - Hip
  - Tibia

Conclusion

- Mandible fractures can be encountered frequently and potentially challenging to repair

- Condyle fractures are the most common type of mandible fracture

- There is a balance between standard AO technique, and times when semi rigid fixation will be appropriate
Conclusion

- Infection rates can be as high as 20% for angle fractures.

- Debridement of devitalized tissue and possible removal of tooth fragments is necessary, followed by RIGID fixation.

- Despite 40 years of research, there is still no clear consensus regarding the use of perioperative antibiotics, although it is clear using them (for some time) decreased the risk of infection for open fractures.
Questions?