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A comprehensive review of the anatomy of carpal tunnel syndrome and its homoeopathic treatment

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ABSTRACT :

The transverse carpal ligament forms the upper barrier of the carpal tunnel, during its passage through the carpal tunnel, a tiny passageway in the wrist, while the carpal bones form the lower boundary. There are nine flexor tendons in all, and the median nerve the most significant nerve in the upper limb passes via the carpal tunnel. The development of carpal tunnel syndrome is brought on by ischemia injury to the median nerve, high blood pressure and mechanical stress. It accounts for 90% of all occurrences of neuropathy, making it the most prevalent focal mononeuropathy. Entrapment neuropathy is the result of compression of the median nerve during its passage through the carpal tunnel. Pain, numbness and paresthesia in the median nerve distribution area are the first symptom of this disorder. It is a progressive illness that, if left untreated can result in permanent loss of hand function and sensation in most individuals. Anatomy, epidemiology, pathophysiology, etiology, clinical symptoms, diagnostic techniques, and the utility of homeopathic medication in the treatment of this illness that significantly impairs a patient's quality of life and causes substantial morbidity are all covered in this article.

KEYWORDS : Carpal tunnel syndrome, Homoeopathic medicines, Entrapment neuropathy Median nerve

INTRODUCTION

A form of compressive neuropathy called carpal tunnel syndrome is brought on by mechanical distortion brought on by compressive forces. Carpal tunnel syndrome is described as a symptomatic compression neuropathy of the median nerve at the wrist level in the American Academy of Orthopedic Surgeons (AAOS) Clinical Guidelines on the Diagnosis of carpal tunnel syndrome.^[11] It makes about 90% of all entrapment neuropathies and is the most common and well known type of median nerve entrapment. A persistent focal compressive neuropathy brought on by an increase in pressure inside rigid anatomical structures is known as an entrapment neuropathy. The neuropathy known as carpal tunnel syndrome is brought on by the median nerve becoming trapped at the level of carpal tunnel, which is defined by the transverse ligament and the carpal bones. The elevated pressure within the carpal tunnel is the primary cause of its onset. Pain, numbness, and paraesthesia are the early symptoms affecting just the lateral part of the fourth digit and the first three digits.^[2] The symptoms can vary, ranging from wrist pain that affects the entire hand to pain that sometimes radiates up the forearm or beyond the elbow. As the illness worsens, people may become clumsy, lose their fine motor skills, develop hand weakness, and eventually have their thenar muscles atrophy. People who work in jobs that require repetitive wrist movements, extended exposure to vibrating equipment, or frequent computer use are far more likely to acquire this illness. The main risk factors for this syndrome are pregnancy, rheumatoid arthritis, diabetes, hypothyroidism, obesity, and genetic predisposition.^[3]

ANATOMY OF CARPAL TUNNEL

On the palmar side of the wrist, next to the flexor retinaculum, lies a narrow osteofibrous canal. It serves as a conduit for structures that travel between the hand and the front side of the forearm. It also transmits the median nerve and the tendons of flexor pollicis longus, flexor digitorum superficialis, and flexor digitorum profundus muscles. The carpal arch, a deep parts created by the palmar side of carpal bones, makes the tunnels floor. The pisiform bone and the hamate hook surround the carpal arch medially, while the tubercles of the scaphoid and trapezium carpal bones encircle it laterally. The flexor retinaculum, a ligament made of connective tissue, forms the roof of the carpal tunnel. The ligament creates a tunnel by bridging the gap between the medial and lateral ends of the carpal arch.^[2,3] Nine tendons including the tendon of the flexor pollicis longus, four tendons of the flexor digitorum superficialis, and four tendons of the flexor digitorum profundus, are located in the tunnel together with the median nerve. The synovial tendon is sheaths that envelope each tendon, allows for unrestricted mobility between them. The flexor pollicis longus tendon has its own synovial sheath, whereas the eight tendons of the flexor digitorum profundus and flexor digitorum superficialis are encased in a single sheet.^[3]

EPIDEMIOLOGY

The most prevalent entrapment neuropathy, carpal tunnel syndrome, is estimated to affect 3.8% of people, in the general population, the incidence falls between 1% and 5%. With a 3:1 female to male ratio, it is more common in females than males. Those who are obese are twice as likely to acquire this syndrome. It usually affects adults between the ages of 40 and 60 and is rare in children.^[4] The prevalence of carpal tunnel syndrome during pregnancy has been estimated to be around 2%, but the prevalence of diabetes in people is 14% without diabetic neuropathy and 30% with it.

ETIOLOGY

- a) **Extrinsic causes** Are those that cause the tunnels volume to increase. Pregnancy, menopause, obesity, hypothyroidism, renal failure, oral contraceptive use, and congestive heart failure are among the disorders that affect the body's fluid balance.
- b) Intrinsic factors These include tumors and lesions that resemble tumors that are found inside the nerve and increase the volume occupied inside the tunnel.
- c) Neuropathic factors Diabetes, alcoholism, vitamin toxicity or deficiency, and exposure to toxins are among the conditions that significantly contribute to the symptoms of carpal tunnel syndrome. This is because they have an impact on the median nerve without necessarily raising the carpal tunnels interstitial pressure.^[5]

PATHOPHYSIOLOGY

A combination of ischemia injury, increased pressure, and mechanical damage to the median nerve located within the carpal tunnel causes the syndrome. In the carpal tunnel, normal pressure falls between 2 and 10 mmHg. Changes in wrist posture cause significant variations in the fluid pressure inside the carpal tunnel, wrist flexion increases the pressure by 8 times, while extension increases it by 10. Therefore one of the main risk factors for carpal tunnel syndrome is repetitive hand movement. Demyelination of the median nerve occurs when it is repeatedly exposed to mechanical forces. While the axons remain intact demyelination of the nerve begins at the compression site and may extend throughout the internodal segment. A stoppage of nerve transmission follows.^[4,5] Endoneural edema may develop if the compression continues because it may disrupt blood flow to the endoneural capillary system, changing the blood-nerve-barrier. It results in a vicious loop that includes local metabolic change ischemia, and venous congestion. Fibrosis which inhibits nerve gliding and causes damage and mesoneurium scarring, can result from chronic compression. Because the nerve sticks to the surrounding tissue, it tries to glide out of its fixed position during movement, which causes the affected nerve to be tangled. Tenosynovitis, also known as inflammation of the flexor muscle tendons, can lead to elevated pressure in the carpal tunnel and, ultimately, carpal tunnel syndrome.

CLINICAL PRESENTATION

- 1. Hand pain accompanied by disagreeable tingling or numbness in the median nerve's distal spread.
- 2. Affected hand function and grip strength are diminished.
- 3. During the day clumsiness and activities involving wrist flexion occurs, and symptoms worsen at night.
- 4. Patients frequently report of phenomenon called the "flick sign" in which symptoms are elevated by flicking or shaking the wrists.
- 5. Non-standard symptoms of carpal tunnel syndrome, includes writer's cramp, or exhaustion, shoulder discomfort, cold sensitivity in the fingers, forearm pain, or numbness in just the three fingers.
- 6. On nerve conduction studies, patients may occasionally exhibit visual thenar atrophy and denervation.
- 7. Dynamic carpal tunnel syndrome- This ailment is characterised by little symptoms or objective examination findings, and individuals only experience symptoms when engaging in strenuous activity, typically related to their job or regular work.^[6]

DIAGNOSIS

- 1. The best method to diagnose carpal tunnel syndrome is through detailed case history, taking into consideration the relation of symptoms with their time of occurrence and their intensity. Based on presenting symptomatology, it is classified into 3 stages: -
- a. **Stage 1:** Patients have frequent awakenings during the night with a sensation of a swollen, numb hand. Complain of severe pain which radiates from the wrist to the shoulder, and an annoying tingling in their hand and fingers (brachialgia paraesthetica nocturna). Handshaking (flick sign) relives the symptoms. During the morning, a sensation of hand stiffness may persist.
- b. Stage 2: The symptoms appear during the day as well, primarily when the patient moves their hands and wrists repeatedly or stays in one position for an extended period. When a patient has a motor deficit, they report that they can no longer feel their fingers and that objects frequently fall out of their hands.
- c. Stage 3: The median nerve often reacts poorly to surgical decompression at this point, and atrophy of the thenar eminence is clearly visible. Sensory problems may lessen at this stage. Along with extreme compression, weakening, and atrophy of the abductor pollicis brevis and opponens pollicis, there is also pain in the thenar eminence.
- 2. Two tests are another method of diagnosing the syndrome:

- a) Phalen's test The patient is asked to flex their wrist and maintain that position for 60 seconds as part of the Phalen's test. If it causes pain or paresthesia in the median nerve's distribution, that is a positive reaction. While the specificity of Phalen's test spans from 40% to 98%, the sensitivity falls between 67% and 83%.
- b) Tinel's test This test involves tapping the wrist's volar surface. If this results in paresthesia in the thumb, index, middle, and radial sides of the ring fingers—the fingers innervated by the median nerve—that is a favorable reaction. Tinel's test has a specificity of 30% to 94% and a sensitivity of 48% to 73%.^[6]
- 3. **Studies of Nerve conduction (NCS)** Since it is an objective test that gives details on the physiological condition of the median nerve in the carpal tunnel, it is regarded as the gold standard for diagnosing carpal tunnel syndrome.
- 4. **MRI-** A great diagnostic tool for identifying uncommon pathological reasons of this illness, such as ganglion, hemangioma, or skeletal deformity, is magnetic resonance imaging (MRI); the existence of these may change the course of surgical intervention.
- 5. Ultrasound (US)- Because the thickness of the median nerve, the flattening of the nerve inside the tunnel, and the bowing of the flexor retinaculum are all characteristics of carpal tunnel syndrome that are effectively visible on ultrasound, has been used to diagnose the condition.

HOMOEOPATHIC MANAGEMENT OF CARPAL TUNNEL SYNDROME

Viola Odorata

Numbness in the right wrist that spreads to the hand and fingers, rheumatic pain in the wrist, particularly on the right side, pressing and drawing pain in the wrist and back of the hand, stitching pain in the tips of the fingers, particularly the tip of the second finger, pain that gets worse when you rest, swelling in the right side of your hand, and pressing pain in your wrist from a load are all symptoms of carpal tunnel syndrome. Cold, dry weather exacerbates complaints.^[7]

Guajacum Officinale

Immobilization, constriction, and shortening are the main symptoms of carpal tunnel syndrome. contraction of the tendons and muscles, particularly after a cold. Heat sensation in the hand and wrist; cool application relieves rheumatic pain. Left wrist complaints are exacerbated by movement and warmth. Hand discomfort when grasping anything, rheumatic pain in the finger joints, wrist pain that draws and tears, wrist pain that presses into the fingers, and weakness in the extremities after minimal effort. burning sensations and a need to stretch. Stiff, shortened, and swollen tendon.^[8]

Ruta Graveolens

Hand coldness accompanied by tendon and muscular contraction, as well as hand formation with inflammation of the joints. inflammation of the finger joints and conditions following wrist injuries, discomfort upon bending the joints and with mild activity, and wrist pain that seems as though it is fractured. Soreness in the wrist and back of the hands, rheumatic stiffness in the hands, weakness in the hands, and paralytic wrist discomfort as if dislocated, especially when moving. Cold weather and physical exertion exacerbate complaints, as do conditions following accidents including blow bruising, falls, and pain that feels like it's digging up. Complaints that are made worse by writing, pressure, and rainy weather are made better by warm air. Tendon tightness, inflammation, and stiffness accompanied by bruised aches and weakening.^[8]

Hypericum Perforatum

Hand onset, particularly in the morning, with a fuzzy feeling in the hands; wrist injuries; numbness in the hands with straggling joint pain; damage to nerve-rich areas; pain radiating upward along the nerve; and conditions resulting from punctured wounds following surgery. Cold, rainy, and foggy weather exacerbates complaints. Neuritis.^[8]

Calcarea Phosphorica

Rheumatism accompanied with stiffness and arthritic aches that become better with movement Weakness of muscles with tingling, cramping, and numbness while writing, wrist cramps when moving, inflammation, and itching around the rest of the wrist, and flexor muscles with a bruised feeling, numbness in the hand, especially when waking up in the morning, complaints of right wrist pain, aching, and burning pain when extending two fingers reduction in wrist discomfort caused by the bed's warmth and paralysis of the wrist.^[9]

Medorrhinum

Discomfort in the wrist and hand that gets worse when you close your hand, numbness in your hand, especially on the left side, and numbness in your fingers, especially your fourth finger, as well as discomfort in your index and second fingers. Stiffness and restlessness in the fingers, particularly after exertion, hand and wrist edema, and hand and finger shaking. sensation of heat in the hand, particularly the palm. There is scorching agony in the palm of the hand and paralysis in the forearm.^[9]

Natrium Muriaticum

Finger formation, hand jerking, hand convulsions, and numbness in the forearm and hand. Pain from light exertion while at rest. itchiness in the fingers and wrist. Flexor muscle paralysis. Hands shaking while writing. The wrist and hand feel hot, the hand feels heavy, the hand and fingers are inflamed, the forearm and hand are lame, the right hand is numb, especially when lying on something hard, and the fingers are numb, especially in the morning.^[9]

CONCLUSION

Carpal tunnel syndrome, which makes up 90% of all entrapment neuropathies, is still one of the most common types of median nerve entrapment. In addition to giving a general overview of carpal tunnel syndrome, this article concentrates on the anatomy of the condition and highlights the use of homeopathic remedies in its treatment.

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