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A REVIEW OF RECENT ADVANCES IN CARPAL TUNNEL SYNDROME



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ABSTRACT

Background and objective: Carpal Tunnel Syndrome (CTS) is a complicated disorder associated with localized median nerve compression in the carpal tunnel, which is associated with neurological symptoms, pain and functional limitation of the wrist, which in turn leads to problems in daily routine activities and reduced ability to work and ultimately negatively affecting quality of life and public health status.

Materials and Methods: This reviewed study was carried out by doing search in Scholar Google, PubMed and Elsevier databases using keywords such as carpal tunnel syndrome, treatment outcome, review, corticosteroids, and diagnosis. Approximately 40 articles were selected that were fully reviewed.

Conclusion: The CTS diagnosis should be based on history, physical examination, and the results of electrophysiological studies. The mild symptoms of CTS can be treated using conservative treatment, in particular topical steroid injection, and in moderate to severe cases, surgery is the only effective treatment that removes the median nerve compression. In moderate to severe cases, surgery is the only treatment that removes the median nerve compression

Introduction:

Carpal Tunnel Syndrome (CTS) is a complex disorder with local compression of the median nerve in the carpal tunnel(1, 2). The term "carpal tunnel syndrome" was first published in 1953 by Kremer(3). This disease, with the compression of the hands' median nerve, causes nerve symptoms, pain and functional limitation of the wrists and leads to problems in daily routine and the reduction of the ability to work by affecting the quality of life and general health(4, 5). Symptoms and causes of carpal tunnel syndrome:

This disease is more common in middle-aged individuals between the ages of 30 and 60. More severe clinical and electrophysiological symptoms of median nerve compression (MNC) may be seen in the elderly(6, 7). In most cases, the cause of this syndrome is unclear(8), and most CTS cases are congenital idiopathic and some focal or systemic diseases such as wrist injury, arthritis, diabetes, thyroid disease, rheumatoid arthritis, and pregnancy can increase median nerve compression (MNC) in the carpal tunnel and help develop CTS(9, 10). The classic CTS symptoms are numbness and paresthesia in 31/2 radial fingers. The initial complaint is waking up at night with numbness or pain in the fingers. The day time symptoms are often demonstrated in association with activities of the wrist's placing in

the initial flexion or extension or (with) the need for repetitive movement of structures that pass through the carpal tunnel(11). The syndrome may also be caused by injury to the volar carpal ligament of the upper part of the carpal tunnel. Thickening, the fibrosis of this area does not lead to its extension, which increases the median nerve compression and restricts the blood flow to that nerve. As a result, median nerve function will be impaired and syndrome symptoms will manifest. Numbness and pain in the hand may be associated with pain in the volar aspect of the wrists and forearm. With the relief of the symptoms, the patient may describe the symptoms locally by moving hands (12, 13).

Patients may complain of a sense of swelling in their hands. They often find that they are having difficulty wearing gold and watches. This feeling changes throughout the day or week(14). Some patients also report cold hands and dry skin. In the later stages of the CTS, numbness may be proved and movement disorders may be more revealed with complaints of weakness shown by functional decline. Then the patients may report the throwing of objects(15).

Functional limitations:

CTS-related functional limitations often include sleep problems due to frequent awakenings due to symptoms. Since fixed or repetitive movements are difficult, it often becomes more difficult to drive a car and continuous use of keyboards and mouse of a computer. The other symptoms such as weakness in the thenar eminence may cause problem while holding up the handle. Deep CTS may lead to functional limitations such as inability to tie the shoes laces, buttoning up the shirt and leaving the key into the lock(11, 16).

Diagnostic studies

Diagnosis of CTS is summarized as follow based on clinical criteria of the American Academy of Neurology (1993): paresthesia; pain; muscle swelling; weakness or trigger or exacerbation of sleep; fixed position of the hand or arm; repetitive hand or wrist movement that is reduced by changing the position or shaking of hands; the sensory impairment or muscle hypotrophy of the thenar muscle and median nerve innervation(17) and the Modified Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) evaluates "functional situation" measured using a 10-item scale (writing, closing the buttoning up the shirt, holding, taking, bathing, dressing up, computer work / typing and driving). The possible score range was 1 (mildest) to 5 (The most severe)(11, 18). Certain common tests for the diagnosis of CTS symptoms include Phalen's, Tinnel's and nerve compression tests. The Phalen's test involves testing the wrist flexion and requires the patient to keep his forearm straight while the fingers lowered and pressed against each other. If one or more of the symptoms of CTS, such as burning sensation or increased

numbness occur with this movement and continue for one minute while performing this test. The Reverse Phalen's Maneuver is the same as the completed test with forced extension. Tinnel's test involves a distally severe tap on the wrist joint just to stop the wrist distal joint. The test result is positive in case of dispersion of the median nerve sensory impairment. A lot of pressure was applied by the tester on the space between the thenar and hypothenar eminence for 30 seconds and the arm was kept constant during the compression test of the carpal tunnel(19-22). The American Academy of Orthopedic Surgeons (AAOS) has published guidelines for the diagnosis and treatment of CTS and suggested that the most reliable method for clinical diagnosis include neurophysiologic test, obtaining the patient' history and physical symptoms, along with self-reporting chart about patient's hand (11). However, this is not widely accepted and there is much debate about the need for neurophysiological testing to detect CTS. Neurophysiological studies are often used in secondary care, especially before surgery or in severe clinical profiles. However, neurophysiologic studies are not always consistent with clinical severity and precise prediction of results in patients with mild to moderate CTS is not shown. There is an unstable primary care access to nerve conduction studies across the UK. Therefore, these researches usually allocated for uncertain diagnosis and today, in these circumstances, conservative therapies are needed for mild / moderate cases to lead decisions to daily routines (23). Studies also suggest that the "Golden Standard" CTS test is an electrodiagnostic test. Electromyography and nerve conduction studies can confirm the diagnosis(24), determine the possible severity of nerve injury, measure and guide the effects of the treatment, and rule out diseases, such as radiculopathy and brachial plexus(25, 26). The diagnosis achieved by electrodiagnostic tests or electromyography is used to investigate the speed of neural conduction of the electrodes are placed on the patient's hands and wrists(27). To this end, a few small electric shocks are created in the place where the speed of transmission of messages is measured by the nerves. In electromyography, a fine needle is inserted into the muscle and the electrical activity of the nerve is observed on a screen. Therefore, the severity of the injury to the medial nerve can be determined. Ultrasound research, median nerve enlargement detection, may help the diagnosis process (28). As usual, ultrasound examination may show nerve flattening inside the tunnel and enlargement of the proximal and distal nerve to the tunnel(29). Apparently, collection of recent papers confirms that ultrasound with the median nerve transverse section cannot replace the electrodiagnostic test to detect CTS, but can provide complementary results. Ultrasound examination should be considered in suspicious or secondary CTS cases (30). Wrist radiography may be useful in case of suspected fracture or degenerative joint disease. Blood tests should also be performed in case of suspected primary rheumatologic disease or endocrine disorder. These include fasting blood sugar testing, erythrocyte emptying rates, thyroid function, and rheumatoid factor. Various studies and trials have been conducted to prove the superiority of the therapies so that they use the one with the least pain and the highest impact. The research group led by MehboobAlam (2018) aimed at comparing the effectiveness of neural mobilization and ultrasound therapy on the severity of pain in the carpal tunnel syndrome. In this study, the neural mobilization group showed better results than the ultrasound method. Several other studies support these results, such as the researches carried out on tendons and nerve surgeries among 197 patients with CTS and the results showed that 70.2% of the patients undergoing nerve and tendon surgery had good and acceptable results (31). In a research study conducted in Turkey, wrist pain significantly decreased after the nerve exercise session. Patients who performed nerve exercises experienced rapid pain relief and improved performance. Nerve exercises with wrist movements can significantly improve its function and the nervous pressure significantly decreases (32). Anthony et al showed that ultrasound is a very useful treatment for patients with CTS and that the results are long-lasting. A double-blind randomized study was performed on patient with CTS using

ultrasound (for 20 sessions). The results showed that the symptoms of the patients improved significantly at the end of the second and seventh weeks and after six months (32). Kim et al. (2017) also performed a study on the effectiveness of clinical effects of needling therapy on patients with carpal tunnel and the results showed that the acupuncture method, which includes acupuncture and scalpel functions, increases the blood flow to the lesions using miniscalpel-needle (MSN). The treatment is very simple using this technique and its positive outcome is achieved in a short time. Its pain is remarkably lower than the surgery. It is very useful for those having limitations for performing surgical procedures(33). The Ramos-Zúñiga et al. study group conducted a clinical trial with the aim of providing a micro-surgical approach (low-invasive surgery, under local anesthetic, without further tissue involvement, and statistical strategy). Local anesthetic microsurgery is a suitable treatment for CTS because it is fast, safe and effective and leads to a reduction in invasive anesthetic procedures, hospital stay and related costs. In this case, the patient experience lower pain postoperatively, and at least injury is caused at the treated site (34-36).

Treatment:

After definitive diagnosis, the treatment can be started using cautious management and therapeutic solutions. The therapeutic solutions for the disease, drug therapy, mobility exercises, acupuncture and manual therapy, open surgery, endoscopic surgery, and other procedures such as ultrasound(37). Overnight splinting of a wrist in a neutral position may help completely reduce or relieve the symptoms of CTS. The full-time splint use, if tolerated, is recommended to further improve the symptoms and electrophysiological measures. Most nonsteroidal anti-inflammatory drugs are prescribed as a supplement to the wrist splinting. However, studies have shown that nonsteroidal anti-inflammatory drugs, vitamin B6, and diuretics are often more effective in relieving CTS symptoms(38). Corticosteroids (such as prednisone) or lidocaine can be injected directly into the wrists or used orally (for prednisone) to reduce MNC and reduce immediate and temporary reduction of mild or moderate symptoms of the disease. Long-term consumption of corticosteroids, however, can make it difficult for the body to regulate insulin levels. Therefore, it is contraindicated for diabetics. Underlying diseases such as hypothyroidism, rheumatoid arthritis, diabetes, should be treated. Frequent wrist rest periods should be prescribed, especially when occupational activity involves a fixed or repeated position and strong wrist flexion or extension(11). Although corticosteroid injections is considered as a common primary care intervention, there may be a potential risk of potential injury, including median nerve injury, infection, and tendon rupture(39). Although the incidence rate is very low and evidence is based more on the case description of this risk, in this experiment, it is recommended to reduce the number of permitted injections to one in the 6-week treatment period by lowering the intervention into a less potent corticosteroid (20 mg of duro-medrol). The use of ice may be effective in relieving symptoms after drug consumption periods. Tensile and strengthening exercises can help people to reduce the symptoms of disease. Acupuncture and manual treatment can be beneficial for some patients with CTS. Ice has been used for prolonged periods to reduce pain and swelling. In addition, the yoga is one of the therapeutic strategies. The results of the studies on this exercise show its potential for reducing pain and improving the ability of fingers among patients with CTS(40, 41).

Conclusion: Carpal tunnel syndrome is one of the most common environmental neuropathies, which is prevalent mainly in middle-aged women. The exact cause and pathogenesis of CTS is unclear. The risk of CTS is higher in people exposed to high pressure, high strength, repetitive work and vibrating instruments. The CTS diagnosis should be based on history, physical examination, and the results of electrophysiological studies. The mild symptoms of CTS can be treated with conservative treatment, especially topical steroid injection. In moderate to severe cases, surgery is the only treatment that removes the median nerve compression.

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