Carpal Tunnel Syndrome Diagnosis

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KEYWORDS

• Carpal tunnel • Median nerve • Nerve compression • Neuropathy • Ultrasound

KEY POINTS

- Symptoms include numbness, tingling, and/or pain in the ventral-lateral hand, possibly thenar atrophy and weakness, which typically worsens at night.
- Positive provocative testing includes Tinel, Phalen, and carpal compression.
- Positive electrical testing includes nerve conduction studies revealing initially prolonged median peak sensory latencies (slowing across the wrist), with normal ulnar and radial latencies.
- Ultrasound imaging reveals median nerve enlargement at the proximal wrist, median nerve compression during stress testing, and muscle intrusion during hand motion (digit flexion or extension) that compresses the median nerve.

INTRODUCTION

Carpal tunnel syndrome (CTS) is a very common nerve compression syndrome, generally not considered difficult to diagnose.[1–4] However, the method of diagnosis may vary among clinicians. Although diagnosis is important, determination of the degree or severity is useful because it may influence the treatment approach.[5] For example, during the early stages and milder forms of CTS, there may be ample time to begin a trial of conservative treatment without risk of significant denervation. However, in more advanced cases with axon loss, delayed interventional treatment increases the risk of irreversible progressive median nerve (MN) injury. In addition, neuromuscular ultrasound (NMUS) can demonstrate contributing factors that often injure the MN, and once identified, these factors can be addressed in the treatment plan for improved outcomes.[6,7]

Definition

CTS refers to a constellation or aggregate of hand symptoms that are linked to the median neuropathy at the wrist.[1–4] There are many various causes, some

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beyond the scope of this article; however, it is usually considered to be multifactorial[6,7]:

- Increased intracarpal pressure
- Decreased MN mobility (from fibrous fixation)
- Median nerve deformation (ie, compression, stretching, traction)
- Increased stiffness of the synovium and flexor retinaculum (ie, transverse carpal ligament [TCL])
- Relative thenar muscle hypertrophy or increased thenar muscle mass with intrusion into the carpal tunnel
- Flexor tendon thickening and tightening during activity

Symptom Criteria

The following are typical symptoms that accompany CTS. It is important to keep in mind that these symptoms may be quite variable, thus requiring clinical examination and electrodiagnostic (EDX) testing to confirm.[1–4]

- Numbness: thumb and first 2 to 3 fingers (and lateral aspect of the fourth digit), primarily ventral
- Tingling: same distribution as numbness
- Weakness: thumb abduction and opposition (dropping or problems holding objects)
- Pain: ventral wrist and hand
- Autonomic features (temperature or color changes, dry skin, swelling)
- Provocative factors: nocturnal worsening; aggravated by sustained wrist flexion or extension, repetitive hand activity

CLINICAL FINDINGS

Physical Examination

Sensory examination is often normal in CTS, despite patient complaints and other diagnostic findings.[1] The pattern of sensory loss may not follow the classic MN distribution in the hand (which includes the ventral thumb, index, middle, and lateral half of the ring finger) due to anatomic variations.[1] Examination for pin sensation is quite subjective, but monofilament testing adds some degree of objectivity and can be used to map out sensory loss within the MN distribution.[8] Abnormal 2-point discrimination (and vibratory loss) is a later manifestation due to more severe nerve injury.[1,8]

Positive provocative Tinel and Phalen (**Fig. 1**) tests are not considered reliable or confirmatory, but may be helpful by adding to the clinical impression.[1–3] The problem is that they are not objective tests, and the precise method of application is highly variable among clinicians. **Fig. 1**A illustrates the proper and commonly used improper method of performing the Phalen test. Carpal compression may also be useful and can be applied simultaneously with the Phalen test as the operator grasps the patient's wrist and maintains flexion dorsally while providing focal pressure over the MN ventrally (see **Fig. 1**B).

Palpation of the wrist for mechanical restriction over the carpal canal can assist in diagnosis[9] and has been demonstrated to have a sensitivity of greater than 90%,[10] using EDX as the gold standard. The most reliable motion testing involves transverse extension and thenar extension/abduction (**Fig. 2**).[9] Palpatory diagnosis also correlates well with EDX.[9–11]

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