Cervical Radiculopathy Coexisting with Carpal Tunnel Syndrome: Double-Crush Syndrome

KARPAL TÜNEL SENDROMU İLE SERVİKAL RADİKÜLOPATİ BİRLİKTELİĞİ: DOUBLE-CRUSH SENDROMU

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Summary

This clinical and electrophysiological study was planned to determine the incidence of carpal tunnel syndrome coexisting with cervical radiculopathy. One hundred- ninety -two female patients(192) with cervical root lesions were evaluated. The mean age was 49.0 ± 7.9 years. Age and sex matched 30 healthy subjects were accepted as controls. Detailed physical examination, electrophysiological, and radiological (X-ray, CT, MRI)studies were performed in both the patients and controls. Sensorial and motor conduction studies of bilateral median nerves were performed by standardized nerve conduction velocity technics of Medelec Synergy machine (EMG). Ninety female patients (46.8%) were defined as having double-crush syndrome.

In conclusion, it has been suggested that cervical root lesion may coexist with distal entrapment neuropathy frequently and it should be kept in mind when the treatment is planned.

Key Words: Cervical Radiculopathy, Carpal tunnel syndrome, Double crush syndrome

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Özet

Bu çalışma, servikal radikülopati ile birlikte olan karpal tünel sendromu insidansını saptamak için, klinik ve elektrofizyolojik olarak, planlandı. Yaş ortalaması 49.0±7.9 olan 192 servikal kök lezyonlu kadın hasta değerlendirildi. Yaş ve cinsiyet olarak uygun 30 sağlıklı birey kontrol grubu olarak kabul edildi. Detaylı fizik muayene, elektrofizyolojik ve radyolojik (X-ray, CT, MRI) çalışmalar, hasta ve kontrol grubunda yapıldı. Bilateral olarak median sinirin duyusal ve motor ileti çalışmaları Medelec sinerjinin standardize edilmiş sinir ileti hız tekniği ile yapıldı. Doksan kadın (%46.8) hasta, double -crush sendromu olarak tanımlandı.

Sonuç olarak, servikal kök lezyonu, distal sinir tuzak nöropatisi ile sık olarak birlikte olup, tedavi planlanırken, bu birliktelik akla gelmelidir.

Anahtar Kelimeler: Servikal radikülopati, Karpal tünel sendromu, Double crush sendromu

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The concept that many entrapment neuropathies result from "double-crush" (DCS) along the peripheral nerve fibers was proposed by Upton and McComas in 1973 (1). They hypothesized that a proximal lesion along an axon predisposes it to injury at a more distal site along its course through impaired axoplasmic flow (2,3). The presence of additional pain in the shoulder and upper arm in some patients with carpal tunnel syndrome (CTS) as well as the occasional failure of surgical decompression suggest that in many CTS cases a coexisting lesion proximally, mostly cervical root compressions, may be partly responsible for the clinical picture (4-6). Cervical radiculopathy has also been noted to be associated with more distal secondary compression in a high percentage of cases such as ulnar nerve compression that occur at the elbow (UN-E) (7,8).

EMG is the most useful electrophysiologic technique for evaluating suspected radiculopathy with a diagnostic sensitivity of 82%. Late responses such as F waves are abnormal after injury, during which time the EMG is normal. The latency of the response is recorded and delays in latency may occur with pathologic involvement of peripheral nerves, plexus, roots or anterior horn cells. F-wave latency is prolonged in many patients who had confirmed compressive cervical or lumbar radiculopathies (9). Therefore, slowing of proximal motor conduction, estimated by F-waves, in patients with CTS could be considered as an indicator of an additional proximal lesion (6). Although some authors suggested that electrophysiological testing is not always necessary in patients with symptoms and signs that are clearly compatible with the diagnosis of CTS or UN-E, nerve conduction studies confirm the diagnosis of these syndromes with a high degree of sensitivity and specificity (10,11).

In the present study, patients with cervical root lesions were investigated in order to search for the coexistence of carpal tunnel syndrome revealing a double crush syndrome.

Patients and Methods

Subjects: Symptomatic subjects with clinical and electrodiagnostic criteria of cervical root lesion (CRL) were enrolled in the study. Asymptomatic subjects were recruited among office staff at our university hospital. Patients with systemic diseases such as diabetes mellitus, acromegaly, rheumatoid arthritis, amyloid, thyroid dysfunction, infection, gout, pseudogout and trauma (healed fracture of wrist) were excluded.

All subjects provided informed consent approved by the Local Ethical Commitee for participation in the study.

Clinical tests: Each patient was evaluated by a same clinical examiner using a list of clinical features (pain, paresthesias or numbness in the hand, symptoms provaked by sleep, symptoms provoked by sustained position of the hand, sensory loss in the median nerve distribution, weakness or atrophy of thenar muscle) and tests (Tinel's and Phalen's tests), which represent parameters for diagnosis of CTS (12). Phalen's test was performed by maintaining maximal voluntary wrist flexion for a period of 60 seconds. The test was considered positive if there were dysaesthetic symptoms in the cutaneous distribution of the median nerve. Tinel's sign was positive when percussion over the palmar aspect of the wrist with a standard reflex hammer caused pain or paresthesia to radiate into the hand.

Electrophysiological testing protocol: Standard electrophysiological testing techniques were used (13). All measurements were made with a Medelec Synergy equipment by the same investigator. Nerve conduction study parameters were performed as recommended by the American Association of Electrodiagnostic Medicine, American Academy of Neurology and American Academy of Physical Medicine and Rehabilitation) (14,15). In the two upper extremity, median motor and sensory nerve conduction studies and median antidromic sensory distal latency differences were obtained from 14 cm distances of digit IV. F-wave recordings were obtained from abductor pollicis brevis (APB) muscle following stimulation of the median nerve at the wrist. At least 10 waves were recorded for each nerve and the F-wave minimal velocity and F-wave persistence were estimated. Standard needle electromyography (EMG) of necessary muscles were performed on all asymptomatic subjects, with the muscle at rest and during voluntary contraction. Abnormalities consistent with active or chronic denervation were recorded.

In CTS, the diagnosis was based on two or more of the following clinical and electrodiagnostic results (4,8,11,16,17);

1. Hands with clear symptoms of CTS, consisting of pain predominantly at night, paresthesias and dysesthesias, numbness, sensory deficit in the territory of the median nerve, and weakness of the abductor pollicis muscle.

2. Prolonged median sensorial peak latencies, - recorded at index finger (>3.03 msc)

3. Prolonged difference between antidromic median sensorial distal latencies by using wrist stimulation; points were 12 cm proximal to the recording electrode (>0.38 msc).

4. Prolonged median motor distal latencies; recorded from the abductor pollicis brevis muscle (lateral thenar muscle) and after distal stimulation at the proximal wrist crease (>4.05 msc).

5. Isolated EMG abnonnalities (active or chronic) of the APB muscle suggestive of denervation.

In CRL, the diagnosis was based on clinical, imaging and electroneurologic findings.

Data analysis: Normative data were obtained prospectively from 30 healthy controls (asymptomatic subjects) utilising identical techniques. The abnormal lower and upper limit of each measure were calculated from the control group data as the mean ± 3 standard deviations. A parameter was interpreted as pathologic when it is exceeded this value.

For statistical analyses, t test was performed by using SPSS 9.0 software. Data were analysed with tables for each test to determine their sensitivity and specificity. The accepted level for statistical significance was $p<0.05$.

Results

192 female patients (mean age 49.0 + 7,9 years) who had clinical and/or electrodiagnostic (EDX) parameters for CRL were included in this study. Ninety patients (%46.8) fulfilled the criteria of DCS. The demographic data of DCS groups were shown in Table 1.

The control group consisted of 30 healthy female subjects with the mean age of 42,1 ± 9.3 years. There was no statistically significant difference regarding age and body mass index (kg/cm^2) between patients and controls ($p>0.05$).

Clinical characteristics of DCS patients were shown in Table 1. 46 (51.1%) had unilateral CTS, and 44 (48.8%) had bilateral CTS. Fifty-three of DCS patients (58.8 %) had F-wave abnormalities.

Table 1. Demographic and clinical caracteristics of DCS patients

Parameters	**The number of patients (n=90)**
Female	90 (46.8%)
Age(years)	45.0±72
The numbness or paresthesias of the hand	90
Nocturnal paresthesia	85
Positive Tinel's sign (R / L)	48 /42
Positive Phalen's sign (R / L)	49/41
Median/ulnar hypoesthesia	69
Thenar/hypothenar athrophy	17
The weakness of APB or ADM	17

Discussion

DCS is encountered with some frequency in the current literature, particularly in surgical publications. Most of these have involved upper extremity nerve fibers, usually with the proximal injury being at the root or plexus level, and the distal injury located along one of the main peripheral nerves of the limb. One of the most commonly described associations has been CRL and CTS, as initially reported by Upton and McComas(1). The types of proximal lesions mentioned have included neuralgic amyotrophy, traumatic, radiation-induced, axilla compression and thoracic outlet syndrome (3). The difficulties for the DCS exist in two separate contexts; (1) whenever the proximal lesion is situated within the spinal canal (e.g. with radiculopathies) and (2) whenever the distal lesion affects a peripheral nerve structure that has an extensive proximal origin (e.g. the median nerve at wrist). Lesions within the spinal canal are in compliance with the DCS hypothesis whenever they affect motor fibers. For this reason DCS has many features that sharply limits its clinical use (5).

Morgan et al. (2,4) surveyed retrospectively 12.736 limbs with CTS or UN-E. They reported that in 435 of these limbs (3,4%) CTS or UN-E coexisted with CRL, but only 98 (0.8%) had an association that was anatomically appropriate. Only 69 (0.5%) of the 98 cases demonstrated axonal loss at the distal lesion site on electrodiagnostic studies. The authors didn't demonstrate a frequent associaton between CRL and either CTS or UN-E (2).

Mc Comas et al. (1) reported 76% rate of DCS but they also included cervical spondylosis cases. In other studies, the frequency of DCS was reported as follows; Liveson 48%, Osterman 18%, Crymble 15% (they included cervical spondyloarthropaty), Cassavan et al 14 %, Hurst et al 11% (they included cervical osteoarthritis), Yu et al 11%, Kuntzer 6% (4).

Upton and McComas (1) found that, of the 115 patients presenting with carpal tunnel or cubital tunnel compression, 70% had associated electrodiagnositc evidence of cervical compression (12). Yu reported 525 cases of carpal tunnel syndrome, with 11%) having signs of cervical radiculopathy (18). Of the patients 48.5% had clinical, EDX and radiological DCS findings (18). Our study did not involve cervical inflammatory arthritis in CRL group. Our ratio of DCS (46.8%) was consistent with the literature.

Simpson et al. (7) demonstrated an equally high incidence of association of carpal tunnel synrome and more proximal entrapment. Of note, within the group of patients with cervical radiculopathy 41% had also bilateral carpal tunnel syndromes. This information strongly suggests that a preexisting proximal level of compression can render the distal nerve more susceptible to a second compression.

Anastosopulos and Chroni (6) studied 26 patients and 21 age-matched controls to investigate the effect of CTS on median nerve proximal conduction estimated by F-waves and suggested that, F wave conduction velocity measurement from before and after carpal tunnel for estimating the effect of proximal lesion, is a useful test (6). They particularly recommended F-wave recording from proximal of the carpal tunnel to exclude the effect of slowing in carpal tunnel region. In our DCS study 53 patients (58.8%) had F-wave abnormalities. Our results support the importance of the F-wave abnormalities in demonstrating proximal nerve lesions. But we have no records from proximal of these entrapment regions.

In conclusion, we suggest that, the relationship between CTS and CRL as named DCS plays an important role for diagnosis, planning the treatment and follow-up of patients with CTS and this coexistence must be kept in mind.

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