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Are extramedian symptoms associated with peripheral causes in patient with carpal tunnel syndrome? Electrodiagnostic and ultrasonographic study

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ABSTRACT

Objective: To evaluate the relationship between extramedian spreading of sensorial symptoms and median and ulnar nerve cross-sectional area (CSA) and to compare the ultrasonographic and electrophysiological findings in patients with carpal tunnel syndrome (CTS) with or without extramedian sensory symptoms.
Design: Cross-sectional study.
Materials and methods: Patients with CTS were divided into two groups as with or without extramedian symptoms and were assessed clinically, electrophysiologically and ultrasonographically by three blind investigators. In electrophysiological tests, median and ulnar nerve conduction studies were performed. Nerve cross-sectional areas were measured at hook of hamate, psiform bone, radio-ulnar joint, one-third distal part of forearm, and medial epicondyle by ultrasonography.
Findings: The study was completed with 61 patients (108 hands). Extramedian symptoms were present in 31 patients (54 hands). Finger grip strength was lower, pain values evaluated with visual analogue scale were higher in patients with extramedian symptoms ($p < 0.05$). There was no statistically significant difference in electrophysiological and ultrasonographic parameters.
Conclusion: According to our results, extramedian symptoms are not related to nerve conduction studies or nerve ultrasonography, these symptoms may be explained with central sensitization in patient with CTS.

1. Introduction

Carpal tunnel syndrome (CTS) is the most frequent peripheral neuropathy and caused by the entrapment of the median nerve inside the wrist. The prevalence in the population has been reported as 3.8% (Atroshi et al., 1999). The clinical presentation of CTS is pain, numbness, burning, tingling in the distal distribution of median nerve. However these sensory symptoms can also be seen outside of median nerve distribution. Many studies have reported that the pain spreads to the extramedian areas and proximal part of upper extremity (Zanette et al., 2010, 2007; Nora et al., 2005). This phenomenon contributes to peripheral nerve, dorsal root ganglion and central nerve system sensitization (Nora et al., 2005; Zanette et al., 2007; Campbell and Meyer, 2006). Diagnosis of CTS depends on clinical symptoms, physical examination and supportive findings obtained using electrophysiological methods. In recent years, diagnostic value of musculoskeletal ultrasonography (USG) has increased particularly for the CTS. USG is a cheap, radiation-free and non-invasive method. In recent studies, ulnar nerve cross-sectional area began to evaluate in CTS, but cross-sectional area (CSA) of ulnar nerve wasn't investigate, when the symptoms spread to extramedian areas. The aim of this study is to assess of association between extramedian spreading and CSA of median and ulnar nerves in patients with CTS. We hypothesized that incase of extramedian spreading, the ulnar nerve CSA is increased. The second goal of this study is to compare electrophysiologic and ultrasonographic data in patients with CTS with median and extramedian spreading.

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2. Materials and methods

2.1. Subject

Ninety-four patients who were referred to physical medicine and rehabilitation outpatient clinic were included to study during January 2014 to June 2014. The study was approved by University Ethics Committee. Patients were informed about the study and informed consent form was observed.

The patients who were 25–60 years old woman, suffering from CTS symptoms at least 2 months and diagnosed CTS based on electrodiagnostic studies were enrolled to the study. Symptoms of CTS are pain, numbness, tingling, burning in the hand and weakness or clumsiness of hand. Provocative factors are sleep, sustained hand position, repetitive action of wrist. Changing posture or shaking hand reduces the symptoms. The exclusion criteria were; prior treatment for CTS, history of upper extremity trauma, systemic disease (diabetes mellitus, thyroid disorders, rheumatoid arthritis, renal failure, neurologic disease and etc.), pregnancy, hand osteoarthritis, myofacial pain syndrome, fibromyalgia, neck pain (with or without radicular pain). The patients with concomitant ulnar neuropathy, polyneuropathy or radiculopathy which was diagnosed by electrodiagnostic studies were excluded from the study. The patients with bifid, trifid median nerve, persistent median artery or space-occupying lesion which were determined by ultrasonography were also excluded for preventing measurement issues.

The clinical, electrophysiological and ultrasonographic assessments were done by three masked researchers.

2.2. Clinical assessment

All clinical evaluations were performed by the same physician (MAL). All patients' demographic data including gender, age, occupation, level of education, height, weight, body mass index, comorbidities, surgery history was recorded. Systemic physical, musculoskeletal, neurological examinations and Tinel and Phalen tests were done. Hand pain was evaluated using visual analog scale (VAS). Boston carpal tunnel syndrome questionnaire, which has been used for the assessment of symptom severity and functional capacity, was included. Turkish validity and reliability study of this questionnaire has already been done (Sezgin et al. 2006). A high score indicates symptom severity and low functional capacity (Levine et al., 1993). Hand grip and finger grip muscle strength measurements were performed using a Jamar dynamometer and pinchmeter while the patient was sitting, elbow 90° flexed beside trunk, and forearm in neutral position. Tip pinch was measured while thumb was on top and second finger was below. Three measurements were done in this position and their average was taken.

Hands were classified according to a self-administered hand sensory symptoms diagram (Zanette et al., 2010). The patients painted this hand diagram according to distribution of their sensory symptoms (pain, numbness, tingling, burning). The diagrams separated median and extramedian distribution. Diagrams involved the thumb, index, middle and ring fingers and also one-third of dorsum of these fingers were evaluated as the median distribution. Diagrams involved little finger with/without the other fingers were evaluated as the extramedian distribution. When all fingers, palm or dorsum involved, it was considered as the extramedian distribution (Fig. 1).

2.3. Nerve conduction studies

All nerve conduction studies (NCSs) were performed by the same physician (I.Y.) who was blinded to clinic evaluation and sonographic results. NCSs were performed using Medtronic-Keypoint (Denmark, 2007) device and under the standard room temperature of 25 °C. Hand temperature was maintained at 32 °C or greater. Median motor NCSs were recorded with surface electrodes from abductor pollicis brevis muscle. The standard distance between stimulation at wrist and recording electrode was 8 cm. Median, ulnar motor nerve proximal and distal latencies, motor nerve conduction velocities, compound muscle action potential amplitudes were measured. Median sensory NCSs were recorded with wire electrodes from third digit antidromically with the standard distance of 14 cm. Ulnar sensory NCSs were recorded from 5th digit with the standard distance of 13 cm. For all sensory NCSs, distal latency, sensory nerve action potential amplitude and sensory

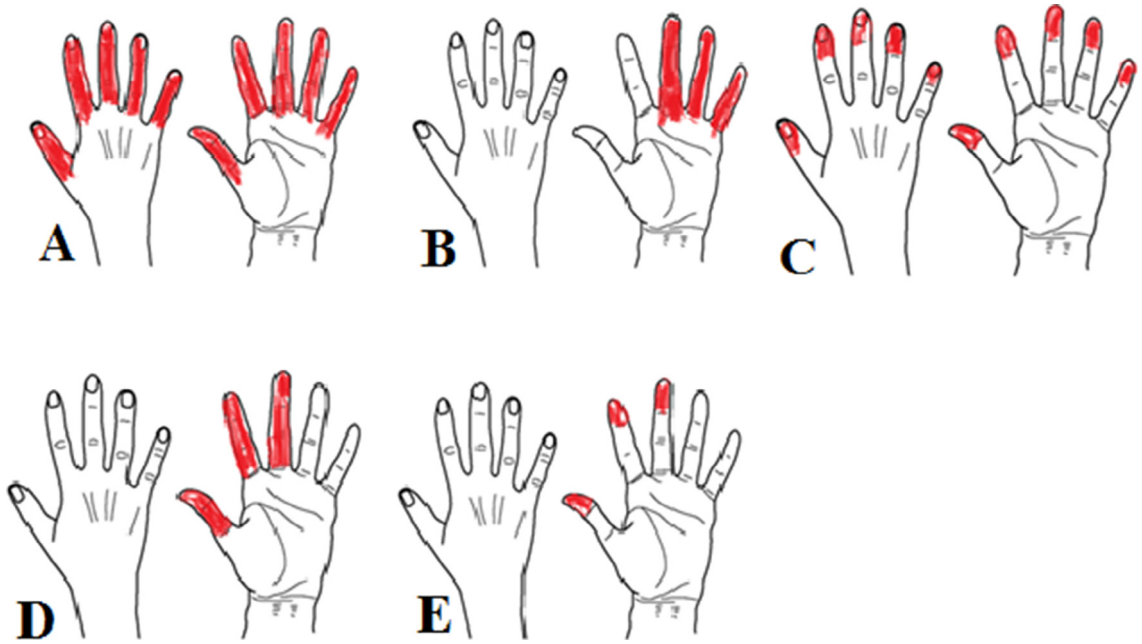

Fig. 1. Examples of hand diagram for extramedian distribution (A,B,C) and median distribution (D,E).

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