UPPER EXTREMITY NEURO EXAM & COMMON PATHOLOGIES

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Introduction

• A good physical exam is the cornerstone art of a physiatrist. “we should own it”
• The art of a good neurologic exam is comprehensive, meticulous and provides a unique perspective to disease process.
• Should usually narrow down your differential diagnosis, help with recommending ancillary studies.
Goals

- Learn to scrutinize pt for unique physical and key findings
- To master the art of the upper extremity and neck neurologic exam
- To define the disabilities and handicaps that emanate from the disease
- Identify common nerve entrapments and syndromes encountered in our practice
Nervous system history

• Common chief complaints:
  • neck pain,
  • shoulder pain,
  • numbness, tingling, parasthesia.
  • weakness,
  Swelling, clumsiness, nocturnal pain.
• Limited range of motion
History of Presenting Complaint

- Site
- Onset (Acute vs Chronic)
- Frequency
- Duration
- Precipitating and relieving factors (walking, neck movement, or rest)
- History of trauma.
Review of Systems

Sphincter disorder: bowel/bladder incontinence

• Weight Loss. (malignancy)
• Seizures, tremor, fatigue
• Fevers/Chills/septic source (e.g., teeth, etc.)
• Skin marks: rashes, café-au-lait, angiomata.
• Cardiac murmurs, cyanosis, resp insuff, pulse irregularity.
Past Med History

- Diabetes, hypertension, stroke
- Spinal cord injury (spondylosis, myelopathy, radiculopathy, stenosis)
- Infections: (polio, HIV, syphilis, TB, fungal, parasitic, abscess.
- Vit B12 Deficiency
- Syringomyelia, Multiple sclerosis
- Auto immune Dz. (Rheumatoid, Sjogrens, Lupus)
Past Surg Hx

- Anterior/Posterior decompressions
- Spinal fusion
- Laminectomy/foraminotomy
- Needle Biopsy, ESI, Discography, SI joint injections etc
- CSF shunts
- Corpectomy
- PLIF/TLIF
Social/Occupational History

- Alcohol consumption
- Smoking
- IVDA
- Employment, any work limitations, toxins, repetitive trauma.
- Pre-morbid function hx
- Exercise, lifestyle, etc
- Hx of litigation
Buzz words for pain description

- **Allodynia**: pain due to stimulus that does not normally provoke pain.
- **Hyperalgesia**: increased response to stimulus that is normally painful.
- **Hyperpathia**: when threshold to pain appears elevated but, once reached, the stimulus is excessively felt.
- **Dysesthesia**: an unpleasant abnormal sensation whether spontaneous or evoked.
- **Parasthesia**: abnormal sensation whether spontaneous or provoked
Spinal & Peripheral system
Brachial Plexus Anatomy
Tools used for PE

- Reflex hammer
- Safety pin/paper clip
- Tuning Fork
- Cotton wool wisp, Q-tip
- Goniometer
- Calibrated compass.
- Strain guage
- Dynamometer
Sensory exam

- Pain
- Light touch
- Temperature
- Joint position
- Vibration
- Two point Discrimination
- Sensory inattention
- Stereognosis
- Graphesthesia
Dermatomes

- C5: shoulder
- C6: root of thumb
- C7: Middle digit
- C8: little digit
- T1: axilla.
- REMEMBER C7 EXTENDS DOWN MIDDLE FINGER.
Dermatomes
Sensory exam

- Pain: use safety pin on control surface eg face, then rapidly compare with dermatomes.
- Light touch: use cotton wool wisp
- Temp: use cold object eg test tube
- Vibration: tuning fork
- Two point discrimination: Use 2 blunt points (paper clip) applied 5 mm apart to fingers or calibrated compass
Sensory exam

- Joint position Sense: (proprioception) hold the sides of pts finger, demonstrate up/down mvt, close eyes and ask pt to specify direction of mvt.
- Grab thumb method
- Stereognosis: use coins in pocket
- Graphesthesia: trace numbers/letters on hand.
- Sensory extinction, inattention, neglect.
Sensory exam

• Classification; with pin prick
• 0: no sensation at all
• 1: feels pressure, no sharp sensation
• 2: normal sensation
Motor exam

- Appearance;
- Asymmetry, deformity,
- Wasting, hypertrophy (measure circumference)
- Fasciculation
UMN Vs LMN lesion

• Upper motor neuron signs;
  • Hyporeflexia, spasticity increased tone, clonus, tremors, chorea, ballismus, athetosis dystonia, apraxia.

• Lower Motor Neuron signs;
  • Hyporeflexia, flaccidity, atrophy and fasciculations.
Co-ordination

- **Dysmetria**: finger to nose, intention tremor
- **Dysdiadochokinesia**
- **Arm bounce**: excessive swinging
- **Rebound phenomenon**: flex elbow against resistance, sudden release may cause hand to strike face due to delay in triceps contraction.
Motor Exam

- **Pronator drift**: hold outstretched arms with hands supinated for approx 1 min.
- Positive if arm slowly drifts down or hand pronates. (UMN)
Reflexes

• **Biceps Jerk**: C5, C6 musculocutaneous nerve.
• **Brachioradialis jerk**: C5, C6
• **Pronator teres jerk**: C6, C7
• **Supinator Jerk**: C6, C7, radial nerve.
• **Triceps jerk**: C7, C8 radial nerve
• **Hoffmann reflex**: C7, C8. (Flick pts terminal phalanx of third digit, suddenly stretching flexor tendon on release, quick thumb flexion movement indicates UMN.)
Tone

- Assess by flexing and extending the elbow and wrist.
- **Clasp knife**: initial resistance to mvt, that is suddenly overcome. (UMN)
- **Lead pipe**: steady increase in resistance thru mvt. (extra pyramidal lesion)
- **Cog wheel**: Ratchet like increase in rigidity. (extrapyramidal lesion)
Ashworth Classification

- 0. No increase in muscle tone.
- 1. Slight increase in tone giving a “catch” when affected part is moved in flexion or extension.
- 1+. Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the reminder (less than half) of the range of motion.
- 2. More marked increase in muscle tone through most of the range of motion, but affected part(s) easily moved.
- 3. Considerable increase in tone; passive movement difficult.
- 4. Affected part is rigid in flexion or extension.
Strength

- Manual muscle testing:
  - 0/5; no contraction.
  - 1/5; visible, palp muscle contraction
  - 2/5; mvt with gravity eliminated
  - 3/5; mvt against gravity only
  - 4/5; against gravity + some resistance
  - 5/5; mvt with full resistance
Neck Exam

• Range of motion, tenderness, stiffness
• **Spurlings sign** (Roy Glenwood Spurling 1894-1968, Harvard Neurosurgeon):
  • Axial compression of spine and rotation to ipsilateral side with pain symptoms reproduced or worsens radicular symptoms, Due to foraminal stenosis or nerve root irritation
Neck exam

• **Lhermitte’s Sign**: (Jacque Jean Lhermitte 1877-1959, French Neurologist & Neuropsychiatrist)

• Flexing of neck reproduces shock like sensations that extend down the spine and shoot into limbs. Caused by trauma to C Spinal cord, MS, Cervical cord tumor, spondylosis or B12 deficiency.
Serratus anterior C5,6,7

- Press arms against wall
- Look for scapula winging
Shoulder abduction;

- Deltoid (middle)
- C5,6, axillary nerve
- Supraspinatus
  C5,C6. suprascapular nerve
Elbow Flexion

- Biceps C5,6 musculocutaneous nerve: flex with hand supinated

- Brachialis: C5,C6, flex with hand in full pronation

- Brachioradialis C5,C6 radial nerve: flex with hand in mid position
More extension and flexion

- **Elbow ext, Triceps**: C6, 7, 8, radial nerve
- Wrist Ext: ECRL & ECRB C6, C7
- **Finger Ext**: Ext digitorum, C7, 8, post interosseous nerve.
- **Thumb Abd**: APB median C8, T1, APL, EPB (C6, 7 radial)
- **Finger flex**: FDP 1/11, C8 median Nerve
- FDP III/IV C8 ulnar nerve
- **Thumb opposition**: Opponens pollicis C8/T1 median nerve, Flexor Pollicis Brevis median/ulnar, and APB.
- **Finger Abd/Add** dorsal/palmar Interosseous ulnar C8/T1
Manual muscle testing

• C5, 6, 7, 8, and T1
Cervical Radiculopathy

- Herniation of disc compressing a spinal nerve root.
- Symptoms: neck pain radiating to arm aggravated by extension, numbness, parasthesia,
- Spinal stenosis, spondylosis, ligament hypertrophy, spondylolisthesis, inflammatory radiculitis.
- Decreased strength, reflexes, sensation in affected limb.
Cervical radiculopathy: Studies

**MRI**: high sensitivity, False positive 10%, good screening test, use gadolinium to r/o epidural abscess, malignancy, discitis, osteomyelitis.

- **Xrays**: C-spine, flex/ex views
- **EMG/NCS**: positive if PSW’s seen in 2 muscles supplied by the same nerve root + paraspinals. SNAP’s/NCS (pre-ganglionic), F wave, H reflex are normal. Abnormal SSEP’s may be seen in myelopathy or spinal stenosis. EMG sensitivity 60-70%, good confirmatory test
- **ESR**: screen for infections etc
Conditions that mimic radic

- Fibromyalgia
- Regional Myofascial syndrome
- Polymyalgia Rheumatica
- Sternoclavicular joint arthropathy
- Acromioclavicular joint arthropathy
- Shoulder bursitis, impingement syndrome, bicipital tendonitis
- Lateral epicondylitis (tennis elbow)
- DeQuervain’s tenosynovitis
- Trigger finger, stenosing tenosynovitis
Brachial Plexus syndromes

- **Klumpke paralysis**
- Augusta Marie Klumpke: 1859-1927
  French neurologist
- Lower Plexus (C8, T1)
- Paralysis of hand intrinsics, claw hand, sensory loss and a Horner's syndrome if T1 is involved
Brachial plexus syndromes

- **Erb-Duchennes palsy**
- Wilhelm Heinrich Erb (1840-1921) German Neurologist. Described condition in a thesis in 1875
- Upper plexus (C5,6)
- Deltoid, supraspinatus, infraspinatus, biceps, brachialis paralysis
- Waiter’s tip position
- Huge malpractice issue.
- Surgical repair with sural nerve graft.
- SNAP’s affected, postganglionic lesion.
Burners/ Stingers

- Traction neuropathy of upper plexus during sports injuries.
- Mainly football, wrestling.
- Numbness, tingling, parasthesia & proximal muscle weakness.
- Symptoms usually resolve in minutes.
- If symptoms persist order MRI, EMG/NCS to proximal shoulder muscles.
- C5/6 muscles affected, shoulder wasting may occur.
Thoracic outlet syndrome

- Compression of brachial plexus C8-T1 fibers, subclavian artery and vein due to fibrous band or cervical rib
- Neck/shoulder pain, parasthesia in the forearm, made worse by carrying suitcase/bag
- Adson’s sign: loss of radial pulse on abduction and external rotation of the shoulder.
- EMG/NCS: True neurogenic TOS, medial antebrachial cutaneous and APB, more involved than Ulnar motor and sensory and vice-versa for post cardiac surgery sternotomy.
Brachial Neuritis

• AKA neuralgic amyotrophy, Parsonage-Turner syndrome.
• Incidence: 1.64:100,000 pts, 2.4:1 M/F ratio
• Viral, vaccination, strenous exercise, IVDA
• Acute shoulder pain, rapid onset, proximal muscle weakness.
• 66% unilateral, 34% bilateral involvement
• Minor sensory loss, outer aspect of shoulder
• Wasting in 3-6wks.
• 89% recover in 3 yrs.
Pancoasts Tumour

- Apical squamous cell Cancer
- Involves lower cervical & upper thoracic roots
- Severe pain around shoulder and down inside arm
- Weak wasted hand muscles
- Sensory loss in C8/T1 dermatomes
- Horner's Syndrome (stellate ganglion, sympathetic chain) involved.
Neoplastic Vs Radiation Induced Plexopathy.

- Horners syndrome reported more in tumor pts
- Pain reported in 80% of tumor pts Vs 19% in radiation pts
- Radiation tends to involve upper trunk (78%) and tumor lower trunk (72%)

- Other radiation plexopathy peals;
- Radiotherapy of axilla > 6000 rads have higher risk of fibrosis.
- Lower plexus damage seen in 1-3% pts
- Lymphedema is a common problem, makes EMG’s difficult
- Delayed onset 5-30 mths
- Resultant fibrosis causes entrapment of brachial plexus
- Myokymia and fasciculations seen on EMG in radiation plexopathy.
Long thoracic nerve (C5, 6, 7)

- Serratus anterior
- Damaged by carrying heavy objects, strapping the shoulder, limited brachial neuritis, DM
- Scapula winging
Suprascapular Nerve (C5,6)

- Supraspinatus and infraspinatus
- Weakness in arm abduction (supraspinatus) and external rotation (infraspinatus).
- Entrapment at suprascapular notch involves both muscles Vs spinoglenoid notch that involves only infraspinatus
Musculocutaneous nerve (C5,6)

- Supplies biceps, brachial and coracobrachial
- Sensory; lateral border of arm
- Damaged by humerus fx
- Weakness in Elbow flexion, forearm supination and absent biceps reflex
Radial nerve (C6,7,8)

- **Saturday night palsy**: wrist drop (weak extensors), sensory loss dorsum of hand & forearm. Absent supinator or triceps reflex.

- Axilla Vs Spiral groove entrapment: Distinguished by sparing of the triceps and anconeus in spiral groove entrapment.

- **Post interosseous Neuropathy** (pure motor): involves EIP and EDC with sparing of brachioradialis and ECR (Arcade of Frohse)

- **Superficial radial sensory**: due to tight handcuffs/wrist ware
Ulnar nerve entrapment

- Medial cord C7/8.
- Cubital tunnel syndrome
- Injury or entrapment at elbow or distal to medial epicondyle.
- Weakness results in claw hand (ring and small fingers) or benediction sign.
- Positive Froment’s test. weakness of adductor pollicis.
- Atrophy of 1st dorsal interosseous
- Positive Tinel’s at elbow.
- EMG/NCS, drop in amplitude and conduction velocity (>10m/s) across elbow. Inching technique sometimes used to find focal conduction block.
- Surgical transposition/elbow pads used to treat.
Benediction sign/ claw hand
Ulnar Nerve entrapment (wrist)

- Guyon’ canal: Sensory loss in digits 4&5, weakness in all ulnar intrinsic hand muscles.
- Deep terminal branch proximal to hypothenar innervation: No sensory loss, weakness in all intrinsics
- Deep terminal br. Distal to hypothenar : as above except sparing of hypothenar muscle.
- Digital sensory br. No weakness, sensory loss in digits 4&5.
Median nerve Anatomy
Median Nerve (C7,8)

- Sites of entrapment; Carpal tunnel, pronator teres heads, ligament of struthers, bicipital aponeurosis
- Weakness abd/opp of thumb, pronation of forearm, wasting of thenar muscles
- Sensory loss in index and middle finger (variable)
Anterior Interosseous Syndrome

- Kiloh-Nevin Syndrome.
- Purely motor nerve
- Supplies FDP digits 2&3, FPL, and pronator quadratus
- Trauma, Parsonnage turner syndrome (NAM).
- OK sign.
Pronator Teres Syndrome

- Median nerve entrapment between heads of pronator teres, first muscle supplied
- Diffuse forearm pain & parasthesia
- Positive tinel's, decreased wrist flex, finger flex, thumb opposition.
- Differentiate from CTS, by wrist weakness and more diffuse sensory loss
Carpal Tunnel Syndrome

- Symptoms:
  - Median nerve distribution, numbness & parasthesias.
  - Nocturnal pain and numbness
  - Weakness of grip, dropping things easily.
  - Worsening of symptoms with use of hands e.g. driving
CTS

• Signs:
  • Weakness of thumb abduction (APB)
  • Loss of median nerve sensation.
  • Positive Phalen’s or reverse Phalen’s sign, tested by holding hands in flexion or extension of wrist for 60 sec with symptom reproduction. (highly sensitive/specific)
CTS

• Tinels Sign: reproduction of median parasthesias by pressing or tapping the median nerve at the wrist. (not highly sensitive/specific)
• Positive Flick sign: ask pt if she/he wakes up at night with pain & numbness. If pt says yes, ask what she does, if pt shakes of flicks hand that is a positive sign. Do not give the patient any visual or verbal cues.
Risk factors

- Diabetes
- Repetitive hand movements
- Rheumatoid Arthritis
- Pregnancy
- Obesity
- Thyroid disease
- Common in women 50’s and 60’s
EMG/NCS for CTS

- Distal motor latencies to APB: 40% sensitive, down from 80% in 60’s.
- SENSORY STUDIES:
  - **Numb thumb**: Median/radial diff >0.5ms
  - **P8 Mid palm/Orthodromic stimulation**: median/ulnar diff >0.3ms
  - **Split ring finger**: median/ulnar diff >0.4 ms
  - Combined sensory Index (CSI) of all three studies > 1 is 98% sensitive.
- EMG controversial, will see PSW’s in thenar muscles, usually used to r/o radiculopathy
Carpal Tunnel Treatment

- Carpal tunnel landmarks.
- Median nerve exposed
- Surgical release
- Weight loss
- Braces, resting wrist night splints.
- Tunnel injections
Ischemic Insult

- Muscles can tolerate ischemia up to 4 hrs, at 6 hrs effect is uncertain, 8 hrs irreversible damage
- Peripheral nerves can survive up to 4 hrs w/only neurapraxic damage, at 8 hrs changes are irreversible
Compartment Syndrome

- Acute compartment syndrome
- Subacute Compartment syndrome
- Volkmann’s ischemic contracture
- Recurrent compartment syndrome
- Compartmental syndrome
Volkmans Ischemic Contracture

- Forearm flexed in pronation
- Wrist flexed
- MP joints hyperextended
- PIP/DIP flexed
- Insensate hand, loss of median, ulnar nerve
CRPS: reflex sympathetic dystrophy

- Complex regional pain syndrome, AKA causalgia, shoulder hand syndrome, sympathetically maintained pain (SMP).
- CRPS type 1: due to trauma, soft tissue injury, sprain, strain, surgery, fx, surgery.
- CRPS type 2: due to injury to large peripheral nerve.

- 3 stages: 1. acute (hyperemic), 2. dystrophic (ischemic), 3. Atrophic stage.
CRPS

• Symptoms: constant burning pain, allodynia, hyperpathia, local edema, warmth and skin changes.
• Xray; patchy osteoporosis, 3 phase bone scan( flow and static phase inc uptake)
• Tx: PT, prednisone, alpha blockers,, TCA’s, Neurontin, CBZ, stellate block, Bier block, neurolysis, sympathectomies, etc.
References

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