Compressive Neuropathies of the Upper extremity

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Median Nerve Compression Syndromes

• Nerve Entrapment at the Wrist
  – Carpal tunnel syndrome
• Compressive Neuropathies in Proximal Forearm
  – Pronator syndrome
  – Anterior interosseous syndrome
CARPAL TUNNEL SYNDROME

• Epidemiology
  – Classically
    • Posttraumatic
    • Female
    • Middle age
  – More recently
    • Younger
    • Industrial worker
    • Repetitive motions
RISK FACTORS

- Clear intrinsic risk factors
  - Female
  - Pregnancy
  - Diabetes
  - Rheumatoid arthritis
RISK FACTORS

• Occupational factors
  • Task repetition
  • Posture
  • Mechanical stress
  • Force
  • Vibration
  • Temperature (cold)
CARPAL TUNNEL SYNDROME

- Median nerve entrapment in the carpal tunnel
- Chronic inflammation?
- Amyloid deposition?
- Repeated mechanical stress?
- Vascular sclerosis and ischemia?
CARPAL TUNNEL SYNDROME

• Ikdea (06):
  – Increases in carpal canal pressure
  – 10 mm distal to distal wrist crease
  – Pressures correlated with nerve conduction results
CARPAL TUNNEL SYNDROME

• Szabo (‘89)
• Increased carpal tunnel pressures with exercise in patients with CTS
• Sustained and delayed recovery of normal pressures after exercise in CTS
Double Crush
CARPAL TUNNEL SYNDROME

- Pain
  - Along median nerve
- Paresthesias in median nerve distribution
- Normal thenar sensation
PRONATOR SYNDROME

- Entrapment of median nerve in proximal forearm
- Forearm pain along median nerve
- Sensory changes in median nerve distribution
- Rare if actually real
AIN PALSY

- AIN innervations
  - FPL
  - FDP IF (MF)
  - PQ
  - No sensory component
AIN PALSY

- Complete palsy or incomplete with weakness
- FPL, FDP IF
- Pinch causes IP hyperextension
- Weak pronation with elbow flexed
CARPAL TUNNEL SYNDROME

• Symptoms worse at night (waking up)
• Extreme wrist positions
  • Talking on phone
  • Driving
• Dropping objects due to weakness or altered sensibility
  • Cups, dishes
PHALEN’S MANEUVER

• Wrist flexion with elbow on table
• Paresthesia in response to position
• Numbness and tingling in radial digits in 60 sec. = pos. test
• Probable CTS (sen.0.75, spec. 0.47)
TINEL’S SIGN

• Tap on median nerve at wrist
• Site of irritable nerve due to axonal injury
• Tingling and shooting pain in nerve dist.
• Probable CTS (sen. 0.60, spec. 0.67)
CARPAL COMPRESSION TEST

• Direct compression of median nerve
• Paresthesia in response to pressure
• Paresthesia occur within 30 sec.
• Probable CTS (sen. 0.87, spec. 0.90)
SENSORY TESTING

• Static two point discrimination
  >6 mm = advanced nerve dysfunction or nerve laceration

• Rarely useful in CTS

• Monofilaments testing is better

• Value greater than 2.83gm in radial 3 digits

• Probable CTS (sen. 0.83)
EMG/NCS

- It's important to remember that CTS is a **CLINICAL** diagnosis.
- Electrodiagnostic tests should **NOT** be used independently in making diagnosis.

Glowaki (JHS ‘96)
- 30% Patient with CTS and normal NCS responded to surgery.
- Concluded: EMG/NCS does not correlate with surgical outcome.
CARPAL TUNNEL SYNDROME

- Early
  - Intermittent symptoms
  - No weakness of thumb abduction
  - No permanent numbness or paresthesias
  - No atrophy
  - Treatment = wrist splints, activity modification, limb positioning 6–8 weeks
CARPAL TUNNEL SYNDROME

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STEROID INJECTIONS

- Preoperative response to cortisone injection
- Diagnostic value
- Prognostic value
CARPAL TUNNEL SYNDROME

- Intermediate
  - Constant paresthesia, numbness
  - No atrophy
  - +/- Muscle weakness of thumb abduction
  - Pain with irritability of nerve
  - Treatment = surgical decompression
CARPAL TUNNEL SYNDROME

• **Late**
  - Sensory loss
  - Muscle atrophy
  - Weakness grasping objects
  - +/− Pain
  - Treatment = surgical decompression
  - Surgery will halt progression & pain
SURGICAL TECHNIQUES

• What is the better surgical technique?
  – Open release
  – Limited open release
  – Two incision release
  – Endoscopic release
OPEN CARPAL TUNNEL RELEASE

• Under direct vision release all structures
• Explore median nerve and other carpal pathology
• Safe and efficient under local

• Larger incision
• May have more incisional irritation
ENDOSCOPIC RELEASE

• Smaller incision
• May have improved short term recovery
• Avoid palmar incision

• Regional or general anesthesia
• Not able to visualize median nerve or intercarpal pathology
• Increased risk of NV damage
OPEN VS. ENDOSCOPIC

• MacDermot (JHS ‘02)
  – Randomized blinded prospective trail
  – Short and long term outcome measures

• Endoscopic group better short term outcome
• Endoscopic group lower long term satisfaction (higher reoperation rate)
• NO SUBSTATIVE DIFFERENCE NOTED
OPEN VS. ENDOSCOPIC

• Cochrane Review 2006
  • No better alternative than standard open CTR
  • Earlier return to work with endoscopic: conflicting results
  • No strong evidence to replace standard open CTR
HAND THERAPY

• Pomerance (JHS ‘07)
  – Prospective randomized study
  – Two week of post operative therapy vs. home therapy
  – No change in outcome noted
  – Therapy added $600-$900

• However, there is a role for patients with
  – Limited digital motion
  – Edema
  – Incision tenderness
WORKER’S COMPENSATION

• Higgs (JHS ‘94)
  – CTS outcome in worker’s compensation patients
  – Residual symptoms more common in WC patients

– 73% of WC patients changed jobs due to residual symptoms
– 2% non-WC changed jobs
ELDERLY PATIENTS

• Townshend (JHS ‘94)
  – 83 CTR in patients over 70 yrs.
  – 80% with severe changes
  – 94% satisfied at 1 year

• Weber (JHS ‘04)
  – 105 CTR in patients over 65 yrs.
  – 83% very satisfied with results at 6 months
  – Reduced paresthesia, night pain
  – Improved strength & sensibility
ELDERLY PATIENTS

- Keep in mind that 5-10% not satisfied
- Important to discuss goals and recovery before surgery

- Pain relief is main goal
- Long term recovery to be expected in most patients
DEPRESSION

• Ring (JHS ‘07)
  – 82 Patients with CTR
  – Survey of outcome and satisfaction
  – Dissatisfaction correlates with depression and ineffective coping skills
  – More than a peripheral nerve problem
RE-OPERATION

- Cobb (JHS ‘96)
  - 113 patient with CTR re-operation
  - 15 failed surgeries needing 3rd operation

- Risk factors for failure
  - Worker’s Comp
  - Pain in ulnar nerve dist.
  - Normal Nerve studies

- 20% dissatisfied with final result
Compression of the ulnar nerve at the elbow

CUBITAL TUNNEL SYNDROME
Figure 1
Ulnar nerve compression
Experimental Stretch Neuropathy

- Continuous stretching (2N) of rat tibial nerve for 1 hour resulted in no histologic, EDX or functional abnormality.
- 2N load applied cyclically 60-120 times/hr. lead to abnormalities.
- This suggests that a small strain applied repeatedly might lead to nerve dysfunction.
Traction Neuropathy: Pathophysiology

- Injury to or scarring of the mesoneurium causes the nerve to adhere to surrounding structures
- Subsequent movement then causes traction on the nerve
Proximal Ulnar Nerve Fascicular Topography

- Approximately 20 fascicles
- Motor fibers to FCU, FDP are deep
- Motor fibers to intrinsics, sensory fibers are superficial, hence more susceptible to early compression
Cubital Tunnel Syndrome

- 4 potential sites of compression
- Interbrachial ligament (misnomer: Arcade of Struthers)
- Medial intermuscular septum
- Epicondylar groove
- Aponeurosis between 2 heads of FCU (arcuate ligament)
Clinical

• Intermittent numbness/tingling small and ring
• Exacerbation by repetitive elbow flexion
  – Sleeping position
  – Holding a phone
  – Driving
  – Leaning on a flexed elbow
Clinical

• Mild neuropathy:
  – Positive elbow flexion test (10% false positive)
  – ± Positive tinel over cubital tunnel
  – ± Scratch test
69% sensitivity and 99% specificity
Clinical

• Severe neuropathy:
  – Abnormal 2pd of small and ring
  – Weak intrinsics, clawing of ring, small
  – Positive Froment’s sign
Nonoperative treatment

• Avoidance of elbow flexion
• NSAIDs (cortisone ineffective)
• Ergonomic workstation modification
• Nighttime elbow extension splint
Operative procedures

• In situ decompression (includes endoscopic)
• Medical epicondylectomy
• Subcutaneous anterior transposition
• Intra-muscular transposition
• Submuscular transposition
Submuscular Transposition

Flexor origin

Nerve course - before

Nerve course - after
Outcomes

• Good results for in-situ release in 17/18 patients with McGowan stage I (paresthesia only with normal motor and sensory exam).

• When there are constant symptoms, demyelination is present and recovery may take 6-8 months.

• Residual sensory complaints are common.

• Intrinsic wasting rarely recovers in an adult
Ulnar Tunnel Syndrome
Etiology

- Benign tumors (ganglion >> lipoma, GCT tendon sheath)
- Trauma (hook of hamate fracture, cycling, wheelchair athletes)
- Anomalous muscles, thickened pisohamate lig.
- Ulnar artery aneurysms, thrombosis
Clinical presentation

- Paresthesia of small and ring
- Abnormal 2pd of small and ring
- Tinel's over Guyons canal
- Weakness of intrinsics and ADM
- Froment's sign
- Normal FCU, FDP
- Normal DCBUN
- NEGATIVE ELBOW FLEXION TEST
Clinical presentation

• Paresthesia of small and ring
• Abnormal 2pd of small and ring
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• Weakness of intrinsics and ADM
• Froment’s sign
• Normal FCU, FDP
• Normal DCBUN
• NEGATIVE ELBOW FLEXION TEST
Tunnel begins at proximal edge of the palmar carpal ligament, and extends to the fibrous arch of the hypothenar muscles. Length = 4 - 4.5 cm.
3 zones:

- **Type I:**
  - mixed motor and sensory
- **Type II:**
  - pure sensory
- **Type III:**
  - pure motor
Nonoperative treatment

• The mainstay of treatment is activity modification.

• Bicyclists should avoid riding with their hands low on the handlebars.

• Avoid repetitive percussion on the ulnar border of their palm.

• Wrist splinting and cortisone injections have no role in this condition.
Surgical Treatment

• Intrinisic wasting and/or sensory loss are a sine qua non for decompression.
• The presence of a mass occupying lesion also mandates surgical treatment.
• Ulnar artery thrombosis or aneurysm may be treated with ulnar artery repair or ligation.
OUTCOMES

• Clinical recovery is seen in the majority of patients when the ulnar nerve entrapment is due to a space occupying lesion.[Foucher, 1993]

• Motor recovery is less predictable when compared to sensory recovery, especially when the compression is due to a fibrotic hypothenar arch or of a longstanding nature.[Zoch, 1990]
Case example

- 31 y.o. E.R. resident with 4 month Hx of intrinsic wasting and weakness.
- No recent Hx of trauma, cycling or systemic disease
- PHx: ORIF of 5th metacarpal base 3 yrs. previously
Physical Exam

- FDI – O power and wasting
- 2\textsuperscript{nd} to 4\textsuperscript{th} DI – Power 3-4+, significant wasting
- ADM - 5+ power, no wasting
Physical Exam

- + Froment’s sign
- normal 2 point discrimination*
- normal Allen test
Investigation

- X-ray - healed 5th MC base fracture with 3-hole plate
- Guyon’s canal ultrasound: normal
  - no evidence of tumors or ulnar artery aneurysm/thrombosis
- Two electrical studies spaced 6 weeks apart:
  - Normal abductor digiti minimi
  - Increasing denervation 1\textsuperscript{st} dorsal interosseous
Surgery (10/29/01)

- Decompression of Guyon’s canal to adductor pollicus
- No nerve indentation or fibrous arches
- No screw impingement
6 mth f/u

- FDI - 5+, minimal wasting
- 2nd DI - 5+
- 3rd PI - 3+
- ADM - 5+
- (-) Froments sign