Differential Diagnosis of Lateral Elbow Pain

Live 2019 Update

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Differential Diagnosis of Lateral Elbow

Course objectives

– Verbalize the key anatomic structures that could be involved with lateral elbow pain: humeroradial joint, extensor carpi radialis brevis (ECRB), extensor digitorum communis (EDC), lateral ulnar collateral ligament, and radial nerve

– Recognize when special tests are needed to rule out posterolateral rotatory instability

– Perform a systematic clinical examination to determine the pain-generator
Chapter One

Anatomy of the Lateral Elbow
The Elbow

Pain reference

- More reliable than shoulder
- Localized to the area
- Moderately trustworthy
The Elbow Complex

- Humeroulnar
- Humeroradial
- Proximal radioulnar
- (Distal radioulnar)
Elbow Anatomy
Elbow Anatomy (cont.)

Humeroradial joint (HRJ)

- Can be a source of pain at the lateral elbow
Humeral Capitulum
Radial Head

Anterior, left elbow

Radial Head in Supination

Radial Head at rest position
Radial Head Asymmetries

Radial Head Asymmetries (cont.)

Asymmetries in the radial head
Radial Head Asymmetries  (cont.)

- Neutral between pronation and supination

- Full pronation and/or supination

Stability Through Force Closure

Loading (such as grip), provides stability to the HRJ
Proximal Radioulnar Joint (PRUJ)

Maximal loose-packed position (MLPP)
- 70 degree flexion
- 35 degree supination
PRUJ: Radial Notch

Lateral Epicondyle  |  Medial Epicondyle
Lateral           |  Medial

Distal-Proximal Axial Cut

Ulna
Elbow Anatomy

Capsule and Ligamentous Support
Elbow Complex Capsule: Anterior

• Not as important biomechanically
• More important clinically: very thick

Elbow Complex Capsule: Posterior

- Not very extensive vs. anterior capsule
- The posterior portion of the capsule can become entrapped between the radial head and capitulum

Elbow Complex: Capsular Plica

- **Plica**: redundancy of the capsule (develops embryonically)
- Can become painful
- **Posterior plica**: can become irritated with elbow extension (especially hyperextension)
Lateral Ligaments

These ligaments do not provide strong stabilization to the lateral aspect of the elbow.

- Lateral Collateral Ligament (LCL)
- Radial annular ligament
Lateral Ligaments (cont.)

- This is the most important lateral stabilizer
- Limits valgus stability from 0 to 140 degrees

Lateral ulnar collateral ligament (LUCL)
Lateral Ligaments (cont.)

- The lateral ulnar collateral ligament (LUCL) arises from the lateral epicondyle and inserts onto the proximal ulna.
- Taut in both elbow flexion and extension.

Lateral Ligaments (cont.)

- Lateral ulnar-collateral ligament (LUCL): most important stabilizer to prevent posterior lateral rotatory instability (PLRI)
- PLRI: PRUJ is intact
  - Forearm moves as a unit

Annular Ring

- The proximal portion is cartilage (Type I collagen), the distal portion synovial tissue
- The radial head translates during pronation and supination; but the primary function of annular ring is to protect radius from inferior dislocation

Annular Ring (cont.)

- Attaches from coronoid process to coronoid process
- Synovial fold can become thickened, which can become a pain generator
Medial Ligaments

Bundles: anterior, posterior, intermediate (or transverse)

Medial Ligaments (cont.)

- Anterior bundle
- Restrains pronation of the ulna on the humerus

Medial Ligaments (cont.)

- Anterior bundle
- “The maximum valgus and internal rotatory instability after transection of the anterior band, 11.7 degrees and 11.2 degrees respectively, were found at elbow flexions of 30 degrees and 40 degrees"

Elbow Anatomy

Muscles
Lateral Group: Brachioradialis
Lateral Group: Extensor Carpi Radialis Longus (ECRL)
Lateral Group: Extensor Carpi Radialis Brevis (ECRB)
Lateral Group: Extensor Digitorum Communis (EDC)
Lateral Group: Extensor Carpi Ulnaris (ECU)
Lateral Group: Anconeus
Supinator
The Pathway of the Radial Nerve
Irritation Sites

- Fibrous bands: thickened fascia superficial to the HRJ
- ECRB
- Leash of Henry: vascular network/branches of the radial artery
- Arcade of Frohse: tendinous portion of the supinator
  - Most common site
- Supinator

Chapter Two

Pathomechanics of Lateral Elbow Pain
Etiologies

• Musculotendinous
• Articular
• Ligamentous
• Neural
Lateral Epicondylosis

- Common condition for which people seek therapy
- Numerous etiologies present similarly
- A systematic examination helps a therapist identify the pain generator to formulate a structure-specific plan of care
Extensor carpi radialis brevis

- “In patients with lateral tennis elbow, the origin of the extensor carpi radialis brevis is always more or less involved”
Lateral Epicondylosis (cont.)

Patient history: age

- Most prevalent in the forth decade of life (19% of population 30 to 60 years of age)
- Women more severe than men
- Duration: six months to two years
- Commonly recurs

# Lateral Elbow Pain: Musculotendinous Tendinopathy extensors

<table>
<thead>
<tr>
<th>“Self limiting disorder”</th>
<th>“Non self limiting disorder”</th>
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<tbody>
<tr>
<td>Spontaneous healing within 8 to 12 months(^1)</td>
<td>No spontaneous healing(^2)</td>
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Lateral Elbow Pain: Musculotendinous (cont.)

Etiologies

- Too much load, or too little load-ability
- Overuse
- Degeneration: tendinosis
- Hypomobility HRJ synovitis: capsule hypertrophy
- Hypermobility HRJ
- Limits in the chain
- Technique
- Increased sympathetic activity and decreased vascular supply
Lateral Elbow Pain: Musculotendinous (cont.)

Decreased loadability

- Age: highest incidence in 40 to 49 year olds
- Decreased collagen integrity and vascular supply

Lateral Elbow Pain: Musculotendinous (cont.)

Overuse

- The ECRL and ECRB remain the only active synergistic muscles during grasping
- Increased grip → decreased blood supply → ischemia and anaerobic crisis
- Result: fatigue and overload, especially eccentric
- Fatigue effects are generally larger in extensors vs. flexors
Lateral Elbow Pain: Musculotendinous (cont.)

Tendinosis

- Consequence of a degenerative and avascular processes
- Associated with degenerative tendon microtears in response to cumulative loading

Tendinosis

- Non-inflammatory response in the tendon
- Has been named angiofibrioblastic tendinosis
- Consequence of a degenerative and avascular processes
- Characterized by disorganized immature collagen formation in association with immature fibroblastic and vascular elements

Lateral Elbow Pain: Musculotendinous (cont.)

Tendinosis

- Gross pathologic presentation: grayish edematous friable material
- The location is in 100% in ECRB, and additionally in EDC in 35%
- 20% of patients have associated bony exostosis at the lateral epicondyle

Lateral Elbow Pain: Musculotendinousous (cont.)

- Sympathetic nervous system
  - Increased duration leads to increased activity of the autonomic nervous system
  - Increased tissue susceptibility
  - Increased sensitization and pain

- Incidence of median, radial and ulnar nerve sensitivity greater in patients with chronic lateral epicondylitis

Fernández-de-Las-Peñas C, Ortega-Santiago R, et al. Specific mechanical pain hypersensitivity over peripheral nerve trunks in women with either unilateral epicondylalgia or carpal tunnel syndrome. JOSPT. 2010; 40(11):751-60.
Lateral Elbow Pain: Musculotendinous (cont.)

Vascular compromise

- Undersurface of the tendon is essentially hypovascularized
- May contribute to vulnerability of the tissue
- Noted reduction of healing response and possible contribution to tendinosis

Lateral Elbow Pain: Articular

“Some painful syndromes of the lateral side of the elbow are not related to tendinitis or to posterior interosseous nerve compression, but have an intra-articular origin”

Lateral Elbow Pain: Articular (cont.)

Etiologies

- Osteocartilagenous
- Capsular
- Ligamentous

Lateral Elbow Pain: Articular (cont.)

- **Capsular**
  - Plica
  - Traumatic synovitis
  - Non-traumatic synovitis

- **Ligamentous**
  - Annular ring
  - Lateral ulnar collateral ligament (LUCL)

Lateral Elbow Pain: Articular (cont.)

- Capsular
- Plica
  - Consequence of an insertion redundancy

Lateral Elbow Pain: Articular (cont.)

- Capsular
- Synovitis
  - Traumatic vs. non-traumatic
  - Synovial fold
  - Can result in capsular hypertrophy

Lateral Elbow Pain: Ligamentous

Ligamentous

- Annular ring
- Lateral ulnar collateral ligament (LUCL)
  - Posterior lateral rotatory instability (PLRI)
  - Most common form of elbow instability

Posterolateral Rotatory Instability

• Patient history: LUCL injury = PLRI
• Most common form of instability
• **Acute traumatic event:** fall on an outstretched hand with the forearm in supination, causing an axial load in the valgus direction
  – Results in disruption of the stabilizing structures starting laterally and progressing medially

Patient History

Complaints

– Nonspecific lateral elbow pain
– Painful snap or click
– Occasional locking with possible giving way
– Symptoms while pushing up from prone with the forearm in supination
– Apprehension in extension and supination

Lateral Elbow Pain: Ligamentous

- Case of three middle-aged women who presented with atraumatic lateral epicondylitis with clinical findings consistent with PLRI
- Underwent debridement and reconstruction of LUCL

Posterior Lateral Rotatory Instability (PLRI)

Mechanism of dislocation

- Combination of valgus and supination with axial compression during flexion

Spectrum of Instability

0
Reduced

1
PLRI

2
Perched

3
Dislocated

Axial compression
Supination

Posterolateral Rotatory Instability (PLRI)

- Most common
- Ulna “supinates” away from the trochlea
- Involves combination of axial forearm rotation and valgus

Valgus Instability

Corresponding overload on the lateral side

- HRJ chondromalacia, osteophytes, loose bodies

Radial Tunnel Syndrome

Sign and symptoms

- Localized tenderness over the radial nerve, approximately five cm distal to the lateral epicondyle
- Patients typically report aggravated pain at night that may interfere with sleeping
- Arm fatigue is a common clinical presentation

Radial Tunnel Syndrome (cont.)

Relationship to tennis elbow

- It is estimated that radial tunnel syndrome is present in 5% of patients diagnosed with lateral epicondylitis
- Radial tunnel symptoms increase with use of the tennis elbow strap

Lateral Elbow Pain: Nerve

“The tendinous arcades of the ECRB and supinator will compress the radial nerve when the elbow is in extension, pronation with wrist flexion”

Irritation Sites

- Fibrous bands: thickened fascia superficial to the HRJ
- ECRB
- Leash of Henry: vascular network/branches of the radial artery
- Arcade of Frohse: tendinous portion of the supinator
  - Most common site
- Supinator

Classification

- **PIN inflammation** in radial tunnel
  - No motor weakness: radial tunnel syndrome

- **PIN compression**
  - Compression in the tunnel
  - Increased motor weakness: PIN syndrome

Classification (cont.)

- **Radial tunnel syndrome:** predominant complaint is pain
- **PIN syndrome:** predominant complaint is weakness (with ECRL preserved)

Chapter Three

Clinical Examination
So How Do We Know What’s Causing the Problem?

- Tendon
- Joint
- Nerve
Lateral Epicondylosis: Proximal Screen

- Rule out external rotator cuff impingement
- Referred pain to the deltoid, but can occur distally to the lateral elbow

Lateral Epicondylosis: Proximal Screen (cont.)

Scapular dyskinesia

External rotator cuff impingement
- C5 referral pattern
Limits in the Chain

• 123 patients with unilateral symptoms, 75 men and 48 women with a mean age of 43 years (19 to 63) and a mean symptom duration of eleven months (0.5 to 72)

• In patients with unilateral radial epicondylalgia, almost all measured ROMs of the elbow and wrist were found to be limited in the affected arm

Solveborn SA, Olerud C. Radial epicondylalgia (tennis elbow) - measurement of range of motion of the wrist and the elbow. JOSPT. 1996; 23(4): 251-257.
Limits in the Chain (cont.)

• 23 patients with unilateral symptoms, 18 men and 5 women with a mean age of 43 years (19 to 63) and a mean symptom duration of 16 months

• In patients with unilateral radial epicondylalgia, shoulder ER was significantly reduced on the affected side (P = 0.038)

Lateral Epicondylosis: Testing
Active and Passive Elbow Flexion

- Look for
  - Quantity
  - Quality: end feel
- Test in
  - Full supination
  - Forearm neutral
  - Full pronation
Active and Passive Elbow Extension

• Look for
  – Quantity
  – Quality: end feel

• Test in
  – Full pronation
  – Full supination
Wrist Extension with RD and UD

- Positive extension with RD > extension with UD
  - ECRB and/or EDC tendinopathy
- Positive extension with RD = extension with UD
  - Suspect HRJ chondropathy
  - Perform special tests
Lateral Epicondylosis: Testing

- **Most** will have positive wrist extension
- We need extra tests
- First, add wrist extension with RD and UD
  - Positive RD and negative UD → lateral epicondylosis
  - Positive RD and positive UD → HRJ
Metacarpophalangeal Extension

• Positive pain IF and MF
  – Suspect ECRB tendinopathy
• Positive pain IF through SF
  – Suspect EDC tendinopathy
• Positive pain middle finger only
  – Suspect radial nerve
  – Confirm with resisted supination, tinel sign, scratch collapse test, and upper limb neurodynamic testing
ECRB: Proximal Attachment

Exam findings

- Most pain with wrist extension with RD
- Mild pain with passive wrist flex
- Most pain with MP extension of IF and MF
- Tenderness over five mm by five mm cube on the top of the lateral epicondyle
- Very common
EDC: Proximal Attachment

Exam findings

- Most pain with wrist extension with RD
- Mild pain with passive wrist flex
- Most pain with MP extension of IF, MF, RF, SF
- Tenderness over anterior lateral epicondyle
- Relatively common in concert with the ECRB

Special Tests

Likelihood ratio (LR): allows the clinician to determine the probability that a target pathology is present by relating the result of the test with the pre-test probability

- LR more than one indicates that the test result is associated with the pathology
- LR close to one has little clinical significance
- Diagnostic accuracy of any test is considered useful if
  - Positive (+) LR is 2.0 or greater
  - Negative (-) LR is 0.50 or less

How are likelihood ratios calculated?

- The LR of a positive test result (+LR) is sensitivity divided by one minus the specificity.
- The LR of a negative test result (-LR) is one minus the sensitivity divided by specificity.

Special Tests (cont.)

- **Pull (Wolff) test**: HRJ chondropathy
- **Humeroradial joint position test**: malalignment, plica
- **O’Driscoll or pivot shift test**: posteriolateral rotatory instability (PLRI)
- **Push up sign**: posteriolateral rotatory instability (PLRI)
- **Chair sign**: posteriolateral rotatory instability (PLRI)
- **Valgus stress test**: MCL/HRJ chondropathy, PLRI
- **Resisted forearm supination**: radial tunnel
- **Upper limb neurodynamic test number two**: radial tunnel
- **Grip test**: lateral tendinopathy
**HRJ Chondropathy: Pull (Wolff) Test**

- **Indications:** pain with both wrist extension with RD and wrist extension with UD
- **Patient performs resisted wrist extension against examiner’s forearm**
- **Repeat test with distal pull at radius**

**Step one**
HRJ Chrondropathy: Pull (Wolff) Test (cont.)

- Positive test: decreased pain with distal pull
- If pain increases: more likely a tendinopathy
HRJ Chondropathy

- Evaluated via arthroscopy the articular cartilage in 31 elbows undergoing surgery for lateral epicondylosis
- Results: cartilage injuries of the capitulum were found in 65% of cases and cartilage injuries of the radial head found in 81% of cases
  - The absence of ECRB tears was independently associated with a higher risk of cartilage injuries of the capitulum
- Conclusion: cartilage injury was frequently found in the lateral edge of the capitulum and radial head

Special Tests: Malalignment, Plica

**Humeroradial joint position test**

- Monitor radial head position as you transition from passive elbow flexion to extension.
- Feel HR joint line to appreciate thickness and texture of a plica, which may be irritated.

*Step one*
Special Tests: Malalignment, Plica (cont.)

Humeroradial joint position test

- Positive (+) test: increased motion of radial head in a posterolateral direction
- Next, perform joint specific testing to localize the problem

Step two
Special Tests: PLRI

O’Driscoll or pivot shift test

- Patient supine and the arm overhead
- Supination and valgus moments with axial compression applied during flexion causing the radius and ulna to subluxate maximally at approximately 40 degrees to 70 degree flexion

Special Tests: PLRI (cont.)

- Place the patient’s elbow in an extended position to begin the test.
- While palpating the HRJ, provide a supination force at the forearm and valgus moment at the elbow with axial compression as you flex the patient’s elbow.
- If positive, the radius and ulna will sublux at approximately 40 degrees to 70 degree flexion.
“A limitation of the pivot shift test for posterolateral instability of elbow test is that it requires general anesthesia to optimize accuracy”

– Not recommended provocative test
Special Tests: PLRI (cont.)

- Positive LR: 0.87
- Negative LR: unable to calculate
- **Active apprehension test**
  - Patient is required to perform an active floor push up
  - Positive push up sign: apprehension or dislocation with terminal extension

Special Tests: PLRI (cont.)

Chair sign

• Positive LR: 0.87
• Negative LR: unable to calculate

• Active apprehension test
  – Patient is required to stand from the sitting position by pushing on the seat with the hand at the side and the elbow fully supinated

Special Tests: PLRI (cont.)

- Positive chair sign: apprehension or dislocation with terminal extension
- Reluctance to fully extend elbow

Axial load, valgus, supination of forearm

Special Tests: PLRI (cont.)

- Push up sign
- Chair sign
- If positive: refer to MD
Valgus Stress Test

- **Valgus stress with forearm pronation:** instability present in this position indicates the MCL is deficient
- **If instability is present with both supination and pronation:** posteriolarateral rotatory instability (PLRI)

Valgus Stress Test (cont.)

Forearm pronation

Forearm supination

Valgus Testing

“Valgus stress is applied to a pronated forearm, only the medial structures of the elbow are tested… Instability that is present in this pronated position actually indicates that the medial collateral ligament is deficient; If increased in pronation and supination: PLRI”

Moving Valgus Stress Test

- Patient is upright with shoulder abducted to 90 degrees
- Therapist support the upper arm with the elbow in maximum flexion
- Moderate valgus torque is provided until the shoulder reaches its limit of external rotation
- The elbow is then rapidly extended to 30 degrees while maintaining the valgus torque
  - LR: infinity
  - LR: 0.05

- MCL insufficiency
  - “Shear Angle” Pain Zone
  - Sensitivity = 1.0
  - Specificity = 0.75

Moving Valgus Stress Test (cont.)

- MCL insufficiency
- **Positive test**
  - Must reproduce patient’s medial elbow pain at the MCL
  - Pain should be maximal between 120 degrees and 70 degrees of flexion (shear angle) as opposed to total arc of movement (shear range)

Resisted Forearm Supination

Positive (+) test elicits pain at the radial tunnel

Tinel Sign

- Tap four to five cm distal to the lateral condyle at the radial tunnel
- Positive (+) test: reproduction of nerve symptoms
Scratch Collapse Test

Technique

- The therapist provides resistance with shoulder ER
- The area of the radial tunnel is lightly stroked
- The resistance is reapplied to determine if a change in strength is detected

Scratch Collapse Test (cont.)

**Technique**

- The therapist provides resistance with shoulder ER
- The area of the radial tunnel is lightly stroked
- The resistance is reapplied to determine if a change in strength is detected

Scratch Collapse Test (cont.)

- Positive test: sudden loss in strength
- Proposed mechanism: when the nervi-nervorum at the site of the neuritis is stimulated, an ipsilateral central inhibition is transiently activated

Special Tests: Radial Nerve

• Upper limb neurodynamic test (ULNT) vs. upper limb tension test (ULTT)
  – “Neurodynamic” encompasses the neurophysiological aspects of mechanosensitivity

• Test the active movement first: if negative, then you do not need to test passively

• Looking for a hyperalgesic response
  – Hyperalgesia: increased response to a stimulus that is normally painful
  – ULNT may be more sensitive on the involved side
  – This is why we need to test the uninvolved side first

Upper Limb Neurodynamic Test Number Two: Radial

• Active test

• Passive test
  – Thumb flexion
  – Wrist flexion and UD
  – Forearm pronation
  – Elbow extension
  – Shoulder abduction

Upper Limb Neurodynamic Test Number Two: Radial (cont.)

Passive test

- Thumb flexion
- Wrist flexion and UD
- Forearm pronation
- Elbow extension
- Shoulder abduction

Grip Test

• Using a handheld dynamometer, patient performs three consecutive trials for the involved and uninvolved UE
  – At 90 degrees of elbow flexion
  – At full elbow extension
• Patient is asked to rate their pain from mild to severe

Chapter Four

Live 2019 Update
Lateral Elbow Pain

Updates regarding our understanding of pain with more chronic conditions
Lateral Elbow Pain: Presentation of Pain

• Purpose: to evaluate the influence of pain sensitization on the prognosis of lateral epicondylitis (LE) treated by self-stretching and use of a counterforce brace

• N=131 patients with LE symptoms for under six months
  – Measured pain sensitization by assessing pressure pain thresholds (PPTs) in the uninvolved middorsal forearm and administering a pain sensitization questionnaire (PSQ)

Lateral Elbow Pain: Presentation of Pain (cont.)

Pain sensitivity questionnaire (PSQ)

- 17 items grading how painful a situation would be (0 to 10 pain scale)
  - Bumping shin badly on a hard edge
  - Imagine burning tongue on a very hot drink
  - Imagine muscles are slightly sore as a result of physical activity
  - Imagine you trap your finger in a drawer
  - Imagine you take a shower with lukewarm water
  - Imagine you have a mild sunburn on your shoulders, etc.

Lateral Elbow Pain: Presentation of Pain (cont.)

• Used the self-administered questionnaire: disabilities of the arm, shoulder and hand (DASH) score to determine functional status

• Results
  – Higher pain sensitization measured by PPTs and PSQ scores correlated with increased DASH score and longer symptom duration
  – Pain sensitization measured by PPTs and PSQ scores correlated with initial symptom severity and duration and was associated with poor prognosis in terms of improved DASH scores for nonsurgical treatment for lateral epicondylitis

Lateral Elbow Pain: Presentation of Pain (cont.)

- Lim et al., evaluated the conditioned pain modulation (CPM) in lateral epicondylalgia patients compared with controls, and to better understand the relationship between CPM and clinical pain measures in lateral epicondylalgia

- What is the conditioned pain modulation?

Conditioned pain modulation (CPM)

- **Definition:** conditioned pain modulation is a psychophysical experimental measure of endogenous pain inhibitory pathway in humans; the “pain inhibits pain” phenomena

- CPM paradigms consist of the evaluation of a painful test stimulus followed by a second stimulus after the painful conditioning stimulus has been withdrawn

  • In most subjects the pain intensity experienced with the test stimulus will be reduced during or immediately after exposure to the conditioning stimulus

Lateral Elbow Pain: Presentation of Pain (cont.)

Conditioned pain modulation (CPM)

– “There is great interest in the science and conduct of CPM testing as there is a growing body of evidence suggesting that CPM may be an important biomarker of chronic pain and a predictor of treatment response”

Lateral Elbow Pain: Presentation of Pain (cont.)

- N=20 with lateral elbow pain for on average for 10.2 months
- Diagnostic criteria: pain over the lateral epicondyle with gripping, resisted wrist or middle finger extension or palpation of the lateral epicondyle in conjunction with reduced pain-free grip
- Tested the pressure pain threshold (PPT) at the lateral epicondyle before and during the heat pain-conditioning stimulus (applied over the left calf)
  - After three minutes of the heat stimulus retested grip strength and reassessed PPT

Lateral Elbow Pain: Presentation of Pain (cont.)

• **Results**
  – Unlike the pain-free control group, individuals with lateral epicondylalgia did not exhibit the conditioned pain modulation

• **Discussion**
  – Those with lateral epicondylalgia might contribute to ongoing nociceptive afferent input and increase the excitability of spinal cord neurons
  – Further studies are required to better understand the relationship between heightened spinal cord excitability and less efficacious conditioned pain modulation in chronic pain

Primary aim of study: to examine the association between tendon structural and sensory characteristics in people with chronic lateral epicondylalgia

N=66

- Diagnostic criteria: lateral elbow pain present for a minimum of six weeks aggravated by palpation, gripping, and resisted wrist/finger extension

Evaluated the tendon structural changes with static ultrasound images and sensory changes using quantitative sensory testing: PPT, cold pain threshold, heat pain threshold, and vibration detection threshold

Lateral Elbow Pain: Presentation of Pain (cont.)

• Results
  – Few structural characteristics are related to sensory system changes, and in many cases the relationship is conflicting
  – The more severe clinical symptoms were associated with less severe structural and sensory characteristics

• Discussion
  – Pain in tendinopathy may be derived from the increased expression of nociceptive substances near or in the peritendon

Lateral Elbow Pain: Presentation of Pain (cont.)

Discussion

- The nociceptive stimulation from the peritendon may occur due to increased tendon thickness or a reactive process in the healthy load-bearing portion of the tendon in response to the inability of the degenerative tendon to transmit tensile load.

- This reactive-on-degenerative model may explain the lack of association between structural tendon changes and sensory and clinical characteristics in lateral epicondylalgia, as the size and severity of the degenerative tendon are not responsible for the magnitude of nociception in this model.

Lateral Elbow Pain

Updates with Articular Issues
Lateral Elbow Pain: Intra-articular Issues

Synovial plica

- The presence of a pathologic radiocapitellar synovial plica is a potential source of lateral elbow pain
- Normally, existing plicae have no known function and do not cause any symptoms
- Humeroradial synovial plica is quite common in throwing athletes and golfers


Synovial plica

- Rajeev and Pooley reviewed the outcome of 121 patients who underwent arthroscopic resection of the humeroradial synovial plica for persistent lateral elbow pain
- **Clinical presentation** (in addition to lateral elbow pain): catching or snapping sensation and locking in extension
- Pain in the humeroradial synovial plica may be due to pain fibers in the folds, as well as a release of cytokines and other inflammatory mediators
  - Entrapment of abrasion of the synovial fringe also leads to the development of chondromalacia and pain
Lateral Elbow Pain and OCD

Osteochondritis Dissecans (OCD)

- History: OCD of the capitellum occurs due to repetitive compression at the radiocapitellar joint from either excessive valgus or axial loading (i.e., overhead throwing)
  - Highest incidence: youth baseball players from 1 to 7%
- Clinical presentation: progressively worsening pain over the lateral aspect of elbow, decreased ROM and mechanical symptoms that may interfere with athletic performance
  - Almost exclusive to the dominant arm
    - On physical exam, the most common finding is tenderness over the radiocapitellar joint or capitellum with the elbow maximally flexed

Lateral Elbow Pain and Intra-articular Issues

- Retrospective review describing a novel arthroscopic treatment involving resection of the capsulosynovial fringe for symptoms mimicking lateral epicondylitis
- N=35, follow up: 9.2 years
- Pain scores decreased from 8/10 to 0/10
- Author’s opinion: the degenerative capsular fold that impinges on the radial head becomes interposed in the anterior or posterior portion of the radiocapitellar joint which causes typical lateral epicondylitis symptoms that are exacerbated by contraction of the strong wrist extensors

New diagnostic tool for lateral elbow pain, as no tests have been designed to investigate the anterior and posterior compartments of the elbow

Two new clinical tests
  - SALT: supination and anterolateral pain test
  - PEPPER: posterior elbow pain by palpation-extension of the radiocapitellar joint

N=10 atraumatic lateral elbow pain unresponsive to conservative treatment

In 90% of patients, at least one test was positive
  - All patients with signs of lateral ligamentous patholaxity or intra-articular abnormal findings had a positive (+) response to at least one of the two tests

Lateral Elbow Pain and Intra-articular Issues (cont.)

Potential pain generators

- Lateral epicondyle
- Anterior capsule and synovial tissue
- Posterior aspect of humeroradial joint (aka: radiocapitellar joint)
Special Tests: Intra-articular Issues and Synovitis

- **SALT (supination and anterolateral pain test):** high sensitivity but a low specificity and is accurate in detecting the presence of intra-articular abnormal findings, especially synovitis.

- **PEPPER (posterior elbow pain by palpation-extension of the radiocapitellar joint):** was sensitive, specific and accurate in the detection of radial head chondropathy.

SALT: Supination and Antero-Lateral Pain Test

- Slide your finger from the lateral aspect of the radial head to the anterior aspect while simultaneously supinating the forearm.

- **Indications**
  - Localized pain anterior to the radial head.

Arrigoni et al, 2017
SALT: Supination and Antero-Lateral Pain Test (cont.)

- Slide your finger from the lateral aspect of the radial head to the anterior aspect while simultaneously supinating the forearm.

- **Indications**
  - Localized pain anterior to the radial head.

Arrigoni et al, 2017
SALT: Supination and Antero-Lateral Pain Test (cont.)

Positive (+) test: reproduction of anterior elbow pain, indicating the presence of at least one intra-articular finding, especially synovitis

Arrigoni et al, 2017
Positive (+) test: reproduction of anterior elbow pain, indicating the presence of at least one intra-articular finding, especially synovitis.
SALT Test Video
PEPPER: Posterior Elbow Pain by Palpation-extension of the Radiocapitellar Joint

- Using your thumb, place pressure at the level of the joint while extending the elbow
- **Indications**
  - Localized pain on the posterior aspect of the radiocapitellar joint

Arrigoni et al, 2017
PEPPER: Posterior Elbow Pain by Palpation-extension of the Radiocapitellar Joint (cont.)

- Using your thumb, place pressure at the level of the joint while extending the elbow

- **Indications**
  - Localized pain on the posterior aspect of the radiocapitellar joint

Arrigoni et al, 2017
Positive (+) test: reproduction of posterior elbow pain, indicating radial head chondropathy
Positive (+) test: reproduction of posterior elbow pain, indicating radial head chondropathy
PEPPER Test Video
Lateral Elbow Pain: Intra-articular Issues

- Systematic review to determine if joint mobilizations are effective in improving pain, grip strength, and disability in adults with lateral elbow tendinopathy
- Evaluated 20 studies
- Conclusion: there is compelling evidence that joint mobilizations have a positive effect on both pain and/or functional grip scores across all time frames compared to control groups in the management of lateral elbow tendinopathy

Lateral Elbow Pain: Updates with Ligamentous Issues
Lateral Elbow Pain and PLRI

• Objectives
  – To evaluate the inter- and intra-observer reliabilities of MRI for the diagnosis of lateral epicondylitis
  – To examine whether the degree of tendon injury was related to other elbow abnormalities on MRI
  – To investigate the correlation between elbow abnormalities on MRI and patient symptoms

• Methods
  – 51 subjects with chronic lateral elbow pain; average duration of symptoms: 2.3 years

Lateral Elbow Pain and PLRI (cont.)

• Results
  – Other than extensor injuries, radial collateral ligament (RCL) and lateral ulnar collateral ligament (LUCL) injury was the most common accompanying elbow abnormality
  – Significant correlation between the degree of extensor tendon injury and RCL/LUCL injuries
  – Also significant correlation between the degree of RCL/LUCL injuries and Visual Analogue Score (VAS)

• Conclusion
  – In addition to extensor tendinopathy, RCL/LUCL abnormality was the most common accompanying finding
  – The degree of RCL/LUCL injuries positively correlates with severity of pain

Lateral Elbow Pain and PLRI (cont.)

Posterolateral rotatory instability (PLRI)

- “Lateral elbow pain may have several etiologies, including lateral plica, radial tunnel syndrome, radiocapitellar cartilage lesions and posterolateral rotatory instability (PLRI) which may coexist with other etiologies. In PLRI-induced lateral elbow pain, the characteristic of pain is usually provoked by leaning on the hand in a slight flexion and forearm in supination”

- Described a surgical reconstruction for 36 patients with chronic lateral elbow pain with a nontraumatic PLRI

Lateral Elbow Pain and PLRI (cont.)

Additional test for PLRI

- Previously discussed the Push Up Sign and Chair Sign for assessment of a PLRI
- The table-top relocation test helps to differentiate between a PLRI and intra-articular injury
- Performed in three steps


Lateral Elbow Pain and PLRI (cont.)

Table-top relocation test

- Set up position: patient grasps the outer edge of a table and performs a press up maneuver with the olecranon pointing laterally


Lateral Elbow Pain and PLRI (cont.)

Table-top relocation test

   – Step one

• Patient is then asked to push down through the hand on the edge of the table, allowing the elbow to flex
• Positive (+) test: pain and apprehension occurs at about 40 degrees of flexion


Lateral Elbow Pain and PLRI (cont.)

Table-top relocation test

- Step two
  - This is repeated with placing your thumb over the radial head
  - Symptoms of pain and instability should be relieved as the thumb prevents posterior subluxation of the radial head
  - Positive (+): alleviation of pain

Lateral Elbow Pain and PLRI (cont.)

Table-top relocation test

  – Step three
    • The therapists’ thumb is removed during mid-elbow flexion
    • Positive (+) test: pain and apprehension return

Table-top relocation test

- If pain and apprehension occur during steps one and three and are relieved during step two, this reinforces the diagnosis of posterolateral instability and helps to exclude intra-articular injury.
Lateral Elbow Pain and PLRI (cont.)

- The push up sign, chair sign, and table-top relocation test all use the patient’s body weight to create an axial load and valgus torque on the elbow, resulting in posterolateral subluxation
  - However, they do not determine the severity of the instability
- The authors presented that dynamic fluoroscopy and ultrasound can readily show PLRI in many cases, further research and validation in the clinical setting is needed

Lateral Elbow Pain and PLRI (cont.)

• Retrospective review of 14 patients with chronic lateral elbow pain and insufficiency of the lateral ulnar collateral ligament
• They found the number of steroid injections and number of cases receiving steroid injections more than three times were significantly higher in patients with ligament insufficiency
• Conclusion: assessment of stability is important in patients with chronic lateral elbow pain and risk factors such as multiple steroid injections

122 elbows diagnosed with intractable lateral epicondylitis underwent arthroscopy

- None of the elbows demonstrated instability on physical exam
- Under anesthesia, the elbows were examined for subtle instability via fluoroscopy and divided into two groups: stable and unstable
Lateral Elbow Pain and PLRI (cont.)

• **Results**
  
  – 17 elbows (13.9%) had subtle instability
    
    • The preop VAS was higher in this group as well as a history of multiple corticosteroid injections
  
  – 15 elbows showed subtle instability among 28 elbows with abnormal MRI findings

• **Conclusion**

  – Recommended to consider checking for subtle instability, especially when patients have a history of multiple corticosteroid injections (at least three) or severe pain and positive MRI

Special Tests

- **Plica:** history of catching or snapping sensation and locking in extension
- **PLRI:** history of multiple corticosteroid injections
  - In addition to push up sign and chair sign, can perform the table-top relocation test
- **Chondropathy:** PEPPER test (posterior elbow pain by palpation-extension of the radiocapitellar joint test)
- **Intra-articular issue with synovitis:** SALT test (supination and antero-lateral pain test)
Lateral Elbow Pain: Assessing the Kinetic Chain
Assessing the Kinetic Chain

Looking proximally at the shoulder

- Case-control study: assessed scapular alignment and shoulder strength
- N=51 with unilateral LE with 51 age-matched controls
- Diagnostic criteria
  - Pain with palpation over the lateral epicondyle or ECRB muscle
  - Pain with resisted wrist extension
  - Pain with passive stretch to the wrist extensors

Assessing the Kinetic Chain (cont.)

- Assessed scapular position with the lateral scapular slide test (LSST)
- Measured the distance between the inferior angle of each scapula and the closest spinous process using a tape measure in three positions:
  - Arms at side in neutral
  - Hands on hips (lateral iliac crests) with thumbs pointed posteriorly
  - Shoulders in 90 degree abduction with full internal rotation

Assessing the Kinetic Chain (cont.)

- Subtracted the uninvolved measurement from the involved
  - If greater than or equal to 1.5 cm difference, this was considered a positive result, indicating scapular asymmetry
- Then measured strength in the following order: (using hand-held dynamometer: maximum of three reps) patient seated
  - Shoulder internal rotation (IR)
  - Shoulder external rotation (ER)
  - Shoulder abduction

Assessing the Kinetic Chain (cont.)

- Assessed scapular stabilizers: upper trap, middle trap, and lower trap

- **Results**
  - Scapular asymmetry was greater in patients with lateral epicondylalgia vs. controls
  - Shoulder ER strength was significantly weaker than controls
  - The involved side with the lateral epicondylalgia subjects was significantly weaker than the uninvolved side with shoulder abduction, ER, and IR

Scapular Position at Rest

Step one

– Find the spinous process of C7 (typically the most prominent at the lower cervical spine)
Scapular Position at Rest (cont.)

Step two

- To confirm C7, move up to the C6 spinous process and extend the patient’s cervical spine
- You should feel it disappear, due to the anterior translation of the vertebra
Scapular Position at Rest (cont.)

Step three

– Once you find T2, compare the height with the superior angle of the scapula

– This will help you to determine if the scapula is elevated (above T2) or depressed (below T2)

– Normal scapular alignment is T2 to T6
Scapular Position at Rest (cont.)

Step four

– Assess the distance from the medial scapular border to the thoracic spine
– This can determine if the scapula is abducted
Scapular Position at Rest (cont.)

Step five

– Assess the position of the inferior angle in relation to the rib cage

– If it is more prominent, the scapula may be anteriorly-tilted
Assessing the Kinetic Chain Video
Looking Proximally at the Shoulder

• Case study of a 54-year-old women with a five month h/o lateral elbow pain
  – Her scapula presented in an abducted position on the involved side
    • With manual correction into adduction, patient’s grip strength improved by five kg and pain decreased from 7/10 to 0
• Intervention: middle and lower trap strengthening
  – Three sets of ten, two times per day (no specific strengthening for wrist extensors) over ten weeks

Looking Proximally at the Shoulder (cont.)

- **Treatment progression**

- **Outcome**: complete resolution of lateral elbow pain with return to all activities and grip strength improved by 38%

- **Conclusion**: assessment and treatment of scapular musculature warrant consideration in the management of lateral elbow pain

• Cross-sectional study compared 28 patients with symptomatic lateral epicondylalgia and 28 age-matched controls

• **Results:** the involved side with lateral epicondylalgia had significantly lower values for middle trap, lower trap, and serratus anterior strength compared to the uninvolved side

• **Conclusion:** when compared to age-matched controls, impairments of scapular musculature strength and endurance were present in patients with lateral epicondylalgia

• Weakness of the scapular musculature could be a result of lateral epicondylalgia

Looking Proximally at the Shoulder (cont.)

- Aim: compared the normalized eccentric peak torque of the shoulder abductors and ERs using a Biodex isokinetic dynamometer
  - Compared healthy athletes, athletes with tennis elbow, and athletes with golfer’s elbow to help establish proper treatment programs for those with elbow pathologies
- Experimental non-randomized controlled study
- N=30 male elite athletes (weight lifters, volleyball players, and swimmers)

Looking Proximally at the Shoulder (cont.)

• **Results:** a significant increase in the mean values of shoulder abductors and ERs normalized eccentric peak torque in the healthy control group compared with both the tennis elbow and golfer’s elbow groups, which may attribute to the imbalance between the elbow and shoulder joint function in the kinetic chain.

• **Conclusion:** this imbalance tends to decrease the stability of the shoulder and place high stress on the distal joints of the upper kinetic chain.
  – Rehab of the affected joint (elbow) and other joints in the same kinetic chain (shoulder) should be included.

Rotator Cuff Strength

Assessing external rotator (ER) strength

- With patient’s arm at side, perform resisted ER, just proximal to patient’s dorsal wrist with verbal cue, “don’t let me move you”
Rotator Cuff Strength (cont.)

Assessing internal rotator (IR) strength

- With patient’s arm at side, perform resisted IR, just proximal to patient’s volar wrist with verbal cue, “don’t let me move you”
Rotator Cuff Strength (cont.)

Assessing shoulder abductor strength

– With patient’s arm at side, perform resisted abduction with verbal cue, “don’t let me move you”
Assessing the Kinetic Chain Video 2
Scapular Stabilization

• In Ann’s clinical experience, what helps lateral elbow pain patients get better and stay better?

• **Answer:** scapular stabilization of the serratus anterior, middle trap and lower trap, the muscles that tends to be weakest with lateral elbow pain (in Ann’s clinical experience) is the middle and lower traps
Assessing Scapular Stabilizer Strength

Middle trapezius
Assessing Scapular Stabilizer Strength (cont.)

Lower trapezius
Summary

- **Resting scapular alignment**
- **Rotator cuff strength:** strength of the shoulder abductors, internal rotators, and external rotators
- **Scapular stabilizer strength:** especially middle trapezius and lower trapezius
Psychological Factors

- **Purpose:** to investigate whether patients with tennis elbow have a different psychological profile compared with healthy controls
- **Case-control design:** 69 subjects and 100 controls
  - Self-reported questionnaire about big five personality traits: perfectionism, anxiety, depression, work satisfaction, and working conditions

Psychological Factors (cont.)

• **Results:** tennis elbow patients are less agreeable and have more depressive feelings; men: are more perfectionists compared with healthy controls

• **Conclusion:** doctors (and therapists) should take more time during the consultation to adapt their explanations about the condition, as not to increase anxiety or depressive feelings and to strengthen the doctor/therapist-patient relationship

Question and Answer Session
Psychological Factors:

Pain:

Clinical Testing:

Tendon Involvement:

Joint Issues:


Proximal issues (scapular alignment and shoulder strength):


Original Bibliography:


29. Fernández-de-Las-Peñas C, Ortega-Santiago R, et al. Specific mechanical pain hypersensitivity over peripheral nerve trunks in women with either unilateral epicondylalgia or carpal tunnel syndrome. JOSPT. 2010 ;40(11):751-60.
60. Solveborn SA, Olerud C. Radial epicondyalgia (tennis elbow) - measurement of range of motion of the wrist and the elbow. JOSPT.1996; 23(4): 251-257.