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Carpal Tunnel Syndrome in Primary Care Settings: What We Should Know

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ABSTRACT

Carpal tunnel syndrome (CTS) remains one of the most common peripheral nerve entrapment syndromes. The patient may experience pain, numbness, and tingling in hand and arm of the affected individual. Treatment for CTS falls under two choices between conservative and surgical therapy. Mild and moderate symptoms are offered to be treated with conservative treatments, including oral and transvenous steroids, vitamin B6, vitamin B12, and corticosteroids injection. A further option is using a surgical procedure with a carpal tunnel release (CTR) by cutting the transverse carpal ligament (TCL) to increase space and relieve the pressure within the tunnel. As there are many cases of CTS worldwide, astute primary care physicians (PCP) must diagnose and choose the right treatment option. Clinicians should acknowledge some basic information about CTS to provide cost-effective and proper treatment. Clinicians can select Conservative treatments before referring the patient to an orthopedic surgeon or neurosurgeon. Failure to respond to conservative therapies is a case that needs hospital referral consideration.

Keywords: carpal tunnel syndrome, primary care, primary care physician

INTRODUCTION

Carpal tunnel syndrome (CTS) remains one of the most common peripheral nerve entrapment syndromes. Most of the CTS cases are reported as median nerve compression.[1] This common medical condition usually causes complaints of pain, numbness, and tingling in hand and arm of the affected individual. The compression and extortion of the median nerve as it proceeds through the wrist.[2] CTS can be found and separated into acute and chronic CTS, as chronic CTS is much more reported.[3] It is reported that at least 3,8% of people with complaints of unresponsiveness, aching, and itchy feeling if their hand have CTS.[4,5] 20% of people who are having pain, numbness, and a tingling sensation in their hands are thought to be having CTS based on clinical examination and electrophysiological testing.[6] Ultimately, the most common diagnosis of a patient with these symptoms is idiopathic CTS.[7]

Symptoms of CTS varies; it may start with a feeling of numbness or swelling in the middle of the night until extreme wrist pain spreads to the shoulder. The feeling of inconvenient perception can be felt all over the thumb, index finger, middle finger, and the radial side of the ring finger.[8] These painful symptoms may accumulate and form a functional disturbance regarding grip strength and hand function. Untreated CTS over a long period may cause muscle wasting in the base of the thumb.[9] A study also predicted that around 4% and 5% of people experience CTS worldwide, with elderly individuals between 40 and 60 years the most vulnerable.[10] Female is more susceptible than male to acquiring CTS based on considerable evidence reported; the reason is still unknown though many

theories describe the potential role of hormone, occupation, and anatomical

The working activity of each individual is strongly linked with the occurrence of this musculoskeletal disorder.[4,9] Manual laborers commonly acquire CTS as it might be caused by strain and repetitive stress. CTS is a debilitating disorder and is associated with increased absence in workplace.[4,13] The increasing life span of the general population and number of diabetic patients contribute to the rising incidence of CTS.[14]

Treatment for CTS falls under two choices between conservative and surgical therapy. Mild and moderate symptoms can be treated with conservative treatments, including oral and transvenous steroids, vitamin B6, vitamin B12, and corticosteroids injection.[15,16] The last treatment option is through carpal tunnel release (CTR) surgical procedure by cutting the transverse carpal ligament (TCL) to increase space and reduce the pressure in the carpal tunnel.[17] In the US, CTR is performed 450.000 times annually and is quite the financial burden, accumulating a total cost of 2 billion dollars.[18] Primary care physician (PCP) needs to know and understand the syndrome to rule out the best diagnostic and proper treatment of choice needed. Many patients will visit primary care settings accompanied by mild and moderate symptoms.[19] A correct choice of treatment and early diagnosis may treat and prevent disease progressiveness into further stages and needing referral.

CTS is an interesting case as the prevalence is quite large and widespread. It is essential for PCP to recognize how to diagnose and choose the proper treatment. In this paper, the authors discuss the importance on how PCP may help in such situation.

DISCUSSION

Anatomy of carpal tunnel

The carpal tunnel is located at the base of the palm. Eight carpal bones with partial tough fibrous at the roof are called transverse carpal ligament (TCL) and the carpal sulcus at the base.[20] On the ulnar edge, it is demarcated with the hook of hamate, pisiform, and pyramidal bone. Apart from that, scaphoid bone, trapezoid bone, and tendon of the flexor carpi radialis (FCR) delimited the radial edge. Ten structures are running down throughout the tunnel, including four tendons of flexor digitorum superficialis, four tendons of flexor digitorum profunda, flexor pollicis longus, and the median nerve. The entrance of the carpal tunnel is placed by the median nerve located dorsally to the palmaris longus muscle or betwixt both FCR and long palmar muscle.[20,21] Median nerve is naturally located onward to the flexor tendon of the index finger or the superficial flexor of the middle finger. It may also be positioned among the thumb's long flexor and the index finger's superficial flexor in the neutral wrist position. There are six median nerve branches, including the thenar branch, three palmar branches (two branches in the thumb and one in the index finger), and common palmar digital nerves throughout the second and third spaces.[21]

Risk factors

The combination phenomenon of compression and tension is causing this compressive syndrome. The compression sites can be located at two different places, at the level of the proximal limit of the carpal tunnel and the level of the tightest location, near hamate hook.[23] CTS can be classified into two different varieties, acute and chronic CTS. In 1854, Sir James Paget first described the most common cause of acute CTS: the radius fracture. Burns, coagulopathy, local infection, and injections are also highly associated with acute CTS.[24] However, the more common form is the chronic form of CTS, which can persist for a longer duration, from months to years. Discovering the etiology of CTS is sometimes quite tricky. Some of the causes can be divided into several groups, local, regional, and systemic causes. Local causes include inflammation in the region, trauma, tumors, and anatomical anomalies. Regional causes may include the condition of

osteoarthritis, rheumatoid arthritis, amyloidosis, and gout. Other conditions related to systemic causes are diabetes, obesity, pregnancy, and many other conditions that may contribute to inflammation.[24] Pregnant women in the third semester are often found with CTS and are usually bilateral. Most patients in this form will heal spontaneously or have a good outcome with conservative treatment following the delivery.[24,25] This medical condition is related to several risk factors. Excessive usage of the wrist is related to the prominent flexion or extension position, flexor muscle, and exposure to vibration. Occupation also plays a significant role as it may contribute to this repetitive trauma disorder.[7,26] Repetition, force, external pressure, posture, and vibration are physical factors strongly related to occupational in CTS.[24,26] Sectors with repetitive usage of the same limb are often found to acquire CTS, such as agriculture and forestry, fishing, manufacturing, and construction. However, occupation as a standalone risk factor does not represent the occurrence of CTS. Hence, the combination of many factors is participating.[26]

Economic effect

3,8% of people with unresponsiveness, aching, and itchy feeling complaints have CTS. As the most common clinical condition related to peripheral neuropathy, approximately $2 billion was spent in 1995 in United States to perform surgical decompression for 400,000-500,000 patients. In the UK, the regular rate of carpal tunnel release is 43-74 per 100,000.24 Not only does the economic aspect affect healthcare providers, but it also affects the patients, as the patients may have a setback on their career.[27]

Pathophysiology

A combination of several factors is involved in the pathophysiology of CTS.[28] Increased pressure in the carpal tunnel is one of the culprits. The standard pressure ranged from 2 mmHg to 10 mmHg.[6] Movement in wrist positions causing a different sudden wrist pressure, followed by the dramatic fluid movement is another cause. Wrist extension changes the pressure to 10 times its initial level, while flexion causes an increased pressure of 8 times the average level.[7,28] Median nerve demyelination can occur because of repetitive mechanical forces. Demyelination of the median nerve that arises in the compression, later on, may develop further to the whole internodal segment. The persistent compression causes not only neurapraxia but also blocks the endoneurial capillary system's blood flow.[7,29] Should this condition persists, it will alter the blood-nerve barrier, resulting in an endoneurial edema. Carpal tunnel release shows that ischemic injury is also thought to be an essential aspect as it may worsen limb paraesthesia. The 3 phases in this ischemic condition include raised intrafunicular pressure, damaged capillary and edema, and obstructed arterial flow. Increased pressure in the carpal tunnel can also be the result of synovial tissue thickening.[28,30]

Inflammation of the synovial tissue of the flexor tendons, called tenosynovitis, may also cause increased pressure in the carpal tunnel as it induces the expression of prostaglandin E2 and vascular endothelial growth factor (VEGF).[31] This inflammation will result in constrictive scar tissue in response to the injury. Hence, it may cause some disturbance in the median nerve.[32] Small nociceptive fibers also play a role in the CTS distribution. Abnormal diffusion of the Na^+ channels in the disrupted nociceptive fibers, can induce ectopic discharge and hyperexcitability state, resulting in pain.[28,33]

Diagnosis

The primary care setting is a vital point in determining the next step of CTS patient management. A proper investigation should be commenced to establish a CTS diagnosis to plan the exact treatment. In the assessment, several features should be noticed, such as special features and

provocative factors of CTS.[34] The clinicians should ask about symptoms duration, severity, character, location, radiation (do the pain radiate from the upper hand?), and progression (worse or better since the onset?). Any history of patients' comorbidities and lifestyles should also be asked. The correlation between the working activity and the symptoms should also be considered by asking about the maneuvers that may alleviate complaints.[34,35]

Several other diagnoses should be considered, including peripheral neuropathy, cervical radiculopathy, wrist/ trapeziometacarpal, arthrosis, wrist tendonitis/tenosynovitis, and ulnar neuropathy.[34,35]

Physical examination is crucial. Clinicians should take note of the patient's body characteristics, including age, BMI, body habitus, range of motion of the wrist and hand, any deformities, swelling, atrophy, and skin trophic changes.[19] The examination should also include sensory and motor function to discover the classic symptoms of CTS. The sensory examination shows a decreased sensation in the 1st to 3rd digit and radial side of the 4th digit unilaterally. It is important to compare both hands. This examination may help to discover the localization of median nerve distribution. Motor properties such as pinching, gripping, and thumb adduction should also be tested. Unintentional dropping and clumsiness toward objects may point to CTS.[8,19] A positive flick sign has 93% sensitivity and 96% specificity for CTS.[36]

Provocative tests commonly used to identify CTS in the clinical setting are Phalen's, reverse Phalen's, median nerve compression, and Tinel's tests, with the two most common tests being Phalen's and Tinel's tests.[34-36] Phalen's test is done by asking the patient to flex the wrist and place the dorsum of hands together for 60 seconds. Pain or paraesthesia elicited prove the positive sign of this test.[34] Different studies showed the distinctive result in the sensitivity and specificity of each test. Phalen's test has around 57-68% sensitivity with 58-73% specificity. Reverse Phalen's test can be done by placing both palmar together to achieve maximum wrist extension for 60 seconds. A median compression test also can be done; this test requires the wrist to be placed in a neutral position before applying moderate pressure to the median nerve for approximately 30 seconds. Tinel's test is performed by tapping the volar wrist repeatedly over the carpal ligament; any pain or paraesthesia in any fingers of median nerve innervation is a positive result. Tinel's test has 36-50% sensitivity and 77% specificity.[29,34-36]

The combination of several tests showed better sensitivity and specificity results. For example, positive findings on both Phalen's and median compression test result in 80% sensitivity and 92% specificity.[36] Any notable sign of abductor pollicis brevis weakness should be noted. Also, thenar atrophy may occur as it is 90% specific for CTS. However, it has only 16% sensitivity.[35,36]

Additional investigation with electrodiagnostic and nerve conduction studies may be done if proper equipment is available. These studies obtain information on action potential in both sensory and motor nerve fibers. The American Academy of Orthopedic Surgery (AAOS) suggests that clinicians may use these methods to eliminate some of the differential diagnoses. The usage of ultrasonography has recently been quite popular with the goal of reducing patients' discomfort. However, ultrasonography usage in diagnosing CTS still lacks evidence.

Primary care setting treatment

There are several treatment options for PCP to choose from. Conservative treatments can be chosen before referring the patient to a neurosurgeon or orthopedic surgeon specializing in hand. Despite many debates around non-surgical therapy, most conservative therapy, such as splinting and steroid injection, is still recommended in many countries. Other conservative treatment options are oral and transvenous steroids, vitamins B6, vitamins B12, and

corticosteroids injection.

Splinting

The neutral wrist position produces the lowest pressure in the carpal tunnel compared to flexion and extension. Mild and moderate symptoms can often be treated with splint, which holds the wrist in a neutral position. Pain or numbness in the middle of the night is usually effective to be controlled by the usage of nocturnal splints. This removable wrist is suitable for patients who repeatedly wake up at night. Splinting is relatively cheap and effective in the early stage of CTS. Most splints' efficacy lasts for about six months.

Corticosteroid injection

Corticosteroid injection is temporarily effective in providing relief and alleviation of symptoms. Within a few months, the symptoms tend to recur. Apart from the efficacy of corticosteroid injection, the success in relieving CTS symptoms may also confirm CTS diagnosis. This kind of injection needs to be performed by an orthopedic surgeon or neurosurgeon who does the technique regularly. Misplaced injections may cause earlier recurrence of the symptoms and damaged nerves.

Hospital referral

Failure to respond to conservative treatments is a case that needs a hospital referral consideration. Good information is needed to be delivered by the PCP regarding the next step of treatment options. Proper explanation of surgical decompression of carpal tunnel is also crucial as the study reported that the reason behind non-attendance to hand clinic referral is the poor explanation the patients received. Comprehensive counseling from the PCP should inform the patients that the referral will likely end up in a surgical procedure. Basic details of carpal tunnel decompression are essential to be delivered, including the postoperative recovery and the procedure. The procedure will be done by applying a pressure cuff to the arm as it holds the blood flow. The transverse carpal ligament will then be released. The sutures will be removed 10-14 days following the surgery. This procedure may enhance the volume of the carpal tunnel by around 15 -20%. Most of the patients can be cured, and only a small number were left with minor symptoms.

CONCLUSION

As one of the most common peripheral neuropathies disorders, PCP needs to notice and diagnose CTS at the right time. Early diagnosis can help treat and prevent disease progressiveness into further stages without needing to refer. Clinicians should know some basic information about CTS, and clinicians should be able to deliver proper and accurate information regarding the patient's condition. PCP must treat patients following their capability. Severe complaints or therapy failure establish the need for hospital referral to neurosurgeon or orthopedic surgeon specializing in peripheral nerve or hand.

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