Radial Head and Neck Fractures

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Objectives

• Anatomy
• Elbow Instability
• Radial head fractures
  • Classification
  • Treatment
• Radial neck fractures
  • Treatment
• Essex-Lopresti Injuries
Anatomy
Anatomy – Superficial Lateral Elbow

- Triceps
- Lateral Epicondyle
- Olecranon
- Biceps
- Common Extensor Origin

Reference: Clinical Library of Thomas Krupko MD
Anatomy - PIN

Anatomy – Deep Lateral Elbow

Reference: Rockwood and Green’s - Figure 32.2
Anatomy – Lateral Elbow

- Lateral Epicondyle
- Greater Sigmoid Notch
- Olecranon
- LUCL
- Coronoid
- Radial Notch
- Radius (head resected)
- Supinator Crest

Reference: Clinical Library of Thomas Krupko MD
Anatomy – Medial Elbow

Reference: Rockwood and Green’s - Figure 32.2
Elbow Stability
Elbow Stability

• Static
  • Ulno-humeral joint
  • Radio-humeral Joint
  • LUCL
  • Anterior bundle of MCL

• Dynamic
  • Common flexor origin
  • Common extensor origin
  • Biceps
  • Brachialis
  • Triceps

• Radius resists axial load and valgus
Mechanism of Injury

- Typically fall onto outstretched hand
  - Axial loading
  - Valgus force
- Radial head/neck fractures occur along a spectrum of elbow instability
- Any treatment requires complete understanding of the injured bone and soft tissue
  - CT scan can provide valuable info

Reference: Rockwood and Green’s - Figure 32.16
Elbow Instability

Stable

Simple dislocation
Radial Head Fx
Radial Head Fx + Dislocation

Unstable

Post Trans Olecranon Fx Dislocation
Terrible Triad

Reference: Previous OTA Slides
Radial Head Fractures

- Mason Classification – Type 1
  - Non-displaced fx or minimally displaced (<2mm)
  - No mechanical block to forearm rotation

Reference: Previous OTA Slides and the Clinical Library of Thomas Krupko MD
Radial Head Fractures

• Mason Classification – Type 2
  • Displaced >2mm or angulated
  • Possible block to rotation

Reference: Previous OTA Slides and the Clinical Library of Thomas Krupko MD
Radial Head Fractures

- Mason Classification – Type 3
  - Comminuted
  - Displaced
  - Obvious block to rotation

Reference: Previous OTA Slides and courtesy of Thomas Wright MD
Radial Head Fractures

• Mason Classification – Type 4
  • Hotchkiss Modification
  • Bridges the gap with more complex elbow instability
  • Radial head fx with elbow dislocation

• Beware LUCL avulsion and coronoid fx (terrible triad)

Reference: Clinical Library of Thomas Krupko MD
Radial Head Fractures – Treatment Algorithm

Fracture Size > 25%

No

Displacement > 2mm

No

Early Motion

Yes

Motion Limited

No

Early Motion – Close F/U

Yes

Excision of Fragment

Displacement > 2mm

No

Motion Limited

Yes

3 or More Fragments

No

Early Motion – Close F/U

Yes

ORIF

Reference: Revised from Previous OTA Slides
Lateral Elbow – Approaches

- Kocher
  - Most often utilized for radial head
  - Interval
    - Anconeus – Radial Nerve
    - ECU – PIN
  - 5cm incision from lateral epicondyle distally
  - Angled posteriorly 30-45 degrees
  - Often deep soft tissues will be disrupted by injury

Reference: Clinical Library of Thomas Krupko MD
Lateral Elbow – Approaches

• Kocher Pitfalls
  • Damage to LUCL
    • Stay on anterior half of radial head
  • Damage to PIN
    • Pronate the arm to move nerve distally
    • Carefully dissect distal to annular ligament

Reference: Rockwood and Green’s - Figure 32.2
Lateral Elbow—Approaches

• Kaplan
  • Distal extension becomes dorsal Thompson approach
  • More often used for radial neck/proximal radial shaft fxs
• Interval
  • ECRB – Radial nerve or PIN (variable)
  • EDC – PIN
• 10cm incision from lateral epicondyle to Lister’s Tubercle
Lateral Elbow—Approaches

• Kaplan Pitfalls
  • PIN injury
    • Palpable between two heads of supinator.
    • Distal dissection can be utilized to locate the nerve (see image)
    • Can also split supinator (next slide)

Reference: Clinical Library of Thomas Krupko MD
Lateral Elbow—Approaches

• Kaplan Pitfalls
  • PIN injury
    • Palpable between two heads of supinator.
    • Image shows supinator split and nerve exposed

Reference: Clinical Library of Thomas Krupko MD
Lateral Elbow—Approaches

• Kaplan Pitfalls
  • PIN injury
    • Final approach gives significant exposure of radial head, neck, and proximal shaft for more complex fractures

Reference: Clinical Library of Thomas Krupko MD
Lateral Elbow – Less Common Approaches

- EDC Split
  - Roughly half way between Kocher and Kaplan
  - Pros and Cons the same as these approaches

- Modified Boyd
  - Posterior approach
  - Elevate LUCL from lateral epicondyle
  - Can be used for combined olecranon/radial head fxs
  - Possible risk of synostosis
  - See references for complete technique
Radial Head Fractures – Treatment Algorithm

Fracture Size > 25%

- No
  - Displacement > 2mm
    - No
      - Early Motion
    - Yes
      - Excision of Fragment
  - Yes
  - Motion Limited
    - No
      - Early Motion – Close F/U
    - Yes
      - Early Motion – Close F/U

Displacement > 2mm

- No
  - Motion Limited
    - No
      - Early Motion – Close F/U
    - Yes
      - Excision of Fragment
  - Yes
  - 3 or More Fragments
    - No
      - ORIF
    - Yes
      - Arthroplasty

Reference: Revised from Previous OTA Slides
Radial Head Fractures – Excision

- Isolated radial head (stable joint)
  - Partial or complete resection can be a reliable option
  - Beware subtle instability
  - May lead to PLRI or radial shortening long term

- Radial head fx with ulno-humeral or longitudinal instability
  - Complete resection is contra-indicated
  - Partial resection a viable treatment option for small fragments (<25% of joint)

See References for more on long-term outcomes
Radial Head Fractures – Treatment Algorithm

Fracture Size > 25%

No

Displacement > 2mm

No

Early Motion

No

Early Motion

− Close F/U

Yes

Motion Limited

No

Early Motion

− Close F/U

Yes

Excision of Fragment

Yes

Displacement > 2mm

No

Motion Limited

No

ORIF

Yes

3 or More Fragments

No

ORIF

Yes

Arthroplasty

Reference: Revised from Previous OTA Slides
Radial Head Fractures - ORIF

- Articular fx
  - Anatomic reduction
  - Compression

- Implants
  - Mini-frag screws
  - Headless compression

Reference: Courtesy of Matthew Patrick MD
Radial Head Fractures - ORIF

• Articular fx
  • Anatomic reduction
  • Compression

• Implants
  • Headless compression
    • Tripod Technique
      • See references for technique guide

Reference: Courtesy of Jacqueline Geissler MD
Radial Head Fractures - ORIF

- Articular fx
  - Anatomic reduction
  - Compression

- Implants
  - Periarticular locking plates

Reference: Courtesy of Matthew Patrick MD
Radial Head Fractures – Implant Placement

- Care must be taken to keep implants out of the proximal radio-ulnar joint
  - Block to supination and pronation

- Safe zone
  - 100 degree area
  - Between tip of radial styloid and Lister’s Tubercle

Reference: Previous OTA Slides
Radial Head Fractures – Greenspan View

Reference: Clinical Library of Thomas Krupko MD
Radial Head Fractures – Intra-op Greenspan
Radial Head Fractures – Treatment Algorithm

Fracture Size > 25%

No

Displacement > 2mm

No

Early Motion

Early Motion – Close F/U

Motion Limited

No

Early Motion

Motion Limited – Close F/U

Yes

Excision of Fragment

3 or More Fragments

No

ORIF

Yes

Arthroplasty

No

Yes

Motion Limited

Early Motion

Early Motion – Close F/U

Reference: Revised from Previous OTA Slides
Radial Head Fractures - Replacement

• Head options
  • Round
    • Easier placement
  • Eccentric
    • Mimics native anatomy
    • More difficult to place
  • Bipolar
    • Articulates at the head/neck junction
    • Dislocation can occur

• Stem options
  • Smooth
    • Loose fitting stem
    • Allows implant to find proper alignment
  • Porous/Pressfit
    • Can loosen causing pain
    • Can result in dilatory remodeling
  • Cemented
    • Typically used for salvage
Radial Head Fractures - Overstuffing

- Radial head height typically 0.9mm proximal to lateral coronoid process
- Only 2mm overstuffing causes 1mm of ulno-humeral gapping
- Common complication
  - Especially in unstable elbows that allow for the placement of large implants
- Leads to....
  - Possible increased rate of capitellar erosion
  - Decreased flexion
  - Medial subluxation of the ulna

Reference: Clinical Library of Thomas Krupko MD
Radial Head Fractures - Overstufing

Correct Size

Overstuffed

Reference: Clinical Library of Thomas Krupko MD and Courtesy of Thomas Wright MD
Radial Head Fractures - Overstuffing

• Direct visualization
  • Most accurate way to determine appropriate head size
  • Radial head should be just at or proximal to radial notch of the ulna
  • Pictures show appropriate placement

• Intra-op Fluoro
  • Needs to be assessed in flexion and extension
  • Less reliable
  • > 6mm overstuffing must be present to consistently be seen on fluoro

Reference: Courtesy of Matthew Patrick MD
Radial Head Fractures – Stem Loosening

• Occurs with press-fit stems
• Typically within 1 year of surgery
• Significant dilatory remodeling of the proximal radius can also occur

• Removal of the implant may lead to proximal migration of the radius
• Cemented arthroplasty can be used for salvage if needed

Reference: Courtesy of Matthew Patrick MD
Radial Head Replacement – Outcomes

• Mid to long term outcomes are good to excellent typically

• Elbow stiffness is most common complication
  • Average approx. 10-135 degrees

• Loss of flex/ext strength of approx. 10%

• Peri-implant lucency common, but rarely requires revision

• Rate of OA approx 30%
Radial Neck Fractures
Radial Neck Fractures - Treatment

- Similar to radial head
- Non displaced
  - Non-op
- Displaced
  - No block to motion
    - Non-op
  - Block to motion
    - ORIF

Reference: Clinical Library of Thomas Krupko MD
Radial Neck Fractures - ORIF

• Kocher approach
  • Transverse neck fractures

• Kaplan/Thompson approach
  • Extension into the proximal radius

• Kickstand screws
  • Simple fx patterns only

• Plating (mini-frag vs anatomic)
  • Comminution

Reference: Clinical Library of Thomas Krupko MD
Complications

• Similar to radial head
  • PIN injury
  • Impingement of implants
• Stiffness
  • Most common
  • Functional ROM of flexion/extension is 30-130 degrees

Reference: Previous OTA Slides and the Clinical Library of Thomas Krupko MD
Essex-Lopresti Injuries
Essex-Lopresti Injuries

• Radial head/neck fracture with:
  • Interosseous membrane disruption
  • DRUJ disruption

• Physical exam
  • Palpation of DRUJ for tenderness and shuck of the joint is critical

• Radiographs
  • Be sure to evaluate entire film
  • Contralateral films may help in diagnosis

Reference: Courtesy of Thomas Wright MD
Essex-Lopresti Injuries

• Treatment (Controversial!!)
  • Step 1 – Obtain contralateral films
  • Step 2 – Pin the DRUJ vs repair of TFCC
    - Attempt to match contra side
  • Step 3 – ORIF or arthroplasty of radial head
  • Step 4 – Possible reconstruction of interosseous ligament

• Pre-op contralateral films are essential to restore length and wrist alignment

Reference: Courtesy of Thomas Wright MD
Post-op Protocol
My Post-op Protocol

• For all stabilized fxes and dislocations regardless of fixation

• Initially
  • Immobilization for 10-14 days

• Secondarily
  • Early ACTIVE range of motion
  • Allows dynamic stabilizers to help hold reduction of joint
  • Will reduce pseudosubluxations
  • Limits elbow stiffness

• Some limit active shoulder abduction if LUCL was repaired
Summary

• Anatomy
  • Lateral elbow ligaments and PIN location are critical

• Elbow Instability
  • Make sure that you understand the injury

• Radial head fractures
  • Classification (Mason)
  • Treatment

• Radial neck fractures
  • Treatment

• Essex-Lopresti Injuries
  • Don’t miss!
References

References

- Ring D, Quintero J, Jupiter JB. Open reduction and internal fixation of fractures of the radial head. JBJS. 2002 Oct 1;84(10):1811-5.