ORIGINAL ARTICLE

Electrophysiological Grading of Carpal Tunnel Syndrome

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ABSTRACT

Background: Carpal Tunnel Syndrome (CTS) is the most common entrapment neuropathy caused by a conduction block of distal median nerve at wrist. Women are affected more commonly than men. Clinical signs are quite helpful in diagnosis but electrophysiological tests yield accurate diagnosis and severity grading along with follow-up and management.

Aim: To utilize nerve conduction studies (NCS) to diagnose carpal tunnel syndrome and further classify its severity according to the AAEM criteria.

Methods: This descriptive study was conducted at the Department of Neurology, Sh. Zayed Medical College/Hospital, Rahim Yar Khan from June 2013 to Dec 2014. Overall, 90 patients and 180 hands were evaluated through nerve conduction studies. Patients with clinically high suspicion of CTS were included for NCS. Clinical grading was done using the AAEM criteria for CTS. Other variables like duration of symptoms, handedness, bilateral disease and gender were noted. Mean and median were calculated for age of the patients.

Results: Ninety patients and 126 hands were identified with carpal tunnel syndrome. Most patients (80%) were females with age range from 19 to 75 years. More than one third had bilateral disease. Dominant hand was involved in majority of the patients. Most patients had (42.8%) severe CTS as per AAEM criteria. Also duration of symptoms directly correlated with severity of disease.

Conclusion: Nerve conduction study is a valuable tool in accurate diagnosis and grading of carpal tunnel syndrome.

Keywords: Phalen sign, Tinel Sign, electrophysiology, median nerve

INTRODUCTION

Carpal tunnel syndrome is common in the general population with more women affected than men[1]. Carpal tunnel syndrome (CTS) is the most commonly-encountered entrapment neuropathy with an incidence of 139 per 100,000 person-years for men and 506 per 100,000 person-years for women[2]. The symptoms and signs are caused by compression of the median nerve along the carpal tunnel, which is formed on the distal, medial, and lateral sides by the carpal bones and on the volar surface by the deep transverse carpal ligaments.The classic symptoms of CTS are numbness and paraesthesia in the first three fingers of the hand, which is commonly exacerbated at night[2]. The diagnostic signs include sensory loss along the lateral aspect of the hand, motor weakness and wasting of abductor pollicis brevis (APB) muscle, and eliciting Tinel's and Phalen's sign at the wrist. There is substantial variation in symptom frequency and intensity in patients with CTS that poorly correlates with underlying pathology[3]. Clinical manifestationsare still the most important for diagnosis, but objective indicators, such as electrophysiological findings, are quite valuable[4,5,6]. It is well recognized that physical examination maneuvers have limitations in sensitivity and specificity[7,8]. Numerous studies have been conducted on the diagnostic findings on electrophysiology, and on CTS grade assessment[9,10,11,12,13,14]. The nerve conduction study (NCS) is a definite diagnostic test for CTS with high degree of sensitivity and specificity. This test demonstratesa distal lesion of the median nerve and excludes other peripheral conditions resulting in similar symptoms[15]. The utility of nerve conduction study as a diagnostic criterion standard has been tested by several investigators[16]. In this study, we evaluated the diagnostic utility of NCSs by grading carpal tunnel syndrome according to the American Association of the Electrodiagnostic Medicine (AAEM) criteria.

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PATIENTS AND METHODS

This is a descriptive cross-sectional study conducted at the Neurology department of Sheikh Zayed Medical College/Hospital, Rahim Yar Khan. Ninety patients presenting to the neurology out-patient clinic from June 2013 to December 2014 were taken for data collection and analysis. Patients presenting with typical symptoms and signs of carpal tunnel syndrome were selected for nerve conduction studies (NCS).Motor and sensory NCS of median and ulnar

nerves were performed in both hands. The temperature was maintained at >32ºC during the procedure. For motor NCS, the median and ulnar motor nerves were stimulated at wrist 6.5 cm proximal to the active recordingelectrode. The sensory responses were obtained at digit II and digit V for the median and ulnar nerves, stimulating antidromically at 13cm and 11 cm, respectively. The normative values taken in our laboratory for median motor latency is <4.0ms and median sensory distal peak latency <3.5ms. Grading of CTS was done using the American Association of the Electrodiagnostic Medicine (AAEM) criteria:(A) Mild CTS: prolonged distal sensory peak latency with±decreased sensory amplitude; (B) Moderate CTS: abnormal median sensory peaklatencies with prolongation of the distal motor latency; (C) Severe CTS: prolonged motor and sensory distal peak latency either with a low or absent SNAP or CMAP; (D) Very severe CTS: absent thenar motor or sensory response either with a present or absent lumbrical response. Descriptive statistics were calculated for the gender, grade of CTS, handedness of the patient, bilaterality of the disease, duration of symptoms and the side of the hand affected. Mean and median were calculated for age of the patients.

RESULTS

Of the patients coming to the electrophysiology laboratory, 90 patients, and 126 hands with CTS confirmed on electrophysiological study were included. The majority of the patients were female (80 %).The mean age at presentation was 38 years, with the youngest patient at 19 years and oldest at 75 years. More than two-thirds of the patients were between 25 and 50 years of age. NCS revealed bilateral CTS in 36(40%) and unilateral CTS in 54(60%). Dominant hand involvement was present in 82 patients (91.1%). CTS grading using the AAEM criteria revealed following results: 27 patients (21.4%) had mild CTS, 27(21.4%) had moderate CTS, 54(42.8%) had severe CTS and 18 (14.3%) had very severe CTS (Table 1). The median duration of symptoms for mild, moderate and severe CTS were two months, four months and 12 months, respectively, suggesting the increasing severity of CTS with longer durationof symptoms

Table 1: Grading of CTS (AAEM Criteria)

Grading of CTS	Frequency	Percent %
Mild CTS	27	21.4
Moderate CTS	27	21.4
Severe CTS	54	42.8
Very severe CTS	18	14.3

DISCUSSION

Most patients with CTS initially present with pain and numbness to their general practitioner. Early diagnosis and classification of severity are necessary for an appropriate treatment plan[17]. Most patients have a long duration of symptoms with varied treatments taken. As CTS has a fluctuating symptom course, no significant functional disability and medical expenses, the patients tend to ignore the symptoms for longer time interval. CTS is the most common entrapment neuropathy, with prevalence of 10-20% for symptoms in the population-based studies[18].

In our study, there is a higher predominance of female patients with CTS with a ratio of 4:1, compared to other studies[19,20]. The reasons for higher female predominance can be many. Indulgence in household works, pregnancy, increased incidence of hypothyroidism and morphological characteristics of female hands. The mean age at the time of presentation is similar to that of other studies and follows a normal distribution (19). The majority of the patients presented were with dominant hand involvement. This was noted in both right- and left-handed individuals, and the clinical symptoms appeared to be more severe in the dominant hand when symptoms are bilateral. The predominant group had severe CTS severity (42.8%).

In entrapment neuropathy, nerve conduction velocity is generally thought to be a sensitive indicator of the severity of demyelination and ischaemia at the entrapment point. Thus, conduction velocity measurement in CTS is of diagnostic significance. Further, since conduction velocity measurement can identify subclinical lesions, it has particular value in initial diagnosis[21,22]. Documentation of electrophysiological abnormalities in the median nerve is helpful to establish both diagnosis and follow-up in patients with CTS[23]. There are several types of clinical neurophysiologic evaluations of the median nerve across the wrist. Sensory and motor nerve conduction study of the median nerve segment across the wrist compared to another nerve segment that does not go through the carpal tunnel (radial or, ulnar nerve) are the most sensitive and accurate techniques[24]. The electrophysiological evaluations are helpful in the diagnosis and planning a management protocol for the patients[25].

The current study is one of the first attempts at using AAEM as a criterion standard for grading CTS in an out-patient setting. Most of these patients have strong clinical evidence of CTS and were referred for confirmation using NCS. The study results emphasize the importance of NCS in grading of patients with CTS. Identifying clinical grade and

subclinical cases can help in early intervention and prevention.

The study has limitations in failing to separately identify predisposing conditions such as diabetes mellitus, hypothyroidism, trauma, collagen vascular diseases, pregnancy and occupational risks. Hence, screening for predisposing conditions should be done in suspect cases. Further, overall accuracy of NCS in diagnosing CTS is variable and depends upon the criterion used; results from a single center study cannot be an alternative to a population-based study. Moreover, in a chronic process like CTS, results at a single point in time cannot predict progression or regression of symptoms for which a follow-up is required.

The study results show that NCS is a valuable tool in confirming diagnosis, grading and management of CTS. It is further helpful in identifying subclinical cases as well.

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