Carpal Tunnel Syndrome
Making Evidence-Based Treatment Decisions

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KEYWORDS

• Carpal tunnel syndrome • Treatment • Outcomes • Complications • Costs

KEY POINTS

- CTS is one of the most common musculoskeletal disorders of the upper extremity.
- Although a high rate of repetitive hand/wrist motions is a risk factor, there is insufficient evidence to implicate computer use in the development of CTS.
- Initial treatment generally is nonoperative, with the strongest evidence supporting bracing/splinting.
- Strong evidence supports operative treatment, regardless of technique, as superior to nonoperative treatment.
- Complications are infrequent and most are minor and transient.

According to the clinical practice guideline (CPG) from the American Academy of Orthopedic Surgeons[1] (AAOS), carpal tunnel syndrome (CTS) is "a symptomatic compression neuropathy of the median nerve at the level of the wrist, characterized physiologically by evidence of increased pressure within the carpal tunnel and decreased function of the nerve at that level." It is the most common compressive neuropathy affecting the upper extremity, present in approximately 3% to 6% of adults in the United States.[2] A study of a "working population" of adults (mostly industrial workers) identified CTS in 8%.[3] CTS also is the most expensive upper extremity musculoskeletal disorder, with an estimated cost of medical care in the United States of more than $2 billion annually. Nonmedical costs, such as workers' compensation costs, lost wages, lost productivity, and disability, are even higher; the median time lost by US workers with CTS is 28 days.[4]

RISK FACTORS FOR CARPAL TUNNEL SYNDROME

Reported risk factors for the development of CTS include age, smoking, obesity, rheumatoid arthritis, diabetes, lupus, hypothyroidism, and multiple sclerosis.[5] Women, especially those taking birth control pills, going through menopause, or taking estrogen, have the highest risk of developing CTS. Working with vibrating tools or on an assembly line that requires prolonged or repetitive flexion of the wrist has been suggested as a risk factor, but scientific evidence is conflicting. The AAOS CPG notes strong evidence that body mass index and a high rate of hand/wrist repetition are associated with an increased risk of developing CTS. A widely held idea is that CTS is associated with computer use,[6,7] but evidence is insufficient to support this; in fact, several articles have disputed it altogether.[8–10] A systematic review and

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meta-analysis that involved 25 studies (92,564 individuals) suggested that type 1 and type 2 diabetes are risk factors for CTS.[11] Another meta-analysis of 58 studies (1,379,372 individuals) determined that high body mass index markedly increases the risk of CTS; obesity increased the risk two-fold, and each one-unit increase in body mass index increased the risk of CTS by 7%.[12]

DIAGNOSIS, PHYSICAL EXAMINATION

CTS is primarily a clinical diagnosis. Symptoms usually include numbness and pain or paresthesia in the median nerve distribution. Commonly used provocative tests include wrist flexion (Phalen), nerve percussion (Tinel), and carpal compression (Durkan) tests. The carpal compression test was found to be more specific (90%) and more sensitive (87%) than either the Tinel or Phalen test (Table 1).[13] No single test in isolation is sufficient to make a definitive diagnosis of CTS. The key elements of a diagnosis of CTS are medial nerve distribution numbness, nocturnal wakening, thenar atrophy, a positive Phalen test, loss of two-point discrimination, and a positive Tinel sign.[14]

Electrodiagnostic studies (EDS) and imaging studies generally are reserved for patients in whom the diagnosis is questionable, but this remains an area of controversy. A survey of members of the American Society for Surgery of the Hand (ASSH) determined that 72% would advise carpal tunnel release (CTR) based on a classic history and examination and complete relief following cortisone injection,[15] whereas in a later survey 90% indicated that they used EDS before recommending surgery.[16] A more recent survey of 134 physicians in Michigan, however, found that 57% required a diagnostic test before recommending surgery for CTS (most often EDS).[17] EDS, although most commonly used, add little to the diagnosis of CTS.[18] The AAOS CPG notes limited evidence that a hand-held nerve conduction study may be helpful in the diagnosis of CTS. With a sensitivity of 49% to 84% and specificity of 95% to 99%, EDS are no more sensitive or specific than physical examination testing. The CPG also reports moderate/limited evidence that supports not using MRI or ultrasound for diagnosis. These adjunctive tests are expensive, and the benefit/cost ratio should be carefully considered before using them.

Table 1
Commonly used provocative tests for carpal tunnel syndrome

Test	Sensitivity (%)	Specificity (%)
Phalen (wrist flexion)	68–70	73–83
Tinel (nerve percussion)	20–50	76–77
Durkan (carpal compression)	87	90
Electrodiagnostic studies	49–84	95–99
Ultrasonography	82	92
MRI	63–83	78–80
Computed tomography	67	87

Adapted from Durkan JA. A new diagnostic test for carpal tunnel syndrome. J Bone Joint Surg Am 1991;73(4):536; with permission.

TREATMENT

Nonoperative Treatment

Many patients with mild or moderate CTS respond to nonoperative treatment, and generally an initial trial of conservative treatment is recommended. Cha and colleagues,[19] however, found that outcomes were not as good in patients who initially had nonoperative treatment and delayed surgery for an average of 6 months compared with those who had surgery as their initial treatment.

Nonoperative modalities with the strongest evidence of benefit are bracing/splinting[20,21] and steroid injections.[22,23] Both wrist splints and soft wrist braces have been shown to obtain improvement in symptoms and function when compared with wrists with no treatment.[20,21,24] Corticosteroid injections have been reported to be successful in relieving symptoms, at least at short-term; longer-term outcomes are variable. Blazar and colleagues[23] reported that a single corticosteroid injection obtained symptom relief in 79% of 52 wrists at 6 weeks; at 6 months and 12 months only 53% and 31%, respectively, were symptom-free. Others have described early symptom relief in up to 80% of patients,[25–27] but with steadily decreasing success at longer-term follow-up and surgical treatment required in 15% to 94% of patients at 12 to 18 months.[25–28]

The use of multiple injections remains in question. Berger and colleagues[29] reported that 30 of 120 patients had good outcomes with a single injection, 11 required a second injection, and five needed a third injection to reach a good outcome; 28 (52%) had good outcomes at 1 year. At 6 weeks, 79% of patients reported by Blazar and colleagues[23] had symptom relief with a single injection.