Elbow Stress Reactions

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I have no conflicts of interest in relation to this presentation

Outline
- Pathophysiology
- Epidemiology
- Mechanism of Injury
- History
- Physical exam
- Imaging
- Treatment
16 year old RHD pitcher
- 8 weeks posterior elbow pain
- No history of trauma
- Pain initially dull, now sharp
- Throws 150 pitches per week

Case report

Physical Exam
- Elbow ROM 5-130
- Tenderness to palpation posterior olecranon
- (-) tenderness at medial/lateral epicondyle
- (-) elbow effusion
- (-) varus/vaogus laxity
- (-) Milking test

Case report

X-rays
- Negative
Case report

MRI
- Fluid sensitive sequence
- Olecranon adema
- No fracture
- Otherwise normal

Diagnosis:
Stress reaction of the elbow

Wolff’s Law
1) Bone is deposited and reabsorbed to achieve optimum balance between strength and weight
2) Trabecular bone is formed during growth and development in orientations that line up with the direction of the principle mechanical stresses that act on the bone
3) Both phenomena occur through self regulating mechanisms that respond to mechanical forces acting on bone tissue

Wolff J, 1892
Pearson OW, Wk Phys Anthrop 2004
Young’s Modulus

- Bone stressed in elastic range, returns to original configuration
- Stress beyond elastic range creates microfracture
- Per Wolff’s law, new bone is formed in response

Matuck et al. 2016

Stress Reaction and Fracture

Stress outpaces the body’s ability to create new bone

Stress Reaction vs Stress Fracture

Stress Reaction

- Peri-trabecular and periosteal inflammation and edema with or w/o periosteal new bone formation

Stress Fracture

- Trabecular and cortical fracture lines

Stress reaction is the precursor to stress fracture
Mechanism

**Insufficiency Fracture**
Normal stress on abnormal bone

**Fatigue Fracture**
Abnormal stress on normal bone

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Stress reaction of the elbow

Seldom reported in literature

Olecranon stress reaction
- 1 case series and 3 case reports
  - 10 total cases

Olecranon stress fracture (in baseball)
- 5 case series and 4 case reports
  - 44 total cases
Epidemiology

Stress fractures represent 0.8% of high school sports injuries

Of those injuries, 2.8% involve the upper extremity

Olecranon is the most common stress fracture in baseball

Predominantly occurs in pitchers

Additional upper extremity stress fractures in baseball:
- Radial shaft
- Ulnar shaft
- Distal humerus

Mechanism of injury

Repetitive micro trauma from one of two sources:

Impingement of the olecranon in the olecranon fossa

OR

Excessive tensile forces of the triceps on the olecranon during acceleration phase of throwing

Presentation

Gradual onset of posterior elbow pain

Pain present during acceleration and follow-through

Progressively worsens

Improves with rest, but resumes with pitching
Examination

- Limited extension with elbow ROM
- Localized pain on palpation
- Pain on bone stress
- Pain on percussion of olecranon
  - Schekeran et al. 2002

Provocative tests

**Arm bar test**
- Elbow extended
- Shoulder internally rotated
- Hand placed on examiner's shoulder
  - (+) test elicits pain when examiner pulls down on olecranon to simulate forced extension

**Snapping extension test**
- Place continuous valgus stress on elbow
- Extend from 30° flexion to full extension
- Repeat without valgus stress while palpating posteromedial olecranon for tenderness
- Assessing for painful impingement
Imaging

- X-rays usually negative
- Throwing athletes with posterior elbow pain
- Low threshold for advanced imaging

- MRI or Bone scan is diagnostic
- CT scan may not detect stress reaction

Bone scan

- Increased uptake in olecranon

- Highly sensitive but:
  - Time consuming for patient
  - Cannot differentiate between stress reaction and fracture
  - Lacks detail for preoperative planning
  - Significant radiation exposure

MRI

- Gold standard
Stress reaction radial shaft
Can occur outside of the olecranon in throwing athletes

29 year old professional pitcher
Gradual onset vague right forearm pain with pitching

Complications
Stress fracture
Non-union
- High risk in olecranon stress fractures

Indications
Non-Operative
Stress reactions
Initial treatment of stress fractures in recreational athletes

Operative
- Stress fractures in elite athletes
- Failure of conservative treatment
Non-operative management

- **Throwing cessation** min. 6 weeks
- Identify modifiable risks factors
  - Throwing mechanics
  - Throwing program after 6 weeks **AND**;
  - Pain free on provocative tests
  - Full ROM
- Consider bone stimulator
  - (evidence lacking)

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**Stress Injury of the Proximal Ulna in Professional Baseball Players**

Mark S. Schickendantz, MD, Charles P. Ho, MD, PhD, and Jason Koh, MD

Retrospective review
- 7 professional baseball players with stress reactions
- All managed non-operatively

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**Stress Injury of the Proximal Ulna in Professional Baseball Players**

Mark S. Schickendantz, MD, Charles P. Ho, MD, PhD, and Jason Koh, MD

**Treatment**
- Throwing cessation for 6 weeks
- 4 weeks hinged elbow orthosis 20° short of extension
- Sport specific rehabilitation after 6 weeks
- Throwing program started when full ROM, no pain on valgus stress or extension test
- Throwing program started on average week 8
Stress Injury of the Proximal Ulna in Professional Baseball Players

Mark S. Schneckendanz, MD, Charles P. Ho, MD, PhD, and Jason Koh, MD

Results
7/7 returned to play professional baseball
6/7 still playing baseball at time of follow up (average follow up – 4 years)
1/7 lost to follow up (traded)
Return to play ~ 12-14 weeks

Indications

Non-Operative
- Stress reactions
- Initial treatment of stress fractures in recreational athletes

Operative
- Stress fractures in elite athletes
- Failure of conservative treatment

Operative management

Most common 6.5mm/7.3 mm cannulated screw
- Down intramedullary canal for oblique fractures (A1/A2)
- Perpendicular to transverse fractures (B1/B2)
- Paci et al. 2013

Consider bone graft for non-union
Retrospective review of 18 baseball players
All failed conservative treatment

Results
17/18 returned to baseball
Return to throwing ~ 29 weeks
Played on average 3.2 additional years of baseball

Complications
33% required hardware removal
11% had surgical infection

Case report (cont.)
Patient underwent non-operative management
6 weeks of throwing cessation
Followed by 6 week throwing program
Cleared to return to sport at 12 weeks
Conclusion

Elbow stress reaction - early stages of the development of a stress fracture

Low index of suspicion
- High-volume throwing athlete
- Posterior elbow pain
- Negative x-ray

Early MRI is critical to make diagnosis before development of fracture
Non-operative treatment has been successful in the few reports of stress reactions in the literature.
Operative management is mainstay after development of stress fracture.

THANK YOU!