

Carpal Tunnel Syndrome

Diagnosis/Condition:	Carpal Tunnel Syndrome
Discipline:	Integrated
ICD-10 Codes:	G56.0
Origination Date:	2000
Review/Revised Date:	10/2025
Next Review Date:	10/2027

Carpal tunnel syndrome (CTS) is the most common and widely known peripheral nerve entrapment, accounting for 90% of all neuropathy cases, with an incidence of ~4% in the US population.¹ The etiology of CTS can be related to repetitive exposure to vibrations or forceful angular motions, genetic predisposition, injury, and specific conditions such as diabetes, pregnancy and morbid obesity. This condition is observed with increased frequency in females and the elderly.²

The etiology of CTS is suggested to be a combination of a structural predisposition, (i.e., the carpal tunnel is too small), and trauma to the wrist that leads to swelling.³ Symptoms occur when the median nerve becomes pressed or squeezed at the wrist through the carpal tunnel (a narrow rigid passageway of ligament and bones at the base of the hand). Sometimes, thickening from irritated tendons or other swelling narrows the tunnel and causes the median nerve to be compressed. The result may be pain, weakness, or numbness in the hand and wrist, radiating up the arm.

Review of recent work suggests that CTS is associated with “demyelination of peripheral nerve trunk and spinal nerve root neurons [that] may be responsible for much of the abnormal pathology.” From this perspective, CTS (and other entrapment neuropathies) is probably due to mechanical irritation, thus providing a rationale for mechanically focused evaluation and treatment.⁴

Patients with CTS frequently present with concurrent neck and arm pain. Evaluation of all anatomical sites for possible nerve involvement may be valuable.^{5,6}

The most current guideline, developed by the American Academy of Orthopedic Surgeons (AAOS), suggests non-invasive therapies such as splinting and steroids as initial treatment options.^{7,8} For patients presenting with CTS and median nerve denervation, early surgical intervention is recommended.⁹ Not surprisingly, surgical procedures for CTS are the most common hand and wrist procedure in the U.S., accounting for an estimated 200,000 surgeries annually.¹⁰

A 2020 publication suggests that in the long term, manual therapy, including desensitization maneuvers of the central nervous system, resulted in similar outcomes compared with 4 year follow-up post-surgery.¹¹ In contrast, a more recent systematic review suggests non-invasive options for mild-moderate CTS and surgical interventions for severe cases; the authors conclude, “choice of treatment should be individualized, considering patient preferences and symptom severity.”¹²

Subjective Findings and History ¹³

- Pain in the wrist, palm and/or sometimes proximal radiation in the forearm, arm, and shoulder.
- Hand weakness, loss of fine coordination, and/or atrophy.¹⁴
- Classically, worse at night, relieved by dependency.
- Paresthesia or hyperalgesia in the median nerve distribution in radial-palmar aspect of the hand.
- Sensory deficit in the palmar aspect of the first three digits and radial aspect of the 4th and/or weakness of thumb opposition, volar abduction.
- Activities history: repetitious wrist movements, sustained wrist/hand contractions such as grasping and pinching, use of vibrating tools, knitting. Can be insidious onset.
- Trauma: history of fracture, burns, inflammation, space occupying lesions.
- Concurrent systemic illnesses: metabolic/hormonal, vascular, thyroid disease, autoimmune, hematologic, and congenital abnormalities (e.g., diabetes, rheumatism, myxedema, acromegaly, and some types of medications may precipitate symptoms).
- Higher incidence in pregnancy, BMI >30, females >40 years old.¹⁵
- According to StatPeals, “Occupations involving frequent exposure to vibrating equipment, or repetitive movements significantly elevate the risk of developing CTS for individuals.”
- Medications: CTS could be a side effect of certain medications. Aromatase inhibitors used in breast cancer (e.g., anastrozole, exemestane and letrozole), osteoporosis treatments with bisphosphonates (e.g., Fosamax, Alendro, Ossmax), and oral anticoagulants (aka blood thinners) used in atrial fibrillation, stroke, DVT, (e.g., Pradaxa, Eliquis, Xarelto).¹⁶

Objective Findings

- Palpation: Evaluate for spinal and upper extremity joint dysfunction and soft tissue problems to rule in or out neuritis of a referred, radicular, or peripheral etiology that mimics or complicates median nerve compression.
- Neurologic examination: Tinel and Phalen signs have good specificity but poor sensitivity. Thenar strength loss or atrophy indicates more advanced or chronic cases.
- Passive elbow flexion/pronator test.
- Positive apprehension test.
- Radiographic examination (if other conditions are suspected).
- Wrist and hand configuration may predispose to CTS (wrist ratio for example).
- Electrodiagnostic evaluation may be conclusive; nerve conduction velocity (NCV) studies must be correlated with clinical symptoms and, by themselves, are insufficiently specific to establish a diagnosis of CTS. ¹⁷
- Ultrasonographic measurement of the cross-sectional area (CSA) of the median nerve at the carpal tunnel inlet is useful in diagnosing and grading CTS.¹⁸
- Electroneuromyography is used to measure median nerve dysfunction at the wrist and confirm the clinical diagnosis of CTS. ^{19,20}
- Isokinetic evaluation of wrist strength.²¹
- A consensus conference was organized that identified a combination of symptoms (numbness, tingling, burning and pain in combination with nocturnal symptoms) plus

abnormal median nerve function based upon nerve conduction studies (NCS) as the 'gold standard' for the diagnosis of CTS.²²

Assessment

The clinical impression should indicate the specific anatomical structures involved and clinically correlate them with the mechanism of injury, history, subjective complaints, and objective findings. Pre-existing or concurrent medical conditions that are unrelated to work or non-work activity but are risk factors in themselves for CTS should be considered. It is well established that several systemic conditions (e.g. diabetes, hypothyroidism, gout, autoimmune diseases) and pregnancy/postpartum can increase the risk of developing CTS.

Plan

Current therapies for CTS are divided into two primary classifications, invasive (surgical procedures) and non-invasive (splinting, pharmacological and manual therapies). Guidelines developed by the American Academy of Orthopedic Surgeons (AAOS) suggest non-invasive therapies such as splinting, ultrasound, and steroids as initial therapy, although data suggests relief is temporary.^{23,24}

Treatment Modalities

Mind-Body and self-care therapies:

- PELOID (mud) therapy.²⁵
- Magnetic therapy.²⁶
- Activities/work restrictions: Limit use involving aggravating activities. May need ergonomic jobsite/activities evaluation, alternative keyboards, breaks during computer work.²⁷
- Postural awareness and training

Manual Adjustments/Manipulation:

- Spinal, carpal, and soft tissue manipulation.^{28,29,30}
- Carpal bone mobilization techniques.³¹

Soft Tissue Therapies:

- A 2025 meta-analysis (n=12; 479 participants) suggests benefit of lymphatic drainage techniques (manual therapies & kinesio-taping)
 - *...further research is needed to confirm its long-term clinical utility...current evidence suggests that it may serve as a beneficial addition to non-surgical management strategies for CTS.*³²
- General and Targeted Massage has been shown to assist with pain. Targeted Massage has shown improvement to grip strength.^{33,34}
- Instrument assisted soft tissue mobilization (Graston) for pain, strength, and movement.^{35,36}
- Relaxation massage.³⁷
- Functional massage.
- Self-massage³⁸
- Myofascial release therapy and movement re-education.^{39,40}

Herbal Medicine (Western):

- Topical herbal therapy (Matricaria rucutita).^{41,42}
- Curcumin via local phonophoresis.
- CBD oil preparations.
- Capsaicin ointments.

Supplements and Nutrients:

- B6 as a part of the B complex.
- Omega-3 fatty acids.⁴³
- Oral Curcumin.⁴⁴
- Combination therapy (alpha-lipoic acid, curcumin phytosome, and B-group vitamins).⁴⁵
- Acetyl-L-carnitine, alpha-lipoic acid, phosphatidylserine, Vitamins C, E, B1, B2, B6 and B12.⁴⁶

Pharmaceuticals (Prescription):

- Medication-oral steroids.⁴⁷

Immobilization, Bracing, Taping:

- Temporary splinting, especially at night (Cock-up wrist splint), night orthoses.⁴⁸

Physical Modalities (Western):

- Ultrasound.^{49,50}
- Mechanical traction.⁵¹
- Low level laser therapy.^{52,53,54,55}
- Paraffin bath therapy.⁵⁶
- Phonophoresis.⁵⁷
- Transcutaneous electrical nerve stimulation (TENS).⁵⁸

Movement and Exercise:

- Neural gliding exercises.^{59,60}
- Neurodynamic techniques.
- Progressive resistance exercises⁶¹ for wrist, stretching exercises for muscles along path of median nerve.
- Yoga (Overhead arm extension [urdhva hastasana], trunk extension [dandasana], chair twists [bharadvajasana]).

Injection Therapies:

- Ultrasound guided corticosteroid injection.^{62,63}
- Platelet rich plasma (PRP) therapy.^{64,65,66}
- Hyaluronidase.⁶⁷
- Ultrasound-guided 5% dextrose prolotherapy.⁶⁸

Surgical Procedures:

- Surgical nerve decompression (or mini incision).^{69,70,71}

Acupuncture:

A limited number of English language clinical trials (n=12) have assessed acupuncture for the treatment of CTS. These trials, along with numerous non-English RCTs, are summarized in three systematic reviews.^{72,73,74} Although each review suggests benefit from acupuncture, they all conclude that the RCTs are too heterogeneous or of low quality. Of note, the majority of these RCTs (8/12) demonstrated positive outcomes when acupuncture was compared to current guideline recommended usual care options (e.g. NSAIDs, oral steroids and night splinting).^{75,76,77,78,79,80,81,82}

Based on the literature the following conclusions can be drawn:

The evidence is promising but inconclusive on the effects of acupuncture for the treatment of carpal tunnel syndrome.

- The most recent systematic reviews emphasize the methodological shortcomings of the RCTs, concluding that the evidence is encouraging but not convincing.^{75,76,77}
 - Supported by a 2024 overview of systematic reviews, “*Acupuncture might be beneficial... given the existing evidence limitations...further high-quality research [is needed].*”⁸³
- Two small RCTs have been published since these systematic reviews; both suggest benefit of adjunctive acupuncture:
 - A 2023 RCT (n=40) suggests, “*physiotherapy plus acupuncture, was more effective than physiotherapy alone...*”⁸⁵
 - A 2020 RCT (n=60) suggests acupuncture plus splinting was equally effective and in certain cases better than the conventional medical treatment [Celebrex plus splinting].⁸⁴
- The evidence is supported by experimental investigations demonstrating enhanced (fMRI) cortical plasticity for CTS patients who receive acupuncture.^{84,85}

Laser Acupuncture:

Two small RCTs suggest benefit of laser acupuncture.

- A 2024 RCT (n=76) suggests low level laser acupuncture (655nm wavelength) was superior to electro-acupuncture (100Hz @ 2-5 mA)⁸⁶
- Another 2024 RCT (n=36) suggests the addition of laser acupuncture, is more effective compared to night splints alone in pregnant women with CTS.⁸⁷

Electroacupuncture-Like Magnetic Therapy (ELMT)

- A small RCT (n=40) suggest that ELMT is superior to TENS for patients with CTS (all patients performed nerve glide exercise)⁸⁸

Outcomes Assessment Tools (OATS):

- Visual analog pain scale/numeric pain rating scale.
- DASH (disabilities of the arm shoulder and hand).<https://orthotoolkit.com/dash/>

- Boston Carpal Tunnel (Levine) Questionnaire. <https://gettingitrightfirsttime.co.uk/wp-content/uploads/2021/12/BCTQ.pdf>

Length of Treatment

- Estimated duration of initial care: may continue up to 8 weeks.
 - AAOS Guidelines suggest non-invasive therapies as initial treatment options⁸⁹

Referral Criteria

- Conservative interventions are appropriate for up to 8 weeks.⁹⁰
- Referral for nerve conduction studies/advanced imaging if poor response to conservative care (4-8 weeks).
- Referral for surgical consultation may be appropriate after 4-8 weeks of care with inadequate improvement.

Resources for Clinicians

StatPearls: Carpal Tunnel Syndrome (2025): www.ncbi.nlm.nih.gov/books/NBK448179/

Resources for Patients

National Institute of Neurological Disorders and Stroke. Carpal Tunnel Fact Sheet.

<https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Fact-Sheets/Carpal-Tunnel-Syndrome-Fact-Sheet>

Carpal Tunnel Syndrome. MayoClinic.org.

<https://www.mayoclinic.org/diseases-conditions/carpal-tunnel-syndrome/symptoms-causes/syc-20355603>

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