What's Up with That Upper Extremity?

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DISCLOSURES:

I have no relevant relationships with ineligible companies to disclose within the past 24 months.

Overview

- Review general history and physical examination of the upper extremity.
- Review specific history, anatomy and special physical exam skills for rotator cuff, elbow and wrist pathology.
- Review treatment options and gold standard imaging for upper extremity pathology.

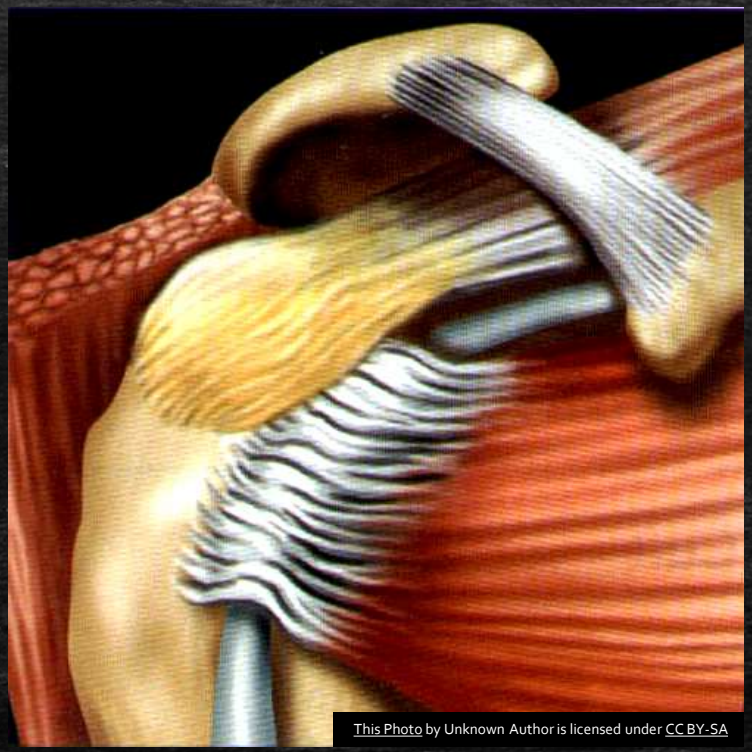
General History

- History of present illness
  - Specific- pain, swelling, skin color changes, deformities, increase warmth, decreased range of motion
  - Disruption of daily activities
- Risk Factors:
  - Age
  - Obesity
  - Smoking
  - Genetics
- Past medical history
  - Specific- HTN, Diabetes, Rheumatoid and/or Osteo-Arthritis, Marfan or Ehler-Danlos syndromes, Gout, Lupus
  - Past trauma or surgeries
  - Work history/activities/hobbies
- Common causes:
  - Overuse and repetitive motions
  - Degenerative changes
  - Trauma

Physical Exam Basics

- Inspection
- Palpation
- Range of motion (ROM)
- Strength against resistance (SAR)
- Sensation
- Pulses

Rotator Cuff Pathology



Rotator Cuff Pathology Epidemiology

- Prevalence
  - Rotator Cuff pathology affects approximately 20% of the population over the age of 60.
- Demographics
  - Seen in individuals who engage in repetitive overhead activities, such as athletes and manual laborers.
- Risk Factors
  - Age, genetics, and previous shoulder injuries

Anatomy of the Shoulder

- Bones: Humerus, Scapula, Clavicle
- Muscles: Rotator Cuff, Deltoid, Scapular stabilizers, Bicep, Tricep
- Tendons: Rotator cuff, Deltoid, Bicep, Tricep
- Nerves: Axillary, Long Thoracic, Suprascapular, Musculocutaneous
- Vessels: Axillary artery branches superior thoracic, thoracoacromial, lateral thoracic, subscapular, anterior/posterior humeral circumflex

- Rotator Cuff Muscles and Tendons:
  - Supraspinatus
  - Infraspinatus
  - Teres Minor
  - Subscapularis

Rotator Cuff Pathology-Clinical Presentation

Pain Patterns:

- Deep aching pain
  - "toothache"

Impact on Daily Activities:

- Reaching overhead
- Lifting objects
- Sleeping

Range of Motion:

- Reaching overhead
- Reaching behind the back

Rotator Cuff Pathology

Condition	Description	Symptoms	Causes
Tendinitis	Inflammation of the rotator tendons.	• Pain with overhead activities, • Possible tenderness over the supraspinatus, infraspinatus or lateral/posterior-lateral border of the acromion	• Overuse • Repetitive motion • Age
Impingement	Compression of the rotator cuff tendons between the acromion and the humeral head.	• Pain and weakness, especially with arm elevation • Pain lying on affected side	• Subacromial impingement, associated with repetitive overhead activities
Tears	Partial or complete tears, most common supraspinatus.	• Pain over lateral deltoid • Weakness • Limited ROM, and at times snapping or popping sensation	• Aging-middle to older • Degeneration • Overload • Impingement • Trauma
Bursitis	Inflammation of the subacromial bursa.	• Pain and swelling over the anterolateral aspect of the shoulder below the acromion • Pain is localized and usually no radiation	• Overuse • Trauma • Other rotator cuff pathology such as impingement

Condition	Physical Exam
Tendinitis and Impingement	• Limited ROM and weakness with SAR testing, specifically abduction and external rotation • Tenderness over the supraspinatus, infraspinatus muscles or lateral/posterior-lateral border of the acromion • **+ Painful Arc** • **+ Neer and Hawkin's tests** • **+ Empty Can/Jobes**
Tears	• **+ Painful Arc test** • **+ Drop arm test** • **+ Weakness with external rotation** • **+ Empty can/Jobes** • **+ Lift off test**
Bursitis	• Tenderness at the anterolateral aspect of the shoulder below the acromion • Warm and boggy below acromion • **+ Painful Arc test**

Painful Arc Test

- Patient has arm at their side, elbow flexed to 90 degrees and externally rotated 30 degrees. Examiner applies resistance to forearm while patient externally rotates.

Findings: Positive test with pain, likely tear with weakness.

90% sensitivity 74% specificity

Micheroli R, Kyburz D, Ciurea A, Dubs B, Toniolo M, Bisig SP, Tamborrini G. Correlation of findings in clinical and high resolution ultrasonography examinations of the painful shoulder. J Ultrason. 2015 Mar;15(60):29-44. doi: 10.15557/JoU.2015.0003. Epub 2015 Mar 30. PMID: 26674725; PMCID: PMC4579705.

Neer's Test

- Examiner passively forward flexes the patient's arm while supporting scapula to prevent shoulder shrugging due to guarding.

Severity by arc angle, patient reports pain at:

- 90 degrees mild impingement
- 60-70 degrees moderate impingement
- 45 degrees or below severe impingement

72% sensitivity 60% specificity

Hegedus EJ, Goode AP, Cook CE, et al. Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests British Journal of Sports Medicine 2012;46:964-978

Hawkins-Kennedy Test

- Examiner stabilizes shoulder passively flexes patient's shoulder to 90 degrees, flexes elbow 90 degrees and internally rotates shoulder.

Findings: Positive test if pain with internal rotation.

58-80% sensitivity 56-67% specificity

Hegedus EJ, Goode AP, Cook CE, et al. Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests British Journal of Sports Medicine 2012;46:964-978

Empty Can/Jobe's Test

- Patient abducts shoulder 90 degrees with full elbow extension then adducts 30 degrees with full internal rotation (thumbs down-empty can). Patient then resists examiners downward force.

Findings: Positive test with localized pain. If pain, proceed to full can test. If no pain or weakness with full can test, impingement due to rotator cuff less likely.

74% sensitivity 30% specificity

Hegedus EJ, Goode AP, Cook CE, et al. Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests British Journal of Sports Medicine 2012;46:964-978

Drop Arm Test-supraspinatus

- Examiner passively abducts patient's arm to 90 degrees, has patient hold the position and then slowly lower the arm to the side.

Findings: Positive test confirmed if patient has sudden arm drop or weakness with smoothly lowering arm to side. Pain is common with lesions, weakness points towards tear.

24% sensitivity 96% specificity

Jain NB, Luz J, Higgins LD, Dong Y, Warner JJ, Matzkin E, Katz JN. The Diagnostic Accuracy of Special Tests for Rotator Cuff Tear: The ROW Cohort Study. Am J Phys Med Rehabil. 2017 Mar;96(3):176-183. doi: 10.1097/PHM.0000000000000566. PMID: 27386812; PMCID: PMC5218987.

External Rotation Test-infraspinatus

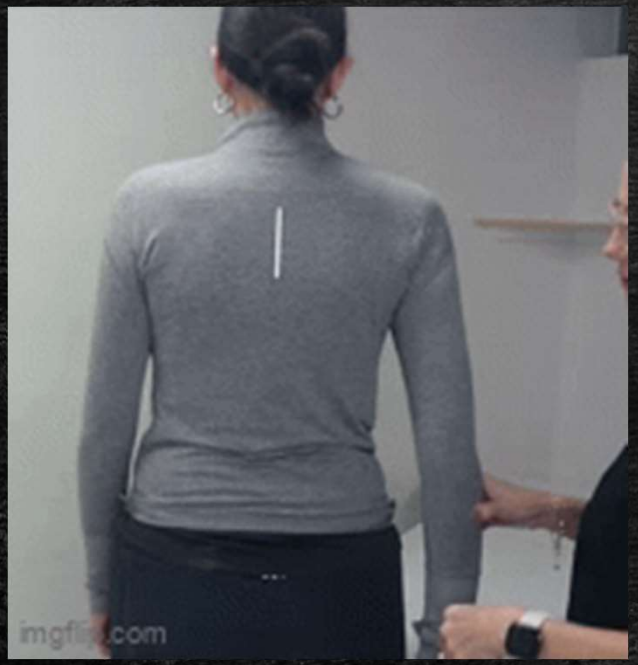
- Patient has arm at their side, elbow flexed to 90 degrees and externally rotated 30 degrees. Examiner applies resistance to forearm while patient externally rotates.

Findings: Positive test with pain, likely tear with weakness.

90% sensitivity 74% specificity

Micheroli R, Kyburz D, Ciurea A, Dubs B, Toniolo M, Bisig SP, Tamborrini G. Correlation of findings in clinical and high resolution ultrasonography examinations of the painful shoulder. J Ultrason. 2015 Mar;15(60):29-44. doi: 10.15557/JoU.2015.0003. Epub 2015 Mar 30. PMID: 26674725; PMCID: PMC4579705.

Lift Off Test-subscapularis



- Patient places hand behind back with palm facing out and then lifts it away from back against examiners resistance.

Findings: Positive test is patient cannot raise the hand off the back with resistance or compensates by extending the elbow and shoulder

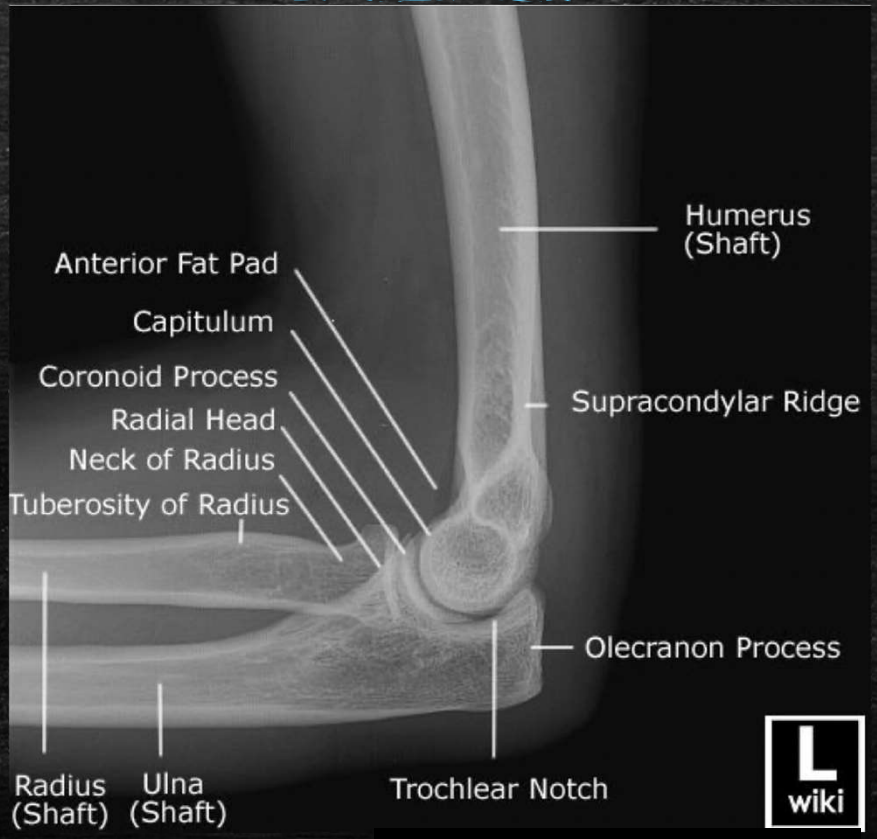
25% sensitivity 92% specificity

Schiefer M, Júnior YA, Silva SM, Fontenelle C, Dias Carvalho MG, de Faria FG, Franco JS. CLINICAL DIAGNOSIS OF SUBSCAPULARIS TENDON TEAR USING THE BEAR HUG SEMIOLOGICAL MANEUVER. Rev Bras Ortop. 2015 Nov 4;47(5):588-92. doi: 10.1016/S2255-4971(15)30008-2. PMID: 27047870; PMCID: PMC4799441.

Differentials & Differentiating Factors

- Adhesive Capsulitis
  - Global restrictions of shoulder movements
- Shoulder Osteoarthritis
  - Pain aggravated by movements and relieved by rest
- Acromioclavicular joint arthritis
  - Tenderness directly over AC jt with cross arm compression and movement
- Superior Labral Anterior-Posterior lesion
  - Weakness to the arm, clicking and popping, instability

Elbow Pathology



Elbow Pathology Epidemiology

- Prevalence
  - Elbow pathology varies across populations but is estimated to affect approximately 1-3% of the general population.
- Demographics
  - Elbow pathology can affect individuals of any age but is more commonly observed in those aged 30 to 50, impacting both genders equally.
- Risk Factors
  - Common risk factors include age, smoking, genetics, and previous elbow injuries.

Anatomy of the Elbow

- Bones: Humerus, ulna, and radius
- Muscles: Biceps Brachii, Brachialis, Brachioradialis, Triceps, Anconeus
- Tendons: Bicep, Tricep, Brachialis, Brachioradialis, Aconeus
- Lateral and Medial Collateral Ligaments
- Nerves: Median, Radial, Ulnar, Musculocutaneous
- Vessels: Brachial artery

Wrist extensors/flexors with origin within the elbow:

- Common Extensors:
  - Carpi radialis brevis
  - Digitorum communis
  - Carpi ulnaris
- Common Flexors:
  - Carpi ulnaris
  - Palmaris Longus
  - Carpi Radialis

Elbow Pathology-Clinical Presentation

Pain Patterns:

- Periarticular and referred

Impact on Daily Activities:

- ADLs such as brushing teeth, dressing, eating
- Lifting and carrying objects
- Gripping
- Driving

Range of Motion:

- Flexion and extension
- Pronation and supination

Elbow Pathology

Condition	Description	Symptoms	Causes
Lateral Epicondylitis (Tennis Elbow)	Inflammation of the extensor carpi radialis brevis tendon	• Gradual onset of pain and tenderness over the lateral epicondyle • Aggravation with gripping or wrist extension activities.	• Overuse • Repetitive motion- tennis, pickleball, carpentry, manual labor, weightlifting • Age >30
Medial Epicondylitis (Golfer's Elbow)	Inflammation of the medial common flexor tendon	• Gradual onset of pain and tenderness over the medial epicondyle • Aggravation with gripping, wrist flexion activities or lifting objects	• Overuse • Repetitive motion- golfing, baseball/pitching, manual labor • Age 45-54 • Women>men
Bursitis	Inflammation of the olecranon bursa	• Pain and tenderness swelling over the olecranon • Possible erythema, increase warmth and limited ROM	• Direct blow • Repetitive friction • Prolonged pressure • Infection • Gout or RA
Cubital Tunnel Syndrome (Ulnar nerve entrapment)	Compression of the ulnar nerve	• Numbness or paresthesia in the ulnar nerve distribution • Medial elbow pain with radiation along the medial forearm • Grip weakness and difficulty lifting and carrying	• Acute trauma • Nerve compression, traction or friction • Prolonged flexion • Mass lesions

Condition	Physical Exam
Lateral Epicondylitis (Tennis Elbow)	• Localized tenderness over the lateral epicondyle and proximal wrist extensor muscle mass • **+Cozen's test** • **+Mill's Test**
Medial Epicondylitis (Golfer's Elbow)	• Localized tenderness over the medial epicondyle • Pain with resisted wrist flexion with the elbow in full extension • **+Golfer's Elbow**
Olecranon Bursitis	• Tenderness, increase warmth, and swelling over the olecranon • Symptoms reproduced with bursa compression or flexion of elbow
Cubital Tunnel Syndrome (Ulnar nerve entrapment)	• **+Tinel test** • **+Froment's sign** • Reproducible symptoms with prolonged elbow flexion

Cozen's Test: extensor carpi radialis brevis

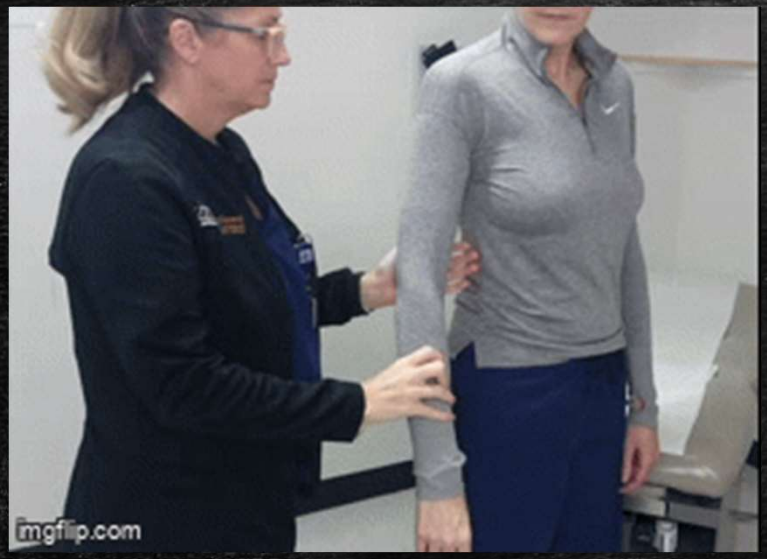
- While patient is in a relaxed position, examiner places one hand/finger on the lateral epicondyle while the forearm is pronated. Patient then makes a fist, radial deviates and extends against examiner resistance.

Finding: Positive test if patient has pain at the lateral epicondyle.

91% sensitivity

Karanasios S, Korakakis V, Moutzouri M, Drakonaki E, Koci K, Pantazopoulou V, Tsepis E, Gioftsos G. Diagnostic accuracy of examination tests for lateral elbow tendinopathy (LET)-a systematic review. Journal of Hand Therapy. 2021 Feb 27.

Mills's Test: extensor carpi radialis brevis



- With patient standing and elbow in flexion, examiner places finger/thumb over the lateral epicondyle, passively pronates forearm, flexes wrist and extends elbow.

Findings: Positive test if patient's pain is repeated with maneuver.

53% sensitivity 100% specificity

Saroja G, Aseer PA, Venkata Sai PM. Diagnostic accuracy of provocative tests in lateral epicondylitis. Int J Physiother Res. 2014 Dec 11;2(6):815-23.

Medial Epicondylitis Test(Golfer's elbow):

- Patient in standing position, examiner places thumb/finger over the medial epicondyle while elbow is flexed then passively supinating the forearm and extends the wrist. While in this position, the examiner then extends the elbow.

Findings: Positive test if maneuver reproduces patient's pain.

Tinel's Sign elbow: ulnar nerve compression

- Examiner locates the ulnar nerve within the groove between the olecranon process and medial epicondyle. The examiner then taps rapidly over the nerve.

Findings: Positive sign if patient reports tingling in the ulnar distribution of the forearm and hand.

62% sensitivity 53% specificity

Beekman R, Schreuder AH, Rozeman CA, Koehler PJ, Uitdehaag BM. The diagnostic value of provocative clinical tests in ulnar neuropathy at the elbow is marginal. J Neurol Neurosurg Psychiatry. 2009 Dec;80(12):1369-74. doi: 10.1136/jnnp.2009.180844. Epub 2009 Jun 23. PMID: 19553231.

Froment's Sign: ulnar nerve palsy

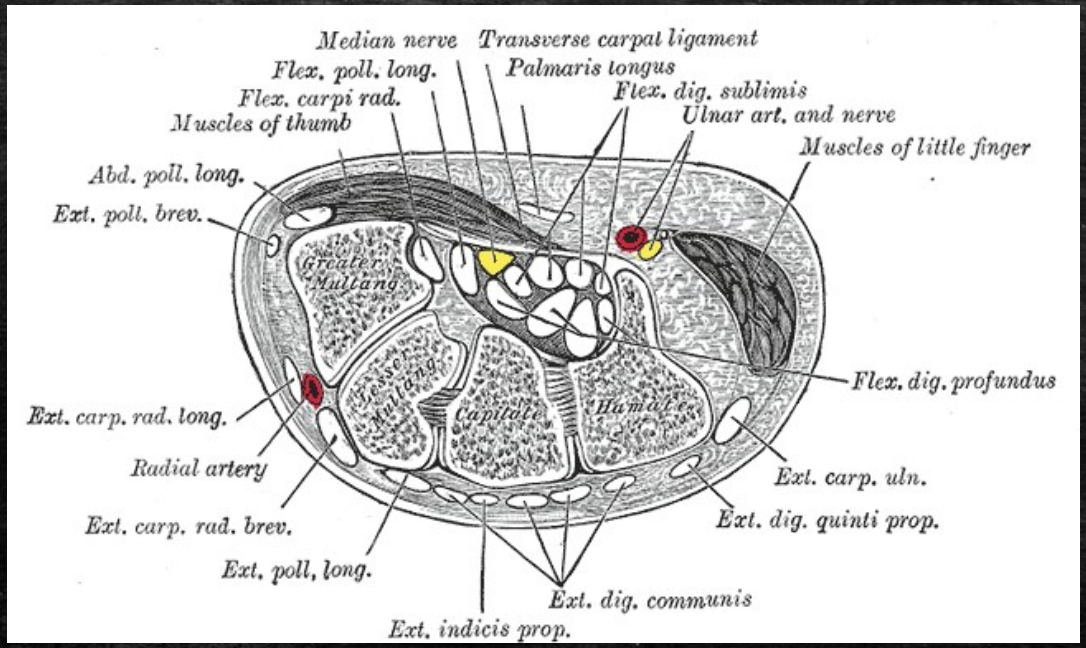
- Patient tries to pinch a piece of paper in between thumb and index finger while examiner pulls paper away.

Findings: Positive sign if the patient compensates by hyperflexion of both interphalangeal joints.

Differentials & Differentiating Factors

- Radial Tunnel Syndrome
  - Lateral elbow pain
- Fractures/dislocations
  - Acute trauma, deformities
- Arthritis Rheumatoid>Osteo-
  - Morning stiffness, bilateral (RA)/
- Gout/Pseudogout
  - Sudden swelling, erythema, LROM

Wrist Pathology



Wrist Pathology Epidemiology

- Prevalence
  - Non-specific wrist and hand pathology affects approximately 10% of the general population.
- Demographics
  - Seen in individuals who engage in repetitive activities, such as athletes and manual laborers.
- Risk Factors
  - Common risk factors include age, smoking, diabetes, hyperthyroidism, pregnancy, higher BMI, genetics, and previous wrist injuries.

Anatomy of the Wrist

- Bones: distal radius, distal ulna, carpal and proximal portions of the metacarpals
- Muscles: flexor carpi radialis, flexor carpi ulnaris, extensor carpi radialis longus and brevis, extensor carpi ulnaris, palmaris longus
- Ligaments: 33 different intra articular and intra-capsular ligaments; intrinsic and extrinsic carpal
- Nerves: Radial, Ulnar, Median
- Vessels: Radial, Ulnar

- Intrinsic Carpal ligaments
  - Scapholunate interosseous
  - Lunotriquetral interosseous
  - Distal row and Palmar midcarpal (7 different)
- Extrinsic Carpal ligaments
  - Volar radiocarpal
  - Volar ulnocarpal
- Focus:
  - Abductor pollicis longus
  - Extensor pollicis brevis

Wrist Pathology-Clinical Presentation

Pain Patterns:

- Laterality
- Numbness
- Paresthesia

Impact on Daily Activities:

- Grasping
- Writing

Range of Motion:

- Flexion
- Extension
- Radial and ulnar deviation

Wrist Pathology

Condition	Description	Symptoms	Causes
Carpal Tunnel Syndrome	Compression of the medial nerve as it travels through the carpal tunnel Anatomic compression and/or inflammation	• Dull, aching pain to hand or wrist with radiation to the proximal forearm • Paresthesia in median nerve distribution • Possible weakness	• Older age • Women>men • Higher BMIs • Repetitive and forceful overuse • Work with vibrating tools • Sustained wrist/palm pressure • Prolonged wrist extension/flexion
de Quervain's Tenosynovitis	Inflammation of the tendon and sheath around the abductor pollicis longus and extensor pollicis brevis	• pain and tenderness at the radial side of the wrist • Decreased ROM of the thumb and wrist with grasping or pinching	• 30-50 years old • Women>men • Pregnancy • Manual labor

Condition	Physical Exam
Carpal Tunnel Syndrome	• **+Hand elevation test** • **+Phalen maneuver** • **+Tinel's sign**
de Quervain tenosynovitis	• **+Finkelstein test** • Eichhoff test: patient clenches thumb with other fingers while deviated the wrist towards the ulna

Hand Elevation Test: median nerve compression

- Patient in standing or sitting position raises both hands above the head and maintains this position for 2 minutes.

Findings: Positive if patient reports tingling or paresthesia in the medial nerve distribution(1^{st}, 2^{nd}, 3^{rd} digit and lateral half of the 4^{th} digit) or dull pain in the median nerve aspect within 2 minutes of exam.

86.7 % sensitivity 88.9 % specificity

Ma H, Kim I. The diagnostic assessment of hand elevation test in carpal tunnel syndrome. J Korean Neurosurg Soc. 2012 Nov;52(5):472-5. doi: 10.3340/jkns.2012.52.5.472. Epub 2012 Nov 30. PMID: 23323168; PMCID: PMC3539082.

Phalen's Test: median nerve compression

- Patient maximally flexes wrist holding dorsum of hands together for 1 minute.

Findings: Positive if patient reports tingling or paresthesia in the medial nerve distribution(1st, 2nd, 3rd digit and lateral half of the 4th digit)

68% sensitivity 73% specificity

MacDermid JC, Wessel J. Clinical diagnosis of carpal tunnel syndrome: a systematic review. J Hand Ther. 2004 Apr-Jun;17(2):309-19. doi: 10.1197/j.jht.2004.02.015. PMID: 15162113.

Tinel's Sign: median nerve compression

- Examiner lightly taps repeatedly over the carpel tunnel.

Findings: Positive if patient reports tingling or paresthesia in the medial nerve distribution(1st, 2nd, 3rd digit and lateral half of the 4th digit)

50% sensitivity 77% specificity

MacDermid JC, Wessel J. Clinical diagnosis of carpal tunnel syndrome: a systematic review. J Hand Ther. 2004 Apr-Jun;17(2):309-19. doi: 10.1197/j.jht.2004.02.015. PMID: 15162113.

Finkelstein Test: Extensor Pollicis Brevis and Abductor Pollicis Longus

- Patient's affected arm rests on the exam table with the wrist ulnar side down with hand hanging off the edge. Assess pain with 1) gravity and active ulnar deviation 2) examiner gently applies ulnar deviation force 3) examiner grasps thumb passively flex it into palm.

Findings: Positive findings with each stage produces pain at the ulnar styloid.

100% specificity

Wu F, Rajpura A, Sandher D. Finkelstein's Test Is Superior to Eichhoff's Test in the Investigation of de Quervain's Disease. J Hand Microsurg. 2018 Aug;10(2):116-118. doi: 10.1055/s-0038-1626690. Epub 2018 Mar 20. PMID: 30154628; PMCID: PMC6103758.

Differentials & Differentiating Factors

- Ganglion Cyst
  - Painless mass however may cause discomfort and LROM
- Osteoarthritis
  - Pain aggravated by movements and relieved by rest
- Rheumatoid arthritis
  - Morning stiffness, swelling, +/-erythema
- Fractures/ligament injuries
  - History of acute trauma, deformities

Upper Extremity Pathology Treatment

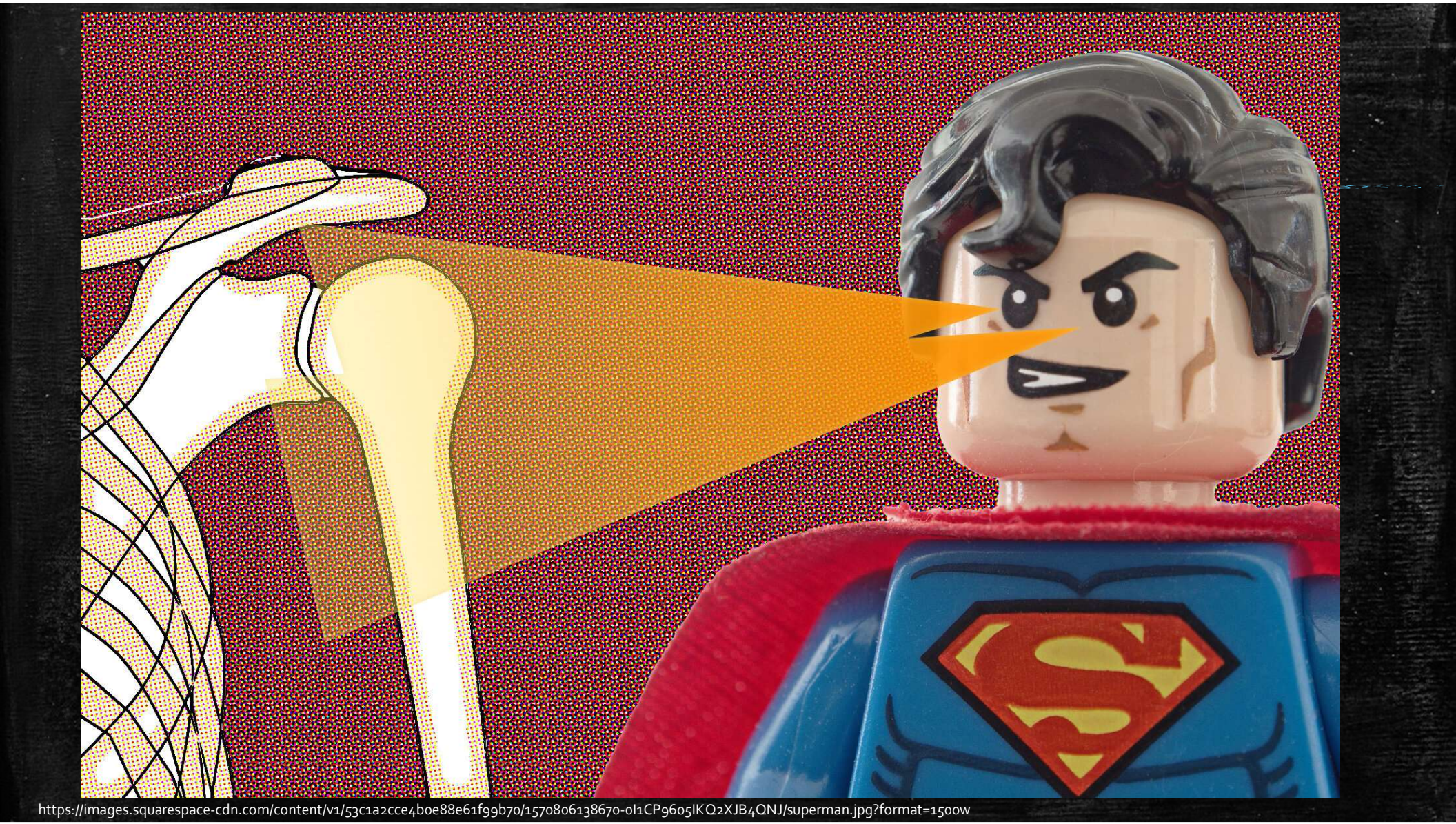
Conservative

- NSAIDS
- Rest
- Heat/Ice
- Massage
- Stretching
- For some conditions splinting
- Ergonomic changes

Non-Surgical

- Physical Therapy
- Injections
- Shockwave/Ultrasound

Surgical



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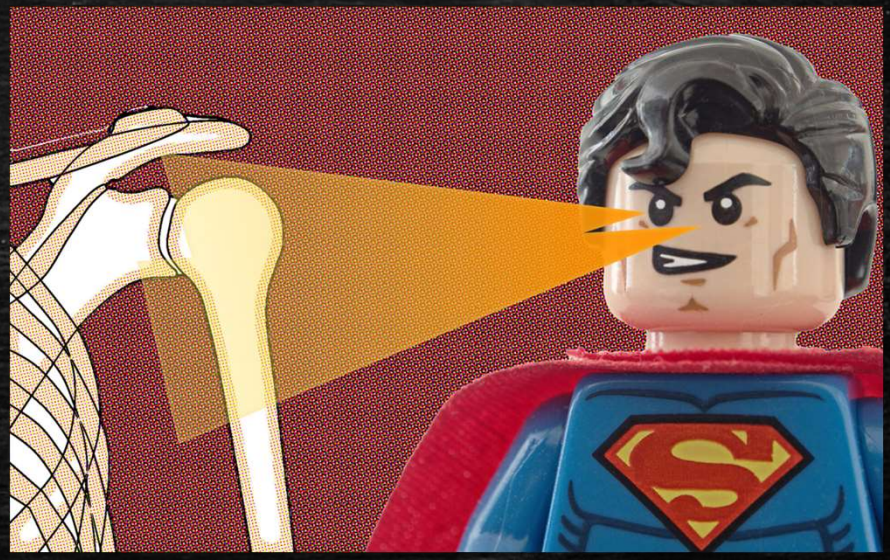
Imaging

Initial

- X-rays
- Ultrasound**

Gold Standard

- MRI



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Take Home Points:

Adding more physical exam components can help provider differentiate pathology that can be conservatively treated verses those that need immediate orthopedic consult.

No single special provocative test offers optimal specificity and sensitivity. However, when these tests are combined, they can assist a healthcare provider in more accurately identifying joint pathology.

Consider using ultrasound for quick and less expensive imaging modality for joint pathology.

References

- UpToDate:
  - Anatomy and basic biomechanics of the hand, wrist, elbow, shoulder, rotator cuff
  - Evaluation of the adult with shoulder, elbow, wrist complaints
  - Carpal Tunnel Syndrome
  - De Quervain tendinopathy
  - Elbow tendinopathy
  - Rotator Cuff tendinopathy
  - Ulnar neuropathy at the elbow and wrist

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One Drive

BOX

Google Drive

Questions:

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