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Is carpal tunnel syndrome a slow, chronic, progressive nerve entrapment?

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HIGHLIGHTS

- Carpal tunnel syndrome (CTS) was more severe in elderly patients than in younger people.
- The frequency of CTS diagnosis among Neurophysiological Studies performed increased with ageing up to 60 years of age.
- Bilateral CTS was more severe than when presenting unilaterally.

ABSTRACT

Objective: The aim of this study is to investigate the presenting profile of patients with carpal tunnel syndrome (CTS) at various ages.
Methods: We performed a cross-sectional study of CTS, analysing the correlation between severity and age.
Results: We examined 3108 subjects with CTS, whose frequency increased from 20.9% for the age group 20–29 years to 61.7% for the age group 50–59 years. It remained at almost 50% in people aged over 80 years (49.2%). More than 50% of people younger than 30 years had mild CTS. Severe CTS progressively increased, reaching more than 50% of the CTS diagnoses in people over 80 years. Of the total number of cases, 80.8% of subjects had bilateral CTS. Mild NCS–EMG abnormalities were seen in 74.1% of patients with unilateral involvement, whereas moderate and severe CTS appeared in 70.3% of patients with bilateral involvement.
Conclusion: There was a clear trend of deterioration with advancing years when comparing severity to age.
Significance: CTS seems to be a chronic condition whose signs and symptoms may vary and progress, becoming worse over time.

1. Introduction

Carpal tunnel syndrome (CTS) is the most frequent mononeuropathy seen in the general population. It results in pain and paraesthesia in the distal median nerve distribution. Sensory symptoms can vary considerably (Bland, 2007; Dumitru and Zwarts, 2001; Mondelli et al., 2001; Becker et al., 2002; Nora et al., 2005; Ibrahim et al., 2012; AAOS, 2007). Pain and paraesthesia are the most common manifestations of CTS (Nora et al., 2005). Autonomic symptoms may also occur (Verghese et al., 2000). Wasting and weakness of the thenar muscles and median innervated lumbricals is seen in severe cases (Meena et al., 2008). The second lumbrical is relatively less affected in severe CTS, as the motor fibres innervating the lumbricals are centrally located in the median nerve (Yates et al., 1981; Verghese et al., 2000).

Although diagnosis of CTS is primarily clinical, a neurophysiological (NCS–EMG) study is the most reliable form of examination to confirm the lesion, and it also provides information on its severity. Furthermore, it also excludes other types of neuropathies (Bland, 2007; Dumitru and Zwarts, 2001; Becker et al., 2002; Kouyoumdjian, 1999; AAOS, 2007; Ibrahim et al., 2012) and is the best objective diagnostic test.

Abbreviations: APB, abductor pollicis brevis muscle; CTS, carpal tunnel syndrome; DML, distal motor latencies; EMG, needle electromyography; NCS–EMG, neurophysiological study; NCS, nerve conduction studies; SPSS, Statistical Package for the Social Sciences; ULBRA, Universidade Luterana do Brasil.

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Various underlying conditions such as obesity, diabetes, inflammatory processes and infection may predispose to CTS, in addition to gender and genetic factors (Dumitru and Zwarts, 2001; Becker et al., 2002; Hakim et al., 2002; AAOS, 2007; Ibrahim et al., 2012; MacDermid and Doherty, 2004). However, in many cases there is no identifiable co-morbidity or causal relationship (AAOS, 2007). The few previously conducted CTS studies in elderly people have shown them experiencing worse electrophysiological changes (Kouyoumdjian, 1999; Seror, 1991), although these studies did not analyse the CTS progression over the course of their lifetimes. Therefore, the aim of this study is to investigate the presenting profile of patients with CTS at various ages.

2. Materials and methods

2.1. Study design

A cross-sectional study of CTS's severity was performed in a large sample.

2.2. Subjects

A prospective evaluation was conducted of 6317 consecutive patients (12,634 hands) referred to the Clinical Neurophysiology Service of the University Hospital of the Universidade Luterana do Brasil (ULBRA). All patients who underwent NCS–EMG had some symptoms of pain, paraesthesia, hypoaesthesia or weakness in at least one upper limb. NCS–EMG of both upper limbs was performed in all patients from January 2000 to December 2007. Sample characteristics (age, gender and number of limbs affected) were compared with the diagnosis and severity of CTS. The diagnosis of CTS was made based on NCS–EMG, according to the criteria described below, in patients complaining of pain or paraesthesia in at least one hand. The exclusion criteria were people younger than 20 years of age, people having NCS–EMG performed on only one upper limb, previous history of CTS release surgery and other neurophysiological diagnoses. The study was approved by the local Research Ethics Committee and informed consent was obtained.

2.3. Electrodiagnostic evaluation

Patients underwent NCS–EMG in both upper limbs. The neurophysiological examination consisted of exactly the same techniques that would be applied in a routine examination. All NCS–EMGs were performed by two clinical neurophysiology specialists following a standardised protocol for the evaluation of CTS, previously described by Becker et al. (2002). This technique follows the American Academy of Neurology practice parameter for electrodiagnostic studies in CTS (Jablecki et al., 2002). In summary, sensory orthodromic NCSs of the median and ulnar nerves were conducted in the finger–wrist (third and fifth fingers, respectively) and palm–wrist segments, and motor conduction of the median nerve registered at the abductor pollicis brevis (APB) muscle. Needle electromyography (EMG) of a sample of muscles innervated by the C5–T1 spinal roots was also performed. Other neurophysiological techniques were performed as needed. Surface electrodes were used for registering the data and extremities were warmed up if the skin temperature was below 32 °C. All studies were performed using Oxford Synergy equipment.

Diagnosis of CTS was made through the presence of any one of the following criteria: (a) a difference >10 m/s between the conduction velocities of the ulnar and median nerves in the palm–wrist segment; (b) a difference >0.5 ms between the peak latencies of the palm–wrist segments of the median and ulnar nerves; (c) absence of a sensory or mixed response of the median nerve, where a diagnosis of polyneuropathy, brachial plexus injury and median nerve injury proximal to the wrist could be excluded; and (d) a difference >0.4 ms between the distal motor latencies (DMLs) from the median and ulnar nerves to the second lumbrical and interosseous muscles, respectively.

Cases were divided into the three groups of severity according to the following criteria: mild CTS, with sensory amplitude after digital stimulation greater in the median than in the ulnar nerve, and with a DML from the median nerve to the APB of 4.5 ms or less; moderate CTS, with sensory amplitude after digital stimulation greater in the ulnar than in the median nerve (or with an amplitude either lower than 8 μV or lower than half of the amplitude in the contralateral median nerve, in cases where comparison with the ulnar nerve was not possible), and with a DML from the median nerve to the APB of 4.5 ms or less; and severe CTS, with a DML from the median nerve to the APB >4.5 ms, reduced amplitude (below 5.0 mV baseline-to-peak) or absent response. Patients with bilateral lesions were classified according to their most severe lesion. These criteria were based on the Bland grading scale for CTS (Bland, 2000) but adapted to facilitate interpretation (Bland 1–2 = mild; Bland 3 = moderate and Bland 4, 5 or 6 = severe).

2.4. Statistical analysis

The information was input into a database constructed for this study using Microsoft Access 2000 and the data were analysed using SPSS version 17.0. A Chi-squared test was applied to verify neurophysiologic diagnosis rate differences in CTS between genders in each age range. A p value of 0.05 or less was considered to be statistically significant.

3. Results

3.1. Study population

Of the 6317 patients (12,634 hands) referred, 3108 (49.2%) met the electrophysiological criteria for CTS.

3.2. Gender and CTS

CTS diagnosis was higher among women in all age groups. The total percentage of cases was 55.3% in female and 28.1% in male patients ($p < 0.001$) (Table 1).

3.3. Age and CTS

Age varied from 20 to 95 years. Fig. 1 shows the CTS frequency and the distribution of electrophysiology tests performed according to age groups. CTS diagnosis progressively increased from 20.9% for the age group 20–29 years, rising to 61.7% for the age group 50–59 years, where it reached its peak. A slight decrease was seen thereafter, but it remained at almost 50% in people aged over 80 years (49.2%). The majority of cases (2056, 66.2%) were aged between 40 and 59 years.

3.4. Electrophysiology study and age

Fig. 1 also shows the number of NCS–EMG examinations performed according to age group. The numbers increased until the age group 50–59 years, after which the figures fell abruptly.

3.5. Severity and age

There was a clear trend of deterioration with advancing years when comparing severity to age. More than 50% of people younger