Carpal Tunnel Syndrome

Background
1. Definition: Entrapment neuropathy of median nerve as it courses through carpal tunnel
   - Stage I:
     - Predominantly nocturnal symptoms of numbness and/or tingling in fingers or hand coinciding with distribution of median nerve
   - Stage II:
     - Nocturnal and daytime symptoms
     - Symptoms associated with repetitive wrist movements or having wrist in one position for extended period of time
     - Complaints of hand weakness and/or dropping objects
   - Stage III:
     - Less sensory complaints, loss of fine motor skills and complaints of weakness more predominant
     - Thenar muscle atrophy
2. General Information:
   - Most common entrapment neuropathy

Pathophysiology
1. Pathology of Disease:
   - Local compressive entrapment causes demyelination leading to nerve block (neuropaxia)
   - If compression persists, local nerve blood flow is impeded. This leads to cascade of events eventually culminating in axon damage
   - Experienced pain thought to result from inflammatory mediators (TNFa) causing abnormal Na+ ion influx into damaged nociceptive fibers.
2. Incidence, Prevalence:
   - 1988 US survey estimated 1.88% of general public to have self-reported carpal tunnel syndrome (CTS)\(^1\)
   - White females among highest prevalence\(^1\)
   - Occupations with higher prevalence than general public:
     - Female supermarket checkers (prevalence 62.5%)
     - Mail service workers
     - Health care workers
     - Construction
     - Assembly and fabrication\(^2,3\)
3. Risk Factors:\(^3\)
   - Repetitive hands/wrists bending and/or twisting
   - Race - more common in whites than non-whites
   - Gender - more common in females than males
   - Use of vibrating hand tools
   - Age - increasing risk per year
   - Wrist ratio: anterior to posterior distance >70% of medial to lateral distance significantly associated with idiopathic CTS\(^4\)
   - Obesity
o Intense keyboard use (>4-6 hrs/day) as risk factor for CTS still unknown^5

4. Morbidity / Mortality:
   o Most cases of unilateral CTS developed bilateral symptoms over time^6
   o CTS common during pregnancy

Diagnostics
1. History
   o Symptom onset
     ■ Night versus day
   o Provocative factors
     ■ Hand positions, repetitive movements
   o Occupation
   o Pain localization
     ■ Median nerve distribution vs. whole hand symptoms
   o Alleviating maneuvers
     ■ Shaking out hands, hand position changes
   o Predisposing conditions
     ■ Diabetes, obesity, acromegaly, pregnancy, polyarthritis
   o Recreational activities
     ■ Baseball, body building

2. Physical Examination
   o Tinel’s Test:
     ■ Tapping median nerve directly over or just proximal to carpal tunnel
     ■ Sensitivity = 67%, Specificity = 68%^7
     ■ Very little diagnostic value in CTS
   o Phalen’s Test:
     ■ Static wrist flexion for 60 seconds or until symptoms reproduced
     ■ Sensitivity = 85%, Specificity = 89%^7

3. Diagnostic Testing
   o Nerve conduction studies:
     ■ Evaluates median nerve sensory and motor pathways
   o Needle Electromyography (EMG):
     ■ Evaluates axonal degeneration of the median nerve

4. Diagnostic Imaging
   o Ultrasound
     ■ Useful to visualize median nerve cross-sectional area as it enters carpal tunnel
     ■ Nerve conduction studies more useful for grading severity
   o MRI Resonance Imaging
     ■ Median nerve signal intensity, transverse carpal ligament bowing, and other measurements of carpal tunnel have very high sensitivity.
     ■ Useful if space-occupying lesion suspected

Differential Diagnosis
1. Key Differential Diagnoses
   o Cervical radiculopathy
2. Extensive Differential Diagnoses
   o Thoracic Outlet Syndrome

**Therapeutics**

1. Acute treatment
   o Wrist splints
     - Neutral wrist splint more effective than cock-up (extension) splint
     - Recommend patients wear splint only at night
     - Night-time use significantly more effective than doing nothing
   o NSAIDS
     - No better than placebo
   o Oral corticosteroids
     - Prednisolone (PEPID – please link to PEPID drug database) 20mg daily for 2 weeks, followed by prednisolone 10mg daily for 2 weeks
     - Less effective than injected steroids (into carpal tunnel)
   o Magnet therapy, acupuncture, exercise, and chiropractic care did not reduce symptoms compared to placebo or control

2. Further Management (24 hrs)
   o Corticosteroid injections
     - More effective than placebo saline injection
     - 40mg Triamcinolone (PEPID – please link to PEPID drug database) (Kenalog®) injected without lidocaine
     - May provide symptom relief for 3-6 months
     - Can be repeated when symptoms return

3. Treatment during pregnancy
   o Wrist splinting less effective in this population
   o Reduction of symptoms with delivery, but not resolution of problem
   o Corticosteroid injections provide significant relief
     - 4mg dexamethasone used in the 3rd trimester

4. Long-Term Care
   o Surgery
     - Indicated for patients who fail conservative methods, have sensory deficits, or muscle atrophy
     - Very good long-term results with very low recurrence rates

**Follow-Up**

1. Return to Office
   o After completion of prescribed therapy or when symptoms return
   o Earlier if inadequate symptom relief

2. Refer to Specialist
   o Orthopedic surgery referral
     - Failure of conservative methods
     - Severe sensory deficit
     - Muscle atrophy
3. Admit to Hospital
   ○ Not indicated

Prognosis
1. No treatment: study of 132 patients who received no treatment found 47% recovered, 28% remained stable, and 23% worsened\textsuperscript{19}
2. Conservative medical therapy: most patients experience symptom reduction
3. Surgical treatment: very good long-term results with low recurrence rates\textsuperscript{18}

Prevention
1. Avoid repetitive wrist movements
2. Weight management
3. Ergonomic keyboards controversial\textsuperscript{12}

Patient Education
1. Handout from American Academy of Family Physicians

References

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