***Case study***

# Carpal tunnel syndrome caused by anatomic anomalies muscles; a three cases report


## Abstract

Carpal tunnel syndrome (CTS) is the most frequent peripheral compression neuropathy. Anatomic variations may be encountered during carpal tunnel surgery.1–3 Compression of the median nerve at the wrist is frequently encountered. Carpal tunnel syndrome usually occurs without any obvious extrinsic causes; several cases have however been reported caused by anomalous or hypertrophic muscles. A survey of the literature shows that compression neuropathy of the median nerve has been reported in relation with anomalies affecting three muscles: the first (or second) lumbrical, the palmaris longus and its anatomic variants and the superficial flexor of long fingers. We can suspect the presence of such an anomalous muscle when the compression syndrome concerns a patient who is not within the "usual" age group with symptoms initiated or aggravated by physical exercise**.**

This report presents three cases of carpal tunnel syndrome caused by anatomic anomalous muscles diagnosed peroperatively**.**



## Keywords

median nerve, nerve compression, carpal tunnel syndrome ,anomaly, muscle, hand surgery.


## Introduction

Carpal tunnel syndrome (CTS) is a frequently encountered condition in middle-aged women; it is in most cases idiopathic. In all other "atypical" carpal tunnel syndromes, a more extensive search for external causes of the compression is necessary. An extrinsic structure is usually responsible for the compression and a systematic search for compressing structures is required [1]. Compression of the median nerve by muscle anomaly is exceptional and performs a specific symptomatology: affects a young adult, manual worker, aggravated by manual activity. Clinical examination searches paresthesia during bending of MP. The ultrasound and MRI are used to make the diagnosis. The lifting of the median nerve compression by opening the carpal tunnel can relieve the patient [2]. We present in this work 3 cases of secondary carpal tunnel

syndrome caused by muscle abnormality. The aim of this work is to present three rare cases of carpal tunnel syndrome causes.

**Cases :**

- Case 1

A 25-year-old female who suffered from paraesthesia, and numbness in the median nerve territory of the left hand for several years. Her symptoms were aggravated by exercise. She had a positive Phalen test and Tinel's sign at the carpal tunnel without thenar atrophy. The clinical diagnosis of CTS was confirmed by electrophysiological examination. Under loco regional anaesthesia, carpal tunnel release was performed through the classic incision. After dividing the transverse carpal ligament, an aberrant tendon was discovered on the anterior surface of the median nerve within its investing tissue (Figure 1). The tendon was inserted deeply into the palmar aponeurosis and evoke abnormal palmaris longus tendon: palmaris profondus. The median nerve was congested. The palmaris longus tendon was palpable above the wrist crease. Further exploration above the wrist was not indicated clinically and the origin of the palmaris profundus was not established. After a few weeks the patient's symptoms resolved completely.

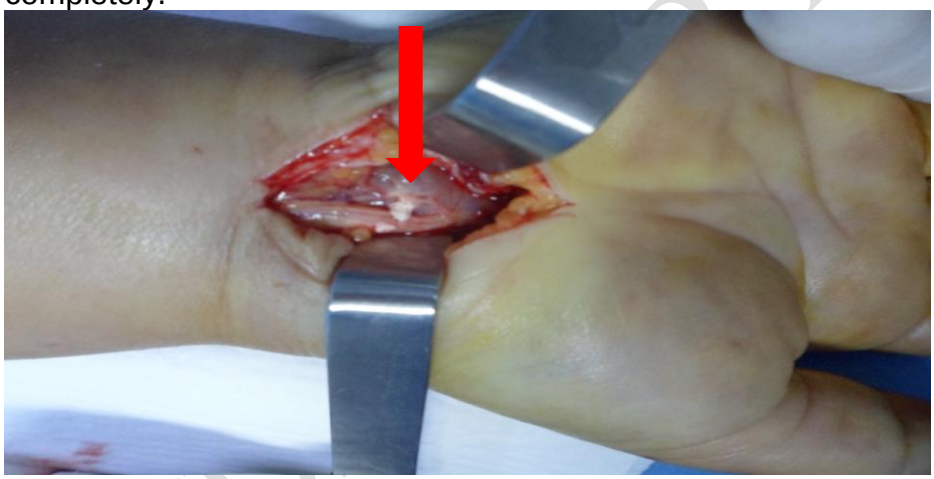

Figure 1: Peroperating view showing palmaris profondus tendon with compression of median nerve.

- Case 2

A 35-year-old left-handed woman, without significant pathological history suffering from numbness, tingling, pain, and weakness in the left hand and affecting the thumb, the index and the middle finger, developed 6 months ago without any traumatic or microtraumatic antecedent (Afshar, 2009). Interrogation of the patient was recorded a progressive evolution over several months with gradual acroparaesthesia in the median nerve territory associated with palmar pain. Her symptoms were aggravated by exercise. Physical examination discovered a decrease in epicritic sensitivity with the Weber test,

without evidence for motricity impairment, using preserved prehensile strength and digital winding as readouts. No abnormalities were seen on laboratory studies.
Functional exploration with electromyography identified a sensitive injury downstream of the carpal tunnel. Standard X-rays did not find abnormalities. Surgery was performed under loco-regional anaesthesia with an axillary block. Carpal tunnel release was performed through the classic incision. Abnormal lumbrical tendon was easily exposed after skin incision and opening of the mid-palmer fascia and the flexor retinaculum. The median nerve was flattened (Figure 2). Postoperatively, the patient went to home with scar care each other day and a prophylactic treatment for algoneurodystrophy with vitamin C for one month. No immobilization was used for this purpose. Complete healing occurred after 21 days of treatment. The last clinical review at the two-month postoperative, showed an entire disappearance of the acroparaesthesia and total functional recovery including full mobility of the fingers, absence of pain, and restoration of the grip strength. No specific rehabilitation was necessary.

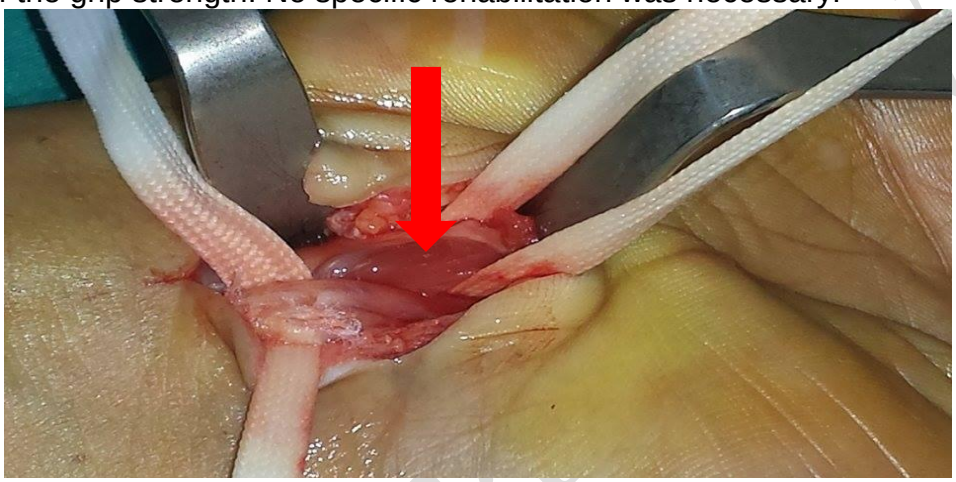

Figure 2: Peroperating view showing hypertrophy of lumbrical tendon and compression of median nerve.

- Case 3:

A 65-year-old female who has suffered from paraesthesia, and numbness in the median nerve territory of the right hand for five years. Her symptoms were aggravated by exercise. Tinel's sign and Phalen test were positive. There was no evidence of thenar atrophy. The clinical diagnosis of CTS was confirmed by electrophysiological examination. Under loco regional anaesthesia, carpal tunnel release was performed through the classic incision. After dividing the transverse carpal ligament, we identified a muscle in the carpal tunnel. Pull on the muscle led to proximal interphalangeal joint flexion of middle finger (Figure 3). The median nerve was congested. After a few weeks the patient's symptoms resolved completely.

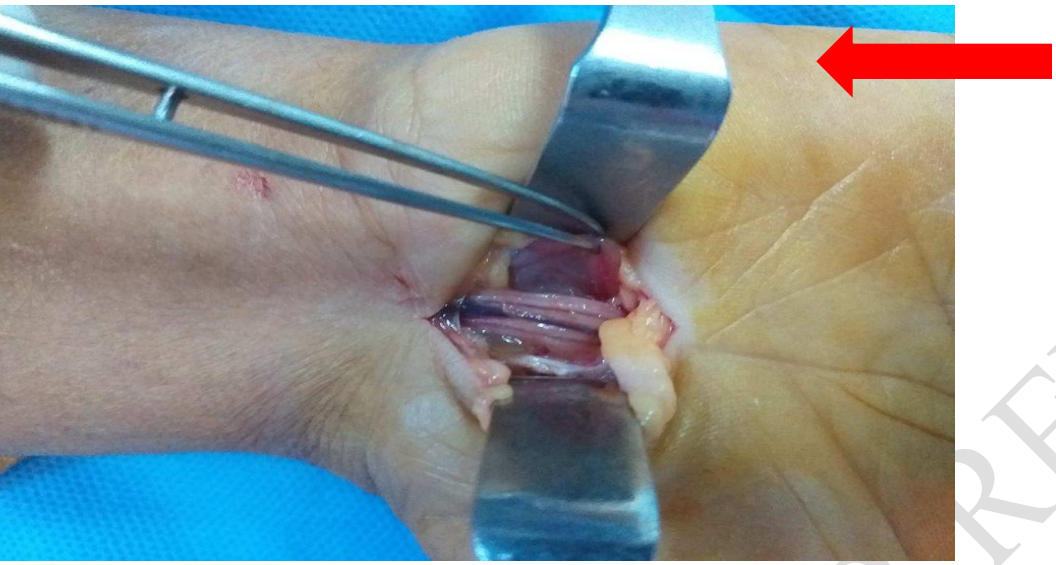

Figure 3: Peroperating view showing hypertrophic and engaged the flexor digitorum superficialis of the middle finger into the carpal canal.

## Discussion

Carpal tunnel syndrome caused by a space occupying lesion is rare and more complicated than idiopathic carpal tunnel syndrome. Compression of the median nerve with anatomic anomalies muscles is very rare and produces an atypical clinical presentation. Facing anatomic anomalies during carpal tunnel surgery is not uncommon. In a study of 382 patients, Tountas et al. reported that 38 hands had an anomalous anatomy. Still and Kleinert [3] reported a series of 9 cases of which 8 presented with a neuro-compression: a carpal tunnel syndrome in 6 cases, the anomalies involved the palmaris longus in 4 cases, the flexor digitorum superficialis in two and abnormal lumbricals in another two cases.

The pathogenesis of carpal tunnel syndrome is varied. In most cases no specific cause can be disclosed; these cases are usually termed “idiopathic” or “primary”. Secondary carpal tunnel syndrome has been caused by various conditions. Abnormal or aberrant

muscles have been well described, particularly in manual workers. These anomalous muscles might be hypertrophic or abnormal lumbricals, a hypertrophic flexor digitorum superficialis or an abnormal palmaris longus (profundus or reversed). All these muscles compromise the available space in the carpal canal, resulting in compression of the median nerve [4].

- Lumbrical muscle

The first or second lumbrical muscle is usually held responsible for the compression. The relationship of the lumbrical muscles and the carpal tunnnel was investigated by Cobb et al. [5]. They found on cadavers that incursion of the lumbricals into the carpal canal during flexion of the fingers is a normal occurrence. It may be a possible cause of occupation-related carpal tunnel syndrome [6, 7].

- M.flexor digitorum superficialis

Anomalies of the muscle belly of the flexor digitorum superficialis of long fingers as a cause for compression of the median nerve were reported and well [8, 9]. In two of them the muscle belly was hypertrophic and engaged into the carpal canal, compressing the median nerve [10]; in the others an abnormal muscle belly originated in the palm and inserted onto the superficial flexor tendon. Resection of this muscle belly seems to be necessary in such cases.

- Abnormal palmaris longus tendon

The palmaris longus muscle is the most variable muscle in the forearm. It can be absent (15% of all patients, more on the left side and in women), hypertrophic, reversed (muscle belly distal rather than proximal), centrally placed, digastric, duplicated or bifid. It can be located deep to the transverse ligament (palmaris profundus) [11]. Anomalies in origin and insertion have also been described and particular accessory insertion slips are well recognized (palmaris accessorius). Lindly and Kleinert [3] found (5.7%) anomalies in 526 CTS surgeries and there was one palmaris profundus anomaly in their experience. Palmaris profundus was first described in 1908. Reimann et al. [13] found one example in 530 cadaver arms.3. It arises as a separate muscle in the middle third of the forearm, deep to the superficialis muscles. Its tendon courses deep into the carpal tunnel as a tenth tendon that may stray from a dorsal to palmar position within the canal, inserting into the palmar aponeurosis. The palmaris profundus is not a variation of the palmaris longus. Several reports indicate that the palmaris longus coexists with palmaris profundus [4, 14].

Ultra-sonogram, CT and MRI has been performed. Recently, arthroscope or minimal invasive surgery has been preferred, however, in cases such as this involving space occupying lesions, symptoms do not improve unless open transverse carpal ligament release is performed in conjunction with removal of the SOL. Based on this study, it is important to perform special tests such as CT or MRI to identify the SOL through physical examination when unilateral CTS patients exhibit swelling or tenderness of volar wrist crease area. The use of MRI scans is an excellent way to examine soft tissue, and also has the advantage to make it possible diagnose exact location and border of lesion and also involvement of surrounding tissue. However, CT scans are superior to MRI with regard to detection of bony lesion. Ultra-sonogram has its advantages such as wide availability, lower cost, and shorter examination time; however, accurate characteristics of SOL cannot be identified [15].

However, imaging is not routinely done for carpal tunnel syndrome, and surgeon's first encounter likely will be intraoperatively. The literature is not conclusive as to whether the anomalous muscle can cause clinical nerve compression. In most cases, the authors have advocated resection of the anomalous muscle [17].There are reports where the patients are managed with just release of the carpal ligament, without resection of the muscle [18], or even with physical therapy alone. However, it must also be noted that, the resection of these anomalous muscles did not lead to any residual deficits. Some authors suggest excision of the muscle when there is a suspicion of it causing the compression, only after identifying the existence of normal structures to preserve function [19].In our cases, conventional open transvers carpal ligament without resection of these anomalous muscle gave immediate painless.

# Conclusion

All space-occupying lesions can compromise the free course of a nerve in an anatomically limited tunnel, for anomalous, aberrant or hypertrophied muscles. A thorough knowledge of every possible anatomic variation is indispensable to surgeons who perform CTS surgery, as an appreciation of the possibilities increases the safety of the procedure [16]. In patients, not belonging to the so-called typical population for carpal tunnel syndrome, younger patients with a neurocompression syndrome related to physical activity, the treating physician should be aware of the possibility of such pathology. An anatomic anomaly may be the aetiology of the CTS and failure to address it results in the persistence to the symptoms and ends in failure to the treatment.

**Consent Disclaimer:**

As per international standard or university standard, patient's consent has been collected and preserved by the authors.

# Competing interests

The authors declare that they have no competing interests

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