Median Neuropathy
Carpal Tunnel Syndrome
CTS

- Median nerve entrapment at the wrist
- The most common focal neuropathy
- F:M 3:1
- Peak age: 40-60
- >70 y/o: F=M
CTS: Hx

• Insidious onset/slowly progressive
• Tingling
• Pain
• Numbness
• “Swollen”
CTS: Hx

- Provocation of sx
  - Sleep due to wrist flexion
  - Hand use
- Dominant > non-dominant hand
- Distribution
  - Digits 1-4
  - Note: Many c/o whole hand or arm involvement
Median Nerve sensory impairment: CTS

Aids to the examination of the peripheral nervous system, 4th edition 2000
CTS: Pathophysiology

- Increased pressure within carpal tunnel leading to a progression of:
  - hypoperefusion
  - ischemia
  - demyelination
  - axon loss
CTS: Risk Factors 1

• Reduced Tunnel space
  – Wrist structure: shallow, narrow wrists
  – RA: synovial thickening and osteophytes
  – OA: osteophytes
  – Ganglia
  – Trauma: fracture, hematoma
• Diabetes: Microangiopathic ischemia
• Hypothyroidism: myxedema
CTS: Risk Factors 2

- Pregnancy: esp 3rd trimester (edema)
- Hemodialysis: beta-2-microglobulin
- Obesity
- Metabolic syndrome
CTS: Risk Factors 3

- Activities:
  - Manual labor
  - Hand held vibratory tools
  - Other work or recreational activities with repeated flexion/extension esp with gripping
  - Sports (wt lifting, football, golf)
  - Chronic wheelchair use
CTS: Risk Factors 4

• *Note: the balance of evidence does not support keyboarding/computer work as a significant risk factor*
CTS: Exam

• Inspection
  – Thenar eminence atrophy

• Sensory
  – Light touch: cotton or your fingers
  – Pin prick at volar vs dorsal surfaces of fingers and palm

• Motor
  – Abductor pollicis brevis
    • Palm flat; thumb abducted at 90 degrees
CTS: Exam

• Provocative maneuvers
  – Tinel’s sign: paresthesias with percussion over nerve at wrist
  – Phalen’s or Reverse Phalen’s Tests
  – Carpal compression test: pressure over the tunnel with both thumbs
CTS: EMG/NCS

• Sensitivity: > 85%
• Specificity: > 95%
• Purpose
  – Confirm dx
  – Determine severity for treatment planning including pre-surgical prognosis
• Limitation
  – Only abnormal when there has been nerve damage
  – Patient discomfort
• EMG will be normal in a patient with episodic hypoperfusion who has not progressed to ischemia/demyelination/axon loss
CTS: Treatment

- Treat underlying medical condition
- Avoidance of precipitating activities
- Wrist splints
  - Nocturnal only vs day/night
- NSAIDs: brief benefit
- Oral steroids x 1 month: temporary benefit
- Gabapentin
- OT
CTS Treatment: Steroid Injections

• Effective in reducing symptoms
• Temporary benefit
• Role:
  – Delay surgery
  – Non surgical candidates
CTS Treatment: Surgical Decompression 1

- Open
- Endoscopic
  - Reduced post op pain
  - ? More rapid recovery

- Equally effective
- 75% success (range 27%-100%)
CTS Treatment: Surgical Decompression 2

• Surgical “failures”:
  – Wrong diagnosis
  – Normal EMG/NCS
  – Incomplete release
  – End-stage CTS: no salvageable nerve
  – Coexistent systemic illness (diabetes, RA)
Proximal Median Neuropathies
Proximal Median Neuropathy

• More likely to be acute: Often a hx of specific trauma or compression

• Broader distribution of weakness
  • Forearm pronation
  • Wrist and finger flexion
  • “Orator’s hand”
  • “Circle sign”

• Sensory: lateral fingers and palm
Median Nerve sensory impairment: arm lesion

Aids to the examination of the peripheral nervous system, 4th edition 2000
Median: Axillary and Upper Arm

- Crutch compression
- Anterior shoulder dislocation
- Humerus fracture
- Stab wounds
- Hematoma
- Dialysis fistulas
- Sleep palsy
Median: Elbow/Forearm

• Elbow fracture, dislocation, and reduction
• Supracondylar Spur and Ligament
• Trauma
• Iatrogenic:
  • Brachial artery catheterization
  • Venipuncture
• Pronator Teres hypertrophy/overuse
• Fractures of radius or ulna
Supracondylar anatomy

Focal Peripheral Neuropathies, 4th Ed. 2010
Ulnar Neuropathy
Ulnar Neuropathy at the Elbow (UNE)
Ulnar Neuropathy at Elbow

• Nerve compression or injury at medial epicondyle or just distal in the cubital tunnel

• M:F approx 2:1
Ulnar groove and cubital tunnel

Focal Peripheral Neuropathies, 4th Ed. 2010
UNE: Etiology 1

- Bony Deformity
  - RA, OA
  - Congenital: valgus deformity or shallow groove
  - Old fracture

- Trauma
  - Fracture
  - Dislocation
  - Soft tissue injury
UNE: Etiology 2

• External pressure: Single or multiple episodes
  • Leaning on elbow at desk or driving
  • Perioperative
  • Critical illness/ICU/prolonged hospitalization

• Repetitive or prolonged elbow flexion
  • Causes compression in cubital tunnel
  • Sleep: can mimic CTS hx
  • Nerve prolapse over medial epicondyle
UNE: Etiology 3

- Compression in cubital tunnel (FCU aponeurosis fibrosis)
- Others
  - Diabetes mellitus
  - Synovial cysts (in RA)
  - Tumor/mass
  - Fibrous band
  - Leprosy
- Idiopathic
UNE: Hx

- Sensory sx in ulnar hand/fingers
- Caveat: Pain often more diffuse/non localized
- Aching at elbow
- Sensory sx wake from sleep or worse with arm use
- Hand/grip weakness
UNE: Sensory Exam

• Modalities
  – Pinprick
  – Light touch with examiner’s fingers or cotton

• Distribution
  – Anatomically medial hand
  – Digit 5
  – Digit 4: medial aspect
  – No sensory loss proximal to the wrist crease
UNE: Sensory Exam

• Tinel’s sign: paresthesias in medial hand with tapping of ulnar nerve at the elbow
  – Not sensitive
  – Not specific
  – Useful if negative on asymptomatic side
Ulnar neuropathy at elbow sensory distribution

Aids to the examination of the peripheral nervous system, 4th edition 2000
UNE: Motor Exam

• Inspect hand intrinsic muscles
  – First dorsal interosseus (FDI)
  – Abductor digiti minimi (ADM)
  – Compare to median innervated APB

• Focused Strength exam
  – Hand intrinsic muscles (ulnar vs median)
  – Wrist flexor with medial deviation (ulnar FCU)
  – Compare to wrist and/or finger extensors (Radial n)
  – Triceps (Radial n)
Ulnar intrinsic muscle atrophy

Focal Peripheral Neuropathies, 4th Ed. 2010
UNE: Other

• Evaluate for ulnar nerve prolapse
  – Palpate nerve in the condylar groove with arm straight
  – Slowly flex elbow while palpating and note any shifting of the nerve over the medial epicondyle
UNE: EMG/NCS

• Goals:
  – Confirm ulnar neuropathy
  – Exclude radiculopathy
  – Localize lesion
  – Determine severity

• Sensitivity: 37-86%
• Specificity: > 95%
UNE: MRI

- Eval for osteophytes, lipomas, ganglia
- Increased T2 signal in ulnar nerve
- Enlargement of ulnar nerve
UNE: Management

• Natural history: Imperfect data
  – Reports that 30-90% have improvement or complete recovery with non-surgical management

• In general surgical intervention is less successful than in CTS
UNE: Non-surgical

• Patient education
• Ergonomics
• Goals
  – Avoid pressure on elbow
  – Avoid prolonged elbow flexion
UNE: Non-surgical

- Ulnar nerve elbow pad
  - Soft sports elbow pad
  - Orthotics company
  - OT fabricated
  - Day use: padding over ulnar groove
  - Night use depends on sleep position
    - Padding over ulnar groove
    - Padding reversed to prevent elbow flexion
Ulnar nerve elbow pad 1

Focal Peripheral Neuropathies, 4th Ed. 2010
Ulnar nerve elbow pad 2
UNE: Non-surgical

- OT if hand weakness
- No clear utility of steroid injections
- Non-surgical mgt first
- Follow closely every 1-2 months
- MRI if decline
- Surgical exploration if significant progression
UNE: Surgical

1. Cubital tunnel decompression
   – Slitting the flexor carpi ulnaris aponeurosis
   – Choice for “idiopathic”

2. Anterior transposition
   – Nerve relocated to anterior elbow surface
   – For nerve prolapse

3. Medial epicondylectomy
   – Removal of the bony prominence over which the nerve stretches with elbow flexion
   – For nerve prolapse

4. Other: remove mass or bony abnormality
Ulnar Neuropathy: Axilla and Upper Arm
Ulnar Neuropathy: Proximal

• Uncommon
• External compression
  • Crutches
  • Sleep/intoxication/coma
• Anterior shoulder dislocation
• Humerus fracture
• Other trauma
• Dialysis fistula: ischemia
Ulnar Neuropathy at the wrist and hand
Ulnar neuropathy: wrist/hand

• Less common than CTS or UNE
• Sx
  • Sensory at digit 5 and ulnar portion digit 4
  • Weakness of ulnar intrinsic hand muscles
• Majority caused by external pressure in palm
  • Cyclists
  • Hand tools
• Other: ganglia, synovial cysts (RA), lipoma
Ulnar neuropathy: wrist/hand

- Diagnostics
  - EMG/NCS
    - Localize lesion
    - Severity
  - X Ray: arthritis or old fracture
  - MRI: ganglia, lipomas
  - U/S: ganglia, lipomas
Ulnar neuropathy: wrist/hand

- Management
  - Avoid ongoing compression
  - Surgical decompression of mass lesions
Radial Neuropathy
Radial Neuropathy

• Less common than either median or ulnar neuropathies
• No overuse syndrome
• No entrapment sites or “tunnels”
• Symptoms dependent on location of injury, typically traumatic or compressive
Radial nerve function

• Elbow extension
• Elbow flexion
• Wrist & digit extension
• Thumb abduction
• Sensation at dorsal arm/forearm/hand
Radial neuropathy: Axilla

• Etiology typically compressive/traumatic
  • Crutch
  • Intoxication/sedation/sleep
  • Proximal humerus fracture
  • Shoulder dislocation
Radial neuropathy: upper arm

- Humerus fracture
- Blunt trauma
- Compression:
  - Intoxication/sedation/sleep
    - Triceps spared
  - Wrist & Finger drop
- Tourniquet
Radial neuropathy: elbow

- Affects the terminal branch of radial nerve: Posterior Interosseous Nerve
  - Finger drop without wrist drop
- Trauma
  - Radius head dislocation
  - Radius fracture and fixation
  - Mid-forearm radius or ulna fractures
- Soft tissue mass
- RA synovial cyst hypertrophy
Superficial Radial neuropathy

- Sensation to dorsolateral hand
- Compression
  - Handcuffs
  - Casts
  - Watchband/bracelets
- Iatrogenic
  - Surgical
  - Venipuncture
Radial Neuropathy: Work up

• EMG/NCS
  • Confirm vs C7 radiculopathy
  • Lesion location
  • Severity/prognosis
• X rays: Fractures/dislocations
• MRI: mass lesions
Radial Neuropathy: Mgt And Prognosis

• Sleep/Saturday night palsies
  • Typically resolve in 6-8 weeks
  • If axon loss: months to a year
  • Prognosis: 90% full recovery

• Fractures/dislocations
  • Prognosis overall 70-88% recovery rate
  • If no evidence of recovery by 2-3 months (clinically/EMG): surgical exploration
Distal Radial Neuropathy: Mgt And Prognosis

• Posterior Interosseous Neuropathy
  • Traumatic: If no evidence of recovery by 2-3 months (clinically/EMG): surgical exploration
  • Spontaneous: EMG/NCS & MRI

• Superficial Radial Neuropathies
  • Avoid compression (watches/bracelets)
  • Laceration: surgical repair
Radial Neuropathy: Mgt

• Occupational Therapy

• Dorsal wrist cock-up with dynamic finger extension
EMG/NCS

• Why?
  • Confirm clinical dx
  • Assess severity
  • Prognosis

• What?
  • Nerve conduction testing
  • Needle electrode exam
EMG/NCS: key

• Operator dependent
• Study is customized to the diagnostic question
• Timing affects diagnostic sensitivity
  • Immediate: not useful
  • 3 weeks for axon loss to show (4-6 ideal)
• “Uncomfortable”
• Requires patient cooperation
EMG/NCS: limitations

• Intolerant patient
• Non-cooperative patient
• Obese
• Elderly
• Chronic lesions can reduce sensitivity for a new condition
EMG/NCS: How to order

• Be specific about the diagnostic question and limb to be studied (if localized)
  • Yes
    • Bilateral CTS
    • Left arm: radiculopathy vs neuropathy
    • Right leg radiculopathy
    • Polyneuropathy
  • No
    • CTS
    • 4 limbs: pain
EMG vs Neurology Consult

Consult
• If results will likely trigger a consult
  • Non-diabetic polyneuropathy
  • Myopathy
  • ALS

EMG
• Comfortable managing the dx
• Pre-surgical cases
EMG/NCS: How to order

• Providence System
  • For now
    • Referral for EMG: limb/indication
    • Don’t put in an order too
  • Coming soon! (they promise)
    • New Epic order
    • No referral needed

• Independent/Non-Providence
  • Referral for EMG: limb/indication
EMG/NCS: Where to order

• PBSI Neurology
  • St Vincent
  • Providence Portland
  • Vancouver: Esther Short
  • Milwaukie
  • Bridgeport
  • Newberg

• PBSI Physiatry
  • St Vincent
  • Providence Portland