An Anatomical Approach to Diagnosis of Elbow Pain

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Outline

• Intended to present most common causes of elbow pain in anatomical approach
• Focus is on etiology, presentation, and diagnosis
Elbow Anatomy

• Condyloid, hinged joint
  — 3 joints
    • Ulnohumeral
    • Radiocapitellar
    • Proximal radio-ulnar joint

• Average ROM
  — Flex/Extension = 0/145
  — Pronation/Supination = 70/85
Elbow Anatomy

- **Stability**
  - Varus
    - LCL
    - Radial head
    - Anteromedial facet of the coronoid
  - Valgus
    - UCL
    - Radial head
    - Lateral, anterior coronoid
  - Anterior/ posterior
    - Capsule
    - Coronoid
Pathology Based on Location

- Distal Biceps Rupture
- Pronator Syndrome
- OCD Lesion
- Osteoarthritis

- Cervical Radiculopathy
- Medial Epicondylitis
- Ulnar Nerve Compression
- UCL Injury
- Valgus Extension Overload

- Posterolateral Rotatory Instability
- Posterolateral Plica
- Olecranon Bursitis
- Triceps rupture
- Valgus Extension Overload
- Posterior impingement
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Cervical Radiculopathy
Lateral Epicondylitis
PIN Compression
Radial Tunnel Syndrome
Posterolateral Plica
Posterolateral Rotatory Instability
OCD Lesion
Panner’s Disease

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Cervical Radiculopathy
Medial Epicondylitis
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Cervical Radiculopathy

“Rich Howard Lesion”
Cervical ???

Spine ???

C5 nerve root
Lateral Epicondylitis
Patient Evaluation

History

- Often insidious
- Often repetitive activity
- Inability/pain with holding items
Patient Evaluation

- Tenderness just anterior and distal to bony lateral epicondyle
- Exacerbated with resisted wrist/digit extension, with elbow in extension
Nonsurgical treatment, the mainstay of management, involves a myriad of options, including rest, nonsteroidal anti-inflammatory drugs, physical therapy, cortisone, blood and botulinum toxin injections, supportive forearm bracing, and local modalities.

For patients with recalcitrant disease, the traditional open débridement technique has been modified by multiple surgeons, with others relying on arthroscopic or even percutaneous procedures.

Evolving treatment options treat patients with lateral epicondylitis.
PIN Compression Neuropathy & Radial Tunnel Syndrome
Anatomy

• Radial Nerve
  – Anterior proximal radius
    » Radiocapitellar jt → n deep to supinator
  – 3-4 fingers’ breadth long
  – Boundaries
    • Lateral/Anterior: Mobile wad
    • Floor: Capsule RC jt
      » Cont as deep supinator
    • Medial: Brachialis, bicep tendon
PIN Compression Sites

• Arcade of Frohse (Most common)
  – Prox edge of head of supinator
    » Nerve passes through
    » 2-4cm distal to radiocapitellar joint
Diagnosis
PIN Syndrome

• Symptoms
  – Initial pain
  – Progressive loss of extensor function

• Physical Exam
  – Absence of sensory deficit
  – Wrist and finger extensors affected
    » NO EFFECT on Brachioradialis & ECRL
PIN Syndrome

• Diagnostic tests
  – MRI: tumor compressing posterior interosseous nerve
  – Electrodiagnostic studies???: denervation of muscles
  – Rheumatologic laboratory panel: rule out inflammatory process

• Differential diagnosis
  – Extensor tendon rupture at wrist
  – Extensor tendon subluxation at MP level (saggital bands)
  – Parsonage-Turner syndrome
Radial Tunnel Syndrome

• Etiology:
  – Repetitive tasks
  – Trauma and swelling
  – Inflammatory conditions
  – Tumors

• Diagnostic studies:
  – Electrodiagnostic studies are usually not helpful
  – Theory – Intermittent compression, dynamic

• Diagnostic injection with local anesthesia in radial tunnel may be helpful if provides temporary pain relief
Diagnosis
Radial Tunnel Syndrome

• Symptoms
  • Pain over the radial tunnel without motor loss, dull, +/- concomitant LE

• Physical Exam
  – Localized tenderness over radial tunnel – mobile wad
    – Maximal ttp 5 cm distal to LE
  – Provocative maneuvers:
    – Active forearm pronation & wrist flexion
    – Resisted forearm supination & wrist extension
    – Resisted middle finger extension - controversial
Radial Tunnel vs PIN Syndrome

- **PIN syndrome**
  - Weakness
    - Chief finding
  - Pain (+/-)
  - No sensory disturbance
  - Compressive structure
    - Space occupying lesion

- **Radial tunnel syndrome**
  - Pain
  - Main complaint
  - Weakness
  - Lesser role
  - Compressive structure
  - Fibrous bands
Posterolateral Plica
The Posterolateral Plica: A Cause of Refractory Lateral Elbow Pain
Ruch DS, Papadonikolakis A, Campolattaro RM

- JSES 2006
  - 10 pts with failed conservative treatment for LE (PT, injection, both)
  - PE findings
    » Max ttp: posterior to lateral epicondyle, centered at posterior radiocapitellar joint
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Results
- Treated with arthroscopic debridement
- 9/10 pts had pre-op snapping sensation at elbow
  - No pt had posterolateral pain after removal of plica

Clinical Relevance
- Synovial plica is potential cause of lateral elbow pain and these symptoms can mimic LE pain, especially in pts with more vague pain.
- Recognize PE/history findings
Posterolateral Plica
Posterolateral Rotatory Instability
PLRI

- First described by O’ Driscoll in 1991
  - Originally postulated that PLRI is from insufficiency of LUCL
- Usually results from injury
  - Dislocation
- Common presentation
  - Clicking/locking or gross instability
Anatomy

- Lateral collateral lig complex: 4 components
  - Lateral/radial collateral lig
  - LUCL
  - Accessory LCL
  - Annular lig
- Functions as varus restraint, stabilizes annular ligament
  - Secondarily acts as posterior buttress for radial head
Mechanism

- PLRI typically occurs in pts w/ history of elbow dislocation
  - Axial compression, supination, valgus force
- Can result as complication from surgical approach (radial head)
  - Kocher: violated LCL complex must be repaired at completion of case
  - Boyd: involves release of soft tissues from lateral prox ulna
Clinical Presentation

- History of 1+ dislocations
- Recurrent painful clicking, snapping, clunking, locking
  - Often during extension phase of motion arc
- Apprehension during activities precipitating instability
Clinical Exam

• Typically benign except for posterolateral rotatory instability test
  • Originally described by O’Driscoll JBJS 1991
  • Analogous to Pivot Shift test of knee
• Pt guarding during maneuver
  • Local anesthesia into joint
• Other tests
  • Posterolateral rotatory drawer test, prone push-up test, chair push-up test
• Imaging
  • Coronoid/radial head fractures, Hills-Sachs lesion of elbow, humeroulnar widening during stress under fluoro
Valgus Extension Overload
Osteochondral Defect
• Common in younger athletes who routinely place valgus compressive stress to elbow
  – Baseball pitchers 13-16 yo, gymnasts

• Typically seen as capitellar lesion

• Causative factors
  – Repetitive valgus stress leads to subchondral microfracture
  – Tenuous blood supply to capitellum
  – Mechanical mismatch between radial head (stiffer cartilage) and capitellum (softer cartilage)
Clinical Presentation

• Activity related posterolateral elbow pain
  – +/- mechanical symptoms if loose body
  – Decreased ROM

• Physical Exam
  – TTP at radiocapitellar joint
  – Decreased ROM, loss of extension (think loose body!)
  – Active Radiocapitellar Compression Test
  – Pain with repetitive pronation-supination actively by patient
Imaging

• Plain films
  – Evaluate for any fragmentation or collapse, flattening

• MRI
  – Can provide definitive dx in early cases
Management

• Based on imaging and exam findings

• **Non-operative**
  
  – Translucent/cystic changes, clear fracture line between lesion and adjacent subchondral bone
    
    » Activity modification
    
    » NSAIDs
    
    » Offloader brace
    
    » Therapy
    
    » Healing usually see at 12-16 wks on plain films
Panner’s Disease

• Juvenile osteochondrosis of capitellum
  – Age 7-12 yo, typically boys

• Plain films show:
  – Fragmentation but not collapse of capitellar epiphysis
  – Flattening and sclerosis of capitellum

• Management
  – Self limiting
    » Activity modification
Pathology Based on Location

Distal Biceps Rupture
Pronator Syndrome
OCD Lesion
Osteoarthritis

Olecranon Bursitis
Triceps rupture
Valgus Extension
Overload
Posterior impingement
Olecranon Bursitis
Etiology

• Fluid collection within bursa with inflammation in surrounding tissues
  – Caused by traumatic, inflammatory, or infectious processes
  – Septic bursitis accounts for 20% of all cases
Relevant Anatomy

• Bursa forms after age of 7 years
  – Formed due to pressure from bony olecranon and shear forces applied?
• Covers dorsal olecranon
  – Extends from most distal triceps insertion to several cm along proximal subQ border of ulna
Clinical Presentation and Exam

• Typically non-tender fluctuant mass over olecranon
  • Tenderness can be associated with mass depending on degree of inflammation
• +/- hyperemia
• Skin temperature
• Septic bursitis: ++ftp, look for draining sinus with cellulitis component
• Bursal fluid analysis
  • Gram stain, WBC count, culture, glucose level
Triceps Tendon Rupture
Triceps Rupture

• Uncommon injury
• Anabolic steroid use, weight lifting, and laceration.
• Risk factors
  – local steroid injection
  – olecranon bursitis
  – Hyperparathyroidism
• Fall on an outstretched hand or a direct blow
• Eccentric loading of a contracting triceps
Triceps Rupture
Posterior Impingement
Valgus Extension Overload

- Olecranon bone spurs
- Radio-capitellar compression
- Tension
- Olecranon fossa shearing

[Image of an anatomical diagram of the elbow joint with labels indicating valgus extension overload.]
Pathology Based on Location

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Brachial Plexus

Cords:
- Lateral pectoral nerve
- Musculocutaneous nerve
- Axillary nerve
- Median nerve
- Ulnar nerve
- Radial nerve

Divisions:
- Dorsal scapular nerve
- Suprascapular nerve
- Nerve to subclavius

Trunks:
- C5
- C6
- C7
- C8
- T1

Roots:
- Long thoracic nerve

Medial cutaneous nerve of the forearm
Medial cutaneous nerve of the arm
Medial Epicondylitis
Medial Epicondylitis

- Morris: originally described condition in rowers occurring “after long and vigorous sculling with pain at inner part of elbow that resolved with rest”
- Much less common than LE
- Risk factors similar to LE
  - Obesity, physical loads, repetitive activity, smoking
- Pts typically middle aged
Medial Epicondylitis Anatomy

- Flexor/Pronator muscle origins
  - Proximal to distal
    - Pronator teres, FCR, palmaris longus, FDS, FCU
  - Most common
    - FCR & Pronator teres
    - Arise from medial supracondylar ridge
Pathogenesis

- Associated with repetitive valgus loads in golf, racquet sports, field sports, football, baseball, weightlifting, archery
- Occupational exposures
- Degenerative tendinosis vs inflammatory tendinitis
- Valgus stress can exceed tensile strength of medial constraints of elbow
  - Leads to tears that can result in epicondylitis to MCL insufficiency
“Golfer’s Elbow ???”

- Important in evaluation of medial elbow pain...
  - Avulsion of flexor pronator origin
- Commonly seen in golfers who hit the ground instead of the huge white beach ball on the tee
  - This is NOT medial epicondylitis, but can be mistaken for it. These pts will NOT get better with conservative care
- Operative fixation best if seen acutely (MRI)
Ulnar Collateral Ligament Injury
UCL Injuries

- Acute
  - Traumatic valgus injury
UCL Injuries

- Acute injuries
  - They heal!
  - Brace and protect against valgus directed forces
- Ulnar nerve gliding
UCL Injuries

- Chronic
  - Chronic stretching and microtearing to the ligament
    - All portions or anterior vs posterior bundles
- Acute on chronic
  - A newer, traumatic injury on a pre-existingly insufficient UCL
UCL Injury Diagnosis

- Physical exam
  - Valgus laxity and pain
    - Evaluate in extension, 30, 60, and 90 degrees of flexion
  - Pain to palpation of the UCL
  - Push off instability
UCL Injury Diagnosis
Valgus Extension
Overload
Etiology

• Describes constellation of injuries resulting from repetitive overhead throwing in those with UCL insufficiency
  – Seen in baseball, tennis, softball, football, lacrosse, track & field events

• Acceleration during early and late cocking phases of overhead motions results in:
  - Valgus extension moment
  - Tensile forces across medial side of elbow
  - Compressive forces across lateral aspect of joint
  - Shear forces in posterior compartment

  • Valgus extension overload phenomenon
Sequelae of Valgus Extension Overload
Sequelae of Valgus Extension Overload

- Repetitive loads to anterior MCL --> ligament attenuation/failure
  - Valgus overload accentuated --> stretch of further medial structures
    » Ulnar neuritis
    » Flexor-pronator mass tendonopathy
    » Medial epicondyle apophysitis (skeletally immature)
- Overload of lateral side --> compressive forces to RC joint
  - Chondromalacia, osteophyte formation, loose bodies
- At extremes of extension --> posterior shear forces produce:
  - Olecranon osteophytes at posteromedial tip
    » Corresponding “kissing lesion” in olecranon fossa/posteromedial trochlea
Ulnar Nerve Compression
Sites of Compression at the Elbow

Site 1: Intermuscular septum
Compression caused by
- Arcade of Struthers
- Medial intermuscular septum
- Hypertrophy of the medial head of the triceps
- Snapping of the medial head of the triceps

Site 2: Area of medial epicondyle
Compression caused by
- Valgus deformity of the bone

Site 3: Epicondylar groove
Compression caused by
- Lesions within the groove
- Conditions outside the groove
- Subluxation or dislocation of the nerve

Site 4: Cubital tunnel
Compression caused by
- Thickened Osborne’s ligament

Site 5: Exit of ulnar nerve from flexor carpi ulnaris
Compression caused by
- Deep flexor-pronator aponeurosis
Clinical Presentation

- Parasthesias or numbness - ulnar two digits
- Pain/soreness - medial elbow and/or forearm
- Symptoms worsened with elbow flexion
- Pain awakens them at night
- Vague/subtle symptoms
  - Easy fatigue ability, subtle sense of clumsiness, weakness or “dropping things”
- Motor symptoms
  - More subtle
  - Severe cases – atrophy, first dorsal interosseous
Clinical Presentation

- Motor testing – check for atrophy
  - Ulnar innervated intrinsic muscle strength – compare to CL side
  - Abd Digiti quinti
  - First dorsal interosseous
  - FDP strength - ring and small finger

- Sensory evaluation may include
  - Two point discrimination - <5-6mm
  - Semmes-Weinstein monofilament evaluation
  - Subjective evaluation of light touch sensibility
Pathology Based on Location

LABCN compression
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Differential Diagnosis

LACN compression from Biceps tendon
Distal Biceps Rupture
Etiology

• Occurs in dominant arm
  – 86%

• Predominantly male
  – 93%

• Mechanism of injury
  – Sudden elongation of biceps during eccentric contraction

• Increased risk with anabolic steroid users

• Smokers
  – 7.5x higher risk of rupture
Etiology

- Dominant arm of middle aged men
- Single traumatic event in which an unexpected extension force is applied to an arm flexed to 90°
- Rupture from radial tuberosity
  - w/wo lacertus rupture
- Pathogenesis
  - Tendon degeneration
  - Hypovascularity
Complete Rupture

- Sudden sharp tearing sensation
- PE
  - Variable weakness
  - TTP antecubital fossa
    - Ecchymosis
  - Palpable defect
  - Retraction deformity
    - Less if lacertus intact
Partial Biceps Tear

- Distal Biceps Tendinosis: Evidence-Based Review
  Micah C. Hobbs, DO, Joe Koch, BS, H. Brent Bamberger, DO
  Grandview Hospital, Dayton, OH;
  and Innovative Resources Consulting, Dayton, OH
Imaging

- **X-rays**
  - Usually normal
  - Tuberosity avulsion

- **MRI**
  - Tendon absence or thickening (T1)
  - Edema at tuberosity (T2)
Pronator Syndrome
Etiology

- Compressive neuropathy of median nerve at level of the elbow
  - More common in women
  - Associated with well developed forearm muscles
    » Weight lifters
- Can be assoc with medial epicondylitis
Clinical Presentation

• Similar to CTS

• Differentiate Pronator Syndrome vs CTS
  – Dull pain over prox volar forearm
  – Sensory disturbances to *palm* of hand ---> palmar cutaneous branch
  – Night symptoms not as common
  – Symptoms often made worse with repetitive pronation-supination
Imaging/Electrodiagnostic Studies

- Plain films of elbow useful to rule out supracondylar process
- EMG with NCS
  - Not common to be confirmatory
  - Can help rule out further sites of compression
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Thank You