An Old Controversy: Is Carpal Tunnel Syndrome Work Related?

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Occupational Medicine

- Is the medical specialty that addresses the relationship between the worker and the workplace.
This multistep process includes the following:
1. Evidence of disease
2. Evidence of exposure
3. Epidemiologic evidence
4. Other relevant factors
5. Validity of testimony
6. Conclusions
Epidemiology

• Studies on disease or exposure of interest measure distribution and determinates of disease. They are then analyzed using statistical methodology to determine if there is an association between the two factors or whether an observed relationship is due to chance occurrence.
Repetitiveness

• A task has a cycle time of less than 30 seconds ie packing a box of jars every 20 seconds
• A task requiring repetitive activity more than 50% of the time ie computer operator entering data over 50% of the day
Review

• Most common focal peripheral neuropathy
• Affects an estimated 3% of adult Americans
• 3 times more likely to affect women than men
• High prevalence rates have been reported in workers performing certain repetitive wrist motions
Clinical Features

• Pain
• Numbness
• Tingling
Volar
Other Features

• Symptoms usually worse at night
  – Enough to awaken patients from sound sleep
• Radiate to forearm, elbow, and shoulder
• Decreased grip strength
• Loss of dexterity
• Thenar atrophy, if syndrome is severe
• One hand typically worse
Causes and contributing factors

- Aberrant anatomy
  - Anamalous flexor tendons
  - Congenitally small carpal canal
  - Ganglionic cysts
  - Lipoma
  - Proximal lumbrical muscle insertion
  - Thrombosed artery

- Infections
  - Lyme disease
  - Mycobacterial infection
  - Septic arthritis

- Inflammatory conditions
  - Connective tissue disease
  - Gout or pseudogout
  - Nonspecific flexor tenosynovitis
  - Rheumatoid arthritis

- Metabolic conditions
  - Acromegaly
  - Amyloidosis
  - Diabetes
  - Hypo / hyper thydroidism

- Increased canal volume
  - CHF
  - Edema
  - Obesity
  - pregnancy
Diagnosis

• Most highly predictive findings
  – Symptom location
  – Hypoalgesia
  – Weak thumb abduction
Principle clinical tests

• Phalen’s maneuver
• Tinel’s sign
• Sensation findings
Consensus committees from the American Academy of Neurology, American Association of Electrodiagnostic Medicine, and American Academy of PM & R recognize nerve conduction study as the diagnostic standard for CTS.
Treatments

• Avoid repetitive wrist and hand motions
• Avoid use of vibratory tools
• Ergonomic measures
• Use of wrist support
• Oral corticosteroids
• Local corticosteroids injections
Approximately 80% of patients with CTS initially respond to conservative measures. However, symptoms recur in 80% of these patients after 1 year.
Predicting the Outcome of Conservative Treatment for Carpal Tunnel Syndrome

Score 1 point for each “yes” answer and zero for each “no” answer. See the scoring key for the predicted successful outcome of conservative treatment.*

1. Have symptoms been present for more than 10 months? Yes _____ No _____
2. Does the patient have constant paresthesias? Yes _____ No _____
3. Does the patient have flexor tenosynovitis (“triggering” of the digits)? Yes _____ No _____
4. Is Phalen’s maneuver positive within less than 30 seconds? Yes _____ No _____
5. Is the patient older than 50 years? Yes _____ No _____

SCORING KEY: zero points = 65% success rate; 1 point = 41.4% success rate; 2 points = 16.7% success rate; 3 points = 6.8% success rate; 4 or 5 points = 0% success rate.

*—Outcome rates are based on the use of wrist splinting and nonsteroidal anti-inflammatory drugs; success rates may be higher with oral corticosteroid therapy or local corticosteroid injection.

FIGURE 2. An approach to predicting the outcome of conservative treatment in patients with carpal tunnel syndrome.

Treatments

• Wrist splinting
• Oral medications
  – Diuretics
  – NSAIDS
  – Vit B6
NSAIDS, diuretics and Vit B6 are no more effective than placebo in relieving CTS symptoms.
Global symptom scores for CTS were significantly improved at 2 weeks and 4 weeks in patients randomized to receive prednisolone in a dosage of 20 mg / day x 2 weeks followed by 10 mg / day x 2 weeks.
Local injection

- 2 recent systematic reviews concluded that local corticosteroid injection provides greater clinical improvement at 1 month compared with placebo.
Mean global symptom scores for the two groups did not differ at 2 weeks. However, significant improvement was evident only in the methylprednisolone injection group at 8 and 12 weeks.
Treatment

• Splinting is generally recommended after injection
• If the first injection is successful, a repeat injection can be considered in a month
• Surgery could be considered if the patient needs more than 2 injections
Treatment

- Ultrasound may be beneficial in longer term management of CTS
Surgery to be considered

• Does not respond to conservative treatment
• Patient with severe nerve entrapment evidenced by
  – NCS
  – Thenar atrophy
  – Motor weakness
Endoscopic vs. Open

- One systematic study found equal effectiveness in relieving symptoms
- Conflicting evidence on whether it allows for earlier return to work
Endoscopic release

• $$$
The controversy...
Much of the problem within the worker’s comp system is that there is a tendency for doctors to offer subjective *opinions*, rather than objective scientific *evidence*.
Daubert / Paoli II Factors

• Based on a US Supreme Court ruling, the courts have moved in the direction of requiring doctors to base their testimony on evidence, which has changed the legal standard for doctors’ testimony from prevailing practice, or opinions, to scientific credibility.
You can tell the judge: you don’t have to take my word or opinion, here is the scientific evidence.
Evidenced Based Medicine

- Patients reliably have better outcomes if doctors are not allowed to exercise discretion, or opinions and are instead required to adhere to standardized and scientifically validated protocol.
None of the reviewed studies had established a causal relationship between distinct medical entities and work activities.
The question of causal relationship was felt to be important because a number of nonmedical issues and decisions rest upon proper identification of contributing factors.
Inaccurate identification of causal relationships could, and has misdirected medical care and led to inappropriate use of funds and unnecessary government interventions.
“Sufficient evidence does not exist in the medical literature to conclude that work is the sole cause of so-called cumulative trauma.
The Industrial Injuries Committee of the American Society for Surgery of the Hand concluded, after a systematic review of literature, that “... sufficient evidence does not exist in the medical literature to conclude that work is the sole cause of so-called cumulative trauma...
The Working Group of the British Orthopaedic Association, again after a systematic review of literature concluded: “The terminology used in published work on repetitive strain injury is most unsatisfactory and should be discarded. No condition should be prescribed as an industrial disease unless it can be unambiguously defined both clinically and pathologically.”
The World Health Organization convened a panel of experts to consider health hazards related to video display terminal (VDT) usage.
“... when intense and continuous operation is required, the need for optimum workplace and screen characteristics is crucial. However, solutions based entirely upon attention to ergonomic factors are not a panacea for low motivation and moral; work design and organization are likely to be more important in determining the operator’s overall acceptance of the computer.”
Dr. Hadler concludes:

• “The *cumulative trauma disorder* hypothesis is not just unsupported, it is unsupportable!”

• “It has been tested for carpal tunnel syndrome, and it is wrong.”
“Primary risk factors in the development of carpal tunnel syndrome are: being a woman of menopausal age, obesity or lack of fitness, diabetes or simply having a family history of diabetes, osteoarthritis of the carpal-metacarpal joint of the thumb, smoking, and lifetime alcohol intake. In most cases …
... work acted as the last straw in carpal tunnel causation. Except in the case of work that involves very cold temperatures (possibly in conjunction with load and repetition) such as butchery, work is less likely than demographic and disease-related variables to cause carpal tunnel syndrome....
The bottom line

- This results in both avoidable long term health effects and ongoing cost to the community.
In the first population based study on CTS, the mean age of diagnosis was 50 years (men) and 51 years (women). Women accounted for 78.5% of the cases.
When psychological and economical factors are important considerations, unequivocal, objective demonstration of specific nerve pathology becomes critical before surgical intervention can be considered.
The only clearly documented intrinsic risk factors appeared to be female sex, pregnancy, and rheumatoid arthritis.
Common Task Related Factors

• Repetitiveness
• Force
• Mechanical stress
• Posture
• Vibration and temperature
Appear to be inconsistent and the mechanism by which they are produced are not well known.
Dr. Szabo states:

“CTS is closely correlated with health habits and lifestyle, but is only peripherally related to workplace activities.”
Another analysis by Dr. Szabo:

81.5% of the explainable variation in electrophysiologic median nerve slowing was due to

- Body mass index
- Age
- The wrist depth / width ratio

Whereas only 8.29% was due to job related factors
The hand surgeon must suppress their surgeon persona and resist treating the extremity without treating the patient. The surgeon must realize early discussion with the patient about different risk factors for this syndrome and not readily attribute the cause to the workplace.
Grundberg, Arnis B. (1983)  
Carpal tunnel decompression in spite of normal electromyography. The Journal of Hand Surgery 8:348-9
• “The role of electromyography in the diagnosis of carpal tunnel syndrome is still being debated”
electromyography, strictly speaking refers to the measurement of action potentials caused by the polarization of muscle fibers
Electromyography

- In use it refers to NCS as well
- Sensory and motor latency
- Motor conduction velocity
- Motor evoked potentials
- Electromyography of appropriate muscles
1. Is electromyography a sensitive indicator of carpal tunnel syndrome?

2. Can the diagnosis of CTS be competently made in spite of normal electromyography?
• 30 of 32 hands were considered cured
• Of these 30, two had mild intermittent numbness and tingling
• And for had mild pain in the wrist with strenuous effort
• There were two failures

• One had subsequent electromyographic study which turned positive and repeat surgical procedure revealed compression of the median nerve by a band in the distal portion of the flexor retinaculum
Conclusions

• 8% false negative electromyographic incidence
Conclusions

• The most sensitive electrical indicator of CTS is sensory conduction velocity which you will find in a NCS/EMG

• Causes of errors in these measurements
  – 1. Temperature of the extremity
  – 2. Poorly calibrated equipment
  – 3. Age of the equipment
Conclusions

• The exact length of the median nerve that is being stimulated and the thickness of the skin can alter distal latency
Conclusions

• The diagnosis of CTS can often be made with confidence in spite of a normal NCS electromyographic study, on clinical grounds