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SPORTS MEDICINE

## Elbow Stress Reactions

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## Disclosure

I have no conflicts of interest in relation to this presentation



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## Outline

- Pathophysiology
- Epidemiology
- Mechanism of Injury
- History
- Physical exam
- Imaging
- Treatment



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### Case report

16 year old RHD pitcher

- 8 weeks posterior elbow pain
- No history of trauma
- Pain initially dull, now sharp
- Throws 150 pitches per week



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### Case report

Physical Exam

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

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### Case report

X-rays

- Negative



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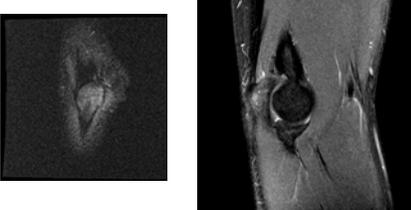
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### Case report

MRI

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



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### Diagnosis:

### Stress reaction of the elbow

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### 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 OM, YrBK Phys Anthrop 2004

Provided by John Conway, MD

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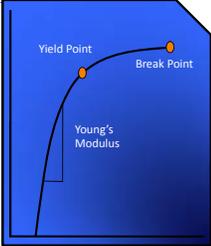
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## Young's Modulus

- 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

Provided by John Conway, MD

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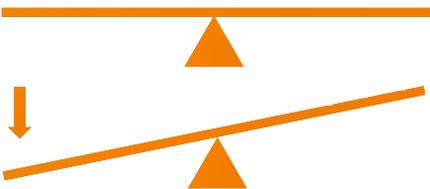
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## Stress Reaction and Fracture

Stress outpaces the body's ability to create new bone



Provided by John Conway, MD

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## 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

Provided by John Conway, MD

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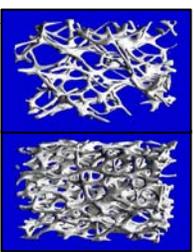
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## Mechanism

**Insufficiency Fracture**  
Normal stress on abnormal bone

**Fatigue Fracture**  
Abnormal stress on normal bone




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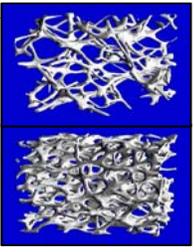
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## Mechanism

**Insufficiency Fracture**  
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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




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## Epidemiology

Stress fractures represent **0.8%** of high school sports injuries  
 Of those injuries, **2.8%** involve the upper extremity  
- Changstrom et al. 2015

Olecranon is **most common** stress fracture in baseball  
- Yamamoto et al. 2011

Predominantly occurs in pitchers

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




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## 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




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## Presentation

Gradual onset of posterior elbow pain  
 Pain present during acceleration and follow-through  
 Progressively worsens  
 Improves with rest, but resumes with pitching



Escamilla et al. 2009

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## Examination

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



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## 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



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## Provocative tests

### 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



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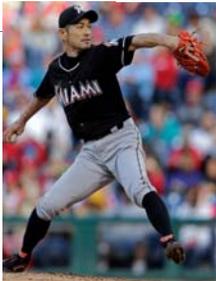
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**Imaging**

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



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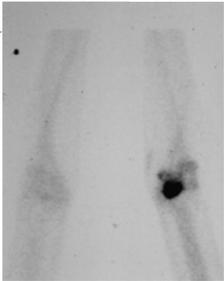
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**Bone scan**

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



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**MRI**

Gold standard



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### 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




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### Complications

**Stress fracture**  
**Non-union**

- High risk in olecranon stress fractures




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### Indications

<p><b>Non-Operative</b></p> <p>Stress reactions Initial treatment of stress fractures in recreational athletes</p>	<p><b>Operative</b></p> <ul style="list-style-type: none"> <li>Stress fractures in elite athletes</li> <li>Failure of conservative treatment</li> </ul>
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## 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 \_\_\_\_\_

*From \*Horizon Orthopedic, Cleveland, Ohio, †National Orthopaedic Imaging Associates, Menlo Park, California, and ‡Northwestern University, Evanston, Illinois*

Retrospective review

7 professional baseball players with stress reactions

All managed non-operatively

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*From \*Horizon Orthopedic, Cleveland, Ohio, †National Orthopaedic Imaging Associates, Menlo Park, California, and ‡Northwestern University, Evanston, Illinois*

**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

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**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

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**Indications**

<p><b>Non-Operative</b></p> <ul style="list-style-type: none"> <li>Stress reactions</li> <li>Initial treatment of stress fractures in recreational athletes</li> </ul>	<p><b>Operative</b></p> <ul style="list-style-type: none"> <li>Stress fractures in elite athletes</li> <li>Failure of conservative treatment</li> </ul>
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**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




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### Cannulated Screw Fixation of Refractory Olecranon Stress Fractures With and Without Associated Injuries Allows a Return to Baseball

James M. Paci,<sup>1†</sup> MD, Jeffrey R. Dugas,<sup>1</sup> MD, Jeffrey A. Guy,<sup>5</sup> MD, E. Lyle Cain Jr.,<sup>1</sup> MD, Glenn S. Fleisig,<sup>1</sup> PhD, Candice Hurst,<sup>3</sup> MPH, Kevin E. Wilk,<sup>3</sup> PT, DPT, and James R. Andrews,<sup>3</sup> MD  
*Investigation performed at the American Sports Medicine Institute, Birmingham, Alabama*

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



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*Investigation performed at the American Sports Medicine Institute, Birmingham, Alabama*

#### Complications

33% required hardware removal  
11% had surgical infection



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### 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



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## 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-rays

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

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THANK YOU!



  
  
Official Medical Provider  
  


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