



# Carpal Tunnel Syndrome

U.S. DEPARTMENT OF HEALTH  
AND HUMAN SERVICES  
National Institutes of Health



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## What is carpal tunnel syndrome?

**C**arpal tunnel syndrome (CTS) occurs when the median nerve, which runs from the forearm into the palm of the hand, becomes pressed or squeezed at the wrist. The carpal tunnel—a narrow, rigid passageway of ligament and bones at the base of the hand—houses the median nerve and the tendons that bend the fingers. The median nerve provides feeling to the palm side of the thumb and to the index, middle, and part of the ring fingers (although not the little finger). It also controls some small muscles at the base of the thumb.

Sometimes, thickening from the lining of irritated tendons or other swelling narrows the tunnel and compresses the median nerve. The result may be numbness, weakness, or sometimes pain in the hand and wrist (some people may feel pain in the forearm and arm). CTS is the most common and widely known of the entrapment neuropathies, in which one of the body's peripheral nerves is pressed on or squeezed.

## What are the symptoms of carpal tunnel syndrome?

**S**ymptoms usually start gradually, with frequent numbness or tingling in the fingers, especially the thumb and the index and middle fingers. Some people with CTS say their fingers feel useless and swollen, even though little or no swelling is apparent. The symptoms often first appear in one or both hands during the night. The dominant hand is usually affected first and produces the most severe symptoms. A person with CTS may wake up feeling the need to “shake out” the hand or wrist. As symptoms worsen, people might feel tingling during the day, especially with certain activities such as talking on the phone, reading a book or newspaper, or driving. Hand weakness may make it difficult to grasp small objects or perform other manual tasks. In chronic and/or untreated cases, the muscles at the base of the thumb may waste away. Some people with very severe CTS cannot determine between hot and cold by touch, and may burn their fingertips without knowing it.

## What are the causes of carpal tunnel syndrome?

**C**arpal tunnel syndrome is often the result of a combination of factors that increase pressure on the median nerve and tendons in the carpal tunnel, rather than a problem with the nerve itself. Contributing factors include trauma or injury to the wrist that cause swelling, such as sprain or fracture; an overactive pituitary gland; an underactive

thyroid gland; and rheumatoid arthritis. Other factors that may contribute to the compression include mechanical problems in the wrist joint, repeated use of vibrating hand tools, fluid retention during pregnancy or menopause, or the development of a cyst or tumor in the canal. Often, no single cause can be identified.

## **Who is at risk of developing carpal tunnel syndrome?**

**W**omen are three times more likely than men to develop carpal tunnel syndrome. People with diabetes or other metabolic disorders that directly affect the body's nerves and make them more susceptible to compression are also at high risk. CTS usually occurs only in adults.

Workplace factors may contribute to existing pressure on or damage to the median nerve. The risk of developing CTS is not confined to people in a single industry or job, but may be more reported in those performing assembly line work—such as manufacturing, sewing, finishing, cleaning, and meatpacking—than it is among data-entry personnel.

## **How is carpal tunnel syndrome diagnosed?**

**E**arly diagnosis and treatment are important to avoid permanent damage to the median nerve.

- A physical examination of the hands, arms, shoulders, and neck can help determine if the person's complaints are related to daily activities or to an underlying disorder. A

physician can rule out other conditions that mimic carpal tunnel syndrome. The wrist is examined for tenderness, swelling, warmth, and discoloration. Each finger should be tested for sensation and the muscles at the base of the hand should be examined for strength and signs of atrophy.

- Routine laboratory tests and X-rays can reveal fractures, arthritis, and nerve-damaging diseases such as diabetes.
- Specific tests may produce the symptoms of CTS. In the Tinel test, the doctor taps on or presses on the median nerve in the person's wrist. The test is positive when tingling in the fingers or a resultant shock-like sensation occurs. The Phalen, or wrist-flexion, test involves having the person hold his or her forearms upright by pointing the fingers down and pressing the backs of the hands together. Carpal tunnel syndrome is suggested if one or more symptoms, such as tingling or increasing numbness, is felt in the fingers within 1 minute. Doctors may also ask individuals to try to make a movement that brings on symptoms.
- Electrodiagnostic tests may help confirm the diagnosis of CTSs. In a *nerve conduction study*, electrodes are placed on the hand and wrist. Small electric shocks are applied and the speed with which nerves transmit impulses is measured. In *electromyography*, a fine needle is inserted into a muscle; electrical activity viewed on a screen can determine the severity of damage to the median nerve.

- Ultrasound imaging can show abnormal size of the median nerve. Magnetic resonance imaging (MRI) can show the anatomy of the wrist but to date has not been especially useful in diagnosing carpal tunnel syndrome.

## How is carpal tunnel syndrome treated?

**T**reatments for carpal tunnel syndrome should begin as early as possible, under a doctor's direction. Underlying causes such as diabetes or arthritis should be treated first.

### Non-surgical treatments

- *Splinting.* Initial treatment is usually a splint worn at night.
- *Avoiding daytime activities that may provoke symptoms.* Some people with slight discomfort may wish to take frequent breaks from tasks, to rest the hand. If the wrist is red, warm and swollen, applying cool packs can help.
- *Over-the-counter drugs.* In special circumstances, various medications can ease the pain and swelling associated with carpal tunnel syndrome. Nonsteroidal anti-inflammatory drugs (NSAIDs), such as aspirin, ibuprofen, and other nonprescription pain relievers, may provide some short-term relief from discomfort but haven't been shown to treat CTS.
- *Prescription medicines.* Corticosteroids (such as prednisone) or the drug lidocaine can be injected directly into the wrist or taken by

mouth (in the case of prednisone) to relieve pressure on the median nerve in people with mild or intermittent symptoms. (Caution: individuals with diabetes and those who may be predisposed to diabetes should note that prolonged use of corticosteroids can make it difficult to regulate insulin levels.)

- *Alternative therapies.* Acupuncture and chiropractic care have benefited some individuals but their effectiveness remains unproved. An exception is yoga, which has been shown to reduce pain and improve grip strength among those with CTS.

## **Surgery**

Carpal tunnel release is one of the most common surgical procedures in the United States. Generally, surgery involves severing a ligament around the wrist to reduce pressure on the median nerve. Surgery is usually done under local or regional anesthesia (involving some sedation) and does not require an overnight hospital stay. Many people require surgery on both hands. While all carpal tunnel surgery involves cutting the ligament to relieve the pressure on the nerve, there are two different methods used by surgeons to accomplish this.

- *Open release surgery*, the traditional procedure used to correct carpal tunnel syndrome, consists of making an incision up to 2 inches in the wrist and then cutting the carpal ligament to enlarge the carpal



tunnel. The procedure is generally done under local anesthesia on an outpatient basis, unless there are unusual medical conditions.

- Endoscopic surgery may allow somewhat faster functional recovery and less post-operative discomfort than traditional open release surgery but it may also have a higher risk of complications and the need for additional surgery. The surgeon makes one or two incisions (about ½ inch each) in the wrist and palm, inserts a camera attached to a tube, observes the nerve, ligament, and tendons on a monitor, and cuts the carpal ligament (the tissue that holds joints together) with a small knife that is inserted through the tube. Following the surgery, the ligaments usually grow back together and allow more space than before. Although symptoms may be relieved immediately after surgery, full recovery from carpal tunnel surgery can take months. Some individuals may have infections, nerve damage, stiffness, and pain at the scar. Almost always there is a decrease in grip strength, which improves over time. Most people need to modify work activity for several weeks following surgery, and some people may need to adjust job duties or even change jobs after recovery from surgery.

Recurrence of carpal tunnel syndrome following treatment is rare. Less than half of individuals report their hand(s) feeling completely normal following surgery. Some residual numbness or weakness is common.

## How can carpal tunnel syndrome be prevented?

**A**t the workplace, workers can do on-the-job conditioning, perform stretching exercises, take frequent rest breaks, and use correct posture and wrist position. Wearing fingerless gloves can help keep hands warm and flexible. Workstations, tools and tool handles, and tasks can be redesigned to enable the worker's wrist to maintain a natural position during work. Jobs can be rotated among workers. Employers can develop programs in ergonomics, the process of adapting workplace conditions and job demands to the capabilities of workers. However, research has not conclusively shown that these workplace changes prevent the occurrence of carpal tunnel syndrome.

## What research is being done?

**T**he mission of the National Institute of Neurological Disorders and Stroke (NINDS) is to seek fundamental knowledge of the brain and nervous system and to use that knowledge to reduce the burden of neurological disease. The NINDS is a component of the National Institutes of Health (NIH), the leading supporter of biomedical research in the world.

Scientists supported by the NINDS are studying the factors that lead to long-lasting neuropathies, and how the affected nerves are related to symptoms of pain, numbness, and functional loss. Researchers also are examining biomechanical stresses that contribute to the nerve damage responsible for symptoms of carpal tunnel syndrome in order to better

understand, treat, and prevent this ailment. By quantifying the distinct biomechanical pressures from fluid and anatomical structures, researchers are finding ways to limit or prevent CTS in the workplace and decrease other costly and disabling occupational illnesses.

Scientists funded through NIH's National Center for Complementary and Integrative Health are investigating the effects of acupuncture on pain, loss of median nerve function, and changes in the brain associated with CTS. In addition, a randomized clinical trial designed to evaluate the effectiveness of osteopathic manipulative treatment in conjunction with standard medical care is underway. Evaluations of these therapies and other therapies will help to tailor individual treatment programs.

Another NIH component, the National Institute of Arthritis and Musculoskeletal and Skin Disorders (NIAMS), supports research on tissue damage associated with repetitive motion disorders, including CTS. Among other research, scientists have developed animal models that are helping to understand and characterize connective tissue in hopes of reducing harmful tissue buildup and identifying new treatments.

More information about carpal tunnel syndrome research supported by NINDS and other NIH Institutes and Centers can be found using NIH RePORTER ([projectreporter.nih.gov](http://projectreporter.nih.gov)), a searchable database of current and past research projects supported by NIH and other federal agencies. RePORTER also includes links to publications and resources from these projects.

## Where can I get more information?

**F**or more information on neurological disorders or research programs funded by the National Institute of Neurological Disorders and Stroke, contact the Institute's Brain Resources and Information Network (BRAIN) at:

### **BRAIN**

P.O. Box 5801  
Bethesda, MD 20824  
301-496-5751  
800-352-9424  
[www.ninds.nih.gov](http://www.ninds.nih.gov)

Information also is available from the following organizations:

### **National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)**

National Institutes of Health, DHHS  
31 Center Drive  
Room 4C02 MSC 2350  
Bethesda, MD 20892-2350  
301-496-8190  
877-226-4267  
[www.niams.nih.gov](http://www.niams.nih.gov)

### **Centers for Disease Control and Prevention (CDC)**

U.S. Department of Health and Human Services  
1600 Clifton Road  
Atlanta, GA 30333  
404-639-3311 or 404-639-3543  
800-311-3435  
[www.cdc.gov](http://www.cdc.gov)

**Occupational Safety &  
Health Administration**

U.S. Department of Labor  
200 Constitution Avenue, N.W.  
800-321-6742  
Washington, DC 20210  
[www.osha.gov](http://www.osha.gov)

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Neurological Disorders  
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Bethesda, Maryland 20892-2540