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Carpal Tunnel Syndrome: Review Article

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Abstract

Carpal tunnel syndrome is a commonest work related problem caused by improper positioning of the wrist. CTS is characterised by pain, paraesthesia and numbness. The etiology of the condition includes, direct trauma, fracture, dislocation of the carpal bone, space occupying lesion, other systemic condition like obesity, thyroidism, kidney disease and is commonly seen in pregnancy. A through assessment and diagnosis is required before starting any treatment, the treatment approach is further classified based on the severity of the condition. In the initial phase of the condition conservative treatment is opted which includes pharmacotherapy, physical therapy, and in severe cases surgical intervention are proved to be effective in relieving symptoms and improve functionality.

Keywords: *Carpal Tunnel Syndrome, Management, Pharmacotherapy, Physiotherapy, Surgical Treatment, Review Article.*

1. Introduction:

Compression of median nerve in the carpal tunnel leading to tingling and numbness over the course of the median nerve. The incidence of CTS is increasing day by day as per the occupational requirements (1). The common causes of injury is direct trauma, space occupying lesion, extension injury, over stretching of the nerve. The clinical features of the injury included pain, paresthesia, numbness, weakness in hand and wrist and limiting individuals' activity of daily living (2). Secondary causes of CTS are traumatise, metabolic condition, infections, neuropathies, or other systemic disorders (3). The initial symptoms of carpal tunnel syndrome is increased pain at the night and atrophy of thenar muscles. The carpal tunnel is a osteofibrous canal located on the volar aspect of the wrist the boundries of the tunnel is formed as follows the carpal bones forms the floor of the tunnel, the flexor retinaculum forms the roof of the tunnel direct blow can cause injury to the nerve. The flexor retinaculum is 3 to 4 cm wide extending from scaphoid bone covering pisiform, trapezius and attaching on the distal hamate
In mild to moderate stage of carpal tunnel syndrome conservative management is the mainstay treatment where application of splinting, physical therapy, electrotherapy, and manual therapy such as mobilization and release have proved to show good results and reduction in symptoms (4).

Certain occupation which requires repetitive wrist extension such as computer workers, house maids, and other conditions like obesity, genetic predisposition, diabetes, rheumatoid arthritis, hypothyroidism, and pregnancy are at higher risk of developing carpal tunnel syndrome. The normal pressure in the Carpal tunnel is 2 to 10 mmHg however when the wrist is in extension the pressure raises 8 to 10 times than normal level. Repeated compression of the nerve lead to demyelination , endoneurial oedema causing disruption of capillary system(5).

The incidence of CTS is 1 to 5% and is more common in female as compared to male. It is commonly seen in 4 and 5 decade of life (6). The etiology of CTS is usually multifactorial caused by compression and traction affecting median nerve. The initial symptoms of CTS includes numbness tingling and pain in thumb in second and third. In the initial phase the symptoms are relived shaking the hands or wrist. The later phase of the disease includes permanent sensory loss, muscle weakness, clumsiness, and challenges in toileting activities and fine motor activity. On examination sensory loss, weakness over the course of median nerve distribution.

2. Mechanism of Carpal Tunnel Syndrome:

The condition is caused by compression and traction which may cause dysfunction of intraneural microcirculation, or lesion to the myelin sheath and injury to axon as well as disruption of function of the adjacent tissues. The compression/entrapment of peripheral nerve is usually caused by compression in the anatomical space by dislocation, oedema, space occupying lesion, increase in the intracapsular/ pressure in the capsule. Other causes of the injury are due to excessive stretching of the nerve while playing a sports or after a trauma which causes poor function of the nerve, in most of the cases it is due to direct blow of the carpal or fall on outstretched hand which injuries the nerve as the articulation between the carpal bone is delicate and is supported by the contours of the bone and soft tissue such as ligaments a direct blow or fall on outstretched hand might alter the position of the carpal bones reducing the space and compressing the nerve the nerve in the tunnel. If the compression is severe the individuals will have immediate symptoms whereas in cases with mild impact injury the persistent compression lead leads to gradual onset of the condition and loss of functionality (7–9). The content of carpal tunnel is as follows

- Flexor pollicis longus
- Four flexor Digitorum superficialis.
- Four flexor digitorum profundus and
- Median nerve

Out of tiis flexor digitorum profunfus and superficialis have a common synovial sheath(10).

3. Aetiologia / Pathophysiology:

Risk Factors:

Various factors are liked to directly or indirectly causing CTS. The risk factors can be further classified as follows

Structural Factors: factors such as bone dislocation, arthritis causing change in anatomical surfaces of the small. Individuals who are having small carpal tunnel.

Gender:

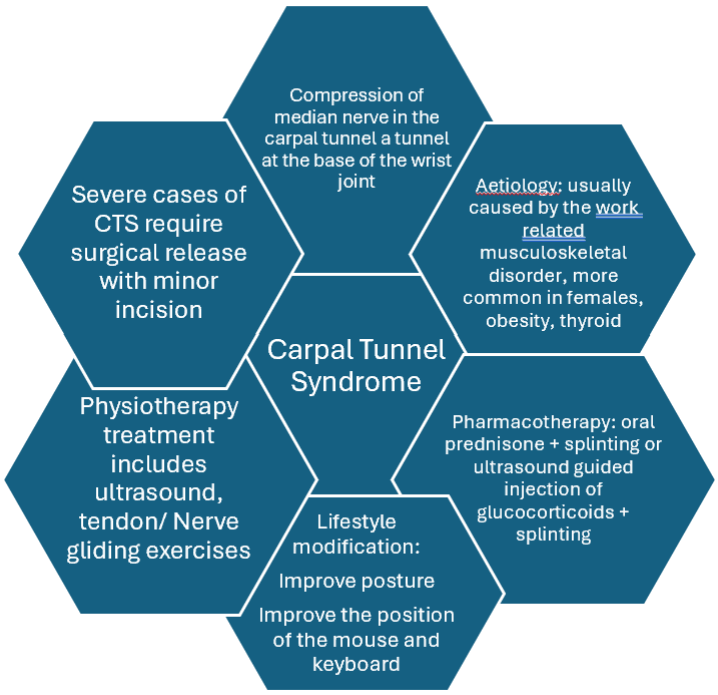
Female are twice at more risk as compared to males, as females have relatively smaller CTS. And sometimes maybe because of hormonal changes.

Nerve damaging condition or inflammatory condition:

Such as diabetes which causes degeneration of the nerve. Whereas some other condition such as rheumatoid arthritis which causes swelling and inflammation of the tenon of the wrist. Conditions like obesity is a risk factor for carpal tunnel syndrome.

Excessive fluid retention by the body leads to increased pressure in the carpal tunnel which leads to compression of the nerve leading to demyelination of the nerve causing tingling and numbness. other condition-like thyroid disorder, kidney failure,

Poor work ergonomics put excessive pressure on the wrist leading to excessive stretching of the nerve causing wear and tear of the neve.



4. Management:

Treatment of carpal tunnel syndrome depends on the stage in which patient come to OPD based on the assessment and etiology the treatment is decided. Usually a multidisciplinary approach is required for better results

1. Lifestyle modification
2. Pharmacotherapy
3. Physical Therapy
4. Surgical Intervention

The initial treatment for carpal tunnel syndrome includes wrist splinting at night which is intermittent and glucocorticoids injections. And positioning the joint in neutral position to avoid stress on the nerve. If the symptoms reduces then continue the same treatment if the symptoms still persists then therapeutic approach is advised (11).
On the other hand glucocorticoids injection proved to give faster results as compared to splinting. (12). A combination of methylprednisolone at 20 -40 mg with 1 % lidocaine injection using ultrasound guidance along with splinting which provides relief. When taken for 3 months. (13). Improper administration leads to exacerbation of the symptoms. (13).
If the above-mentioned treatment fails then administration of oral prednisone 20mg daily for 10 -14 days.
If the treatment fails then the referral to hand specialised therapist is given wherein the therapist assess the joint play, the therapist may advice therapeutic ultrasound over carpal tunnel to reduce oedema, and pain. Whereas in cases where reduced mobility is seen in that cases tendon gliding exercises, nerve gliding exercises are performed to increase the range of motion. In cases where all the conservative treatment fails the patient is advised to under minor release surgery where a minor incision is made to release the pressure. The surgical treatment have 90% success rate and long term relief from the symptoms and .(14-17)
Lifestyle modification:

a. This includes proper workstation height
b. Proper placement of the keyboard to avoid excessive strain on the wrist
c. Soft and firm wrist support while using mouse
d. Proper elbow support while working so as to maintain optimum position of the wrist
e. Frequent breaks every 2 hours and gentle stretching and range of motion exercises
f. Posture Correction Exercise:
    i. Scapular sets
    ii. Chin tucks
    iii. Gentle range of motion for shoulder, elbow, wrist

Surgical intervention:
Surgical intervention is suggested only when the conservative management fails to remit the symptoms or in severe cases such as numbness in the hand, atrophic changes of thenar and hypothenar muscles and reduced hand movement before the surgery the primary cause is identified by going thru thorough radiological investigation such as MRI, CT Scan. After confirming
Conventional open surgery: in this approach the surgery makes a classic incision on the flexor retinaculum which is a 2 cm transverse incision. The main disadvantage of this method is high intricacy scar and discomfort and increased risk of partial release of transverse ligament(11).
Endoscopic Carpal Tunnel Release (ESCTR): A dual portal approach is reported by okutsu et, al. (12). The procedure involve carpal ligament release. The advantages is reduced hospital stay and reduced functional loss.
Modified endoscopies carpal Tunnel Release: in this the skin is incised 1 cm over the proximal carpal crease and ulnar side of palmaris longus side and extension can be done if needed. This technique shoed reduced risk of trauma, better safety and more effective and feasible and low-level healthcare facilities(13).
Ultrasound Guided Carpal Release:
Ultrasound is used to investigate the canal, ad doppler is used to locate ulnar and radial arteries. Ultrasound guided CTR with smaller incision was found to reduce surgery related mobility and complication(14).
Physical therapy:

1. Exogenous Heating: this can be given by paraffin wax or endogenous heat by ultra high frequency therapy (UHFT), the choice depends on the severity of the disease and symptoms, the selectivity of the treated tissue. The application of praffin is about 50 degrees celcius for 15 to 20 mins over the area of discomfort here it is carpal tunnel prior to application of the wax sensations of the skin must be intact to avoid burns and blisters.
2. LASER therapu: application of laser leaddes to symptomatic relief of the symptoms and this is approbed by FDA this causes deep heath and tissue relaxation causing improvement in the symptoms(15,16)
3. Ultrasound : the anti-inflammatory and anti-fibrinolytic action of the ultrasound causes reduction in the pain and promote tissue healing(17–20).

Nerve gliding exercises: a series of tensioning and relaxation of the median nerve causes breaking of the adhesions and reduction in the discomfort caused by reduced excursion of the nerve(15).

5. Conclusion:

We conclude that earlier stages of carpal tunnel syndrome is managed by lifestyle modification, pharmacotherapy and physical therapy modalities like LASER, Ultrasound, paraffin was bath, in cases administration of nerve gliding exercises after deep heating modality have showed promising results where as severe cases of carpal tunnel syndrome needs surgical intervention and recently less

invasive technique have shown promising results by reducing the duration of stay in hospital and discomfort.

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