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# Carpal tunnel syndrome— try these diagnostic maneuvers

Physical maneuvers are an essential step in diagnosing carpal tunnel syndrome. This update can help you get up to speed on diagnosis and treatment.

## PRACTICE RECOMMENDATIONS

- *Before considering surgery, offer patients with mild-to-moderate carpal tunnel syndrome (CTS) a trial of conservative therapy such as splinting or corticosteroids. (A)*
- *Order electrodiagnostic studies (EDS) as needed, to rule out other conditions with a similar presentation, confirm an uncertain diagnosis, and gauge the severity of CTS (C), or when surgery is being considered. (B)*
- *Recommend carpal tunnel release for patients who have severe CTS or have failed to respond to non-surgical treatment. (C)*

### Strength of recommendation (SOR)

- (A) Good-quality patient-oriented evidence
- (B) Inconsistent or limited-quality patient-oriented evidence
- (C) Consensus, usual practice, opinion, disease-oriented evidence, case series

**CASE ▶** Jane K, 52, comes to see you because of discomfort in her right wrist and tingling in her hand. The symptoms began 3 months ago, but have been getting progressively worse, and have started to interfere with her sleep. Ms. K often awakens with “pins and needles” in her hand, and says that she often has the urge to “shake it out.” Her sister has carpal tunnel syndrome (CTS), and Ms. K suspects that she does, too. On exam, you find that Ms. K has a positive Phalen’s and Durkan’s compression test, but normal Tinel’s test. She has normal strength and sensation in her hands. Her neck and upper extremity exam is otherwise unremarkable. You note that her hypothyroidism is well controlled, with a recent thyroid-stimulating hormone level of 1.2 mIU/L.

The patient has tried acetaminophen and ibuprofen, with little relief. She has researched CTS on the Internet and read about cold laser therapy, and wants to know whether you think it will work. What should you tell her?

**C** arpal tunnel syndrome is one of the most common disorders of the upper extremities and the most prevalent compression neuropathy.<sup>1</sup> About 3% of US adults are affected, typically those between the ages of 40 and 60 years.<sup>2</sup> Women are almost 3 times more likely than men to develop CTS.<sup>1</sup>

Other risk factors include diabetes, hypothyroidism, rheumatoid arthritis, pregnancy, obesity, family history, and trauma. A history of hand-related repetitive motions also increases the risk.<sup>3-5</sup> Evidence does not support a definite link between keyboard or mouse use and CTS; however, occupations that require use of hand-operated vibratory tools or repeated and forceful movements of the hand/wrist (such as assembly work and food processing or packaging) are associated with CTS.<sup>6</sup>

The optimal diagnostic approach incorporates history and physical exam findings, including the results of a number of provocative maneuvers, as well as electrodiagnostic studies (EDS) in some cases.<sup>7</sup> While surgery is the definitive treatment

## INSTANT POLL

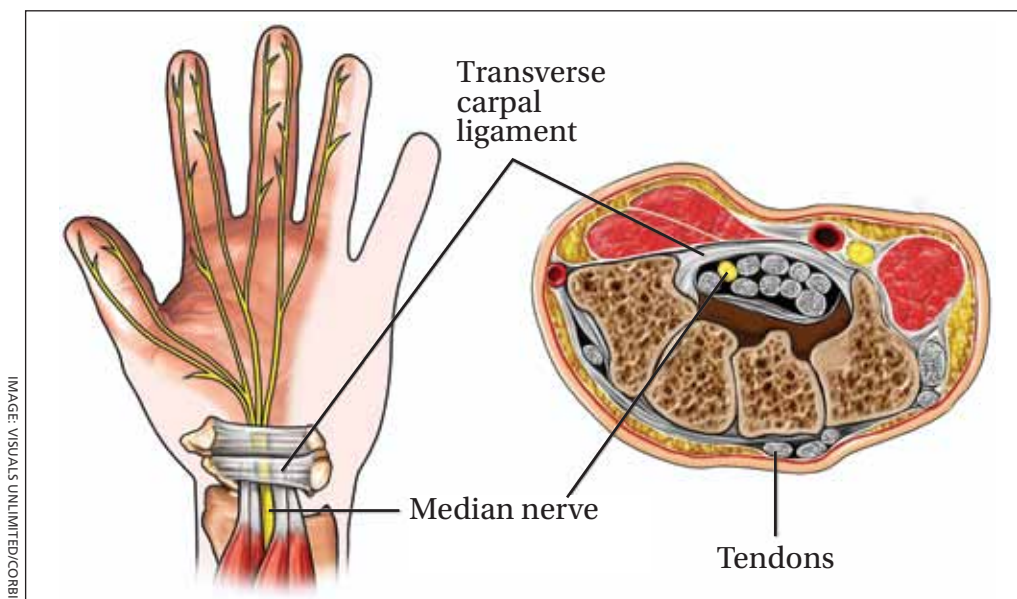
**Which occupational risk factors do you find most often in patients with carpal tunnel syndrome?**

- heavy computer use
- work with vibratory tools
- repetitive motion (eg, assembly line, food processing or packaging)
- no occupational risk factors
- other

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FIGURE

## Compressed median nerve leads to numbness and tingling



for CTS, numerous nonsurgical options exist, including splinting, corticosteroids, and a variety of alternative therapies, some of which (eg, chiropractic and cold laser therapy) have little evidence to support them.

Because family physicians are often the first to see patients with symptoms associated with CTS, you need to know what to look for, when to test, and whether to provide treatment or a referral. Here's what to keep in mind.

### Clinical presentation of CTS

Increased pressure in the carpal tunnel compresses the median nerve, leading to numbness, tingling, or pain in the palmar aspect of the first 3 fingers and the radial half of the fourth (FIGURE). Symptoms vary widely, with pain or numbness localized to the hand or wrist in some cases and pain radiating into the forearm or shoulder in others.

■ **Early in the course of CTS**, symptoms are often most bothersome at night. In a scenario like that reported by Ms. K, patients are often awakened by numbness or tingling and the desire to shake out the affected hand—a phenomenon known as the flick sign.<sup>8</sup> Pain and numbness may occur intermittently at

first, especially with repetitive wrist motion. Activities such as driving or holding a telephone often aggravate symptoms.

■ **As CTS progresses**, the intensity and duration of symptoms increase. Patients may complain of weakness in the hand and report that they often drop things. Paradoxically, patients with more severe CTS sometimes have less pain, rather than more, because of increasing sensory loss.<sup>9</sup>

■ **Late in the course of CTS**, physical exam findings typically include decreased sensation in the fingers innervated by the median nerve, sparing the thenar eminence. (A loss of sensation in the thenar eminence suggests the presence of a lesion proximal to the carpal tunnel, rather than CTS itself.<sup>10</sup>) In advanced cases, weakness of thumb abduction and opposition may occur, as well as atrophy of the thenar eminence.<sup>11</sup>

■ **Sudden onset of severe symptoms** with minimal trauma to the wrist should raise suspicion of a hematoma in the carpal tunnel—a particular risk for patients who have a clotting disorder or are being treated with newer anticoagulants such as dabigatran. Prompt surgical decompression is required to prevent permanent median nerve damage in such cases.<sup>12</sup>

➤ **Sudden onset of severe symptoms with minimal trauma raises suspicion of a hematoma in the carpal tunnel, particularly in a patient who has a clotting disorder or is taking a newer anticoagulant.**

CONTINUED

TABLE 1

## Diagnosing carpal tunnel syndrome, using physical maneuvers<sup>7,13</sup>

Test	Technique	Positive test	Sensitivity (%)	Specificity (%)
Phalen's	Patient holds wrist flexed 90° with elbow in full extension	Pain or paresthesia ≤60 sec	68	73
Tinel's	Clinician repetitively taps wrist over transverse carpal ligament	Pain or paresthesia	50	77
Median nerve compression* (MNC)	Clinician applies direct pressure over the transverse carpal ligament	Pain or paresthesia ≤30 sec	64	83
MNC + Phalen's	Same as above	Same as above	80	92

\*Also known as Durkan's test.

➤ Splinting is equally effective whether used continually or only at night.

### Include these maneuvers in the physical exam

A thorough evaluation of the neck, shoulder, elbow, and wrist is crucial for all patients with signs and symptoms associated with CTS. Provocative maneuvers (TABLE 1)<sup>7,13</sup> are also important as an aid to diagnosis. The results of the following tests should be viewed with caution, however, as studies have found wide variations in their sensitivity and specificity:

■ **Phalen's maneuver.** The patient flexes his or her wrist with the elbow in full extension to increase pressure on the median nerve, and holds the position for 60 seconds. The onset of pain or paresthesia is a positive test. A meta-analysis found the sensitivity and specificity of a positive Phalen's sign to be 68% and 73%, respectively.<sup>7</sup>

■ **Tinel's test.** Tap the volar surface of the patient's wrist just proximal to, or on top of, the carpal tunnel. Pain or paresthesia in the fingers innervated by the median nerve as a result of the percussion constitutes a positive result. Tinel's test is less sensitive than the Phalen's maneuver, but has a similar specificity.<sup>13</sup>

■ **The median nerve (Durkan's) compression test.** Apply pressure over the transverse carpal ligament; the test is positive if pain or paresthesia develops within 30 seconds.<sup>7</sup>

■ **The hand elevation test.** The patient

raises both hands overhead for 60 seconds; here, too, pain or paresthesia is a positive result.<sup>14</sup>

Combining results of provocative maneuvers may increase sensitivity and specificity. Positive results in both the Phalen's and median nerve compression tests, for example, have a collective sensitivity and specificity of 80% and 92%, respectively.<sup>13</sup>

### When (or whether) to order electrodiagnostic studies

While some clinicians consider EDS to be the gold standard in CTS diagnosis,<sup>6</sup> evidence is limited. One issue is the lack of universally accepted reference standards; another is that most studies have been affected by "spectrum bias."<sup>15</sup> What's more, EDS—which include nerve conduction studies (NCS) and electromyography (EMG)—do not always correlate directly with symptoms, and 16% to 34% of mild cases can be missed.<sup>16</sup>

EDS are useful in many instances, however. EMG can rule out other causes of CTS symptoms (TABLE 2 details the differential diagnosis),<sup>7,11</sup> while NCS can aid in diagnosing CTS, gauging its severity, and arriving at a prognosis. Specifically, NCS can detect delayed distal latencies and slowed conduction velocities that can occur when the myelin sheath is damaged by prolonged

**TABLE 2**  
**Differential diagnosis for CTS<sup>7,11</sup>**

Condition	Characteristics
Carpometacarpal arthritis of thumb	Thumb is painful when in motion; radiographic findings
Cervical radiculopathy	Neck pain, nerve root distribution (eg, C6), positive Spurling's test
DeQuervain's tenosynovitis	Painful resisted thumb dorsiflexion, tender at base of thumb
Hypothyroidism	Fatigue, cold intolerance, dry skin, hair loss, abnormal thyroid function tests
Peripheral neuropathy	History of DM, lower extremity involvement
Pronator syndrome (median nerve compression at the elbow)	Tenderness at proximal forearm
Ulnar compressive neuropathy	Compression and positive Tinel's sign: ulnar nerve at elbow or wrist produces pain or paresthesias in 4th and 5th fingers
Vibration white finger	History of use of power drill or other hand-held vibratory tool; symptoms of Raynaud's syndrome
Wrist arthritis	Painful wrist ROM, radiographic findings

CTS, carpal tunnel syndrome; DM, diabetes mellitus; ROM, range of motion.

compression of the median nerve.<sup>17</sup> With more severe compression, axonal damage occurs, as evidenced by reduced action potential amplitudes on NCS. Results of the nerve conduction tests are compared to age-dependent normal values and to results from other nerves on either the same or the contralateral hand. In a 2002 systemic review, the sensitivity of NCS for CTS was 56% to 85% and the specificity was 94% to 99%.<sup>18</sup>

■ **Before and after surgery.** The American Academy of Orthopedic Surgeons (AAOS) recommends EDS when CTS surgery is being considered.<sup>7</sup> EDS may also be used after surgery, to verify neurologic improvement.

■ **Ultrasound.** In patients with CTS, ultrasound reveals an increased cross-sectional area of the median nerve, a finding that has prompted studies of this modality as a diagnostic tool.<sup>19</sup> Although evidence suggests that ultrasound's sensitivity and specificity for CTS would be similar to that of EDS, the optimal cutoff for an abnormal test has not been defined,<sup>19</sup> and ultrasound does not provide information on prognosis or alternate causes.

Thus, AAOS does not currently recommend ultrasound for CTS diagnosis.<sup>7</sup> Mag-

netic resonance imaging is inappropriate for routine CTS diagnosis, as well.<sup>7</sup>

**Treatment: Start conservatively**

Multiple nonsurgical options are available, but the best evidence supports splinting, steroid injection, and oral steroids. Splinting or steroids alone may bring long-term relief for patients with mild to moderate cases;<sup>20</sup> in fact, about a third of mild cases improve spontaneously.<sup>21</sup>

Conservative therapy can also provide relief for those who wish to avoid or delay surgery and for cases of transient CTS (pediatric patients, for example, or those whose condition is associated with pregnancy or hypothyroidism).<sup>18</sup> A successful response to therapy can also help to confirm a CTS diagnosis.

Most conservative treatments begin providing relief within 2 to 6 weeks and reach the maximal benefit at 3 months.<sup>22</sup> If there is no response after 6 weeks, it's time to consider another approach.

In initiating splinting or corticosteroids, here's a look at what to keep in mind:

■ **Splinting.** A splint can be used to maintain the wrist in a position with the least

➤ **Nearly half of patients with mild-to-moderate carpal tunnel syndrome who were treated with steroid injections had improved at 12-month follow-up.**

**WATCH THE VIDEO**

**Nerve-gliding exercises for carpal tunnel syndrome\***

Courtesy of: Pat Stanziano, MPT, SPC, CSCS

[youtube.com/watch?v=B5goXA9MqCA](https://www.youtube.com/watch?v=B5goXA9MqCA)



intracanal pressure, thereby limiting pressure on the median nerve. Splinting is equally effective whether used continually or only at night.<sup>23</sup>

Splinting can relieve symptoms and improve functional status within 2 weeks and the effects can last for 3 to 6 months, eliminating the need for surgery for some patients with mild CTS.<sup>19,20</sup> Nerve gliding exercises, (see image at left), have been evaluated in combination with splinting. While evidence is limited, an at-home program involving these simple exercises may be a beneficial adjunctive treatment with minimal cost or harm.<sup>24,25</sup>

■ **Local corticosteroid injection.** A Cochrane meta-analysis found significant improvement in symptoms and function at one month among patients with CTS who were treated with steroid injection.<sup>26</sup> In many cases, the effects last for many months.

A recent trial found that nearly half of patients with mild to moderate CTS who were treated with steroid injections had improved symptoms and EDS results at the 12-month follow-up.<sup>20</sup> However, while patients with severe CTS experienced improvement at 4 weeks postinjection, most eventually required surgery.<sup>20</sup>

Evidence does not support one particular steroid dose or formulation over another, or one particular injection site.<sup>22</sup> Injecting 4 cm proximal to the wrist flexion crease is as effective as a more distal injection.<sup>26,27</sup>

■ **Caution is required,** however, as risks associated with local injections include tendon rupture and median nerve injury. If a patient experiences intense pain or paresthesia in the median nerve distribution when the needle is inserted, redirect the needle away from the median nerve immediately. For patients who respond well to this treatment, one additional injection can be given after 6 months if symptoms recur.

■ **Oral corticosteroids.** Oral prednisone at a dose of 20 mg/d for 2 weeks improves symptoms and function in patients with CTS, but is less effective than steroid injections.<sup>28</sup> Treatment for 2 weeks is as effective as treatment for 4 weeks; the effects tend to wane after 8 weeks in both cases.<sup>29</sup> Nonsteroidal anti-inflammatory drugs, diuret-

ics, and vitamin B6 have not been found to be effective.<sup>30</sup>

**CASE ►** Ms. K also asks about “those needle tests”—a reference to EDS—which her sister had to diagnose her CTS. You explain that these studies are not necessary at this time because her symptoms are mild and there is no need for other causes to be ruled out.

Instead, you offer her a neutral wrist splint for night-time use and recommend home-based nerve glide exercises. There is no evidence that cold laser therapy is effective, you explain to Ms. K, and it is expensive. She agrees to try the splint and the exercises, and you schedule a follow-up visit in 6 weeks.

**A look at alternative therapies**

There are many nontraditional treatments for CTS, with yoga, carpal bone mobilization, ergonomic keyboards, and ultrasound therapy among them. Some have limited evidence to suggest that they may have a therapeutic effect;<sup>30</sup> others have little or no evidence to support them.

■ **Yoga.** Stretching and improved joint posture with specific yoga exercises may lead to decreased compression within the carpal tunnel and increased blood flow to the median nerve. One small study found that yoga was more effective than nocturnal wrist splinting for pain relief, and had similar improvement for nocturnal symptoms and grip strength.<sup>31</sup>

■ **Carpal bone mobilization.** One small study found this physical therapy technique, which involves movement of the bones in the wrist, to improve symptoms such as numbness and tingling after 3 weeks of therapy. Yet carpal bone mobilization did not relieve pain or help restore function.<sup>32</sup>

■ **Ergonomic keyboard.** Patients who use computers at work may find that an ergonomic keyboard helps to relieve pain associated with CTS, compared with a standard keyboard.<sup>33</sup>

■ **Therapeutic ultrasound.** A recent meta-analysis found that there is only poor-quality evidence for ultrasound as an effective treatment for CTS—a process in which a round-headed instrument applied to the skin delivers sound waves that are absorbed by underlying tissues in the carpal tunnel. And there is insufficient evidence for one type of ultrasound

\*This link is provided for educational purposes only and is not an endorsement of the physical therapist featured in the video.

over another, or to suggest that ultrasound is more effective than other nonsurgical treatments.<sup>34</sup> Notably, ultrasound takes several weeks to provide a therapeutic benefit.

■ **What about acupuncture?** A recent trial found that acupuncture was no more effective than sham acupuncture in relieving symptoms of CTS in patients wearing wrist splints.<sup>35</sup> Magnet therapy, chiropractic, and cold laser therapy are not supported by evidence either.<sup>28</sup>

### Is the patient a candidate for surgery?

Carpal tunnel release provides good long-term outcomes for 70% to 90% of patients and is a cost-effective treatment.<sup>36,37</sup> Evidence supports a trial of conservative therapy, however, before considering surgery for patients with mild-to-moderate CTS.<sup>22</sup> Future studies are needed to identify prognostic characteristics of patients most likely to respond to each type of intervention, and the optimal timing for surgical release.

Patients with severe CTS—with findings such as thenar atrophy, diminished hand function, and median nerve denervation—should be referred for surgery without delay. This recommendation is based on expert opinion, however, as most clinical trials comparing surgical vs nonsurgical treatment exclude those with severe CTS.<sup>38</sup>

### 3 surgical techniques, and a novel approach

Surgical techniques include open, endoscopic, and minimal incision carpal tunnel release, with benefits and drawbacks for each. Compared with open release, for example, patients who undergo endoscopic release have less postoperative pain at 12 weeks, quicker return to work, and fewer wound complications, but are more likely to require surgical revision. And minimal incision release is associated with improved symptoms and function compared with open release.<sup>38</sup> However, there is no long-term evidence that any one of these 3 surgical approaches is more effective than another.<sup>39</sup>

■ **Percutaneous carpal tunnel release** is a novel approach that may be offered in outpatient settings, with local anesthesia and

ultrasound guidance to avoid median nerve damage.<sup>40</sup> Because studies of the safety and efficacy of percutaneous carpal tunnel release are limited, however, this approach is considered experimental.<sup>41</sup> Percutaneous release is not a treatment recommended by the AAOS.<sup>38</sup>

### What to tell patients about postop care

Regardless of the method used for carpal tunnel release, most complications are minor—eg, a painful or hypertrophic scar, stiffness, swelling, and pain or tenderness on either side of the incision—and resolve within a few months.<sup>42</sup> Advise patients not to continue to wear a wrist splint after surgery; doing so can cause stiffness or adhesions and may compromise surgical outcomes.<sup>41</sup> Postoperatively, patients should be instructed to do nerve gliding exercises and to massage their scars, both of which they can safely do at home.<sup>43</sup>

Patients can expect significant symptomatic improvement within 1 week of surgery, and most will be able to return to normal activities in 2 weeks.<sup>44</sup> Those with severe CTS should be warned, however, that it could take up to a year to determine the extent of recovery.<sup>22</sup> Evidence suggests that from 3% to 19% of patients may have persistent or recurrent symptoms even after carpal tunnel release, with up to 12% requiring surgical revision.<sup>45</sup>

**CASE ►** When Ms. K returns, she reports that while there has been some improvement, some activities—such as driving long distances and talking on the phone—still cause numbness and tingling. And, if she doesn't wear the splint at night, she awakens with tingling in her hands. You discuss 2 options—continued conservative treatment with a local steroid injection, or EDS and surgical referral. The patient opts for the injection and continued use of the nocturnal wrist splint and exercises. When she returns in another 6 weeks, Ms. K reports significant improvement. You agree to stop the wrist splint and exercises and advise her to follow-up on an as-needed basis if the symptoms return. **JFP**

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► Patients who use computers at work may find that an ergonomic keyboard helps relieve pain associated with carpal tunnel syndrome.



**Because studies of the safety and efficacy of percutaneous carpal tunnel release are limited, this approach is considered experimental.**

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