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ABSTRACT... Background: Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy. The symptoms of CTS include pain, paraesthesia and hypoesthesia in the hand, in the area innervated by the median nerve, and often occurs or worsens during the night or early morning, waking the patient up. Physical examination and nerve conduction studies are used to diagnose this condition. Early diagnosis and treatment of CTS are important because any delay can cause irreversible median nerve damage. **Objective:** To highlight the role of physical examination and nerve conduction study in the diagnosis of CTS. **Setting:** Kuwait teaching Hospital Peshawar. **Period:** June 2008 to June 2010. **Methods:** Fifty patients of carpal tunnel syndrome were studied. All patients who reported numbness and/or tingling in the median nerve distribution in the hands at least twice weekly during the preceding four weeks were enrolled to undergo clinical examination and nerve conduction tests. Following the clinical examination the symptomatic persons underwent bilateral nerve conduction tests. **Results:** Out of these twelve patients were males and thirty eight were females with a ratio of 1:3.1. The age range was between 20 to 60 years. CTS was bilateral in 22 patients (44%), right-sided in 23(46%) patients and left-sided in 5(10%) patients. **Conclusions:** In addition to the clinical presentation, electrophysiology has been proposed as the standard of care for diagnosing CTS with a recommendation that it should be performed in all cases.

Key words: Nerve conduction study, neuropathy

INTRODUCTION

The carpal tunnel is formed by the transverse carpal ligament superiorly with the carpal bones inferiorly¹. It is through this anatomic tunnel that the median nerve travels, accompanied by the nine flexor tendons of the forearm musculature¹⁻³.

Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy⁴.

Any condition that reduces the size of the carpal tunnel or increases the volume of its content may cause compression of the median nerve. In majority of cases the cause of CTS is unknown, called as idiopathic CTS. However, there are numerous medical conditions associated with CTS, such as diabetes mellitus, thyroid disease, rheumatoid arthritis and pregnancy⁵.

When compression of the nerve occurs, ischemia and mechanical disruption of nerve function may result. Compression induces dysfunctional axonal transport and epidural blood flow due to increased carpal tunnel pressure (CTP). Pathologic analysis shows edema and thickening of vessel walls within the endoneurium and perineurium, fibrosis, myelin thinning, and nerve fiber degeneration and regeneration^{6,7}.

The symptoms of CTS include pain, par aesthesia and hypoesthesia in the hand, in the area innervated by the median nerve, and often occurs or worsens during the night or early morning, waking the patient up. There may also be associated loss of sensibility and strength. The clinical diagnosis of CTS can be confirmed by electro diagnostic studies, which have been found to be highly

sensitive (49% to 84%) and specific (95% or greater)⁸.

Nerve conduction tests are commonly used in the assessment of patients with numbness, tingling and pain in the hands. Carpal tunnel syndrome (CTS) is one of the most common disorders for which nerve conduction tests are performed. A variety of median nerve motor and sensory tests have been introduced for the purpose of establishing the presence of median neuropathy in patients with CTS⁹. Role of magnetic resonance imaging has also been identified in diagnosis of CTS. MR imaging reliably depicts normal carpal tunnel anatomy. It can also identify pathologic nerve compression and mass lesions, such as ganglion cyst that compress nerves¹⁰.

Early diagnosis and treatment of CTS are important because any delay can cause irreversible median nerve damage with persistent symptoms and permanent disability¹¹.

For the treatment of CTS, several conservative and surgical options are available. The most commonly used conservative treatment options are wrist splinting, injection of corticosteroids into the carpal tunnel, non-steroidal anti-inflammatory drugs (NSAIDs), systemic steroids, pyridoxine (Vitamin B6) and diuretics^{12,13}.

PATIENTS AND METHODS

Fifty patients of carpal tunnel syndrome were studied at Kuwait teaching Hospital Peshawar from June 2008 to June 2010. Out of these twelve patients were males and thirty eight were females with a ratio of 1:3.1. The age range was between 20 to 60 years. All patients who reported numbness and/or tingling in the median nerve distribution in the hands at least twice weekly during the preceding four weeks were enrolled to undergo clinical examination and nerve conduction tests. Patients particulars and history of occupation, dominance of hand, affected hand and previous surgery were documented. In all the patients symptoms (pain, swelling, weakness in hand, paresthesias, association with sleep and fever), body mass index (BMI) and signs (Tinnel's sign, Phalen's sign (tingling sensation elicited in hand's median nerve territory on flexion of wrist to 90 degrees), Tourniquet's sign (tingling sensation elicited in

hand's median nerve territory within one minute of applying tourniquet to the affected limb), tenderness and crepitus over wrist, were recorded. The diagnosis of clinically certain CTS required the presence of recurring nighttime or activity-related numbness or tingling involving the palmar aspects of at least two radial fingers. The presence of positive Tinel or Phalen's test and of median nerve sensory or motor deficit was considered supportive of the diagnosis. All hands on which surgery for CTS had been performed were excluded.

Following the clinical examination the symptomatic persons underwent bilateral nerve conduction tests performed by three blinded technicians using the Viking IV apparatus (Nicolet, Madison, WI). Hands with skin temperature below 30°C were warmed. Motor and sensory conduction studies of median and ulnar nerve were performed on both hands. The parameters that were recorded include distal latency and conduction velocity. The electrophysiological criteria that were used for diagnosis of CTS were accepted by presence of two or more in Table-I¹⁴.

Table-I. The electrophysiological criteria for diagnosing CTS

1. Median nerve motor distal latency recording at abductor pollicis brevis and wrist stimulating greater than 4.4ms.
2. Median nerve antidromic sensory peak latency recording at digit II greater than 3.5ms.
3. Difference between antidromic median sensory latency and ulnar sensory latency at digit IV greater than 0.5ms.
4. Antidromic latency difference more than 0.5ms between median nerve at digit II and ulnar nerve at digit V.
5. The same distance of measurement.

Relevant investigations were performed to determine the underlying cause. These investigations include, Random blood sugar, RA factor, Thyroid function test and pregnancy test where appropriate.

All data was entered into SPSS version 14 for statistical analysis.

RESULTS

Fifty patients of carpal tunnel syndrome were studied at Kuwait teaching Hospital Peshawar from June 2008 to June 2010.

Out of these twelve patients were males and thirty eight were females. The age range was between 20 to 60 years. CTS was bilateral in 22 patients (44%), right-sided in 23(46%) patients and left-sided in 5(10%) patients. It is shown in table no II.

Table-II. Side involvement in CTS		
Side involved	Frequency	%age
Right Side CTS	23	46
Bilateral CTS	22	44
Left Side CTS	05	10

Diabetes was reported in 4.0% of the subjects with clinically and electrophysiologically confirmed CTS. Also reported were thyroid disorder in 6.0%, rheumatoid arthritis in 4% and overweight or obesity (defined as body mass index of at least 25 kg/m²) in 20% patients. In the remainder patients no underlying causative disease was found. Mean value for different parameters on nerve conduction studies were calculated from these 50 patients with CTS. These are shown in table no III.

Table-III. Nerve conduction test (mean) result	
Nerve conduction test, mean	Clinically certain CTS (n=50)
Median nerve motor conduction velocity right hand m/s	56.3
Median nerve motor conduction velocity left hand m/s	59.8
Median nerve latency right hand ms	7.6
Median nerve latency left hand ms	7.1
Right median-ulnar nerve sensory latency difference (ms)	0.71
Left median-ulnar nerve sensory latency difference (ms)	0.54

DISCUSSION

This was a prospective study that demonstrated the importance of physical examination and nerve conduction tests in the diagnosis of CTS.

Because, in clinical practice, physicians with varying experience manage patients with CTS, the diagnostic role of nerve conduction tests becomes more important.

Relying solely on the clinical examination in making the diagnosis of CTS might lead not only to missing the diagnosis of CTS in some patients but also to incorrect diagnosis and unnecessary surgery in others. On the other hand, relying solely on nerve conduction tests might lead to some patients who actually have CTS being denied surgical treatment because of their normal test results. Despite the limitations of nerve conduction testing, it is the only tool currently available that can provide direct evidence of median neuropathy at the carpal tunnel to strongly support the diagnosis of CTS in symptomatic patients. Nerve conduction testing also provides an assessment of the severity of median neuropathy, which can be helpful in making decisions concerning type of treatment.

Females had a significantly higher incidence of CTS than males, with an adjusted incidence rate ratio of 3.1 in our study and its incidence is high with increased age. Our results are similar to other studies. Wolf et al¹⁵ has shown female to male incidence ratio of 3.2:1, with the age group ≥ 40 years having a significantly higher incidence. Another by Atoshi et al and by Lam et al have shown that Carpal tunnel syndrome is approximately three times commoner in women than men. The prevalence is greater in patients over 55 yrs of age, and the obese^{16,17}.

There is considerable controversy as to the need for electrophysiology in carpal tunnel syndrome. Electrophysiology has been proposed as the standard of care for diagnosing carpal tunnel syndrome with a recommendation that it should be performed before surgery in all cases¹⁸.

A fundamental problem is the lack of an accepted “gold standard” for the diagnosis of carpal tunnel syndrome. Surveillance criteria have been proposed, pain or

paraesthesia or numbness in the radial three digits of the hand combined with one or more of the following: a positive Tinel's sign; nocturnal exacerbation of symptoms; wasting of APB; abnormal nerve conduction studies¹⁹.

CONCLUSIONS

In addition to the clinical presentation, electrophysiology has been proposed as the standard of care for diagnosing CTS with a recommendation that it should be performed in all cases.

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