Carpal Tunnel Syndrome: Background Information for HemaClear®
Product Specialists

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Abstract

Carpal Tunnel Syndrome (CTS) is the most frequent nerve compression affecting 0.3% of the population of whom 1/3rd (0.1%) requiring surgical release – Carpal Tunnel Release (CTR) each year. It is caused by crowding the median nerve in its passageway into the hand at the base of the palm. The symptoms are numbness, pain of the thumb and the middle fingers and weakness of the muscle at the base of the thumb. While non-surgical treatment is often tried, about a third of the patients require surgery, which is most often performed as an outpatient procedure under bleeding-free conditions and local anesthesia. The sterile Forearm HemaClear® is a safe and effective device for achieving optimal bleeding-free surgical field.

Etiology

The carpal tunnel is a narrow passageway which encloses nine flexor tendons to the fingers and thumb and the median nerve, on the palm side of the wrist (5 Mayo p.1). The median nerve provides sensation to the first 3 ½ fingers (not the pinky) and motor function to hand muscles (thenar). There is minimal space to contain the median nerve and nine tendons (8 Solomon p.119) as they pass from the forearm into the hand (3 ASSH p.1). The specific cause of Carpal Tunnel Syndrome (CTS) is usually unknown (3 ASSH p.1).

Pathogenesis

Compression of the median nerve results in CTS. “In general, anything that crowds, irritates or compresses the median nerve in the carpal tunnel space can lead to carpal tunnel syndrome” (5 Mayo p. 2). As such CTS develops when pressure is placed on the median nerve. In laymen’s terminology – it is a pinched nerve in the wrist (5 Mayo p.1 ). Pressure is created in several ways: swelling of the lining of the flexor tendons (tenosynovitis), joint dislocations, fracture and arthritis, having a bent wrist for extended periods, fluid retention during pregnancy, thyroid conditions, rheumatoid arthritis, and diabetes. It may also result as a combination of causes (3 ASSH p.1). The anatomy of the wrist can also be a contributing factor; a smaller carpal tunnel has less room to accommodate any swelling (5 Mayo p. 2).

Risk Factors

Small anatomy may provide a predisposition to CTS, as there is little room to accommodate any swelling that may develop. Industrial – assembly line work - and cleaning employment with repeated movement of hand and/or vibration may cause trauma leading to CTS (2 Canale p.4285). It was believed that office workers were prone to CTS but this is “controversial and unresolved” (2 Canale p.4285). “In fact CTS is three times more common among
assemblers than among data-entry personnel. A 2001 study by the Mayo Clinic found heavy computer use (up to 7 hours a day) did not increase a person’s risk of developing carpal tunnel syndrome” (6 NINDS p. 2).

**Epidemiology**

CTS patients are usually between 30 – 60 years old and the syndrome is two to three times more prevalent in women than men (2 Canale p.4285). It may affect 1%-10% of the US population. (2 Canale p.4285). CTS is the most common peripheral neuropathy (4 SYMP p. 202).

**Clinical Symptoms**

CTS can be mild to very painful and usually presents every night, disturbing ability to sleep. The most frequent symptoms include pain and paresthesia - burning, numbness, tingling or a combination of the three in the median nerve distribution. Patients try to relieve the symptoms by shaking the arm or hanging it over the side of the bed (8 Solomon p.119). Pain usually does not keep the patient from falling asleep, but typically awakens him/her. Symptoms can also appear during the day and can effect ability to grip a cup or hold a telephone or newspaper, with a tendency to drop things (3 ASSH p. 1). Holding the wrist in a flexed position for an extended period of time can expedite the pain (7 Skinner p.560). The pain can radiate from the hand up the arm, to the shoulder or neck. If not treated, sensation and use of muscles at base of thumb can be permanently damaged (3 ASSH p1).

**Diagnostics**

Early diagnosis of CTS is vital to prevent permanent damage to the median nerve. The diagnosis is based on clinical and physical symptoms. The physical exam includes examination of hands, arms, shoulders and neck. “The wrist is examined for tenderness, swelling, warmth, and discoloration. Each finger should be tested for sensation, and muscles at the base of the hand should be examined for strength and signs of atrophy. Routine laboratory tests and X-rays can reveal diabetes, arthritis and fractures.” X-rays can ascertain if there are other causes for the symptoms (6 NINDS p.2). Differential diagnosis is of utmost importance so as to eliminate other causes of similar symptoms. Diagnostics include provocation tests which try to reproduce the symptoms:

1 – Tinel nerve percussion over the median nerve;

2 – Phalen test – acute flexion of the wrist for sixty seconds;

3 – wrist compression test – pressure over the median nerve proximal to the wrist, to provoke symptoms within thirty seconds (2 Canale p. 4286);

4 – electrodiagnostic studies – NCV - nerve conduction velocity and EMG electromyogram;
5 – novel handheld nerve conduction measuring device – a new diagnostic device to accurately and objectively determine severity of CTS by measuring nerve conduction velocity. The results obtained in this manner also facilitate differential diagnosis (9 Tolonen p.390).

In cases with late diagnosis there is atrophy to median innervated thenar muscles, weakness of thumb abduction and sensory dulling in median nerve (8 Solomon p.119) which may not be reversible.

Treatment

Treatment should begin as early as possible. Underlying causes should be treated, eg., diabetes and hypothyroidism. The affected wrist should be given at least two weeks of rest. Light splints may be worn to prevent wrist flexion, particularly for people who sleep with bent wrists. (8 Solomon p.119). Applying cold packs and rest breaks at work may reduce swelling and bring relief (5 Mayo p.4).

Nonsurgical Therapy

Drugs – Nonsteroidal anti-inflammatory drugs (NSAIDs) may help reduce swelling temporarily (2 Canale p. 4287). They may be effective short term but it has not been shown that they actually improve the carpal tunnel syndrome itself (5 Mayo p.5). Corticosteroids can be injected directly into the wrist to provide temporary relief. They reduce inflammation and swelling which in turn relieve pressure on the median nerve. Oral corticosteroids are not as effective as injection. Diuretics may also reduce swelling (5 Mayo p.5).

Exercise – Physical and occupational hand therapy with stretching and strengthening exercise, as well as changing pattern of hand use, may bring relief (3 ASSH p.1). High-intensity ultrasounds may also provide relief by raising body temperature and promoting healing (5 Mayo p.6).

Alternative treatments – Acupuncture and chiropractic may be helpful but as yet their efficacy has not been proven. Additionally, “Yoga postures designed for strengthening, stretching and balancing each joint in the upper body, as well as the upper body itself, may help reduce the pain and improve the grip strength of people with CTS” (5 Mayo p.6).

Surgery

CTS surgery is a very common procedure in the US. It is a very effective treatment for CTS (9 SYMP p.201). If symptoms do not respond to non-surgical treatment, surgery is indicated (6 NINDS p.3). It is an ambulatory procedure under local anesthesia. The time at which to recommend surgery is still under debate. The Mayo Clinic staff claims that conservative treatment – non-surgical – may be effective if there are mild to moderate symptoms for less than ten months (5 Mayo p.4).

According to the Symposium on the Wrist and Hand, surgery should be considered if conservative treatment of mild and moderate CTS do not bring relief within three months (4 SYMP p.202). The National Institute of Neurological Disorders recommends surgery if symptoms last for more than six months (6 NINDS p.3). Persons with severe symptoms should be referred to surgery immediately (4 SYMP p.202).

Pressure on the median nerve is reduced by cutting the ligament that forms the roof of the tunnel on the palm side of the hand (3 ASSH...
One option is standard open release surgery to divide the transverse carpal ligament at the wrist. A skin incision of up to two inches is made in order to identify and cut the carpal ligament and enlarge the carpal tunnel (6 NINDS p.3). It is done "under direct vision ensuring a safe and complete release. It is the oldest and most commonly used technique...and normally takes less than fifteen minutes." (4 SYMP p.201). Mini-open release surgery was developed to decrease problems of sensitivity following standard open release surgery (4 SYMP p.201). Endoscopic surgery is an alternative option. In this procedure the surgeon makes two incisions (about ½ inch each) in the wrist and palm, inserts a camera attached to a tube, observes the tissue on a screen and cuts the carpal ligament" (6 NINDS p.3). Post-operative recovery rehabilitation from the latter is quicker, but the surgery sometimes misses cutting the entire ligament due to poor visibility (4 SYMP p.201). Nearly all CTS release operations are performed with a tourniquet placed on the upper arm or on the forearm to prevent bleeding and improve visibility. The traditional pneumatic tourniquet is being replaced now by a new elastic exsanguination tourniquet (1 Boiko p.185). Hemaclear®, OHK Medical Devices, Ltd., Haifa, Israel, which is sterile and provides better visibility. Anesthesia is usually by local infiltration of Lidocaine or similar local anesthetics.

Prognosis

CTS symptoms are relieved after surgery, however full recovery can take months. Complications that may occur following CTS surgery include infection, nerve damage, stiffness, and pain at the scar. Occasionally the wrist loses strength. Recurrence is rare (6 NINDS p.3). Most patients (85%) benefit from surgery with lasting relief of CTS. However, patients over 70 years of age may not attain total relief (2 Canale p.4289).

Summary

In conclusion, CTS is a common neuropathy that affects women three times more than men. It can present with mild, medium or severe symptoms. The former may respond to conservative treatment; the latter necessitates surgical intervention. Not treating severe CTS may lead to irreversible thenar muscle atrophy.

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Bibliography