OMT & Sports Medicine for the Upper and Lower Extremities

Mark McKeigue, DO
Ann L. Habenicht, DO, FACOFP, FAAO
ACOFP FULL DISCLOSURE FOR CME ACTIVITIES

Please check where applicable and sign below. Provide additional pages as necessary.

Name of CME Activity: 2017 ACOFP Annual Convention & Scientific Seminars
Dates and Location of CME Activity: March 16 - 19, 2017, Gaylord Palms Resort and Convention Center, Kissimmee, FL, United

Name of Faculty/Moderator: Mark McKelgue, DO

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Date: 11/13/17

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Deadline: Friday, January 20, 2017
OMT & Sports Medicine for the Upper and Lower Extremities, ACOFP, March 16, 2017

MARK E. MCKEIGUE, D.O., FAOASM
PROFESSOR, OSTEOPATHIC MANIPULATIVE MEDICINE
MIDWESTERN UNIVERSITY, DOWNER'S GROVE, ILLINOIS

OBJECTIVES

- To present a case and review a differential diagnosis; first for the upper, and then the lower extremity
- To review the involvement of the cervical spine, thoracic outlet, rotator cuff, elbow, carpal tunnel and the TFCC as the etiology of our patient’s symptoms.
- To review the pertinent anatomy of the extremities.
- To review “special tests” used to make a diagnosis.
- To discuss the use of Osteopathic Manipulative Treatment (Dr. Habenicht) in addition to PPPRICEMM(M) (Dr. McKeigue)
Special Thanks

- Kurt P. Heinking, D.O., FAAO
- Chair, Department of Osteopathic Manipulative Medicine, Chicago College of Osteopathic Medicine, Midwestern University
- My Former Resident!
- My Former Fellow in Sports Medicine 😊
- My current Boss 😊
CC: A 40 year old female triathlete presents to your office complaining of "Numby, tingly, funny feelings in my right arm and shoulder."

HPI: She’s had this on and off for 18 months or so, but it seems to be bothering her more lately. Occasionally it awakens her from sleep and sometimes it effects her grip on her bike or on the bar when lifting in the gym.

She’s used OTC Advil, Tiger Balm and Biofreeze with equivocal results.

Macro Trauma?
Micro Trauma?

Acute or Chronic?

- Little League........
- Ultra-marathon........
History and Physical Examination

- 5 feet, 7 inches (= 67” = 1.7018 meters), 145# (= 65.9 kg).
- BMI = 22.75
- Temp: 97.9; BP 110/70; P=62; R=12.
- Good color; in NAD.
- HEENT: WNL
- Chest clear; Cor RRR; Abd neg

Diagnosis of the Cervical Spine
Structural Exam

AROM /PROM cervical (1st visit)
Range of Motion

- Range of Motion of Cervical Spine
- Flexion/extension – 130°.
- Side bending (lateral flexion) 35° left and right.
- Rotation - 90° left and right.

Active and Passive ROM

**Soto- Hall test**
- Chin tucked
- Hand on sternum
- Pain with Active flexion = muscular etiology
- Pain with Passive flexion = vertebral /ligamentous etiology

**O’Donoghue test**
- Head tilted to side
- Hand on zygoma and temple
- Pain with Active flexion = muscular etiology
- Pain with Passive flexion = vertebral /ligamentous etiology
Neurologic levels

C5 Neurologic Level

C7 Neurologic Level

C6 Neurologic Level

C8 Neurologic Level

Neurology of Upper Extremity

<table>
<thead>
<tr>
<th>Disc</th>
<th>Root</th>
<th>Reflex</th>
<th>Muscles</th>
<th>Sensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4–C5</td>
<td>C5</td>
<td>Biceps Reflex</td>
<td>Deltoid, Biceps</td>
<td>Lateral Arm</td>
</tr>
<tr>
<td>C5–C6</td>
<td>C6</td>
<td>Brachioradialis Reflex (Biceps Reflex)</td>
<td>Wrist Extension, Biceps</td>
<td>Lateral Forearm</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Musculocutaneous nerve</td>
</tr>
<tr>
<td>C6–C7</td>
<td>C7</td>
<td>Triceps Reflex</td>
<td>Wrist Flexors, Finger Extension, Triceps</td>
<td>Middle Finger</td>
</tr>
<tr>
<td>C7–T1</td>
<td>C8</td>
<td>—</td>
<td>Finger Flexion, Hand Intrinsic</td>
<td>Medial Forearm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Med. Ant. Brach. Cutaneous nerve</td>
</tr>
<tr>
<td>T1–T2</td>
<td>T1</td>
<td>—</td>
<td>Hand Intrinsic</td>
<td>Medial Arm</td>
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Upper Extremity Dermatomes

Neurology of the Upper Extremity

Fig. 46: The biceps reflex.
Fig. 47: Testing the biceps reflex.
Fig. 48: The triceps reflex.
Spurling Test

- **Goal:** To assess cervical radiculopathy
- **Patient Position:** Seated.
- **Examiner Position:** The test is performed in three stages.
  - First axial compression is applied with the neck in neutral.
  - Then the neck is extended and axial compression is applied.
  - Finally, the neck is extended and rotated the affected side and axial compression is applied. The neck may also be sidebent to localize the symptoms.

- **Positive Findings:** A positive result is indicated if the patient experiences pain down into the arm on the same side as the compression.

Cervical distraction can also be used.

Findings

- 2/4 reflexes bilat B, Br, T
- Weakly Pos Spurling’s on the right
- Decreased Cervical ROM
- Forward Head

- Working Dx: Cervical Radiculopathy (M54.12)
- Tx: OMT (Dr. Ann)
DeKline Test

Vertebral Artery Test

- Assesses patency of vertebral artery
- Patient placed supine on table
- Clinician supports head at occiput
- Patients neck passively extended, laterally flexed and then rotate toward laterally flexed side for ~30 seconds
- Positive test if dizziness, confusion, nystagmus, unilateral pupil changes and/or nausea present

But I was wrong! It wasn’t a Cervical Radic 😞

So Now what???

Neurogenic?
Venous?
Arterial?
Lhermitte’s Sign

- **Goal**: to identify spinal cord, upper motor neuron lesions, or dural tension.
- **Patient Position**: Long sitting position.
- **Examiner Position**: The examiner flexes the cervical spine while simultaneously flexing one hip.
- **Positive Findings**: Pain shooting down the spine and into the upper or lower extremities.

Figure 3-1. (A) Kypholordotic posture. (B) Swayback posture. (C) Flat back posture.
A-P Curve Problems

- Reversal of the normal curvature places undue stresses on joints and tissues.
- May be a long-standing postural change to nociceptive or viscerosomatic input.

Lordosis at T5-7

Thoracic Outlet Syndrome (TOS) 353.0

- Neck pain
- Shoulder pain
- Arm pain, heaviness, clumsiness
- Numbness and tingling of the fingers
- Impaired Circulation to the Extremities (causing discoloration)
Adson Test

- **Goal:** to test for thoracic outlet syndrome
- **Patient Position:** The patient is seated and rotates the head to the affected side.
- **Examiner Position:** The examiner palpates the radial pulse and then instructs the patient to extend the head and take in a deep breath and hold it. The examiner then extends and externally rotates the arm.
- **Positive Findings:** The examiner identifies the disappearance of the radial pulse.

Halstead Test

- **Goal:** to test for thoracic outlet syndrome
- **Patient Position:** The patient is seated and rotates the head to the affected side.
- **Examiner Position:** The examiner palpates the radial pulse and then instructs the patient to extend the head and take in a deep breath and hold it. The examiner then extends and externally rotates the arm.
- **Positive Findings:** The examiner identifies the disappearance of the radial pulse.
Elvey Test

- Brachial Tension Test
- Depression and abduction of the shoulder in the supine position
- Extension of the wrist
- Stretches dura, & nerve root

Can also be done seated, depress shoulder, extend wrist

Other TOS tests

- Roos Test
- Wright’s Test (a 2-step test)
- Hyperabduction Test
- TOS (Modified) Allen’s test
Roos Test

Roos Test
(Elevated Arm Stress = EAST test,
Abduction External Rotation =
AER Test, Stick Up Test,
Hands Up Test)

Indication: All types of TOS

90° Abduction and external rotation with elbow flexed
Open and close the hands slowly for 3 minutes
NTOS: Pain progress from neck & shoulder to arm,
paresthesia in forearm and fingers
VTOS: Swelling and cyanosis
ATOS: Arm pallor (then reactive hyperemia when lowered)

*minor fatigue and distress are normal
**Some suggested 2-1 min instead of 3

Wright’s (Hyperabduction) Test
The 3 most common places for the Subclavian Artery (TOS) impingement are:

1: Between the Anterior and Middle Scalenes

2: Between an “extra” or “cervical rib” and the first rib

3: Under a tight Pectoralis Minor muscle

TOS Treatment?

OMT (Dr. Ann)
But, wrong again, it’s not TOS 😞

- So, Moving on Down and out to the Shoulder itself

- 3 Joints (GH, AC, SC)

- 1 Articulation (Scapulothoracic)

2 Things to make me think it’s Rotator Cuff Tendonitis M75.10

- Vague pain that awakens the patient from sleep

- Tip of the Deltoid: the referred spot for pain coming from the Supraspinatous
Anatomy Review: Shoulder

Rotator Cuff
Special Tests

- **Adson’s** – Thoracic Outlet Syndrome
- **Apley’s Scratch** – Rotator Cuff Dysfunction
- **Apprehension** – Anterior GH Instability
- **Cross-arm** – AC Joint Inflammation
- **Clunk** – Glenoid Labrum Tear

- **Drop Arm** – Rotator Cuff Tear; supraspinatus weakness
- **Empty Can** – Rotator Cuff Tear; Suprascapular Nerve Entrapment or Neuropathy
- **Hawkin’s** – Supraspinatus tendon impingement

Special Tests

- **Neer’s** – Subacromial impingement
- **Relocation** – Anterior GH joint instability
- **Scapular winging** – Serratus anterior weakness or injury
- **Speed’s** – Biceps tendon instability or tendonitis

- **Spurling’s** – Cervical nerve root impingement or inflammation
- **Sulcus sign** – Inferior GH joint instability
- **Yergason’s** – Biceps tendon instability or tendonitis
Empty Can / Drop Arm

- a. tests the integrity of the supraspinatus muscle
- b. patient position – seated with arm at shoulder level at 45 degree angle from body, thumb pointing down
- c. examiner exerts downward force on forearms while pt. maintains starting position (compare bilaterally)
- d. if pt. is unable to assume starting position (without examiners force), the arm just drops to the side (Drop Arm) and confirms complete tear of supraspinatus

Scapulo-thoracic Rhythm

- During the first 20°-30° of shoulder abduction, the scapula is stable.
- After this, the scapula should move 1° for every 2° of glenohumeral motion. This is the scapulo-thoracic rhythm.
- If this sequence is disrupted, dysfunction of the upper extremity will occur.
- This is one of the primary ways axial spine or thoracic cage dysfunction affects extremity dysfunction.
Subacromial Impingement

- Etiology
  - Primary extrinsic (coracoacromial arch)
  - Subacromial spur
  - Acromioclavicular joint OA
  - Coracoacromial (CA) ligament
  - Variation in size and thickness
  - Calcification/ossification less common
  - Type III (hooked) acromion

MRI Best diagnostic clue:
- Hooked acromion on sagittal images with supraspinatus generation
- +/- Reactive bursitis (bursa fluid)
- Location: Osseous acromial outlet
Shoulder: Rotator Cuff Tendinosis

- Structures Injured: Supraspinatus, Infraspinatus, Teres Minor, or Subscapularis tendon.
- Mechanism of injury: micro trauma secondary to poor shoulder posture / mechanics.
- Special Tests: Neer, Kennedy-Hawkins, Empty Can (Jobe’s Sign), Painful Arc, Scapular Lift Off Test

Rotator Cuff Partial Thickness Tear

- Three types of partial tears of RTC
  - Articular surface partial tear – most common, associated with classical impingement
  - Interstitial – not seen at arthroscopy
  - Bursal surface
Rotator Cuff Partial Thickness Tear

- Partial tears are more painful than full thickness tears.
- Clinical profile: Athlete, patient after 40 years of age with impingement.
- Most partial tears progress to full thickness tears within 2 years.

Scapular Dyskinesis: “Sick Scapula” Syndrome

- Abnormal motion and position of the scapula leading to abnormal kinematics of the GH and AC joints.
- Due to abnormal muscle activation.
- Classification
  - Type 1: Prominence inferior medial border
  - Type 2: Scapular malposition, inferior border prominence, Coracoid pain, dyskinesia
  - Type 3: Prominence of superior medial border, and rotator cuff pathology
And once again, our treatment strategy is???

▶ It’s OMT time with Dr. Ann

The History, the History, and furthermore, the History!

▶ “Upon further review, …”

▶ Our triathlete “forgot” to mention that she’s had a few falls!!!
History

- FOOSH Injuries (Fall On an Out Stretched Hand)
- MVA’s
- Macro Trauma
- Repetitive Overuse
- Athletic Injuries
  - Tennis
  - Rock climbing
  - Golf
  - Gymnastics

Differential Diagnosis

- VINDICATES Pneumonic:
  - Vascular
    - Ischemia
    - Hemarthrosis
    - Avascular Necrosis
    - Thoracic Outlet Syndrome
  - Inflammatory
    - Septic Joint
    - Tendonitis
    - Bursitis
    - Ligament Sprain
    - Adhesive Capsulitis
    - Traumatic Arthritis
Differential Diagnosis

- **Neurologic (lesion)**
  - CVA (i.e. stroke)
  - Cervical lesion
  - Axillary nerve palsy
  - Subscapular nerve palsy
  - Brachial plexus palsy
  - Multiple Sclerosis

- **Neurologic (referred pain)**
  - Cervical radiculopathy
  - Internal organ disease

- **Degenerative**
  - Osteoarthritis

- **Iatrogenic**
  - After Surgery

- **Autoimmune**
  - Rheumatoid Arthritis
  - Systemic Lupus
  - Ankylosing Spondylitis
  - Gouty Arthritis

- **Trauma**
  - Fracture
  - Dislocation
  - Muscle Tear
  - Labrum Tear
  - Capsular Tear
  - Instability

- **Endocrine**
  - Diabetes Mellitus
Differential Diagnosis

- **Somatic**
  - Somatic Dysfunction
  - Muscle Imbalance
  - Impingement
  - Tendinosis
  - Adhesive Capsulitis

In general, pain with movement commonly indicates:
- Impingement
- Muscle spasm
- Inflammatory disorders

Painless movement is indicative of chronic disorders typically requiring rehabilitation and possibly repair of damaged structures.
Injuries – Elbow/Forearm

The Elbow
Elbow/Forearm Functional Anatomy

- Consist of three joints:
  - Ulnohumeral
    - Major motions: flexion/extension
    - Minor motions: adduction/abduction
  - Radiohumeral
    - Supination/pronation
  - Radioulnar
    - Supination/pronation

Elbow Diagnosis

- Check for bicep involvement/ CS
- Palpation of pronator teres
  - If tight palpate R3-4 for dysfunction
- Medial and lateral epicondyle
  - If tight palpate R3-4 for dysfunction
- Check radial head
- Interosseous membrane / fascia
Physical Exam – Elbow

- **AROM & PROM**
  - Include ab/adduction and pronation/supination
  - Elbow injuries result in flexion contractures
- Lateral & Medial Epicondyle
- Olecrenon & bursa
- Biceps tendon and triceps tendon
- Forearm tension
LATERAL EPICONDYLITIS M77.11

- **Etiology**
  - Overuse syndrome caused by chronic varus stress across the elbow
  - Most common sign/symptoms
    - Adult patient with lateral elbow pain

- **Epidemiology**
  - Up to 50% of tennis players
  - 95% of reported cases in general population other than tennis players

LATERAL EPICONDYLITIS

- Lateral epicondyle – origin for extensor carpi radialis brevis, extensor digitorum communis, extensor carpi ulnaris
- PIN passes deep to the “mobile wad of three” (brachioradialis, extensor carpi radialis longus and extensor carpi radialis brevis)
- PIN enters supinator (deep to ECRB) passing through arcade of Frohse
OMT

- Treat upper thoracic spine and ribs
- Subscapularis tenderpoint
- Ipsilateral 4th rib HVLA, CS
- Treat adducted ulna
- Treat pronator teres tension / tenderpoint
- Treat ERCB tenderpoint
- MFR of forearm fascia
- Diagnose and treat cervical spine

The Wrist

- The wrist contains three functional joints.
  - Radiocarpal joint
  - Midcarpal joint
  - Distal Radioulnar joint
    - Contains the Triangular FibroCartilage Complex (TFCC) which transfers force between the distal radius and the distal ulna.
- The true wrist joint is the radiocarpal joint
The Wrist

- **Carpal Tunnel**
  - Formed by carpal bones posteriorly and the flexor retinaculum anteriorly.
  - The tendons of the wrist, the flexors of the fingers, and the median nerve run within the tunnel. The lumbricals can also be found within the tunnel when the wrist is flexed.

---

Functional Anatomy

![Radio-ulnar Joint Cavity diagram](image)
The Wrist

- Tunnel of Guyon
  - Formed by the hook of the hamate and the pisiform.
  - The ulnar nerve and artery pass through the tunnel.
- Anatomic Snuffbox
  - Found on the lateral aspect of the wrist.
  - Site of the body of the scaphoid.

Physical Exam – Wrist

- AROM & PROM
  - Include ab/adduction
  - pronation/supination
- Snuffbox
- Axial load
- TFCC
- 6 compartments (1st most common)
  - Finklestein’s
- Radial pulse
- Shuck test
Functional Anatomy

Triangular Fibrocartilage Tear S63.591A

- Etiology
  - Forearm pronation
  - Hyperextension of wrist + rotational load
  - Degenerative = ulno-carpal abutment syndrome

Ulnar pain
Triangular Fibrocartilage Tear

- Most common signs/symptoms:
  - Ulnar wrist pain
  - Loss of strength
  - Painful DRUJ rotation
  - Tenderness and pain over TFC

- Traumatic tears more common < 40 years
- Degenerative tears more common > 40 years
- Best Imaging tool: MR highly sensitive & specific for fluid extension, TFC morphology/tear pattern
- MRI: Best diagnostic clue: Direct extension of fluid across TFC
Carpal Tunnel Syndrome G56.00

- Clinical symptom complex secondary to compression of the median nerve at carpal tunnel.
- Flexor retinaculum = transverse carpal ligament (TCL)
- Idiopathic – most common (associated with aging)

Differential Diagnosis
- Colles’ fracture
- Inflammatory processes
- Rheumatoid arthritis
- Gout and pseudogout
- Amyloid
- Median nerve tumors
Carpal Tunnel Syndrome

**Epidemiology**
- >50% incidence during lifetime
- Up to 100% incidence with repetitive motion activity
- Inflammation present in only 10%
- Edema present in 85%
- Vascular sclerosis in 98%
- Age: Peak – 5th or 6th decade
- Gender: F > M

**Most common signs/symptoms:**
- Numbness & tingling (median nerve distribution)
- Thumb, index, middle fingers + radial half of ring finger commonly affected
- Increased nocturnal pain + burning
Carpal Tunnel Syndrome

- Physical Exam
  - Muscle atrophy and loss of function late findings
  - Opponens weakness: Earlier finding
  - Atrophy of Opponens: Late findings

- MRI: Best diagnostic clue: Cross sectional enlargement and hyper intensity of median nerve

OMT

- OMT
  - Treat upper thoracic spine and ribs!
  - MRI study at CCOM
  - Treat pec minor tenderpoint
  - Treat cervical spine
  - Treat abducted / adducted ulna, and wrist (Still, MFR)

- OMT
  - Improve supination of elbow if restricted MET
De Quervain’s Tenosynovitis M65.4

- “Washer woman’s” sprain, stenosing tenosynovitis
- Tenosynovitis and tendonitis of first dorsal extensor compartment
- First extensor compartment – directly over radial styloid process
- Fibro/ osseous tunnel = tubular passageway 2.5 cm in length formed by groove in radial styloid & overlying extensor retinaculum

De Quervain’s Tenosynovitis

- Etiology
  - Repetitive activities (chronic micro-overuse) leading to increased friction and inflammation
  - Grasping
  - Pinching
  - Wringing
De Quervain’s Tenosynovitis

- Most common signs/symptoms:
  - Pain at radial styloid
  - Pain increased with wrist & thumb motion
  - Radiation of pain to radial side of forearm
  - Swelling
  - Positive Finkelstein test – not pathognomonic
- Age: 35 – 55 years
- Gender: F: M = 8 – 10:1

De Quervain’s Tenosynovitis

- Trauma
- Racquet sports
- Golf – hyperabduction during golf swing
- Fly fishing
- Javelin & discus throwing
OMT

- Treat upper thoracic spine and ribs
- Treat lateral epicondyle tenderpoint
- Treat thumb myofascial restriction
- Treat abducted / adducted ulna and wrist

- Improve supination of elbow if restricted MET

If I Only Knew 3 Techniques... And Only Had 3 Minutes......

- HVLA (or MET): T-L junction
- CS- Rib supine
- CS- Coracoid process
Summary

▶ A joint above and a joint below? BALONEY!

▶ If you want to sound all Sports Med CAQ-ish you have to know a few special tests, BUT

▶ A good DOc investigates UE complaints by checking the LS junction! And the TL, and the Cervico-Thoracic, and the C-Spine, and the Thoracic Inlet/Outlet, and the Shoulder, Elbow, Wrist, Hand, and, and, and….

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