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The clinical significance of the palmaris longus tendon and functional superficial flexor of the little finger in the pathophysiology of carpal tunnel syndrome

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Abstract

Background: The pathophysiology of carpal tunnel syndrome is associated with increased intracarpal canal pressure. Recently, palmaris longus has been introduced as an independent risk factor for the development of carpal tunnel syndrome. The purpose of this study was to assess the association of carpal tunnel syndrome with the presence of palmaris longus tendon and functional superficial flexor of the fifth finger.

Methods: Fifty-four patients with severe and bilateral carpal tunnel syndromes that had indications for carpal tunnel release, and underwent surgery, were enrolled prospectively in this study. Seventy patients as control group were selected on a basis of age, gender, occupation, diabetes mellitus, thyroid disease, and rheumatoid arthritis. The presence or absence of the palmaris longus tendon and functional superficial flexor tendon to the little finger were assessed in both groups clinically.

Results: The prevalence of palmaris longus agenesis was significantly lower in the carpal tunnel group but there was no association between carpal tunnel syndrome and presence of functional superficial flexor to the little finger.

Conclusion: The presence of the palmaris longus tendon is associated with the development of carpal tunnel syndrome.

Keywords: carpal tunnel syndrome, palmaris longus, risk factor.

Introduction

The pathophysiology of carpal tunnel syndrome is associated with increased canal tunnel pressure. Several studies have demonstrated elevated pressures within the carpal canal in patients with carpal tunnel syndrome [1]. Chronic exposure to absolute hydrostatic pressures greater than 30mmHg has been demonstrated to induce nerve injury [2]. Muscle activity and wrist posture influence hydrostatic pressure within the carpal tunnel. Hydrostatic pressures within the carpal tunnel increase with passive radial and ulnar deviation and especially with wrist extension [1-3]. Recently, palmaris longus has been introduced as an independent risk factor for the development of carpal tunnel syndrome [4]. This study aims to assess the association between the presence of the palmaris longus tendon and functional superficial flexor of the fifth finger and carpal tunnel syndrome.

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Methods

Patients with severe and bilateral carpal tunnel syndrome, who had indications for carpal tunnel release, were enrolled prospectively over a 7 month interval between March and September 2007. Seventy patients as control group were selected on a basis of age, gender, industrial exposures, occupation, diabetes mellitus, thyroid disease, and rheumatoid arthritis. The control group was enrolled prospectively with the following inclusion criteria: non-hand and non-wrist complaints, e.g. elbow arthritis, no previous surgery in the hand and the wrist. Exclusion criteria for both the carpal tunnel and the control group included acute carpal tunnel syndrome, smoking, acute trauma, radiculopathy, cervical disease, double crush syndrome and age less than 30 and body mass index greater than 30 (in kilogram per square meter). Each participant answered questions regarding occupation, handedness, age, gender, diabetes mellitus, thyroid disease, and rheumatoid arthritis. Carpal tunnel syndrome was defined by the presence of hand complaints like paresthesia, numbness and pain in the distribution of the median nerve in conjunction with abnormal median nerve electrophysiological studies. All patients were clinically assessed for carpal tunnel syndrome for the following signs: the carpal flexion compression test, the wrist flexion (Phalen's) test, median nerve percussion (Tinel's) test and thenar atrophy [5]. The electrophysiological criteria for diagnosis of severe carpal tunnel syndrome were prolonged median motor and sensory distal latencies, with either an absent sensory nerve action potential (SNAP) or mixed nerve action potential, or low amplitude or absent thenar compound muscle action potential (CMAP) [6]. Electrodiagnostic studies were performed on both wrists for carpal tunnel syndrome patients. Each patient was clinically examined for the presence of the palmaris longus tendon. This was performed by having the patient oppose and pinch the thumb to the small finger while slightly flexing the wrist. The presence or absence of the palmaris longus tendon was confirmed by visualizing and palpating the tendon immediately ulnar to the flexor carpi radialis tendon. For assessment of functional ability of the superficial flexor tendon to the little finger we used a standard test, with stabilizing other fingers in extension and asking the participants to flex their little finger [7] Absent function was defined as proximal interphalangeal joint flexion of less than 30 degrees. Statistical analysis was done by SPSS software. Statistical significance was determined at $P<0.05$.

Results

Fifty-four patients with severe bilateral carpal tunnel syndrome, who underwent carpal tunnel release, were entered in the study. These patients had the mentioned inclusion criteria. Control group included 70 participants. None

	Carpal tunnel syndrome	Control
Number of patients	54 patients	70 patients
Hand dominance, R: L	50: 4	67: 4
Sex, M: F	5: 49	7: 63
Diabetes	20 patients	19 patients
Thyroid disease	7 patients	7 patients
Rheumatoid arthritis	0 patients	0 patients
Clerical occupation	3 patients	3 patients
Housewives	44 patients	59 patients
Age (SD)	50.6 (10.4)	47.5 (9.9)

Table 1. Participant profile.

	Carpal tunnel syndrome	Control
Bilateral agenesis	0 (0%) patients	9 (13%) patients
Unilateral agenesis	5 (9%) patients	17 (24%) patients
Palmaris longus presence bilateral or unilateral	49 (91%) patients	44 (63%) patients

Table 2. Palmaris longus agenesis prevalence.

of the subjects in both carpal tunnel and control groups reported a history of rheumatoid arthritis. The two groups were similar in dominancy, age, gender, occupation and associated medical conditions (P>0.05 in all categories). The demographic profile of the 124 participants enrolled in this study is listed in Table 1.

In the carpal tunnel syndrome group, we found the palmaris longus to be present bilaterally in 49 (90.7%) participants, while none of the participants had bilateral palmaris longus agenesis and 5 patients had unilateral agenesis of palmaris longus (Table 2).

In the control group, the palmaris longus tendon was present in 44(62.8%) patients bilaterally while 17(24.8%) subjects had unilateral palmaris longus agenesis and 9(12.8%) subjects had bilateral palmaris longus agenesis. A clinically functional superficial flexor tendon to the little finger was present in 31 (57.4%) patients bilaterally and unilaterally in 13(24%) of them in the carpal tunnel syndrome group. In the control group it was functional bilaterally in 41(58.5%) participants and unilaterally in 11(15.7%) of them (Table 3).

Chi-square analysis revealed a significant association between carpal tunnel syndrome and the presence of palmaris longus tendon (P<0.05), while there was no association between the presence of the superficial flexor tendon to the little finger and carpal tunnel syndrome.

Discussion

This study operated under the assumption that these two populations, which were similar in age, gender, occupation, and associated medical diseases, were proportionally influenced by the designated confounding factors. Because of the lack of a clear definition of carpal tunnel syndrome, we selected our cases from patients who had severe carpal tunnel syndrome according to signs, symptoms, and electrophysiological criteria. All of these patients underwent carpal tunnel release. Major medical risk factors associated with carpal tunnel syndrome include diabetes mellitus, hypothyroidism, rheumatoid disease and obesity [1]. A principle focus of carpal tunnel research has been the isolation and identification of industrial, lifestyle, and personal risk factors as predictors of carpal tunnel syndrome. Occupation has been implicated in carpal tunnel syndrome, with typists, nursing personnel and housewives being particularly liable to the condition [8]. The prevalence of absence of the palmaris longus tendon has been extensively studied following the first report of its absence in 1559. There is a wide variation in the reported prevalence of palmaris longus in different ethnic groups [9]. There is even a wide variation in reported studies which have been performed by different authors in the same society [10]. In our study, within the control group, the prevalence

	Carpal tunnel syndrome	Control
Bilateral absence	10 (19%) patients	17 (24%) patients
Unilateral absence	13 (24%) patients	11 (15%) patients

Table 3. Functional absence of superficial flexor tendon of the little finger.

of unilateral, or bilateral, palmaris longus agenesis was 37% (twenty six of 70 participants) which is slightly higher than other studies in the literature [8,9]. On the other hand, the prevalence of palmaris longus agenesis within the carpal tunnel group was 9% (five of 54 participants). Some authors have attempted to correlate the absence of the palmaris longus with other anatomical anomalies and diseases. It has been reported that the incidence of a palmaris longus tendon in patients with Dupuytren´s disease is significantly greater than in a control group in normal hands [11]. The palmaris longus is a weak wrist flexor that becomes confluent with the palmar aponeurosis at the wrist. The palmaris longus may influence the shape and volume of the carpal tunnel, especially in wrist extension under load. Biomechanical and in vivo studies have documented increased carpal tunnel pressures in positions of wrist extension/ flexion and radial/ulnar deviation [1]. Additionally, a biomechanical study demonstrated that palmaris longus loading increases canal hydrostatic pressure more than any tendon passing through the carpal tunnel when loaded beyond 20° of extension. In extension, the palmaris longus vector pulls the transverse carpal ligament toward the median nerve. The palmaris longus insertion into the palmar fascia overlying the carpal tunnel probably exerts a pressure effect on the carpal tunnel, predisposing to the development of carpal tunnel syndrome [12]. Recently, it has been reported that the presence of the palmaris longus is, independently, associated with the development of carpal tunnel syndrome. The level of significance was high ($P<0.01$) [4]. Our finding in this study also reinforces the previous studies in literature regarding the role of the palmaris longus tendon in carpal tunnel syndrome. The main question that arises is how we can use these findings to modify the role of the palmaris longus in patients with carpal tunnel syndrome. Can we prevent the progression of mild carpal tunnel syndromes to severe forms by doing a simple tenotomy of the palmaris longus tendon? The authors believe that further studies should be conducted to answer these questions.

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