Guiding Treatment for Carpal Tunnel Syndrome

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KEYWORDS

• Carpal tunnel syndrome • Neuropathy • Nerve conduction studies
• Electrodiagnosis

KEY POINTS

- Making the correct carpal tunnel syndrome diagnosis is the most important step in treatment. Electrodiagnosis can confirm carpal tunnel syndrome and eliminate mimicking diseases from the differential.
- Treatment should provide satisfactory pain relief and protection of the median nerve from further deterioration.
- The importance and value of reversing focal median mononeuropathy at the wrist in the long term have not been sufficiently addressed, despite its high prevalence and chronic nature.
- Only electrodiagnosis provides information on focal median mononeuropathy at the wrist that could be used to classify carpal tunnel syndrome from mild to severe.
- False positives can cause more harm than false negatives in the case of carpal tunnel syndrome.

INTRODUCTION

Carpal tunnel syndrome (CTS) has long been accepted to be a symptomatic condition caused by compression of the median nerve at the wrist. Historically, the realization that CTS is a clear clinical entity resulting from 1 nerve affected at 1 specific anatomic location took time.[1] Medical understanding of CTS as a focal median mononeuropathy at the wrist (FMMNW) was well-established by the mid-20th century.[2,3] Surgeons treating traumatically injured upper limbs were early pioneers of this field.[4]

Known as the most common focal entrapment mononeuropathy, CTS represents 90% of all entrapment neuropathy and affects millions of Americans. One in 5 ambulatory clinic visits are for CTS, with a reported high incidence and prevalence not only in the United States but in other countries as well. The lifetime risk is estimated to be 10%.[5–8] Both clinicians of general practice and neuromusculoskeletal specialties see,

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diagnose, and treat patients with CTS by recognizing its constellation symptoms and signs and using provocative test, electrodiagnosis (EDX) and more recently imaging modality including computer tomography, magnetic resonance neurography and ultrasound examination.[9–14]

EDX for the diagnosis of CTS has had much in-depth investigation and collective knowledge accumulated since the 1950s.[15] It is especially helpful when the clinical presentation is less straightforward.[16,17] Diagnostic validity has been extensively studied with continuous research interest for further improvements, including the recently published article addressing diagnostic normal values that entailed group consensus and an extensive review of the literature.[18]

Because CTS is such a common and often chronic disease, it has provided physicians and researchers ample opportunities for refining medical treatments and sharing cumulative experiences. There is an impressive volume of literature that is still growing with technological advancements and ongoing academic research. The treatment of CTS, which is typically splinting, corticosteroid injection, and surgery, have been mostly effective.[19,20] Published practice guidelines for treating CTS including the recent guideline by the American Academy of Orthopedic Surgeons, which are endorsed by medical professional organizations including the Academy of Physical Medicine and Rehabilitation and the American Association of Neuromuscular & Electrodiagnostic Medicine.[21]

However, there remain plenty of variations of management with room for discussion and improvement.[22–24] The goal of this article is to review the current literature on the diagnosis and management of CTS, with an emphasis on the role of EDX when treating CTS.

ANATOMY OF THE CARPAL TUNNEL AND MEDIAN NERVE

To understand current CTS treatment practice, a review of median nerve and carpal tunnel anatomy is important. The carpal tunnel is a shallow, U-shaped, bony trough formed by the carpal bones, with the transverse carpal ligament enclosing the open volar side. The carpal tunnel is an inelastic and narrow passage for the median nerve and 9 flexor tendons to travel from the forearm to the hand. The slightly dumbbell-shaped carpal tunnel has a width of 20 to 25 mm. The segment of median nerve traveling inside the carpal tunnel between the levels of the distal wrist flexion crease and the proximal metaphysis is at high risk of becoming entrapped and injured.[25–27]

The median nerve is formed by fascicles from the medial and lateral cord of the brachial plexus. After reaching the elbow, the median nerve sends motor axons to innervate several muscles: the pronator teres, flexor carpi radialis, palmaris longus, and flexor digitorum superficialis. Then, the anterior interosseous nerve branches off, which innervates the flexor digitorum profundus I and II, the flexor pollicis longus and the pronator quadratus muscles. There are several known sites in the arm and forearm that could entrap the median nerve, but these occur with a much lower frequency than at the carpal tunnel. The palmar cutaneous branch of the median nerve piercing through the fascia provides skin sensation of the proximal palm. The remaining median nerve fascicles reach the wrist between the tendons of flexor carpi radialis and palmaris longus and enter the carpal tunnel.

The terminal branches of the median nerve have several proper digital sensory nerves and 1 motor nerve. The proper digital nerves provide sensation to the palmar skin of the thumb, index, and the long and radial sides of the ring fingers, plus the dorsal skin of the distal phalanx of these digits. The terminal motor branch was named the recurrent or thenar nerve because it makes a turnaround in the palm before arriving at