

Association between severity of Carpal Tunnel Syndrome and pain in wrist or hand

Mahinda Kommalage

Department of Physiology, Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka

Correspondence: Dr. Mahinda Kommalage (mahinda1@gmail.com)

ABSTRACT

Introduction: Carpal tunnel syndrome (CTS) is the commonest and widely known entrapment neuropathy. Clinical symptoms, signs and nerve conduction studies have been used for diagnosis and severity assessment of CTS. Pain in hand or wrist is a commonly assessed symptom while different characters of pain are used for diagnosis and severity assessment. The aim of the current study was to identify characters of pain which are associated with the severity of CTS.

Methods: Five characters of pain which are commonly associated with CTS were assessed in 166 patients who were diagnosed to have CTS based on clinical and nerve conduction study findings. The severity of these characters was assessed using a five-grade scale. Correlation of severity of these characters with median motor nerve distal latency (MMDL) was estimated.

Results: Grading on 'how often did hand or wrist pain wake you up during a typical night' and 'severity of pain in hand or wrist during the daytime' correlated with MMDL with Pearson correlations of 0.21 ($p=0.008$) and 0.19 ($p=0.015$), respectively. Scores of other three questions did not correlate with MMDL. Influence of age for this association was investigated by dividing the sample into two groups. Pain associated symptoms showed greater correlations with MMDL in patients aged 45-years or less than those above 45-years. Patients above 45-years presented with less severe symptoms but had more severe nerve compression determined by nerve conduction studies.

Conclusions: Only some characters of pain in hand or wrist correlated with the severity of median nerve compression. Age of the patients determined the degree of association witnessed in these subjects. Severe median nerve compression but less pain can be expected in elderly patients.

Key words: *Carpal tunnel syndrome, Pain in hand, Pain in wrist, Severity of CTS, Questionnaire Sinhala*

Introduction

Carpal tunnel syndrome (CTS) is the commonest and widely known entrapment neuropathy. Early diagnosis and severity assessment is important in managing CTS to prevent development of complications such as muscle wasting. Clinical symptoms and signs have been used, traditionally, for diagnosis and severity assessment of CTS. Furthermore, nerve conduction indices are increasingly used for the diagnosis and severity assessment. However, the cost associated with nerve conduction studies is a limitation for its wide use. One case of occupational CTS costs around \$ 5000 in

the USA (1). In developing countries like Sri Lanka, nerve conduction studies have restricted availability in addition to the high cost.

Even though many surgeons do not request nerve conduction studies for the diagnosis of CTS (2), there are no established clinical criteria to diagnose the condition (3). Development of clinical criteria for diagnosis and severity assessment of CTS is important for resources deprived, developing countries like Sri Lanka. In addition, these criteria need to be in local languages, since assessment of symptoms are influenced by language.

Pain in hand or wrist is a common symptom of CTS. Different characters and associated factors of pain such as diurnal variation and associated sleep disturbances are commonly assessed in patients with CTS. However the types of pain that are more predictive of the severity of CTS are not clear. The aim of the study was to identify character/s of pain which predict the severity of CTS. Other purpose was to investigate the influence of age on symptoms and severity of the disease.

Methods

Patients were selected based on clinical and nerve conduction study findings. Diagnosis of CTS was made on the basis of clinical and electrophysiological assessments by a senior lecturer in Physiology who was medically qualified and experienced in electrophysiological studies. One or more of the following symptoms in the median nerve distribution were used in the clinical assessment: numbness, paresthesia, clumsiness, weakness and pain. Signs such as Tinel's sign, Phalen's sign and wasting of thenar muscle were used as supportive evidence (3). We used median nerve motor distal latency (MMDL) as the electrophysiological parameter in selecting patients. MMDL over 4.2 ms was taken as an evidence for presence of median nerve compression. Several other authors have also used this value for the diagnosis of CTS (4-7). Patients with pre-existing neurological conditions of the upper limbs were excluded. Patients with bilateral CTS were excluded as they had symptoms in both hands and were not able to describe symptoms specific to one side. Often, when they had woken up with nocturnal pain, they were unable to recall the exact side of the pain.

Nerve conduction studies

Nerve conduction studies were performed using a Neuropack MEM 3202 (Nihonkohden, Tokyo, Japan) electromyography machine in the Department of Physiology, Faculty of Medicine, Galle. Surface recording and nerve stimulations were carried out for all studies. Recording electrodes were stainless steel disk electrodes with a diameter of 1 cm. Median motor studies were performed by recording the compound muscle action potential from abductor pollicis brevis with G1 (first recording

electrode) placed over the muscle belly and G2 (second recording electrode) placed over the distal tendinous insertion. The median nerve was stimulated at the wrist (8 cm proximal to the G1) and at the elbow medial to the brachial artery. A strap type ground electrode was placed at the wrist. Compound muscle action potentials with supra maximal stimulation of the nerve were obtained.

Introduction of questionnaire

A self-introductory questionnaire was prepared in Sinhala based on questionnaire developed by Levine et al (8). Questionnaire was introduced only to Sinhala literate patients. Five characters of pain which are commonly associated with CTS were assessed using following questions.

1. How severe is the hand or wrist pain that you have at night?
 - i. I do not have hand or wrist pain at night
 - ii. Mild pain
 - iii. Moderate pain
 - iv. Severe pain
 - v. Very severe pain
2. How often did hand or wrist pain wake you up during a typical night in the past two weeks?
 - I. Never
 - ii. Once
 - iii. Two or three times
 - iv. Four or five times
 - v. More than five times
3. Do you typically have pain in your hand or wrist during the daytime?
 - i. I never have pain during the day.
 - ii. I have mild pain during the day.
 - iii. I have moderate pain during the day.
 - iv. I have severe pain during the day.
 - v. I have very severe pain during the day.

4. How often do you have hand or wrist pain during the daytime?
 - i. Never
 - ii. Once or twice a day
 - iii. Three to five times a day
 - iv. More than five times a day
 - v. The pain is constant

5. How long, on average, does an episode of pain last during the daytime?
 - i. I never get pain during the day.
 - ii. Less than 10 minutes
 - iii. 10 to 60 minutes
 - iv. Greater than 60 minutes
 - v. The pain is constant throughout the day.

Association between the severity of these characters and MMDL was investigated by Pearson correlation. The study was approved by the Ethical Review Committee, Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka.

Results

Total of 166 patients were studied (127 females). Mean MMDL was 5.91 (SD 1.51) ms. Age ranged from 17 to 75 years. Gradings on 'How often did hand

or wrist pain wake you up during a typical night' and 'Do you typically have pain in your hand or wrist during the daytime' (Question 2 and 3) correlated with MMDL with Pearson correlations of 0.21 (p=0.008) and 0.19 (p=0.015). The Spearman rho for the same associations were 0.26 (p=0.001) and 0.17 (p=0.027), respectively (table). Gradings on other three questions did not show significant correlations with MMDL.

Influence of age for this association was investigated by dividing the sample into two groups; 45 yrs or less and above 45 years. Eighty four patients were above 45 years and 82 patients were either 45 or below. In patients aged 45 years or less, scores of 'how severe is the hand or wrist pain that you have at night', 'how often did hand or wrist pain wake you up during a typical night', 'do you typically have pain in your hand or wrist during the daytime' and 'how often do you have hand or wrist pain during the daytime' (Question 1, 2, 3 and 4) correlated with MMDL with Pearson correlations of 0.28 (p=0.012), 0.26 (p=0.022), 0.29 (p=0.010), and 0.25 (p=0.024). The corresponding Spearman rho values were 0.32 (p=0.004), 0.35 (p=0.001), 0.33 (p=0.003), 0.32 (p=0.004), respectively. Grading on question 5 showed significant correlation with MMDL only using nonparametric analysis with Spearman rho of 0.31 (p=0.006). Significant correlations were not found for any question for above 45 years group.

Table: Associations between scores of five pain characters and median nerve MMDL

Character of pain	Pearson correlation (P value) with medical nerve MMDL	Spearman rho (P value) with medical nerve MMDL
Q 1	0.11 (0.145)	0.14 (0.073)
Q 2	0.21 (0.008)	0.26 (0.001)
Q 3	0.19 (0.015)	0.17 (0.027)
Q 4	0.12 (0.121)	0.14 (0.079)
Q 5	0.08 (0.299)	0.10 (0.299)

- Q1: How severe is the hand or wrist pain that you have at night?
 Q2: How often did hand or wrist pain wake you up during a typical night in the past two weeks?
 Q3: Do you typically have pain in your hand or wrist during the daytime?
 Q4: How often do you have hand or wrist pain during the daytime?
 Q5: How long, on average, does an episode of pain last during the daytime?

Discussion

Findings of this study show a correlation between certain characters of pain and the severity of CTS. Previous studies have shown possible association between symptoms and nerve conduction findings (9,10). However, in these studies, symptoms have been analysed together but not individually. In the current study, we showed associations of different pain related symptoms with the severity of CTS, individually.

Nocturnal wake-up due to pain was the most correlated symptom when analyzed without considering age of patients. Nocturnal symptoms were shown, previously, as the symptoms with best correlation with nerve conduction finding when compared with other symptoms (9). Nocturnal symptoms can be more disturbing to the patient than other symptoms, hence, they may recall these symptoms better and can be more accurate in reporting than other symptoms making the statistical analysis more robust.

Age appeared to be a major factor influencing pain in assessing the severity of CTS. When patients older than 45 years were considered, correlation could not be found with any pain associated symptoms. In a study involving elderly CTS patients, it has been shown that elderly patients have severe nerve compression with relatively fewer symptoms (11). Findings of the current study also suggest that elderly patients have severe median nerve compression with fewer symptoms. Therefore, elderly patients may have dissociation between nerve conduction findings and symptoms explaining low correlation between the two. Pain perception is known to be less in elderly and many psychological factors influence their pain perception (12,13). All these factors may contribute for the poor correlation seen between pain and nerve conduction findings in elderly patients. In addition, problems related to data collection due to poor understanding of questionnaire and poor description of complains by elderly patients may have contributed to the low correlation.

Among many indices used to measure severity of medial nerve compression, MMDL is the widely used and easy method. MMDL gets prolonged with severe median nerve compression. MMDL was used to measure the severity of CTS in many previous studies (4-6).

Assessment of pain-related symptoms to measure severity of CTS is useful in resources deprived settings, especially in developing countries like Sri Lanka. Therefore, this study helps to identify pain related symptoms such as 'how often did hand or wrist pain wake you up during a typical night' as a surrogate of the severity of CTS. However, age of the patients need to be considered when assessing these symptoms. Severe median nerve compression with less pain is expected in elderly patients.

This study has many limitations. We were unable to study a gender difference in this association. Since CTS is common among females, our sample contained comparatively a higher number of females than males. Therefore, we could not compare correlations for male and female using these data. Furthermore, the Sinhala version of the questionnaire we used has not been properly validated in our local population.

In conclusion, only some associated quality of pain in hand or wrist are correlated with severity of median nerve compression. These qualities can be used to predict the severity of CTS. Age of the patient is an influencing factor for this association.

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