

AAPA/ AAOS Musculoskeletal Galaxy

Upper Extremity and Cervical Spine Physical Exam Techniques

June 22-26, 2022 Denver, CO

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THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

2022 Musculoskeletal Galaxy
Denver, CO

Upper Extremity Physical Examination
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June 22-26, 2022



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PHYSICAL EXAMINATION
"Same time, every time"

- **INSPECTION**
- **PALPATION**
- **RANGE OF MOTION**
- **SPECIAL TESTS**



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THE ELBOW

- 3 Joints
 - Ulnohumeral joint (Hinge joint)
 - Radiohumeral joint (Pivot Joint)
 - Proximal radioulnar joint
- Kinetics
 - Flexion (biceps, brachialis, brachoradialis)
 - Extension (Triceps)
 - Pronation (pronator teres, quadratus)
 - Supination (biceps, supinator)



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ELBOW PHYSICAL EXAM

INSPECTION

- Obvious deformity
- Edema
- Ecchymosis
- Lesions/wounds
- Carrying angle (average 13° for women, 10° for men)



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ELBOW PHYSICAL EXAM

PALPATION

- | | |
|---|--|
| <ul style="list-style-type: none"> • Bony prominences • Distal humerus • Lateral epicondyle • Medial epicondyle • Radial head • Olecranon | <ul style="list-style-type: none"> • Soft tissue structures • Distal biceps tendon • Triceps tendon • Flexor pronator mass • Medial collateral ligament • Lateral ulnar collateral ligament • Olecranon bursa |
|---|--|



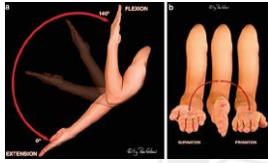
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ELBOW PHYSICAL EXAM

RANGE OF MOTION

- Active
- Passive
- Always examine bilaterally

- Flexion (130°-140°)
- Extension (0°)
- Pronation (70°-80°)
- Supination (80°-85°)



<https://www.youtube.com/watch?v=9881888888>
<https://www.youtube.com/watch?v=9881888888>

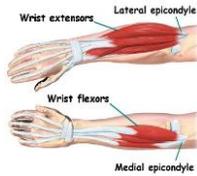


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ELBOW PHYSICAL EXAM

STRENGTH

- Flexion
 - Full supination (biceps)
 - Neutral (brachioradialis)
- Extension (triceps)
- Supination (biceps)
- Pronation (flexor-pronator mass)
- Wrist Extension (ECRL, ECRB, ECU)
- Wrist Flexion (FCR, FCU)



©MMG 2006

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1828886/figure/fig1/>

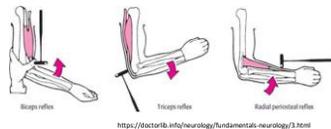


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ELBOW PHYSICAL EXAM

REFLEX TESTING

- Biceps Reflex – C5**
Nerve: Musculocutaneous n.
Segment: C5-C6
- Brachioradialis Reflex- C6**
Nerve: Radial n., Musculocutaneous n.
Segment: C5-C6
- Triceps Reflex – C7**
Nerve: Radial n.
Segment: C7-C8



<https://doctorlib.info/neurology/fundamentals-neurology/3.html>

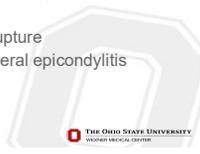


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ELBOW PHYSICAL EXAM

SPECIAL TESTS

- Valgus stress test: Medial (ulnar) collateral ligament (MCL)
- Varus stress test: Lateral ulnar collateral ligament (LUCL)
- Posterolateral Rotatory Instability Test (Pivot Shift Test) or Chair lift test: Lateral ulnar collateral ligament (LUCL)
- Tinel Test: Cubital tunnel syndrome or ulnar nerve compression
- Hook Test: Distal biceps rupture
- Modified Thompson Squeeze test: Triceps rupture
- Resisted wrist & middle finger extension: Lateral epicondylitis
- Resisted wrist flexion: Medial epicondylitis



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ELBOW PHYSICAL EXAM

Hook Test: Distal biceps rupture



THE JOURNAL OF BONE & JOINT SURGERY • BBJ • VOLUME 92-A • NUMBER 11 • SEPTEMBER 3, 2010
Distal biceps tendon injuries



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ELBOW PHYSICAL EXAM

Modified Thompson Squeeze test: Triceps rupture



Modified "Thompson Test"
Part 1. relaxed arm over table

Modified "Thompson Test"
Part 2. squeeze triceps to see extension at elbow

https://link.springer.com/chapter/10.1007/978-3-030-36790-9_34



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ELBOW PHYSICAL EXAM

Cubital tunnel syndrome

- Tinel tap test over ulnar groove produces numbness, tingling or electricity that radiates to the small and ring finger
- Elbow flexion test – prolonged elbow flexion evoke numbness and tingling in the small finger



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WRIST PHYSICAL EXAM

Same time, every time... Principles are the same, but the exam is more problem-focused

- **INSPECT** for obvious deformity, swelling, skin breakdown, open injury or bruising
- **PALPATE** for bony and soft tissue tenderness
- Test active and passive **RANGE OF MOTION** of the wrist and fingers
- Perform **SPECIAL TESTS** as indicated



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WRIST PHYSICAL EXAM

PALPATION – BONY ANATOMY

- Starting point - Lister's tubercle
 - Dorsal surface of the distal radius in line with the web space between the index and middle fingers
- Scapholunate interval
 - Slide fingers 1-2 cm distal to soft depression
- Radial styloid
- Scaphoid
 - Anatomic snuffbox (ulnar deviate the wrist)
- Thumb CMC joint
- Pisiform, hook of hamate
- Ulnar styloid
- DRUJ



A. Sorensen, R. J. Compson. Current Orthopaedics (2005) 18: 171-179. Examination of the wrist – surface anatomy of the carpal bones

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WRIST PHYSICAL EXAM

PALPATION – SOFT TISSUE

- Scapholunate ligament
- “Wrist sprain”
 - ECU
 - ECRL/ECRB
 - FCR
 - FCU
- TFCC
 - Ulnar fovea
- First dorsal compartment (APL, EPB tendons) – DeQuervain’s

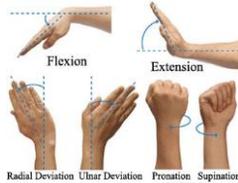


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WRIST PHYSICAL EXAM

RANGE OF MOTION

- Flexion (60°-80°)
- Extension (60°-70°)
- Pronation (70°-80°)
- Supination (80°-85°)
- Radial deviation (10°)
- Ulnar deviation (30°)



<https://www.crossfitmexico.com/blog/simple-solutions-for-poor-wrist-mobility/>



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WRIST PHYSICAL EXAM

SPECIAL TESTS

FINKELSTEIN TEST – DeQUERVAIN’S TENOSYNOVITIS

- Radial sided wrist pain worsened by thumb motion or ulnar deviation
- Wrap fingers over thumb and gently ulnar deviate the wrist



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HAND PHYSICAL EXAM

PALPATION

- Metacarpals
- Phalanges
- Collateral ligaments - fingers
- Thumb UCL/RCL
- Volar plate
- A1 pulleys



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HAND PHYSICAL EXAM

RANGE OF MOTION

- "Composite fist"
- Finger MCP (0 – 90)
- Finger PIP (0-100)
- Finger DIP (0-80)
- Thumb MP (0-55 – widely variable)
- Thumb IP (+15-80)
- Abduction/Adduction



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HAND PHYSICAL EXAM

SPECIAL TESTS – Evaluating for...

- Joint stability
- Tendon injury
- Nerve compression
- Trigger finger
- Vascular compromise
- Infection



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HAND PHYSICAL EXAM

SPECIAL TESTS

THUMB UCL/RCL INJURY

- Apply valgus and varus stress with the joint supported



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HAND PHYSICAL EXAM

SPECIAL TESTS

TENDON EXAM – FDS/FDP

- Isolate each finger
- 15% of the population has no FDS to the small finger



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HAND PHYSICAL EXAM

SPECIAL TESTS

TENDON EXAM – EPL

- Place palm flat and lift thumb off table
- Why can't you have them just give a thumbs up?
- Extension via thumb intrinsics and adhesions between EPL and EPB. This isolates the EPL



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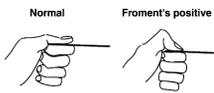
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HAND PHYSICAL EXAM

NERVE EXAM - MOTOR

- Median – Thumb abduction
 - Radial – Wrist extension
 - Ulnar – Finger abduction, cross fingers
 - PIN – Thumb extension, MCP extension
 - AIN – OK sign
- Froment's sign for ulnar nerve:



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HAND PHYSICAL EXAM

NERVE EXAM - SENSORY

- Sensation
- 2-point discrimination**
- Normal = 5mm
- >15mm = concern for nerve laceration



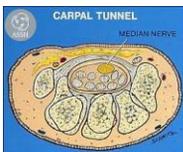
- Semmes-Weinstein Monofilaments**
- Quantitative test for sensory loss
- Normal is green (#2.83, 0.07 force-g)



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HAND PHYSICAL EXAM

MEDIAN NERVE ANATOMY AND DISTRIBUTION



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HAND PHYSICAL EXAM

CARPAL TUNNEL EXAM – TINEL TAP TEST

Tinel tap test

- Tap lightly over the median nerve
- Tapping produces numbness, tingling or electricity to the radial digits



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HAND PHYSICAL EXAM

CARPAL TUNNEL EXAM – MEDIAN NERVE COMPRESSION TEST

Augmented Durkan's

- Apply pressure over the median nerve
- Gently flex the wrist
- Hold 30-60 seconds
- Positive test produces numbness and tingling to the radial digits



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HAND PHYSICAL EXAM

TRIGGER FINGER

TRIGGER FINGER

- Palpate directly over the A1 pulley
- Pain on direct palpation
- Gently flex and extend the finger while palpating the pulley
- Feel for locking or nodular sensation
- Patients can sometimes make the finger lock on its own



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HAND PHYSICAL EXAM

VASCULAR COMPROMISE

ALLEN TEST

- Assess for patency of ulnar and radial arteries by occluding the artery one at a time and observing the hand for perfusion

CAPILLARY REFILL

- Compress nailbed until it blanches
- Assess the time it takes for color to return
- Normal cap refill = <2 seconds



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HAND PHYSICAL EXAM

INFECTION

KNAVEL'S SIGNS

Cardinal signs of flexor sheath infection

- Affected finger held in slight flexion
- Fusiform swelling over the affected tendon ("sausage digit")
- Tenderness to palpation over the affected tendon
- Pain on passive extension of the affected finger



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Physical Exam of the Shoulder

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History: Subjective Complaints

- Age/ Occupation/ Hand Dominance/ Sports
- Mechanism of Injury (MOI)
- Previous injury or surgery on shoulder
- Provocative or Alleviating movements
- Location, rating (0-10), quality of pain
- Night pain (common complaint with RTC tears)
- Paresthesia

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Shoulder Exams

- Inspection/ Palpation
- Range of Motion
 - Adhesive Capsulitis: AROM = PROM
- Strength Test
- Neurovascular Test
 - Shoulder vs C-spine pathology?
- Special Test



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Shoulder Inspection

- Evaluate shoulder movements when patient moves during exam, shakes hand, removes shirt
- Assess for deformities or malalignment (biceps rupture, AC separation, pec rupture, scapula winging, rounded shoulder posture, sulcus, scoliosis, kyphosis)
- Look for any scars, abrasions, ecchymosis, swelling, muscle atrophy (Deltoid- Axillary N.)
- Be sure to compare to contralateral shoulder!

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Shoulder Palpation

Bony Landmarks

- AC Joint/ Clavicle/ SC Joint
- Acromion
- Greater Tuberosity
- Bicipital Groove
- Lesser Tuberosity
- Coracoid Process
- Sternum
- Scapula
 - Superior Medial/ Inferior Angle
 - Scapular Spine

Soft Tissue Structures

- Trapezius Muscle
- Long Head of Biceps
- Pectoralis Muscle
- Deltoid
- Axilla/ Lymph nodes
- Subacromial/ Subdeltoid Bursa
- Rotator Cuff
 - Supraspinatus
 - Infraspinatus
 - Teres Minor
 - Subscapularis

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Shoulder Range of Motion

- Evaluate both AROM and PROM (feel end point)
- Flexion- 180 degrees
- Extension- 45 degrees
- Internal Rotation- 55 degrees (vertebral level)
- External Rotation- 40-45 degrees
- Abduction- 90 degrees
- Adduction

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Shoulder Strength Testing

Manual Muscle Grading (+/-)

- 5 Normal:** Complete ROM against gravity with full resistance
- 4 Good:** Complete ROM against gravity with some resistance
- 3- Fair:** Complete ROM against gravity
- 2- Poor:** Complete ROM with gravity eliminated
- 1- Trace:** Evidence of slight contractility, no joint motion
- 0- Zero:** No evidence of contractility

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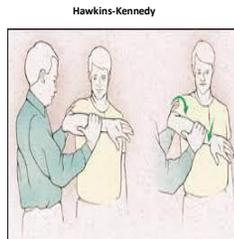
Shoulder Strength Testing

- Flexion: Anterior Deltoid/ Coracobrachialis
- Extension: Latissimus Dorsi/ Teres Major/ Posterior Deltoid
- Internal Rotation: Subscap/ Pec Major
- External Rotation: Infraspinatus/ Teres Minor
- Abduction: Middle Deltoid/ Supraspinatus
- Adduction: Pec Major/ Latissimus Dorsi
- Scapular Retraction: Rhomboid Major/ Minor
- Scapular Protraction: Serratus Anterior

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Shoulder Special Test

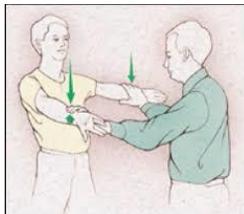
- Rotator Cuff Impingement/ Bursitis
 - Neer: Impingement
 - Hawkins/ Kennedy: Impingement
 - Drop Arm Test:
 - Hornblower's Test



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Shoulder Special Test

- Rotator Cuff/ Impingement
 - Jobe's/ Empty Can Test: Supraspinatus



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Shoulder Special Test

- Rotator Cuff Impingement/ Bursitis
- Bear Hug/ Belly Press/ Lift Off Test: Subscapularis



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Shoulder Special Test

- AC Joint
- Crossbody Adduction

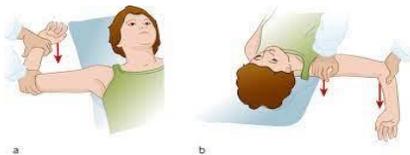
Cross body adduction test



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Shoulder Special Test

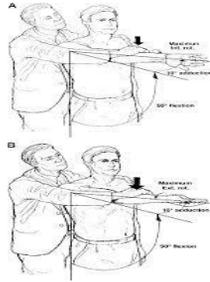
- Instability
- Apprehension and Relocation Test
- Sulcus Sign
- Crank/ Jerk for posterior/ Load and Shift Test



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Shoulder Special Test

- Labral Test/ Biceps
 - O'Brien's Test



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Shoulder Special Test

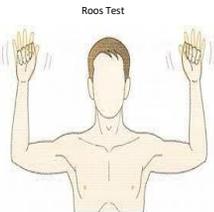
- Biceps
 - Speed's Test
 - Examiner resists forward flexion of the shoulder with the patient's arm fully extended and forearm pronated
 - Yergason Test
 - With the patient's elbow flexed to 90 degrees and forearm pronated, the examiner resists supination while the patient externally rotates the arm against resistance. During this movement, the biceps tendon is palpated in the bicipital groove to assess for the tendon popping out of the groove.

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Shoulder Special Test

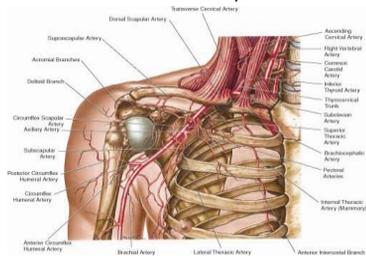
- Thoracic Outlet Syndrome
 - Roos/ EAST Test
 - Adson: extend arm, lateral rotate head toward affected side, deep breath and hold, diminished pulse

Vascular Exam: Brachial and Radial Artery



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Shoulder Vascular Anatomy



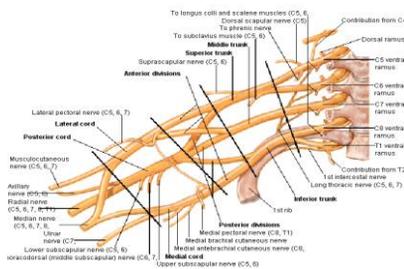
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Shoulder Neuro Exam

- Deltoid: C5-C6/ Axillary Nerve
 - Supraspinatus: C5-C6/ Suprascapular Nerve
 - Infraspinatus: C5-C6/ Suprascapular Nerve
 - Trapezius: Spinal Accessory N/ Cranial Nerve XI
 - Rhomboids: C5/ Dorsal Scapular Nerve
 - Serratus Anterior: C5, C6, C7/ Long Thoracic N.
- Reflex/ Sensation: Refer to C-spine exam

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Brachial Plexus



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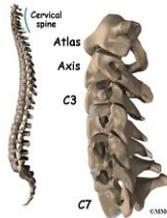
Physical Examination of the C-Spine

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Physical Exam of the Cervical Spine

- Goals**
- Determine if pain/dysfunction has a cervical cause
 - Musculoskeletal
 - Nerve impingement
 - Spinal Cord dysfunction
 - Determine next steps (imaging, referrals)
- General principles of Exam**
- Inspection
 - Palpation
 - ROM (neck/shoulder)
 - Neuromuscular testing
 - Sensory
 - Motor
 - DTR
 - Special Testing

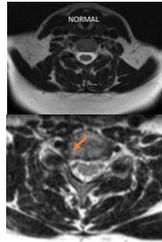


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Anatomy - Cervical



Cervical and thoracic disc/joint disease affect nerve roots at the same level. Or can also/compress the spinal cord.



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Spinal Nerves



- 8 Cervical: Upper Extremity**
 - Nerves named for the vertebra below
 - C8 exits the spine between C7 and T1
- 12 Thoracic: Ribs**
 - nerves named for vertebra above
- 5 Lumbar: Lower Extremity**
 - nerves named for vertebra above
- 5 Sacral: Pelvic organs**
 - nerves named for vertebra above
- 1 Coccygeal - vestigial**

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Clinical Presentation – History*

- +/- Hx of mechanism of injury
 - MVA (whiplash)
 - Fall
 - nothing
- Neck pain variable (+/-)
- Sensory symptoms
 - Pain in distribution of the nerve root, cervical less reliable mapping
 - Dull deep aching pain – myotomal
 - Pins and needles – usually distal
 - Electric/burning/zapping - entire arm
- Can have muscle spasms to try to stabilize injured joint
 - neck, upper back
- Motor symptoms
 - According to innervation
 - All joints have at least two nerve roots, therefore unusual to have complete paralysis of a joint from a radiculopathy
 - Interferes with sleep/work
 - Pain with stretching the nerve
 - Upper cervical nerve roots issues will have patient present with arm on top of head
 - Lower cervical nerve roots with arm against body
 - I can't wash my hair; I can't put my hair in a ponytail

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Clinical Presentation- Physical Exam

- Inspection
 - Observe patient
 - ROM of shoulders and neck
- Palpation
- Neurological Exam is wnl or
 - Reduced sensation or paresthesia with light touch
 - Weakness
 - Guarding = "give away strength"
 - Reduced reflexes in Radiculopathy
 - Increased reflexes in myelopathy
- Special tests
 - Spurling's Test for radiculopathy
 - Testing for differential diagnosis
- Upper motor neuron findings ?
 - +Hoffman's – normal 15%
 - Lhermitte's sign
 - More than 3 beats of Ankle clonus
 - Babinski – upgoing
 - Abnormal Tandem gait
 - Unsteady Romberg's
 - DTR 3+
 - Abnormal Rapid alternating movements

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Deep Tendon Reflexes

- NINDS Scale (National Institute of Neurological Disorders And Stroke)
 - 0: Absent
 - 1+: Low normal, diminished, trace response
 - 2+: Normal
 - 3+: Brisk, more reflexive than normal (more than one joint moves)
 - 4+: Very brisk, hyper reflexive, with clonus
 - 5+: Sustained clonus

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Special Testing

- Spurling Maneuver - Evaluates nerve root compression in foramen
- Upper Motor Neuron testing
 - Hoffman's Test
 - Lhermitte's sign
 - Tandem Gait
 - Rapid alternating movement
 - Babinski's
- Testing of the Upper Extremity may be helpful
 - Shoulder impingement
 - Phalen's for CTS
 - Tinell's for ulnar neuropathy and median nerve neuropathy
 - Rotator Cuff Pathology
 - Etc.

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Physical Exam Special Testing

Spurling Test



- Lateral flexion and extension of the neck with axial compression
- Positive when it recreates radicular symptoms (pain, numbness, tingling, paresthesia) in the appropriate dermatome
- 30% sensitive and 90%specific

Lhermitte's Sign



- Full flexion of cervical spine
- Positive when this results in electric shock sensation down arms, spine, and/or legs
- Indicates spinal cord dysfunction
- Not sensitive, but highly specific

<https://physio-study.com/spurling-test/> (accessed April 18, 2022)

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