

Repetitive Strain Injuries:

Nerve Disorders and The Tunnel Syndromes



In our last article we discussed muscle and tendon disorders, some of the most common Repetitive Strain Injuries (RSI). In this article, we will describe nerve disorders caused by entrapment and wear and tear on the nerves. In the early stages, nerve problems may not be painful at all. Gradually nerve damage will cause changes in sensation and possibly motor control (i.e., numbness, tingling, annoying sensations, hypersensitivity and clumsiness). It is advisable to keep a daily log of activities and symptoms so that patterns may be identified. This is especially helpful when there is a symptom-free period followed by a recurrence of symptoms.¹

There are three major nerves that control the hands: the median nerve, the ulnar nerve, and the radial nerve. The median nerve controls the thumb, the two large fingers, and half of the ring finger. The ulnar nerve controls the pinkie and half of the ring finger. The radial nerve controls the muscles on the back of the wrist and the hand.¹ These nerves do not exit the spine separately. Instead, they are somewhat braided together in what is called the brachial plexus and exit as distinct nerves from there.

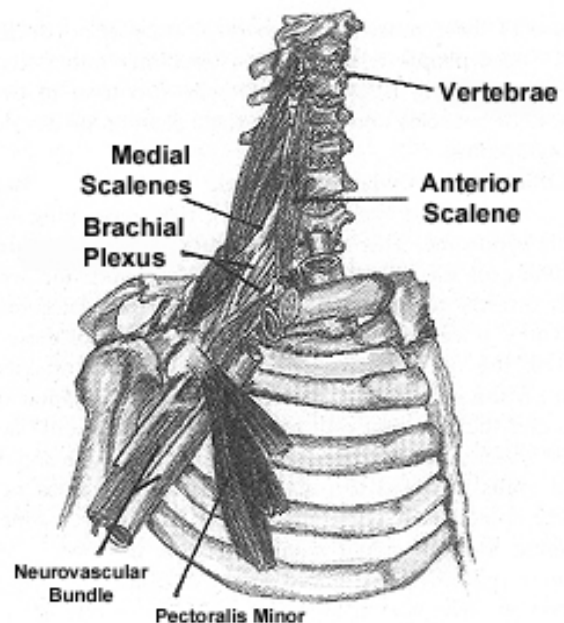


Illustration from Reference 2.

Nerve Problem Scale

Damany and Bellis¹ developed a scale to describe the stages of nerve damage and the associated symptoms that is helpful in understanding the extent of an individual's condition.

0 - Clear sensation. This is normal sensation. You aren't aware that your fingers and hands are there except when something touches them.

1 - Awareness. Very close to normal nerve health, but you may have a slight sensation of tension or something pulling. There is no numbness or reduced sensitivity, but one hand feels slightly different from the other. This is probably below the level of awareness during the development of symptoms, but may be noticeable during the healing process.

2 - *Coldness*. This can be caused by a reduction of blood flow and possibly thoracic outlet problems. Or it can be simply a peculiar sensation from an aggravated nerve.

3 - *Hypersensitivity*. This is a distinct sense of irritation from resting your hands on a surface that wouldn't aggravate a healthy nerve. Even a velour surface or turning your wrist in an odd position may be irritating.

4 - *Pins and Needles*. Rather than having less sensation than normal, you feel more sensation than normal. There are odd feelings as if pins are pricking the surface of your skin or the sensation that microscopic glass fibers are cracking within your skin.

6 - *Pinching*. This may feel as if you had tape attached lengthwise to your fingers, causing a tautness or strain. Again, you feel more, rather than less, sensation than normal.

8 - *Reduced Sensation*. This is a noticeable sensation that the surface of the skin is less sensitive. It may feel thick or leathery.

10 - *Numbness*. There is a feeling of less sensation through and through (e.g., the finger feels loss of sensation fairly deeply, not just on the skin).

15 - *Nerve Block*. You feel nothing other than a thick weightiness as if you have been given a shot of Novocaine. Many RSI patients get this in one hand when they are asleep and are awakened by it.

25 - *Reduced Grip Strength*. You start to lose control of your hands. This is the first stage of reduced motor control. This level makes the numbness and tingling levels seem trivial because there is a definite change in the severity of this condition.

50 - *Clumsiness*. You lose feedback sensations that would normally enable you to exercise fine control over your hands. You cannot coordinate the motion and strength of your grasp.

75 - *Incapacitation*. At this point motor control loss is so severe that you won't do tasks unless forced to. It hurts to perform almost any task.

100 - *Motor Loss*. This is a theoretical level because at level 75, the message is strong enough that people are physically incapable of continuing activity. This level indicates a complete loss of ability to perform, like paralysis.

Nutrition

Nutrition is extremely important in the care of the nervous system. 30% of calories should be from protein, 30% from fats, and 40% from complex carbohydrates.^{2,3} Eating a low fat diet can be harmful, especially in the case of nerve disorders. Essential fatty acids and unsaturated fats play an important role in brain, nervous system, and cellular function.² Essential fatty acids alter the prostaglandin concentrations in your body to decrease the inflammatory response.² Good sources of monounsaturated fats are sesame or sunflower seeds, flax seed oil, avocado, almonds, olive oil, olives, and natural peanut or almond butter. Good sources of essential fatty acids are borage oil, black currant seed oil, and evening primrose oil, and cold-water fish such as wild salmon and mackerel. Eating unprocessed, organic foods such as vegetables, fruit, whole grain breads, grains, nuts, seeds, cereals, fish and poultry is very important. Red meats increase your inflammatory response, so avoid them during flare-up periods.²

Median Nerve Disorders

The median nerve controls both the sensation and motion (motor control) of the thumb, two large fingers, and the inner side of the ring finger, though people differ somewhat on this.¹ The nerve exits the brachial plexus, goes through the chest wall at the thoracic outlet, under the pectoral muscles and through the armpit. It then travels down the inside of the upper arm, crosses the inside of the elbow, down the forearm under the forearm muscles, and through the carpal tunnel to the fingers. This twisted journey of the nerve lends itself to potential trauma at several points.

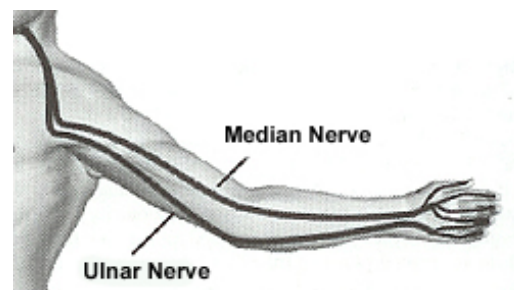


Illustration from Reference 1.

Carpal Tunnel Syndrome (CTS)

CTS is **not** a catch-all term for RSI, although it is frequently used as one. CTS is a very specific disorder involving the median nerve. If you have numbness or tingling in your first three fingers and/or pain in your wrist, sometimes into your forearm up to the elbow, you might have CTS. Symptoms may wake you at night.^{2,4} Just a slight bump may cause shooting pain in the fingers and arm due to increased sensitivity. If you do not have these symptoms, you do not have CTS, although you may be experiencing another RSI.

The carpal tunnel is a channel in the wrist through which the median nerve passes. The bones in the wrist called the carpal bones form a U, connected by a tough, unyielding ligament. This ligament is called the flexor retinaculum, or the transverse carpal ligament. We discussed the problems of tenosynovitis (i.e., inflammation of the tendons) involving this ligament in the last article. As shown in the cross-section, the area between the carpal bones and the flexor retinaculum is a close fit for the finger flexor tendons and the median nerve. Inflammation of the tendons, their sheaths, and the synovial fluid exerts pressure on the median nerve causing symptoms of CTS.² This is probably the most common cause of CTS, but there are several other contributing factors.

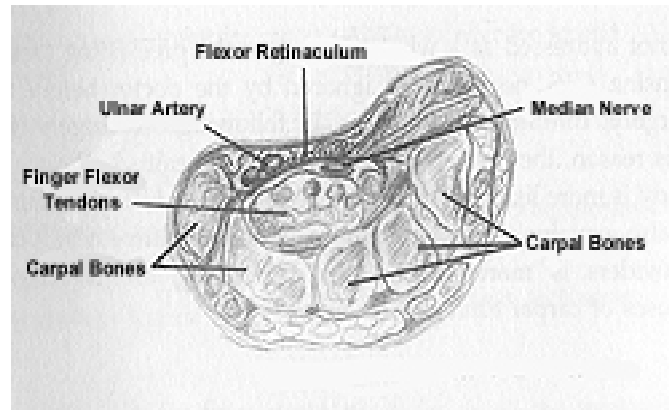


Illustration from Reference 2.

CTS is associated with many other medical conditions, especially involving fluid retention. Pregnancy, use of oral contraceptives, diabetes, thyroid disease and lyme disease are all associated with CTS.⁴ The carpal bones may become misaligned so the flexor retinaculum becomes taut, narrowing the carpal tunnel compressing the median nerve. Misalignment of the forearm bones may cause the misalignment of the carpal bones. This may happen during weightlifting or pushing with the palm while the wrist is extended, such as pushing a heavy cart. Myofascial syndromes may also cause carpal bone misalignment if the forearm and hand muscles attaching to the carpal bones are tightened and shortened.² Previous wrist fracture, enlargement of the bones due to repeated stresses, or even changes to the bones because of diseases such as tumors should be considered when identifying causes of nerve compression.

Direct compression of the carpal tunnel itself may cause CTS. People who rest their wrist on the mouse pad or table while moving the mouse are putting pressure on the carpal tunnel area. Any occupation involving the use of jackhammers, chainsaws, buffers, and grinders subject the wrists to vibration that inhibits blood flow to the nerves and other hand tissues that may cause CTS or Raynaud's disease, which we will discuss in the next article. Restricted blood flow due to working in a cold environment may also cause CTS.



Illustration from Reference 2.

Finally, spinal misalignments in the neck can cause swelling in and around the nerves traveling to the hand. The irritated tissues cause abnormal tensions in the forearm resulting in CTS.

Recovery. Common to all of these problems is the median nerve. The pins and needles, or numbness and tingling sensations result from decreased blood flow, just as when you feel your arm "go to sleep". At this point, if pressure is released, the nerve will heal fully. If blood supply continues to be restricted, the outer layers of the nerve, called the myelin, will break down leaving the inner nerve layer, the axon, unprotected.² Without the myelin, the speed of nerve impulses slows down. The median nerve is composed of thousands of axons, so it takes a long time of abuse to affect overall nerve function. In addition, the myelin can regenerate. So if pressure is relieved, there is still hope that the nerve can heal. If left untreated, the axon will die, which will cause numbness of the skin and atrophy of the muscles controlled by the median nerve. At this point recovery is much less likely.

Treatment. Surgery is not generally recommended unless there is excessive nerve damage or when the nerve has been damaged in a trauma. Surgery involves cutting the flexor retinaculum to release the pressure on the nerve.

Because of the complex nature and often multiple sources of problems with CTS, focusing on just the carpal tunnel area itself is unlikely to solve the problem. This is why symptoms of CTS recur soon after surgery. Resolving problems along the entire arm into the spine is necessary. Myofascial release, treatment of nutritional deficiencies, physical therapy, and correcting sources of pressure and strain at work and home are necessary to correct the problem and prevent recurrence.

Pronator Teres Syndrome (PTS)

The pronator teres muscle crosses the forearm and has two sites of origin. This muscle is responsible for rotating the hand, as in turning the palm of the hand downward, and for flexing the forearm. There are variations among different people in how this muscle attaches to the inside of the elbow.² Recent studies indicate that these variations are the primary cause of compression of the median nerve, which must pass between the two heads of the pronator teres muscle.

In most cases, PTS does not become apparent until a repetitive strain is exerted upon the tissues, eventually causing a wearing-down of these structures leading to compression of the nerve. So, anatomical variations present in the arm musculature do not pose a problem until repetitive strain occurs. The repetitive strain causes fibrosis, scarring, inflammation and degeneration of the tissues, eventually leading to compression of the median nerve. The person suffering from PTS will feel an aching in the elbow, which may be difficult to localize because of the number of structures involved.² Compression of the median nerve from PTS produces symptoms exactly like those of CTS except that elbow pain does not occur in CTS. This is because it is the median nerve that is being compressed in both cases, just in different locations.

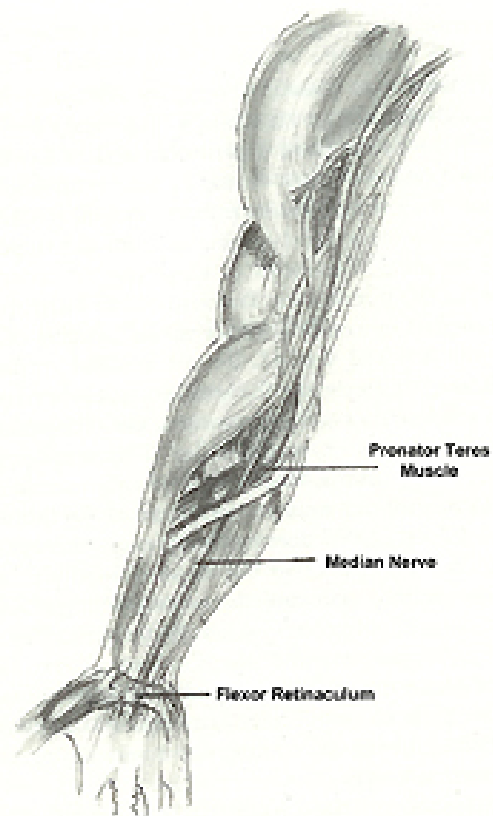


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Applying deep pressure to the pronator teres muscle will cause pain with PTS, but not in the case of CTS. Also, pronating the forearm (rotating inward) against resistance will cause pain in PTS but not in CTS.

Nerve conduction studies can differentiate between the two syndromes when diagnosis is difficult.² Sadly, many carpal tunnel surgeries have been performed unnecessarily when the problem was actually PTS!

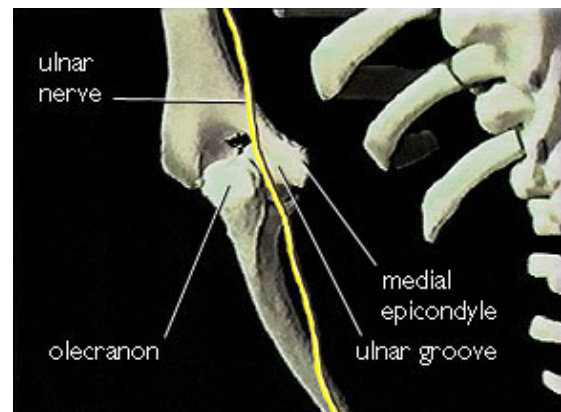
Treatment. Ultrasound, deep tissue massage and active isolated stretching of the opposing muscles, is used to relax the pronator teres muscle. Realignment of the forearm and carpal bones through manipulation and spinal adjustments of the neck will help reduce nerve compression and increase nerve flow to the extremities. Repeated twisting of the arm, such as using a screwdriver, should be avoided until healing is under way. Physical therapy and strengthening exercises will help rehabilitation later in treatment.

Ulnar Nerve Disorders

The ulnar nerve supplies sensation to the front and back of the ring and little fingers and provides motor control of the small muscles in the palm on the pinkie, the small muscles that control lateral movement of the fingers, and two muscles that flex the thumb inward toward the pinkie.² This nerve travels down the arm from the spine and must pass through a small tunnel located at and below the ulnar bone (i.e., the funny bone!) on the inside of the elbow. The nerve then passes down the forearm and through another tunnel at the wrist. As with the median nerve, there are several places along its path where the nerve is subject to stresses and compression.

Sulcus Ulnaris Syndrome

Sulcus means furrow or groove and ulnaris refers to the ulna, a bone of the forearm. So Sulcus Ulnaris Syndrome is a problem in a bone groove near the inside of the elbow.⁴ People who have a shallow groove on the funny bone and who lean on their elbows are likely to develop Sulcus Ulnaris Syndrome. This posture causes compression of the ulnar nerve and cuts off the blood flow. Symptoms are numbness and tingling in the ring and little fingers, with eventual muscle atrophy and clawlike appearance of these two fingers.⁴ In severe or advanced cases, surgery may be required to move the nerve to prevent permanent damage.⁴



Cubital Tunnel Syndrome

The cubital tunnel is located at the elbow. The walls of this tunnel are made up of the bones, muscles and a ligament in the elbow joint. Adhesions in the muscles and tissues surrounding the muscles can prevent the normal gliding of the nerve when the elbow is flexed. Inflammation in the surrounding tissues and the nerve itself cause problems. Repetitive actions involving flexed elbows, such as violin playing and drumming, computer work, carpentry and assembly-line work, irritate the nerve causing fibrosis and scarring.^{2,4} Problems also arise when people rest their upper body weight on their elbows or sit for long periods with elbows bent and pressing into their chair's armrest. The pressure of the body weight on the elbow leads to derangement of the elbow joint and inflammation. Direct pressure on the ulnar nerve itself causes a “pins and needles” sensation in the fingers.² Finally, arthritis may cause degenerative changes leading to small bone spurs in the elbow joint which may compress the ulnar nerve. In this case, surgery may be required to remove the bone spurs and decompress the nerve.²

Cubital Tunnel Syndrome causes tingling, numbness, or changes in sensation in the ring and little fingers. Pain along the inner part of the forearm, traveling down to the pinkie side of the hand is common. Problems laterally deviating the pinkie, weakness in grip strength and clumsiness of the hand often arise. It is common for Cubital Tunnel Syndrome and Medial Epicondylitis (as discussed in the previous article)

to both be present. If left untreated, ulnar nerve compression can cause muscle atrophy in the palm on the pinkie side and loss of sensation to the fourth and fifth fingers.²

Treatment. A combination of ultrasound on the elbow to stimulate healing, myofascial release to the wrist flexors and palm muscles, and manipulation to correct misalignments in the neck and back will aid in initial healing.² Exercises will help rebuild strength after healing has begun. Correction of posture and environmental factors leading to the problem is necessary to avoid recurrence of problems.²

Guyon's Canal Tunnel Syndrome

This disorder is also known as Ulnar Tunnel Syndrome. It is caused by compression of the ulnar nerve in the wrist in the Guyon's tunnel, near the carpal tunnel.^{2,4} The Guyon's tunnel is located on the palm side of the wrist towards the pinkie side, formed by two bones, the hamate and the small pisiform bone. The deep branch of the ulnar nerve passes between these two bones and provides sensory function to the fourth and little fingers, and motor control to the small hand muscles. This nerve is encased in a ligment-like casing and any alteration of the two bones can compress the nerve.² This condition may be caused by repeated deviation or dorsiflexion of the wrist (bending up or down), which may cause pain.⁴ Symptoms include numbness in the ring and little fingers and difficulty grasping.⁴

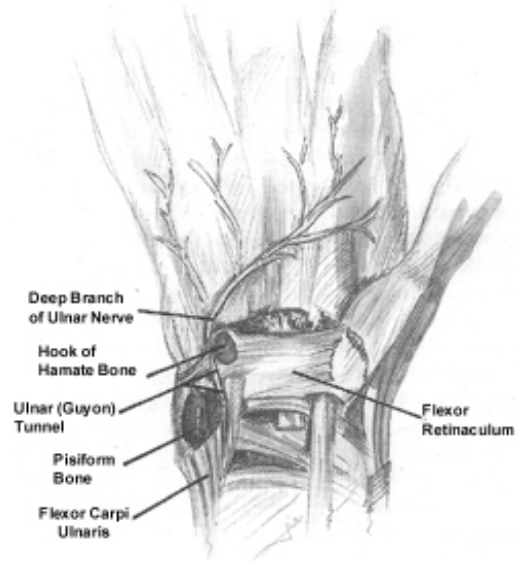


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Direct compression, such as from bicycle riding with pressure on the wrist, can cause harm to the nerve. Vibration from use of equipment such as jackhammers, buffers and grinders can cause compression of the nerve at this point. In addition, forearm tendonitis, Medial Epicondylitis, and flexor tendinitis may occur in combination with Guyon's Tunnel Syndrome. Less common problems are bone tumors, arthritic conditions and gout, which may result in nerve entrapment.²

When people have both Cubital Tunnel Syndrome and Guyon's Canal syndrome, it is called a "double crush," meaning that the same nerve is stressed at two points.⁴

Treatment. Correction of the source of compression is important. Alignment of the neck and wrist bones may be helpful..

Radial Nerve Disorders

The radial nerve starts at the brachial plexus, like the median and ulnar nerves, but then loops behind the arm with a branch that controls the triceps muscle.¹ It spirals toward the outside of the upper arm, goes around the elbow, and supplies the muscles in the top of the forearm which tense when you flex your hand upward.¹ It runs down the forearm to the hand, controlling the extensor muscles of the hand, that open your grasp. The radial nerve is not implicated in as many RSI troubles as the median and ulnar nerves.¹

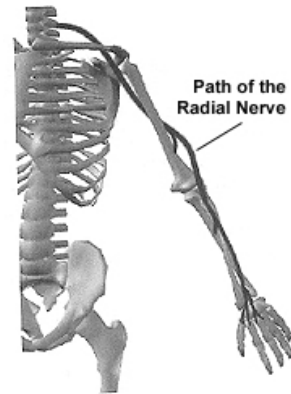


Illustration from Reference 1.

Radial Tunnel Syndrome

The radial tunnel is the encasement of the deep branch of the radial nerve within the supinator muscle just below the elbow joint. This nerve supplies motor control and sensation to most of the forearm muscles and the wrist joints and muscles. Compression of the radial nerve can occur if the supinator muscle goes into spasm resulting from activities that require repetitive hand rotation. This leads to the development of myofascial trigger points, fibrosis and scarring. As the nerve enters the supinator muscle, it passes over the end of the joint connecting the radius (upper arm) and humerus (lower arm) bones and the nerve may become compressed at this point.

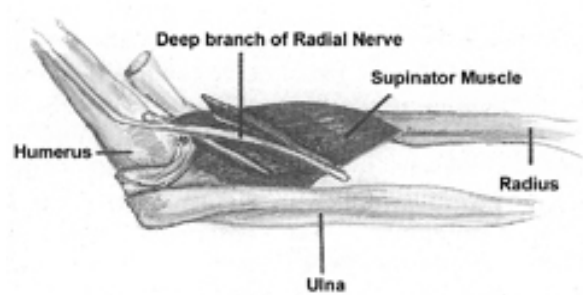


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Deep aching pain of the elbow area below the joint is common and may mimic “Tennis Elbow”. Entrapment of the nerve by the supinator muscle can lead to muscle weakness of the extensor muscles, which causes weakness in extending the hand, fingers, and thumb, and sensory changes from the wrist up the forearm. Occupations with high risk for Radial Tunnel Syndrome include carpenters, bank tellers, grocery checkers and assembly line workers.

Treatment. Alternative therapies such as massage, acupuncture and manipulation should be the first step in treatment to relax the supinator muscle and release nerve compression.² If these treatments are not successful, other sources of nerve compression should be considered such as fibrotic bands in front of the joint capsule, compression from tendons, or even blood vessels in the same space. Surgery should be a last resort for this condition.²

Cervical Radiculopathy

This is a compression that commonly affects the C5 and C6 or C6 and C7 cervical discs in the neck.⁴ It makes head movement extremely painful. This condition occurs most often in people who hold the phone with an upraised shoulder, cradling the phone while they talk.⁴ It can also be caused by years of poor posture at the computer and a forward head position. The results of compression in these cervical discs can result in weakness in the shoulder and upper arm as well as numbness in the fingers.

Treatment. Acupuncture and chiropractic manipulation should be considered the first approaches to treating this disorder. Myofascial release may be recommended if muscle and fascia inflammation are

present, which is common. Eliminating the cause of compression is important, too, such as the use of a headset to avoid cradling the phone.

This article and all of our articles are intended for your information and education. We are not experts in the diagnosis and treatment of specific medical or mental problems. When dealing with a severe problem, please consult with a healthcare or mental health professional and research the alternatives available for your particular diagnosis prior to embarking on a treatment plan. You are ultimately responsible for your own health and treatment!

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