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Case Report

Carpal tunnel syndrome secondary to an accessory muscle: a patient with a variant of palmaris longus

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ABSTRACT

Carpal tunnel Syndrome (CTS) can be idiopathic or secondary to various factors such as trauma, anatomical variations, systemic conditions, or exertion. Diagnosing CTS typically relies on clinical evaluation, including history and physical examination. This case report details a 27-year-old female with juvenile rheumatoid arthritis (JRA) presenting with CTS likely due to rheumatoid arthritis-related flexor tendon synovitis. However, during surgery, an unexpected palmaris longus (PL) muscle variant was identified at the distal forearm as the primary cause of compression. The PL variant, which had not been detected preoperatively by MRI, was located proximal to the wrist crease and was excised during an extended open carpal tunnel release with flexor tendon synovectomy. This case underscores the importance of considering anatomical variations, such as accessory muscles, in CTS diagnosis and treatment. This is important, particularly in the patient seemingly unresponsive to the more common release operation that does not ordinarily enter the forearm. In this patient, serendipitously she had an extended incision on the premise of needing to perform a flexor tenosynovectomy. Surgeons should remain aware of these variations to prevent persistent symptoms and improve surgical outcomes in CTS management.

Keywords: Carpal tunnel syndrome, Muscle variant, Accesory muscle, Carpal tunnel release, Palmaris longus

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most frequent upper extremity compresive neuropathy, with a prevalence ranging 3-10% depending on sex, region-specific and occupation.[1] CTS can be idiopathic or secondary to trauma, anatomic variations, systemic or exertional activities (Table 1).[1] Essentially, any process that increases the carpal tunnel contents can lead to compressive neuropathy. It is a clinical diagnosis primarily made by history and physical exam.[2] The use of carpal tunnel syndrome – 6 tool (CTS-6) is a validated screening and diagnostic tool, while the utilization of ultrasound or nerve conduction study / electromyography (NCS/EMG) as diagnostic tests are valuable when the positive predictive value of CTS-6 is low.[3,4]

This case report serves as an introduction to a brief review of the literature on forearm anatomical variants and median compressive neuropathy. It presents a patient who developed CTS, likely caused by rheumatoid arthritis (RA), which can lead to significant flexor tendon synovitis. However, an intraoperative finding revealed a variant of the palmaris longus (PL) in the distal forearm that was compressing the median nerve. This variant nor site of compression would not have been identified without the extended incision planned for the flexor synovectomy.

Table 1: Idiopathic or secondary causes of carpal tunnel syndrome

Category	Condition
Idiopathic	
Trauma	Carpal dislocation
	High-pressure injection injury
	Posttraumatic swelling/hemorrhage/scar
Systemic	Acromegaly
	Alcoholism
	Amyloidosis
	Diabetes
	Dermatomyositis
	Gout / pseudogout
	Hemophilia
	Hemorrhagic disorders
	Leukemia
	Lipoma
	Lupus
	Myxedema
	Medication (lithium, B blocker, ergot)
	Myeloma
	Persistent/thrombosed median artery
	Rheumatoid arthritis
	Systemic inflammatory conditions
	Synovial sarcoma
	Vitamin deficiency
	Vitamin toxicity
Anatomy	Accessory muscle
	Anomalous slip of the flexor pollicis longus
	Basal joint arthritis Bifid median nerve and median artery
	Distal radius malunion
	Palmaris longus variants
	Proximal origin of a lumbrical
	Small carpal canal
Exertional	Vibratory exposure

CASE REPORT

The patient is a 27 year old right handed female. She has history of juvenile rheumatoid arthritis (JRA) for which she has been treated since her adolescence. She had surgery in the past for right trigger finger release and flexor tendon digitorum superficialis and profundus lengthening involving the right ring and small fingers in 2014. The patient had experienced constant pain in the right hand for the past 6 months, accompanied by an inability to fully flex the fingers (with a 1.5 cm gap from the distal palm crease) and progressively worsening numbness and paresthesias. She had a 30-degree flexion contracture of the proximal interphalangeal joints in the long and ring fingers. Two-point sensory discrimination was reduced in the median nerve distribution on the fingertips, but sensation remained normal at the base of the palm and the small finger. Tinel, Durkan, and Phalen tests were positive at the carpal tunnel. There was no thenar atrophy, and abductor pollicis brevis strength was 5/5 according to the manual muscle testing on Seddon scale.[5] The CTS-6 scored 21 points.[4] The left upper extremity hand was unremarkably normal.

Preoperative hand x-rays were obtained and were pertinent for periarticular osteopenia but no joint destruction nor subluxation. An MRI was performed and showed proliferative flexor tenosynovitis through the wrist. This inflammatory synovitis could be contributing to flexion contracture and CTS (Figure 1).

Surgery was performed, which involved a flexor tendon synovectomy along with an extensile open carpal tunnel release at the wrist and distal third of the forearm. As the median nerve was identified in the distal forearm, a variant muscle belly crossing in a radial to ulnar direction and superficially to the median nerve was noted. There was a thin tendon emerging distal to this muscle belly and proceeding to the carpal tunnel and inserting on the dorsal aspect of transverse carpal ligament (TCL). This accessory muscle was next to the PL and assumed a PL variation given its configuration (Figure 2, A and B). The palmar cutaneous nerve branch of the median nerve was identified and found to be branching off proximal to the accessory muscle. This muscle belly with its distal tendon insertion was clearly identified going deep to the surface of the transverse carpal ligament. A thickening and an

obvious impression on the median nerve was noted under the accessory muscle. The accessory muscle was excised (Figure 2, C). An extensive synovectomy was then performed including the flexor digitorum superficialis, flexor digitorum profundus and flexor pollicis longus. Noticeable excursions and passive range of motion improvement was obtained. At 3 weeks, postoperatively, her numbness and paresthesias had resolved, she had full digit extension of the long and ring fingers and had almost full flexion as distance measured from fingertips to distal palmar crease.

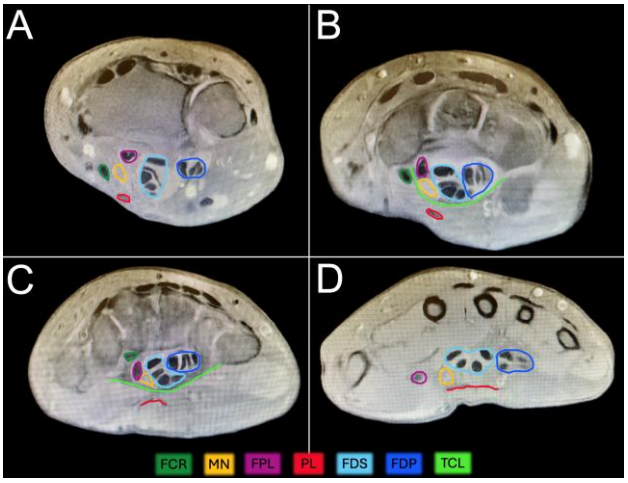

Figure 1: Preoperative MRI T1 fat suppressed axial cuts at different levels demonstrating extensive tenosynovitis in the carpal tunnel as shown by the hyperintense tissue around the flexor tendons. Different structures are outlined in color on each cut and detailed at bottom edge. (A) radiocarpal joint level, (B) proximal row level, (C) distal row level, land (D) metacarpal level.

Note: FCR, flexor carpi radialis; PL, palmaris longus; FPL, flexor pollicis longus; FDS, flexor digitorum superficialis; FDP, flexor digitorum profundus; MN, median nerve; TCL, transverse carpal ligament.

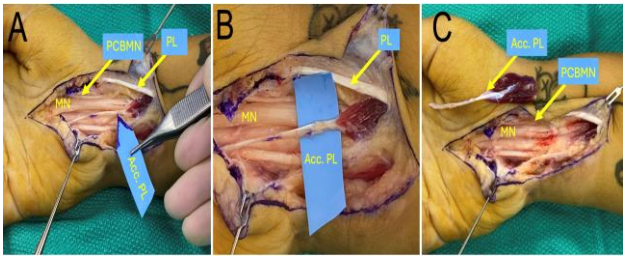

Figure 2: Intraoperative findings after extensile open carpal tunnel release. (A), the accessory palmaris longus is in place. (B), zoomed in image isolating the accessory palmaris longus muscle belly superficial to the median nerve. (C), the accessory palmaris longus is excised and laid on the side for demonstration.

Note: MN, median nerve; PCBMN, palmaris cutaneous branch of the median nerve; PL, palmaris longus; Acc. PL, accessory palmaris longus

DISCUSSION

Although the anatomy of the carpal tunnel was first described by Paget in 1854, it wasn't until a century later that Phalen laid the foundation for describing, diagnosing and treating CTS.[2,6] The 2024 American Academy of Orthopedic Surgeons clinical practice guidelines support the use of the CTS-6 score for diagnosing carpal tunnel syndrome, while recommending NCS/EMG and ultrasound as adjuncts in cases where the diagnosis is unclear or when the positive predictive value of the CTS-6 score is low.[3,4] MRI, though not being common practice for diagnosing CTS, can be useful when CTS is secondary to a mass effect (e.g., tumor, tenosynovitis) or a suspected anatomical variation (e.g., palmaris variant), and even in recurrent CTS.[3,7,8] While CTS can be idiopathic or secondary to various causes, in the reported case with RA, the CTS was thought to be caused by tenosynovitis associated with an unexpected variant of the PL muscle causing a mass effect and stricture, which was not detected on the preoperative MRI but was found incidentally during surgery.

CTS can be seen in 30% of the patients with RA and is secondary to flexor tendon synovitis and radiocarpal joint arthritis.[9] Though the exact prevalence of accessory muscles is unknown, they are frequently found in the upper limbs and can be implicated in compressive neuropathies.[10-13] Börekci et al systematic review found accessory muscles related to CTS in 119 patients as follows: PL (28.6%), lumbrical muscles (19.3%), palmaris profundus (17.8%), flexor digitorum superficialis (16.1%), transverse carpal muscle (5%), flexor digitorum indicis (4.2%), flexor superficialis indicis (4.2%), flexor sublimis (0.8%), accessory superficialis longus (0.8%), flexor pollicis longus (0.8%), abductor digiti minimi (0.8%), abductor digiti quinti (0.8%), and flexor digitorum superficialis brevis (0.8%).[11]

Normal PL presence has been linked to an increased risk of developing CTS.[14] While it is not a component of the carpal tunnel, loading the PL during wrist extension may elevate pressure within the tunnel, possibly by altering its geometry.[14] The accessory muscle occurrence alongside CTS has been reported only rarely, seen in just 13% of operated CTS cases.[11] PL is also the most variable muscle in the forearm ranging from agenesis (12 - 25%, primarily females and on the left side) to variable configurations (9%).[10-12,15,16] It's anatomic variation has been implicated in median and ulnar nerve compressive neuropathy.[10-12,16] PL, with 50% of its variations occurring at the muscle belly, most reported variations include duplicate, reversed, centrally located, digastric, ulnar tendon slip or hypertrophic forms.[12-16] While its anatomical variation has been linked to CTS, it has also been associated with other syndromes, including exertional compartment syndrome and Guyon canal syndrome.[12-16]

Surgical management is treatment of choice for moderate and severe CTS. Symptoms may persist or recur in 3-20% of the cases and 12% may require revision surgery.[11-17] For those having revision surgery, 40% can have unfavorable outcome and 95% may still have persisting symptoms.[11-17] While mini-open and endoscopic carpal tunnel release (CTR) are accepted techniques with similar outcomes, certainly some accessory muscles or variations can be missed during these standard procedures.[3,11-18] However, accessory muscles may be unnoticed even with ultrasound and advanced imaging techniques if they are not clinically suspected.[11]

In conclusion, the PL variant was found proximal to the wrist crease; and while the patient's indication for extended open CTR was flexor tendon tenosynovitis, the PL variant was identified intraoperatively as the primary cause of most of the compression. Had the patient undergone an endoscopic or mini-open CTR, her symptoms would likely have persisted. Thus, this case aimed to raise awareness among surgeons managing CTS.

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