Olecranon Fractures
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Introduction:

• General Comments
  – Diagnosis/Evaluation
  – Treatment Options
  – Complications
• Specific Injuries (Fractures & Dislocations)
  – Isolated Olecranon Fractures
  – Complex Fractures
  – Olecranon Fractures in Children and the Elderly

Olecranon Fracture
Clinical Findings

• Patients present with deformity, swelling & pain
• Inability to Extend the Elbow
• Don’t Miss:
  – Compartment Syndrome
  – Open wounds
    ➢ Remember the ulnar border is subcutaneous and even superficial wounds can expose the bone
  – Nerve injuries (especially ulnar nerve)
    ➢ Especially with open fractures

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### Treatment of Olecranon Injuries

- Successful Functional Outcome
  - Correlates directly with:
    - Accuracy of Anatomic Joint Reduction
    - Restoration of Mechanical Stability that allows Early Motion
    - Respect for the Soft Tissues
    - Maintain the Extensor Mechanism

### Classification

- Multiple attempts at classifying olecranon fractures:
  - Colton
  - Morrey
  - Schatzker
  - AO/ASIF
  - OTA

- Classification helps decide treatment options

### Colton Classification

- Type I: avulsion
- Type II: oblique
- Type III: associated with dislocation
- Type IV: multisegmented
Mayo Clinic Classification

- Type I: Non-displaced 12%
- Type II: Displaced/stable 82%
- Type III: Elbow unstable 6%

Morrey BF, JBJS 77A: 718-21, 1995

Treatment Overview

- If Nondisplaced
  - Treat with Early Motion
- If Displaced – Treat with Open Reduction
  - Transverse: Tension Band
  - Oblique: Add Lag Screw
  - Comminuted: Plate options
- If not repairable – Treat with Excision

Non-Operative Treatment

- If No Articular Incongruity:
  - <1-2 mm displacement
- AND able to actively extend the elbow
Non-Operative Treatment

- Immobilize 60-90 degrees for 7-10 days then gentle motion.
- Repeat x-rays to be sure does not displace
- At 6-8 weeks allow weight-bearing.

Indications for Surgery

- All Displaced Fractures
- All Patients without Active Extension
- Failure of Non-Operative Treatment

Position

- Surgeon’s Preference
  - Supine, lateral, or prone
Technique Illustrations

- From

Incision

- Midline posterior incision curved radially to avoid the tip of the olecranon

Technique Choice

- Evaluate the **dorsal cortex**
  - Tension band technique Converts dorsal distraction forces to compression at articular surface & fracture site
  - If the dorsal cortex is comminuted, mechanical stability is lost
- So
  - If intact: consider tension band wire
  - If comminuted, consider a plate or intramedullary device

Illustration from Capo, John: Orthopaedic Trauma Association Resident Syllabus
Technique Choice

- Evaluate fracture line orientation
  - If Transverse: tension band wire effective
  - If Oblique: a lag screw technique should be considered
  - If Comminuted – usually a plate

Illustration from Capo, John: Orthopaedic Trauma Association Resident Syllabus

Tension Band: Indications

- Displaced fractures proximal to coronoid process and not at risk of compressing the olecranon fossa.
- Contraindicated if the articular surface is comminuted and unstable.

Tension Band Technique

- Reduce fracture with pointed forceps
  - May drill cortical hole for purchase distally
**Tension Band Technique**

- Drill 2 parallel K-wires obliquely into anterior cortex.

**Anchor Pins**

- 71% of patients – migration of k-wires or prominent and painful
- 3x more likely to back out if not anchored in anterior cortex.

**Tension Band Technique**

- Drill a transverse hole distally – should be bicortical to decrease chance of stress fracture.
Tension Band Technique

- Loop 18- or 20 gauge wire or braided cable in a figure-of-8 pattern.
- Placement under the triceps minimizes strangulating the tendon.
- Can use an IV cannula to guide the wire.

Tension Band Technique

- Tightening the loops creates inter-fragmentary compression.

Tension Band Technique

- Ends of k-wires and cut and bent 180 degrees and hammered into bone.
- Split triceps longitudinally and impact k-wires into the posterior cortex (close triceps over the ends) – to minimize hardware prominence.
Tension Band Technique

• Can combine the figure of eight tension band with lag screw fixation for oblique fractures.
**Bone Anatomy**

Coronoid process and the Radial Head resist Anterior-to-Posterior Dislocation

- Beware of narrowing the trochlear (semi-lunar notch) when treating comminuted fractures of the olecranon.

**Plate Technique**

- Standard Technique:
  - Rigid anatomic fixation when fragments are large enough
  - Plate can be used to create tension or lag screws through the plate for oblique fractures.
  - Plate acts as a tension band

**Technique for Plate Fixation**

- Reduce and provisionally fix the intra-articular fragments
  - Then attach to the shaft
- Use
  - Recon or 3.5 LC-DC or Specialized Olecranon Plates
  - Use Mini-fragment (2.7) for smaller patients
- Include Lag screws
Steps

- Isolate Ulnar Nerve if comminuted fracture

Technical Tips for Fixation of Olecranon Fractures

- Use Indirect Reduction Techniques Preserving Soft Tissue Attachments

Plate Location

- No mechanical difference between posterior or lateral placement - King et al., J Shoulder Elbow Surg 5:437, 1996
- Less problems with plate prominence when placed laterally
  - Also can get bicortical screw purchase
- Posterior Plate allows more advantageous screw placement
  - Coronoid screw
  - IM screw
  - Olecranon tip screw
- But Lateral plate allows bicortical fixation at the level of the joint

From Cote, J. OTA Resident Fracture Syllabus
Plate Example
  • Oblique Fracture

Fracture Extending Distally
Distal Fracture

Distal fracture
• Healed
Comminuted Fracture

- Example Plate Fixation for Comminuted Fracture

Minimally Invasive Plating

- Advantages:
  - Does not disrupt soft tissues at the fracture site
  - Less surgical trauma
    ➢ Theoretically less surgical time, less bleeding, lower risk of infection
  - Cosmetically more acceptable scars

Bridge Plating

- Similar to Minimally Invasive Plating
  - But not necessarily through small incisions
    ➢ MIP – fracture site not visualized except radiographically: indirect reduction +/- percutaneous lag screws
    ➢ Bridge Plating – can be MIP, or fracture site visualized with partial direct reduction, but peristomal attachments still maintained
  - More soft tissue damage from surgical trauma than MIP, but less chance of malreduction
Olecranon Bridge Plate Case Example

- 20y/o male – elbow
  - Injury X-rays:

Olecranon Bridge Plate

I&D because subcutaneous ulna higher risk of infection than most GSW’s
  - ORIF allows early motion

Monteggia Fracture-Dislocations

- Classic:
  - Fracture of Proximal 1/3 Ulna with Dislocation of Radial Head
Monteggia Fx-Dx

- Best Treatment
  - ORIF w. Plate Fixation of Diaphyseal Fracture
  - Joint Usually Reduces Indirectly and is stable
  - If Unstable: open reduction of joint
  - If irreducible – usually because the diaphyseal fracture has been mal-reduced

Complex Fractures

- Monteggia Variant
  - Radial Head Not Salvaged
- Radial Head Spacer

Complex Fractures

- Radial Head Repair Preferred over Replacement
**Monteggia Variant**
- Unstable fracture requiring radial head replacement

**With Radial Head**
- Final Images

**Excision Technique**
- Reattach anteriorly close to the articular surface to preserve strength
- Resection more than 50% of the olecranon leads to instability

Gartsman et al., JBJS 63A:718, 1981
Intra-Medullary Options

- Intra-medullary Screws
- Intra-medullary rods

Disadvantages of Intra-medullary Fixation

- Large diameter screws: higher rate of fixation failure than tension band
- Engage intra-medullary cortex – increased torque instead of compression
- But if canal large – poor purchase and inadequate compression.
- Can combine with tension band technique

Anatomy of the Proximal Ulna

- Beware of the bow of the proximal ulna, which may cause a medial shift of the tip of the olecranon if a long screw is used.

From Hak and Golladay, JAAOS, 8:266-75, 2000
JTC 2010
Intramedullary Rod Systems

- Have Advantages over Intramedullary Screws
- Indicated to treat simple olecranon fractures and osteotomies of the olecranon.

IM Fixation Advantages

- System minimizes articular step-off after osteotomy
- Stable thread connection between nail and end cap provide compression between fragments
- Reduced soft tissue irritation
  - Nail buried in medullary canal and threaded screw head also below the surface of the bone
- Stable fixation
  The screw heads contacting the nail, combined with the angled screws, prevent toggling of the implant in the medullary canal regardless of the size of the canal

Technique Rods

- Cortex Perforation & Canal Preparation
- Insert guide wire down center of canal
- Be sure not to bend the guide wire.
- Drill over the guide wire while drilling.
**Rod Technique**

- Can use Awl to perforate the cortex and prepare the canal.
- The awl passes straight into the canal.

**Rod Technique**

- Place the Rod
  - Locking screws and compression devices vary by manufacturer.

**Example (Osteotomy)**

Distal Humerus Fracture Requiring Olecranon Osteotomy for Fixation

Rod is placed Before osteotomy
Rod Placement

• After Fixation is completed:

Pediatric Fracture

• Pin Fixation of Unstable Olecranon Fracture

Pediatric Fracture

• MRI showing Step-off of articular surface
Pediatric Fracture
• Open Reduction and Pin Fixation

Geriatric Olecranon Fractures
• Excision with Triceps Advancement for “unrecoverable” olecranon fractures especially in the elderly with low functional demands.

Excision
• 79 year old – fell – initial tension band technique
Excision

• Nonunion: hardware removed: excision with excellent functional outcome

Outcome

• 95% near normal function
• 20-50% patients develop radiographic evidence of arthrosis at 15-20 year
  – But usually asymptomatic

Potential Complications

• Hardware symptoms in 22 - 80%
• 34-66% require hardware removal
• Hardware failure 1-5%
• Infection 0-6%
• Pin migration 15%
• Ulnar neuritis 2-12%
• Heterotopic ossification 2-13%
Contracture

- Extensor lag: 10-15%
- Always document intra-operative motion:
  - Or the physical therapist will blame your hardware for persistent limitations!
- Avoid with Early Motion

Hardware Pain

- Studies report up to 81% of patients require hardware removal due to proximal prominence

Prominent Hardware

- Comminuted Fracture: Plated with proximal edge off bone to allow two more screws in proximal segment and fixed angled intra-medullary screw (bending the plate distorts the locking hole)
Staged Hardware Removal

- Removal after healing

Nonunion

- Nonunion is usually due to poor BIOMECHANICS
  - Poor Technique
    - Failure to create a stable construct (too few screws, improper compression)
    - Overaggressive iatrogenic damage to soft tissues
  - Poor Initial Fracture Characteristics
    - Open Injury with periosteal stripping
    - Comminuted fracture where interfragmentary compression cannot be achieved
- Occurs both with operative and nonoperative Treatment

Non-Union

- Non-operative Treatment
Nonunion

- Healed

Conclusions for Treating Olecranon Fractures

- Achieve Mechanical Stability with Anatomic Reduction & Stable Internal Fixation
- Optimize the Biology of Healing with Anatomic Reduction, Indirect Techniques, & Maintenance of soft tissue attachments

And the Patient will have a Good Result

Thank you

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