CARPAL TUNNEL SYNDROME: A REVIEW

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Abstract
Carpal Tunnel Syndrome (CTS) is an entrapment of the median nerve beneath the flexor retinaculum in the wrist. It is the most frequently encountered peripheral compressive neuropathy. Although the diagnosis was rare 50 years ago, it continues to be made with increasing frequency, not only because of better diagnostic test, but also because of wide spread public awareness of the condition. Recently a distinct population of CTS patients have been recognized.

Workers engaged in repetitive tasks that involve flexion and extension of the wrist, strong grip or exposure to vibration are at risk. However the incidence of CTS is increasing gradually and it is anticipated that soon it will be the second only to low back pain for work related claimed disabilities in the developing countries.

As the disease is not so common in our country and available information about the disease in many textbooks are inadequate as a result, despite of great enthusiasm, many physcials failed to acquire knowledge about this disease. So in this review attempt has been taken to high light the etiology, pathogenesis, presentation and ‘recent advancement in the management of carpel tunnel syndrome with good patient compliance and effectiveness.

Key words: carpal tunnel syndrome; management; review.

Introduction
Carpal tunnel syndrome (CTS), caused by compression of the median nerve at the wrist, beneath the flexor retinaculum causing neural symptomatology into the hand and upper extremity. It is a common problem in daily rheumatology practice. The syndrome affects an estimated percent of adults American and is approximately three times more common in women thea in men. Patient complains of paresthesia in the hand along the distribution of the median nerve and often pain radiates to the arm. The symptoms intensified at night and the patient tries to get relief by shaking the hand in the air, this is referred to as flick test and is considered the most valued and reliable sign of CTS.

Synonyms
Carpal tunnel syndrome, have some special synonyms. These are:
- Tardy median nerve palsy
- Acroparesthesia
- Median neuritis
- Median thenar neuritis
- Professional or occupational median neuritis
- Thenar neural atrophy

Historical background
- Sir James Paget first described the symptoms of carpal tunnel syndrome in 1854
- In 1911 Ramsey Hunt described this neuropathy
- In 1950 Phalen wrote the first several articles on CTS
- In 1913 autopsy findings by Marie and Foix described grossly and histologically the compressed appearance of the median nerve in the carpal canal

Incidence and epidemiology
- Carpal tunnel syndrome recognized and diagnosed with increasing frequency over the past several decades
- A recent study showed that CTS occurs at a rate of 3.46 cases per thousand person
- Workers at risk for CTS due to repetitive task function include garment workers, butchers, grocery checkers, packers, electronics assemblers, carpenters, typist, musician, cooks, line changers
- It is commonly seen in patients of 30-60 yrs old and two five times more common in fem female than male

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Dynamic anatomy of the carpal tunnel studies evaluating normal carpal interstitial pressure show that
i) When the wrist is in a neutral position, normal carpal tunnel interstitial pressure is 2.5 mm of Hg
ii) With normal wrist flexion carpal tunnel pressure increases to 31 mm of Hg and with
maximal extension this increases to 30 mm of Hg
iii) Even in normal subjects the pressure in the
carpal tunnel is 13 mm of Hg, which may be
increased up to 90 mm of Hg during wrist
flexion and extension

Pathophysiology of CTS
The pathophysiology is not clearly understood but it
is assumed that the initial insult is a reduction in
epineural blood flow, which occurs with 20 to 30
mm Hg of compression. Intra carpal canal pressure
in patients with CTS roughly measures at 33 mm of
Hg and often up to 110 of Hg with extension.
Eventually epineural fluid pressure increases four
fold and block axonal transport. In Sunderland's
view, the ischemic environment within the nerve
impeding axonal transport of the normal nerve
function. Finally limitation of median nerve motion
beneath the flexor retinaculum may play a part in the
development of carpal tunnel syndrome.

Etiology
The most common cause is non-specific flexor
tenosynovitis followed by diabetes (47%),
pregnancy (21-45%), arthritis of the hand (35%),
hypothyroidism and acromegaly (30%).
Contraceptives, amyloidosis and paraplegia are the
other important causes of CTS. CTS associated with
pregnancy first reported in 1957 and incidence of
CTS in pregnancy is (21-45%).

Clinical features
1. Fullness of the wrist
2. Poor dexterity of the fingers and dropping of
   items
3. Paresthesia and numbness of the fingers and
   nocturnal dysesthesia
4. Pain worsening at night and relieved by shaking
   the hand in the air

Physical examination
Tinel's Sign- Percussion of the median nerve at the
level of the carpal creases, frequently is positive to
the long fingers alone, not to the entire median nerve
distribution. Tinel's sign has a sensitivity of 30% and
specificity 88%

Phalen's sign- Phalen's sign or Phalen's wrist flexion
test has a sensitive of 22.2% and specificity 94.6%
Vibratory test- Paresthesia is found along the
distribution of median nerve area in the hand

Diagnosis
The diagnosis of CTS is based on the history and
physical examination. Tinel's sign, positive wrist
flexion test and standard nerve conduction studies
are recognized as the diagnostic standard for CTS
Electrophysiological studies- NCV studies considered
positive when the median nerve sensory latency
exceeds the standard radial and ulnar nerve sensory
latency by more than 0.4 millisecond.

MRI- Proved to be sensitive and specific in
detecting CTS.

Ultrasonography- Ultrasonography is a quick and
relatively inexpensive technique that can provide
important information in CTS.

Differential diagnoses
i) C6 - C7 Radiculopathy
ii) Thoracic outlet syndrome (TOS)
iii) Trigger finger
iv) De Quervain's disease

Management
Once diagnosis is established a trial of conservative
therapy can be used the patients with mild to
moderate symptoms.

a) Drug treatment
   i) NSAIDs have little effect in
      relieving the symptoms and night pain but are
      recommended as a first treatment by some
      Kaplan et al. in their study showed that patients
      treated with splint and NSAIDs are considered cure
      if remain symptoms free for more than 6 months.
   ii) Diuretics: Chang et al. found that diuretics,
       thriclorthiazide 2mg daily for 4 weeks is less
       effective than NSAIDs and prednisolone.
   iii) Vitamin B6: Franzblau et al. reviewed that
       vitamin B6 is effective in selected cases of CTS and
       help in relieving symptoms earlier.

iv) Oral steroid
   A significant effect in favour of
   oral steroid, either using prednisolone or prednisone,
   in a dose of 25 mg/day was demonstrated on
   symptom improvement with two and four weeks of
   treatment

v) Steroid injection: Weiss et al. in their study
    proved that a single steroid injection into the carpal
    canal causes relief of symptoms earlier but long term
effect is uncertain. Culick et al.\textsuperscript{29} reported a mean relief of 27 weeks after corticosteroid injection and splinting. Weiss et al.\textsuperscript{24} reported an average of 11 months symptoms free after a steroid injection. Green\textsuperscript{30} noted that a good response to steroid injection with immediate pain relief from the local anaesthetic co-related with an excellent response. Still 65-95% patients may have recurrence of symptoms after 2-4 months but 11% patients remain symptoms free for up to 45 months.

b) Ultrasound therapy (UST) : is the most widely used treatment modality in physical medicine in the management of CTS. Hong and colleague\textsuperscript{31} found that low dose of ultrasound may facilitate recovery of acute compression neuropathy. Szumski\textsuperscript{13} has shown that application of UST at 0.5-2.0 watts/cm\textsuperscript{2} on a peripheral nerve may increase the conduction velocity due to a thermal effect.

Ozlas et al.\textsuperscript{32} observed that patients with CTS showed statistically significant symptomatic improvement after 2 weeks of treatment. Ebenbichler et al.\textsuperscript{33} conducted a randomized double blind "sham" controlled trial with assessment at baseline after 23 and 7 weeks treatment at a frequency of 1 MHz and intensity of 1.0 watt/ cm\textsuperscript{2} satisfactory improvement and complete remission of symptoms were observed in 68 percent patients of the treatment group.

c) Therapeutic splinting : splinting of the wrist in neutral position helps reduction of carpal canal pressure and may completely relieve CTS symptoms. Length of is about 3 to 4 weeks followed by part time is recommended. Preferably night time splinting for four weeks is also helpful in CTS\textsuperscript{34}.

d) Exercise : muscle strengthening extension such as barbell or tubing exercise, wrist flexion and extension exercise, adduction and abduction, gripping exercise with putty are also helpful\textsuperscript{35}.

e) Activities of daily living (ADL) : changing the design of tools or workstation to eliminate or reduce stimuli for cumulative trauma can be both preventive and curative.

f) Job modification: decrease the incidence of CTS\textsuperscript{35}.

g) Surgical treatment

Indication of surgery
i) Thenar atrophy ii) Tactile sensory loss iii) Failure of non-operative treatment

vi) Recurrence of symptoms after steroid injection in less than 2 weeks v) Post traumatic CTS.

By using specific indication of surgery a 95% improvement rate can be expected and it is important to note that surgery may be effective even it has normal nerve conduction studies.\textsuperscript{36-40}

Conclusion

Though no absolute satisfactory conservative treatment is available at present but trial suggest that conservative treatment seems to offer clear advantage over surgical treatment of CTS. In physical medicine UST therapy seems to be an effective conservative treatment approach. Improvement persisting for at least 6 months in most patients might even suggest the potential superiority of ultrasound treatment. Further research is required to evaluate optimal treatment schedule with this method. Studies are also warranted to compare short term and long term effects of ultrasound treatment or one of the non surgical treatment approach alone or in combination with that of the decompression.

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