The Athlete’s Elbow

It is important to remember when examining the elbow of any athlete or manual laborer that adaptations to repetitive stresses induced by sport/work activities may result in “abnormal” findings which may not represent true pathology!!
Examination & Imaging of the Elbow

- Clinical History
- Inspection
- Range of Motion
- Palpation
- Strength/Neurovascular
- Stability
- Imaging
- Sports Injury Specific Special Tests
Examination & Imaging of the Elbow

- Clinical History
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- Sports Injury Specific Special Tests
Clinical History

- ? Dominant hand
- What, when, where, how?
- Work related
- Any previous injury
- Any previous treatment
Clinical History

- Any Traumatic events
  - Falls, dislocations, lacerations, fractures

- Recent athletic activity
  - Throwing history
    - When, where, how much, how well, how fast
    - Changes in routine or training regimen

- Pain or instability with throwing
  - 85% of throwers with medial elbow instability complain of pain in the acceleration phase of throwing
    - Neurologic symptoms with throwing
Examination & Imaging of the Elbow

- Clinical History
- **Inspection**
- Range of Motion
- Palpation
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Inspection

- Normal carrying angle in adult
  - Male = 10-11 degrees valgus
  - Female = 13 degrees valgus

- Not uncommon for throwers to have > 15 degrees valgus at elbow

- Person with large elbow effusion will tend to hold elbow flexed 70-80 degrees as this corresponds to greatest volume of elbow joint capsule
Inspection

13 degrees Valgus
**Inspection**

- Lateral recess, medial epicondyle, antecubital fossa, olecranon tip
- Prominence of the olecranon tip may indicate posterior/posterolateral dislocation or triceps avulsion
- Ecchymosis anteriorly may indicate biceps tendon rupture
- Ecchymosis medially may indicate a fracture of the medial epicondyle or avulsion injury
Inspection

- Olecranon bursa should be inspected
  - If enlarged may represent bursitis
    - Aseptic vs. septic
- Ulnar nerve subluxation may be visible
Examination & Imaging of the Elbow

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- **Range of Motion**
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Range of Motion

- Active followed by passive ROM
- Normal ROM in adult
  - 0 – 140 degrees +/- 10 degrees in sagittal plane
  - 80 – 90 degrees of forearm rotation in each direction
- With progressive flexion, elbow moves into increasing valgus
Range of Motion

- Generalized ligamentous laxity is associated with increased ROM

- Functional ROM is 30 – 130 degrees flexion and 50 degrees of rotation in each direction
  
  - Morrey et al, JBJS 1981
Range of Motion

- Pain, crepitus, and end feel must be assessed.
- End feel in extension should be “bony” (Cain)
  - Soft endpoint may indicate contracture
- End feel in flexion should be “soft”
  - Firm endpoint may indicate bony impingement
- > 50% of throwing athletes have some degree of elbow flexion contracture
  - King et al, Clin Ortho 1969
Examination & Imaging of the Elbow

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- Sports Injury Specific Special Tests
Palpation: Osseous

- Olecranon
  - Posteromedial tip (impingement)
  - Proximal shaft (stress fractures)
- Epicondyles
  - Fractures
  - Epicondylitis
- Radial Head
  - Fractures
  - Dislocations
Palpation: Soft Tissues

- Anterior
  - Biceps tendon
- Medial & Posterior
  - Flexor-pronator
  - UCL
  - Ulnar nerve
  - Triceps Tendon
- Lateral
  - LUCL & LCL
  - Extensor Tendon
Palpation: Medial & Posterior

Medial Palpation

Posterior Palpation
Palpation: Lateral

Lateral epicondyle
Radial Head
Lateral olecranon
Soft spot
Palpation: Ligaments

- Anterior bundle
- Posterior bundle
- Transverse ligament
- Annular ligament
- Accessory collateral ligament
- Radial collateral ligament
- Lateral ulnar collateral ligament
Examination & Imaging of the Elbow

- Clinical History
- Inspection
- Range of Motion
- Palpation
- **Strength/Neurovascular**
- Stability
- Imaging
- Sports Injury Specific Special Tests
Strength Examination

- Any routine examination of the elbow should include a strength examination (MMT)
  - Rotator cuff
  - Deltoid
  - Biceps
  - Triceps
  - Pronation and Supination
  - Wrist dorsal- and volar-flexion
  - Grip, Intrinsics, and APL
Sensory Examination

- Cursory sensory exam in all patients
  - Bilateral comparison
- Subtle differences in sensory function may not represent true pathology, but may be the first indicator of more serious pathology
- Musculocutaneous, MABC, LABC, Radial, Ulnar, Median
Sensory Examination

- Musculocutaneous
- Antecubital fossa
- Radial
  - First dorsal webspace of hand
- Ulnar
  - Ulnar aspect of 4th & 5th fingers
- Median
  - Pad of Index & Middle
Vascular Exam

- Pulses should be checked in both arms and the quality of the pulse as well as the rate should be compared.
  - Dampened pulses may indicate proximal obstruction
  - Capillary refill and general perfusion should be checked in any patient complaining of altered sensation in fingertips
Examination & Imaging of the Elbow

- Clinical History
- Inspection
- Range of Motion
- Palpation
- Strength/Neurovascular
- **Stability**
- Imaging
- Sports Injury Specific Special Tests
Stability Examination

• No Inherent Stability to Elbow
  • Full Extension – Olecranon Tip & Olecranon Fossa articulation provides some stability against varus/valgus stresses
  • Radial head provides some stability against valgus laxity
    • Pts with radial head fractures may have increased valgus carrying angle
Examination & Imaging of the Elbow

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Elbow Imaging

Radiographs

AP  Lateral  Oblique ER  Oblique IR  Oblique Axial

Bilateral Stress Views

Dominant Arm

Non-Dominant Arm
AP X-Ray

- olecranon fossa
- medial epicondyle
- lateral epicondyle
- olecranon
- trochlea
- capitellum
- coronoid process
- radial head
Lateral X-Ray

- coronoid process
- radial neck
- radial tuberosity
- olecranon fossa
- trochlear notch
- olecranon
- radial head
Radial Head-Capitellum View
Pediatric Ossification Centers

<table>
<thead>
<tr>
<th>ELBOW OSSIFICATION CENTERS</th>
<th>AGE AT APPEARANCE (Y)</th>
<th>AGE AT CLOSURE (Y)</th>
</tr>
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<tbody>
<tr>
<td>Capitellum</td>
<td>1-2</td>
<td>14</td>
</tr>
<tr>
<td>Radius</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>Internal (medial) epicondyle</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Trochlea</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Olecranon</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>External (lateral) epicondyle</td>
<td>11</td>
<td>16</td>
</tr>
</tbody>
</table>
Computed Tomography

- Evaluation of bone and soft tissue abnormalities.
- Articular deformities/injuries
- Complex fractures
Magnetic Resonance Imaging

• Clearly define numerous types of osseous and soft tissue pathology.

• Intra-articular Contrast: Ligament Evaluation Improved with soft tissue contrast.

• Intravenous Contrast: synovial inflammation, osteomyelitis, neoplasms.
Axial MRI

Medial ←-→ Lateral

FIGURE 2-23
Axial MRI

Medial ↔ Lateral
Coronal MRI

Medial ←--→ Lateral
Posterior ←→ Anterior
Elbow Sports Injury Specific Special Tests

• Anterior
  • Biceps Tendon

• Medial & Posterior
  • Flexor-Pronator
  • Ulnar Collateral Ligament
  • Posteromedial Impingement
  • Ulnar Nerve
  • Triceps Tendon

• Lateral
  • Extensor Tendon
  • Posterolateral Rotatory Instability
Elbow Sports Injury Specific Special Tests

- **Anterior**
  - Biceps Tendon

- **Medial & Posterior**
  - Flexor-Pronator
  - Ulnar Collateral Ligament
  - Posteromedial Impingement
  - Ulnar Nerve
  - Triceps Tendon

- **Lateral**
  - Extensor Tendon
  - Posterolateral Rotatory Instability
Biceps Tendon Injury

- Palpation in the antecubital fossa
  - Absence of typically prominent tendon
  - Resisted supination will increase prominence
- +/- Pain in antecubital fossa
  - Ecchymosis may be present
- + Biceps Hook Test
Biceps Tendon Injury
Elbow Sports Injury Specific Special Tests

- Anterior
  - Biceps Tendon

- Medial & Posterior
  - Flexor-Pronator
  - Ulnar Collateral Ligament
  - Posteromedial Impingement
  - Ulnar Nerve
  - Triceps Tendon

- Lateral
  - Extensor Tendon
  - Posterolateral Rotatory Instability
Flexor-Pronator Pain

- Medial Epicondylitis (Golfer’s Elbow)
  - Palpate medial muscle mass/epicondyle while resisting active pronation
  - Pain either within muscle belly or directly over epicondyle
Elbow Sports Injury Specific Special Tests

- Anterior
  - Biceps Tendon
- Medial & Posterior
  - Flexor-Pronator
  - Ulnar Collateral Ligament
  - Posteromedial Impingement
  - Ulnar Nerve
  - Triceps Tendon
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  - Extensor Tendon
  - Posterolateral Rotatory Instability
Medial & Posterior Elbow: Throwing Athlete

- Microtrauma
- Muscle Fatigue
- Posteromedial Overload
- UCL Injury

Breakdown in Valgus Elbow Stability!!
Throwing Elbow Injuries: Clinical History

- **Symptoms**
  - Medial vs. Posterior Elbow Pain
  - Swelling, Catching and/or Locking

- **Phase of Throwing**
  - Acceleration/Late Cocking
    (UCL Insufficiency?)
  - Deceleration/Follow-Through
    (Posteromedial Impingement?)

- **Associated Findings:** Fatigue Related Symptoms, Loss of Velocity, Loss of Control, Ulnar Nerve Symptoms
UCL Palpation

• Deep structure covered by flexor-pronator mass
• Course of ligament from ME to Sublime tubercle of proximal ulna
  • Inserts just distal to articular surface
• Flexion of elbow will move muscle mass anteriorly, uncovering UCL
• Pain with palpation in this region may be indicative of UCL pathology (not specific)
UCL Tests

• Valgus Stress Test
  • Positive if laxity and/or pain

• Moving Valgus Stress Test
  • Positive test if pain between 120° to 90° of elbow flexion

• Milking Maneuver
  • Positive test if reproduces pain & provides apprehension
Arthroscopic UCL Stress View
Posteromedial Impingement
Posteromedial Elbow Tests

- **Posteromedial Impingement Test**
  - Elbow at 20° to 30°
  - Valgus Stress
  - Force Terminal Extension

- Other: Decreased Motion & Crepitus

**Rule Out Other Pathology:**

- Flexor-Pronator Symptoms
  - Resisted Flexion/Pronation Pain
- Ulnar Nerve Symptoms
- Olecranon Palpation & Percussion
- Lateral Elbow Assessment (Pain & Instability)
Repeatedly move elbow into full extension with valgus stress
Medial & Posterior Elbow Imaging

Oblique Axial (110° Flexion)
Medial & Posterior Elbow Imaging

- Complete UCL Tear
- Partial UCL Tear
- Olecranon Stress Fracture
- Combined Injury: UCL & Flexor Pronator
Elbow Sports Injury Specific Special Tests

- Anterior
  - Biceps Tendon
- Medial & Posterior
  - Flexor-Pronator
  - Ulnar Collateral Ligament
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Ulnar Nerve Pathology

- Impingement
- Instability
Ulnar Nerve Testing: Tinel’s Test

- Gentle percussion of the ulnar nerve above or within the cubital tunnel should not elicit pain in the normal elbow.
- Pain or paresthesias in the ulnar distribution is considered a positive test.
Ulnar Nerve Impingement

- Compression Neuritis or Neuropathy
  - i.e., Anomalous bands of triceps insertion may impinge ulnar nerve as they snap over medial epicondyle

- Sensation of “snapping” as the arm is actively extended with ulnar nerve symptoms
  - “Snapping Triceps Syndrome”
    - Spinner and Goldner, JBJS 1998

- Nerve is stable in cubital tunnel
Ulnar Nerve Instability

- Ulnar nerve held in cubital tunnel by overlying and investing fascia
- Rupture or stretch of this tissue may lead to subluxation of nerve
  - Paresthesias
  - Pain with subluxation
  - May have pain with palpation
- Ulnar nerve subluxes anteriorly with increasing flexion of elbow
- Nerve “snaps” back with rapid active extension
Elbow Sports Injury Specific Special Tests

- Anterior
  - Biceps Tendon
- Medial & Posterior
  - Flexor-Pronator
  - Ulnar Collateral Ligament
  - Posteromedial Impingement
  - Ulnar Nerve
  - Triceps Tendon
- Lateral
  - Extensor Tendon
  - Posterolateral Rotatory Instability
Triceps Tendon Injury

- Presence of a palpable triceps gap
- Weakness or loss of active elbow extension
- Findings may be variable in the setting of severe pain and swelling, especially if they are present in a muscular athlete with large bulk
- Ecchymosis may be marked several days, but not immediately, after injury
- Must determine whether injury is partial vs. complete
Triceps Tendon Injury
Elbow Sports Injury Specific Special Tests

- Anterior
  - Biceps Tendon
- Medial & Posterior
  - Flexor-Pronator
  - Ulnar Collateral Ligament
  - Posteromedial Impingement
  - Ulnar Nerve
  - Triceps Tendon
- Lateral
  - Extensor Tendon
  - Posterolateral Rotatory Instability
Extensor Tendon Injury

- Lateral Epicondylitis (Tennis Elbow)
  - Palpate mobile wad while resisting active supination (ECRB most common offender)
  - Pain within muscle belly or over epicondyle

Surgery ONLY if Non-op Fails!
Elbow Sports Injury Specific Special Tests

- Anterior
  - Biceps Tendon
- Medial & Posterior
  - Flexor-Pronator
  - Ulnar Collateral Ligament
  - Posteromedial Impingement
  - Ulnar Nerve
  - Triceps Tendon
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  - Posterolateral Rotatory Instability
Lateral Ligamentous Exam

- LUCL & RCL make up lateral ligament complex
- Apply varus stress with elbow flexed 15-20°
  - Arm is internally rotated to prevent shoulder rotation
  - Pain or increased varus/PL laxity
Posterolateral Rotatory Instability

- PLRI due to insufficiency of LUCL
Posterolateral Rotatory Instability: Tests

**Pivot Shift:** Supine, flexed to 70 degrees, axial load w/ valgus stress

**Chair Push Up Test**
Posterolateral Rotatory Instability: Imaging
Summary

• Develop a System & Follow It
• Cover All Bases
• A Thorough Clinical History will help guide & direct the Physical Examination
• Compare to Contralateral Elbow
• Supplement & Confirm Examination with Imaging
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