Carpel Tunnel Syndrome (Healing Hands): A Comprerhensive Review

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ABSTRACT:

This condition has emerged as one of the most common peripheral neuropathies secondary to median nerve compression within the carpal tunnel-an anatomical passageway of the wrist. Carpal tunnel syndrome most frequently presents with pain, numbness, and paresthesias over the hand area innervated by the median nerve. Most studies reporting on epidemiological analyses document an incidence rate between 1–5% of the population, and among females, it tends to predominate especially in obese populations. It occurs most commonly in the 40–60 age range and with a ratio of females to males of 3:1. Common etiologies are flexor tenosynovitis, diabetes, pregnancy, hypothyroidism, and arthritis, among many intrinsic, extrinsic, and neuropathic causes. The clinical tests, along with Tinel's test and Phalen's, are aided by nerve conduction studies and the Levine Questionnaire in assessing symptoms and can thus lead to a diagnosis for CTS. Treatment plans are both non-operative management and operative treatments, which have evolved into various endoscopic as well as minimally invasive surgical operations. Only advances in diagnosis and treatment could help to ameliorate these concerns, whereas deeper roots plague long-term management.

1. INTRODUCTION:

Carpal Tunnel Syndrome (CTS) is a common peripheral neuropathy resulting from compression of the median nerve within the carpal tunnel, an anatomical compartment in the wrist bounded by the carpal bones and the transverse carpal ligament. This condition leads to increased pressure within the tunnel, impairing median nerve function and causing symptoms such as pain, numbness, and paraesthesia in the thumb, index finger, middle finger, and the radial half of the ring finger. [1,2,3]

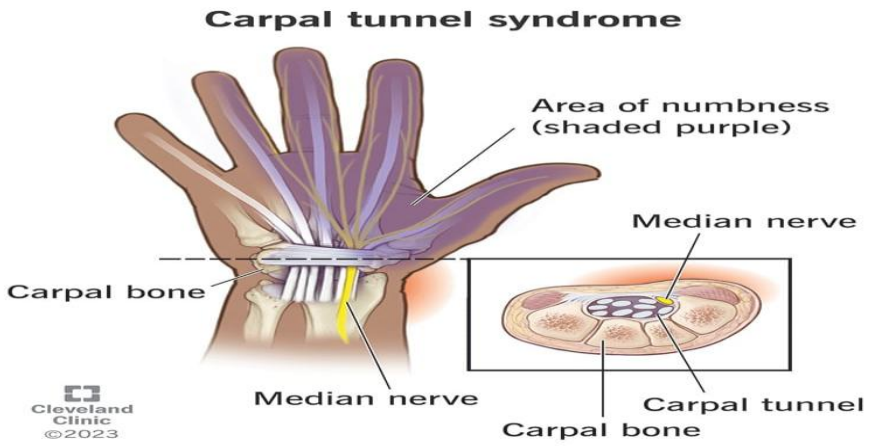

Figure 1.1: Describes Carpel Tunnel Syndrome

EPIDEMIOLOGY

The prevalence of carpal tunnel syndrome in the General population ranges from 1-5%, with a higher frequency observed in women (0.7–9.2%) compared to men (0.4%–2.1%). CTS prevalence is highest among obese women and lowest in thin or normal-sized men, with a female-to-male ratio of approximately 3:1. The reported incidence of CTS varies between 0.125% and 1%.

CTS Typically occurs between the ages of 40 and 60, affecting women up to ten times more frequently than men. In females, the prevalence ranges from 3% to 3.4%, while in males, it is between 0.6% and 2.7%. (4,5)

CAUSES:

The most common cause of CTS is no specific flexor tenosynovitis followed by diabetes (47%), Pregnancy (21-45%), and Hand Arthritis, as well as conditions like hypothyroidism, Acromegaly (30%). Other significant causes include contraceptive use, Amyloidosis and paraplegia. CTS Associated with pregnancy was first reported in 1957 with its incidence pregnancy varying [7].

RISK FACTORS: [8,9]

ETIOLOGICAL FACTORS	• Extended wrist flexion or extension • Monotonous use of the flexor muscles • Exposure to vibration	
MEDICAL FACTORS	• Extrinsic factors	• Pregnancy • Menopause • Obesity • Kidney failure

		• Hypothyroidism • Congestive Heart Failure • Use of Oral contraceptives
	• Intrinsic factors	• Lumps • Tumour like strains • Outcome of distal radius fractures/post traumatic arthritis
	• Neuropathic factors	• Diabetes • Alcoholism • Vitamin deficiency

Table 1.1: Shows Various Risk factors of CTS

PATHOPHYSIOLOGY:

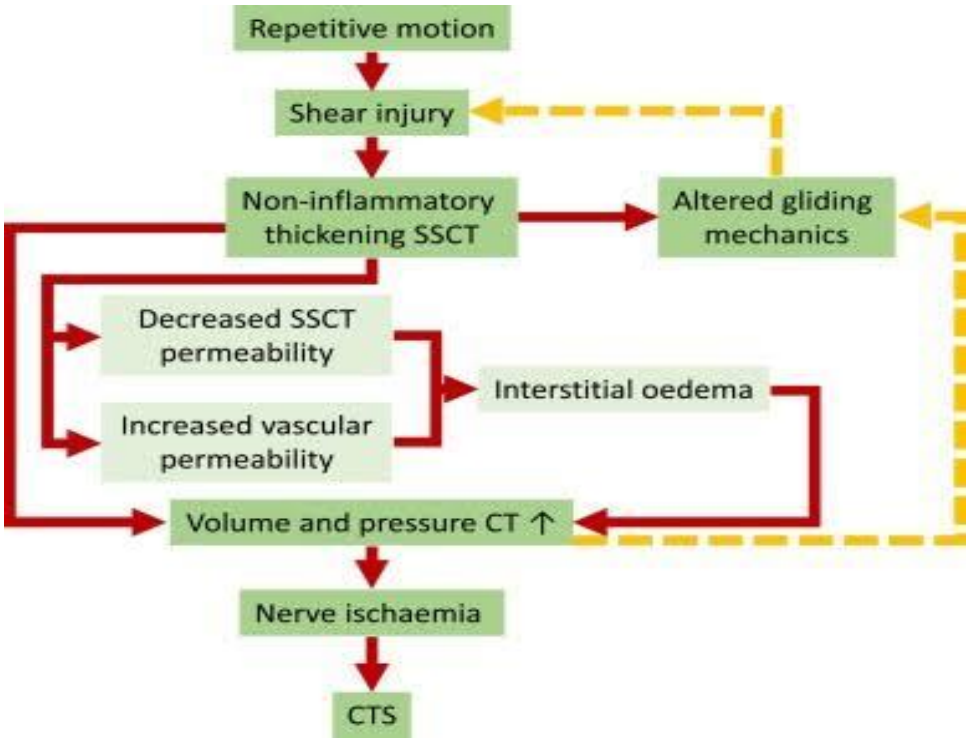

Figure:1.2 shows the pathophysiology of CTS [6]

SIGNS AND SYPMTOMS:

- ✓ Numbness in Hand and fingers
- ✓ Pain Radiating from the wrist
- ✓ Weakness in grip
- ✓ Occasional shock like sensation
- ✓ Atrophy of the surrounding Muscles

Figure 1.3: Shows various symptoms of CTS [9]

DIAGNOSTIC CRITERIA FOR CARPAL TUNNEL SYNDROME:

To diagnose carpal tunnel syndrome, Harrington et al. suggest looking for pain, tingling, or sensory loss in the area served by the median nerve, along with at least one of the following:

- ➢ Positive Tinel's test (tapping the wrist causes tingling in the fingers)
- ➢ Positive Phalen's test (bending the wrist causes tingling in the fingers within 60 seconds)
  - Symptoms worsen at night
  - Muscle weakness or wasting of the thumb muscle (abductor pollicis brevis)
  - Abnormal nerve conduction studies
- ➢ Test Sensitivity and Specificity:
  - Tinel's Test: 64% sensitive, 99% specific
  - Phalen's Test: 75% sensitive, 95% specific

The Levine Questionnaire is a helpful tool for assessing the severity of symptoms and the impact on daily activities. It can be used to screen for carpal tunnel syndrome and to track changes after treatment. [10,11&12]

TREATMENT: [12&13]

CURRENT NON-OPERATIVE TREATMENT	Medicinal	**1.** NSAIDs **2.** Steroids: Injectables/oral **3.** Pyridoxine(B6)
	Modalities	1. Ultra Sounds 2. Lontophoresis
	Splinting Activity Modification	1. Ergonomic Intervention 2. Avocational Assessment
	Exercise	1. Tendon Gliding 2. Nerve Gliding 3. Yoga & stretching
SURGICAL TREATMENT	1. The traditional technique 2. Endoscopic Technique 3. Minimal Invasive Technique	

Table 1.2: Describes the various treatment options of Carpel Tunnel Syndrome

2.DISCUSSION:

This is a very common disorder, which interferes with the quality of life of millions of people, mostly women, and individuals with predisposing medical conditions. It happens by the compression of the median nerve within the carpal tunnel. Many causes lead to this condition, which include the repeated movements of the hand, systemic diseases such as diabetes and hypothyroidism, and changes of hormones during pregnancy and menopause.

The diagnosis relies heavily on clinical tests such as Tinel's and Phalen's, supported by nerve conduction studies, in addition to symptom assessment tools such as the Levine Questionnaire. Such diagnostic criteria would be enough to properly identify the condition and the severity likely to affect daily activity.

Treatment options have ranged from non-invasive to invasive procedures, including NSAIDs, corticosteroids, ergonomic interventions, tendon gliding exercises, to endoscopic and minimally invasive surgical procedures. Non-operative interventions are typically first-line treatments and are effective for mild

to moderate CTS. Surgical decompression is the gold standard for severe cases or when conservative treatments fail.

3.CONCLUSION:

CTS is a very common and debilitating condition, more prevalent in women and in individuals with a predisposition to health problems. Early diagnosis and timely intervention can prevent permanent nerve damage and functional impairment. While both non-operative and surgical treatments can be quite effective in treating CTS, prevention through the management of risk factors and ergonomics is paramount. Improvements in diagnostics and more personalized approaches to treatment may hold the promise for better patient outcomes and overall burden of disease for CTS.

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