Entrapment Neuropathies & Neuropathic Pain

Mazen M. Dimachkie, M.D.
Disclosures

Speaker Bureau

- Depomed, Merck, Pfizer

Grants

- Pfizer, CSL-Behring

Consultant

- Nufactor, Biomarin and Catalyst
Case 1

- A 39 yo woman presents with 3 years h/o right medial proximal forearm pain exacerbated with activity

- Examination:
  - Normal strength, sensory and reflexes
  - Tenderness in the right medial forearm
  - Tinel sign over right medial forearm
  - Supination causes pain radiation to thumb
Case 1

Which nerve is involved?

A. Median at the wrist / Carpal tunnel Sd
B. Median at the forearm
C. Median at the brachial plexus
D. Ulnar at the elbow
E. Radial at the spiral groove
Median Neuropathy at the Wrist aka Carpal Tunnel Syndrome

- The most common entrapment neuropathy
- Lifetime prevalence is 10%, 50% bilateral
- It is a clinical syndrome & mostly sensory
- Occasionally loss of dexterity due to weak opponens pollicis & APB
- Signs: Flick, Tinel & Phalen
Median Neuropathies
At The Forearm

- 4 patients for every 100 CTS patients
- Forearm pain, numbness, tenderness with exercise
- Proximal Tinel sign, slight weakness if any
- Forearm pain with resisted:
  - Forearm pronation: pronator teres syndrome is the most common median NP at the forearm
  - Elbow extension in forearm supination: Ligament of Struthers or supracondylar spur compression
  - Resisted elbow flexion: bicipital aponeurosis Sd
- Provocative tests lack of specificity
DDX of Median Neuropathies

At The Forearm

- Trauma
- Compartment syndrome from blunt trauma
- Mass lesion: tumor, hematoma
- Electrical burn
- MMN
- Mononeuritis multiplex 50% of cases
- Ischemic monomelic neuropathy / A-V fistula
- Thrombophlebitis of the median basilic vein
Anterior Interosseous Syndrome

- Weak FPL, pronator quadratus & long flexor of index & middle fingers
- Pinch sign or OK sign, no sensory loss
- Pain is exacerbated by resisted proximal interphalangeal flexion of the middle finger
- DDX:
  - Form fruste of neuralgic amyotrophy
  - MMN
  - Mass lesion

*Dimachkie MM. Median neuropathies other than carpal tunnel syndrome. In Medlink. Arbor publishing Corp.*
Nerve Conduction Studies

Manifestations of Focal Demyelination

- Slowing of nerve conduction velocity: **synchronized or uniform** loss of myelin from one axon to the next **as in CMT**

- Temporal dispersion: **non-uniform or desynchronized** loss of myelin from one axon to the next, leads to phase cancelation

- Conduction block: **focal & contiguous** demyelination of 2 or more internodes in ≥ 30-50% of axons
Response of PNS to Injury

- Slowed conduction velocity: most common finding in CTS and ulnar NP & correlates with numbness
- Axon loss is common in mononeuropathies
- Reduction in SNAP and /or CMAP amplitude is proportional to percent of axon loss
- Lower motor neuron neurogenic weakness is due to either conduction block or axon loss \textbf{NOT} slowed NCV
Sequence of NCS/EMG Responses To Axon Loss Nerve Injury

- Day 0: Neurogenic firing
- Day 7: Reduced CMAP amplitude
- Day 11: Reduced SNAP amplitude in postganglionic lesions
- Day 21: Fibrillation potentials
- SNAP spared in preganglionic lesions
CTS: Basic EDX Principles

- Sensory then motor latencies delays →
- Sensory amplitudes decline →
- Motor amplitudes decline in more advanced cases
- Inching studies are too variable & technically challenging
- Comparative motor and sensory studies:
  - Transcarpal median & ulnar:
    » Motor: 2nd lumbrical to second interosseus
    » Sensory: Palmar orthodromic
  - Transcarpal median & radial sensory responses
Case 1
Testing

- Routine nerve conduction studies: normal
- Needle EMG: normal
- GM1 antibody panel negative
Case 1

What would you do next?

A. Comparative and other nerve conductions
B. Carpal tunnel release
C. Reassurance & occupational therapy
D. MRI of forearm
E. Treat with intravenous immunoglobulin
Forearm MRI

- Large fusiform, moderately enhancing mass in continuity with the median nerve
- The mass was successfully resected
- Post-operatively: all symptoms resolved

Pathology

- Pathology = benign nerve sheath schwannoma:
  - slow growing encapsulated nerve sheath tumors
  - arise from the epineurium of the peripheral nerves
- 0.8-2.1% of all hand tumors, less frequently in the forearm
- Present with localized isolated pain, positive tinel sign & normal NCS/EMG
Pearls & Oysters

- Forearm & shoulder pain commonly in CTS
- No focal tenderness / Tinel at forearm in CTS
- Provocative tests of proximal median neurpathies are non-specific
- Weakness in muscles other than APB or opponens is not part of CTS
- EMG/NCS is normal in proximal median neuropathy
Case 2

- A 56 yo man presents with left arm weakness
- Prior exposure to lead vapors but denied alcohol
- Examination:
  - Finger abduction 3/5
  - Wrist and finger extensors 2/5
  - Distal interphalangeal extension 2/5
    » With wrist & metacarpophalangeal joints passively extended, distal interphalangeal extension becomes normal
  - Pinprick reduced over dorsal first web space
  - Normal reflexes
Case 2

Which nerve is involved?

A. Median at the wrist / Carpal tunnel Sd
B. Ulnar at the elbow
C. Ulnar at the wrist
D. Ulnar at the brachial plexus
E. Radial at the spiral groove
Ulnar Neuropathy at the Elbow

- The 2nd commonest arm entrapment NP
- Often bilateral
- Multiple Sites:
  - Proximal ulnar groove at the elbow is the most common entrapment site
  - Cubital tunnel
  - Compression in the wrist and hand
- Etiologies: external compression, repetitive traction (elbow), internal compression (ganglia, tumors, fibrous bands)
Ulnar Neuropathy at the Elbow
Presentation

- Numbness in the little finger
- Lack of dexterity / reduced grip
- Weak finger abd/adduction & digits 4, 5 flexion
- Elbow pain
- Claw hand
- Froment’s sign

*Dimachkie MM. Ulnar Neuropathy at the elbow. In Medlink. Arbor publishing Corp.*
Ulnar Neuropathy at the Elbow Predisposing Conditions

- Chronic compression
- Diabetes mellitus
- HNPP
- Elbow condylar or humeral fracture
- Elbow deformity: RA, OA, valgus, Paget’s
- Leprosy
- Ulnar nerve prolapse
- Supracondylar spur
- Mass lesion

Dimachkie MM. Ulnar Neuropathy at the elbow. In Medlink. Arbor publishing Corp.
Ulnar Neuropathy
Differential Diagnosis

- Motor neuron disease
- MMN
- C8 radiculopathy
- Syrinx
- Stroke
- Neurogenic TOS / lower trunk brachial plexopathy
Ulnar Neuropathy at the Elbow

NCS

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Recording Site: Abductor digiti minimi (manus)

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<tr>
<th>Stimulus Site</th>
<th>Lat</th>
<th>Dur</th>
<th>Amp (mV)</th>
<th>Area (mVms)</th>
<th>Temp (°C)</th>
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<td>A5: Erb’s point</td>
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Segment

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Temp: 34.7 °C

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<td>D4</td>
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<tr>
<td>D2</td>
<td>9.2 ms</td>
<td>1.2 mV</td>
</tr>
<tr>
<td>P</td>
<td>10.9 ms</td>
<td>0.7 mV</td>
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**ABSTRACT:** Patients with clinical evidence of ulnar mononeuropathy at the elbow may have normal routine motor and sensory nerve conduction studies, suggesting a low sensitivity for these methods. Other, more specialized techniques may have a higher sensitivity, increasing diagnostic yield, and provide more specific localization of the lesion. We compared the sensitivity and specificity of ulnar segmental nerve conduction studies (SgNCS or “pinching”) at 2-cm intervals with those of routine ulnar motor and sensory studies. We studied 21 arms with symptoms or signs of ulnar neuropathy and 25 asymptomatic control arms. SgNCS proved significantly more sensitive than more routine studies in diagnosing ulnar neuropathy at the elbow, with a sensitivity of 81%, whereas motor conduction velocity in a longer (10–14 cm) segment across the elbow was the next most sensitive at 24%. Recording from the first dorsal interosseous muscle did not improve sensitivity when compared with recording from the abductor digiti quinti. Short SgNCS significantly improves detection of ulnar mononeuropathy at the elbow and should be considered when routine studies are negative and clinical suspicion remains high.


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**THE UTILITY OF SEGMENTAL NERVE CONDUCTION STUDIES IN ULNAR MONONEUROPATHY AT THE ELBOW**

YEVGENY AZRIELI, MD,¹ LOUIS WEIMER, MD,² ROBERT LOVELACE, MD, FRCP,² and CLIFTON GOOCH, MD²
Case 2

- Routine NCS is normal. What would you do next?
  A. Inching of ulnar nerve at the elbow
  B. Test the radial n. at the spiral groove
  C. MRI of forearm
  D. Reassurance & occupational therapy
  E. Treat with intravenous immunoglobulin
Radial Neuropathy
Mechanisms

- Compression: sleep / tourniquet / muscular
- 15% of all humeral fracture accounting for 25% of radial NP
- Systemic disease: diabetes, MMN, leprosy
- Lead poisoning spares brachioradialis (BR) muscle
- Blunt or birth trauma
- Tumor, cyst or lipoma
- Entrapment at Arcade of Frohse
Saturday Night Palsy

- Sunderland 1945
- Radial nerve compression at spiral groove
- Back of the chair or bed partner
- 50% of all radial neuropathies
- Painless wrist and finger drop
- Paresthesias of wrist dorsum
- Good prognosis

Dimachkie MM. Radial Neuropathy. In Medlink. Arbor publishing Corp.
Saturday Night Palsy
Examination

- Triceps and anconeus sparing
- Flaccid BR during elbow flexion (82%)
- Weak wrist and finger extension
- Reduced pin over dorsum of metacarpal joints 1 & 2 (60%)
- “Weak” interossei
- Spared distal phalangeal extension
Case 2

Tests

- More history: awoke with it 3 weeks ago
- Urine heavy metal screen normal, GM1 negative
- Routine left arm nerve conduction studies were normal
- NEE fib. in left:
  - BR
  - EDC
  - Sparing triceps
Case 2

Pearls & Oysters

- Mechanical disadvantage limits hand strength testing in radial neuropathy
- It can fake you in thinking there is weakness in spared muscles such as finger abduction & distal phalangeal extension
- Wrist extension on a flat surface normalizes interosseous muscle strength
- Wrist & metacarpophalangeal joints extension normalizes distal interphalangeal joint extension which is innervated by what nerve(s)?
Case 3

- 54 yo woman with acute left foot drop x 1 month and chronic low back pain x 2 years
- PMH: left breast cancer s/p mastectomy and hormonal therapy, recent weight loss
- Exam:
  - Ankle dorsiflexion & toe extension 2/5
  - Foot inversion 4/5
  - Decreased pin perception on left foot dorsum
Case 3

Which test would you order?

A. EMG
B. Nerve conduction studies
C. MRI lumbar spine
D. MRI lumbosacral plexus
E. GM1 antibody panel
Clinical Presentation

Common Peroneal Neuropathy

- Most common peripheral nerve entrapment of the leg
- Acute or subacute foot drop
- Non progressive
- Foot numbness
- Painless except with mass lesion
- 10% bilateral
Common Peroneal Neuropathy
Associated Conditions

- Weight loss
- Compression
  - Leg crossing, squatting, braces, bandage, cast
  - Surgical procedures / anesthesia
  - Coma
- Diabetes mellitus, HNPP
- Trauma / fracture
- Ganglion cyst & nerve tumor slowly progressive
- Weight loss & leg crossing triggered this case
Case 3
Pearls & Oysters

- Always passively dorsiflex the ankle when testing ankle inversion in pts with foot drop
- In peroneal NP, ankle dorsiflexion weakness is of same degree as toe extension
- In L5 radiculopathy, big toe extension is weaker than ankle dorsiflexion since EHL has more L5 root innervation
- If painful (exclude MM), progressive or no clear trigger, look for mass lesion via ultrasound
Neuropathic pain

Multidimensional management

- Non-pharmacological therapy: PT, splinting, avoidance of compression positions*

- Pharmacological therapy:
  - Corticosteroids*
  - Antidepressants
  - Antiepileptics
  - Topical agents
  - Analgesics
  - Opioid drugs

- Decompression*
Pain Modulation 2013

First line drugs:
- Anticonvulsants: Gabapentin, pregabalin
- Antidepressants: tricyclic antidepressants, duloxetine
- Analgesics: tramadol
- Topical: lidocaine 5% patch

Second line drugs:
- Venlafaxine alone or as add-on to gabapentin
- Carbamazepine, Na valproate, lamotrigine, topiramate

Other drugs:
- Topicals through compounding pharmacy (ketoprofen, amitriptyline, tetracaine, lidocaine, cyclobenzaprine, lioresal, ketamine, gabapentin, carbamazepine)
- Opioids: morphine, oxycodone CR, pain contract…