

## Case Report

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# Carpal Tunnel syndrome secondary to a persistent median artery: A case report

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### Abstract

Carpal Tunnel Syndrome is the most common compressive neuropathy, affecting 5% of the population. Most cases are idiopathic, but structural and occupational factors play an essential role. Several anatomical variations within the carpal tunnel, including persistent median artery, have been described. This review reports a 17-year-old female student with right-sided Carpal Tunnel Syndrome secondary to a persistent median artery.

**Keywords:** Carpal Tunnel syndrome; Persistent median artery; Median nerve.

### Introduction

Carpal Tunnel Syndrome (CTS) is the most common compressive neuropathy, affecting 5% of the population [1]. Entrapment of the median nerve within the carpal tunnel affects median nerve conductivity, resulting in numbness and tingling sensations in the radial 3½ digits of the hand that worsen at night. However, thenar muscle atrophy occurs in severe and longstanding cases, leading to hand weakness and affecting daily living activity [2]. CTS is usually diagnosed clinically, but electrophysiological studies are confirmatory and can help assess the severity of nerve compression and guide treatment. However, 10% of patients with a clinical diagnosis of CTS have normal electrophysiological studies [3]. Imaging studies are recommended when anatomical causes are suspected.

Although most cases of CTS are idiopathic, structural and occupational factors play an essential role. Several anatomical variations of the median nerve within the carpal tunnel have been described, exposing the nerve to extrinsic compression and predisposing it to CTS [4].

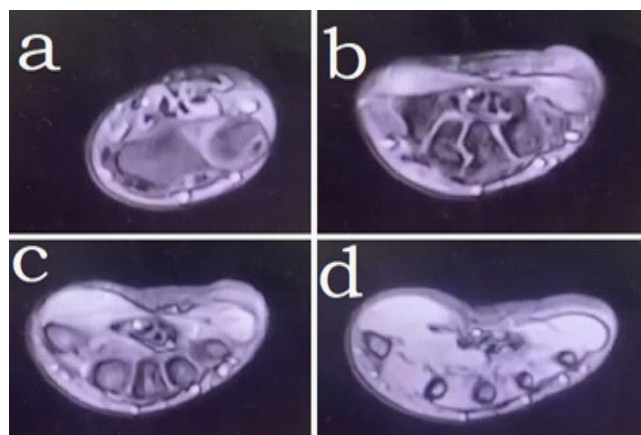
### Case presentation

A 17-year-old student female, right-handed, presented to the orthopedic clinic with a four months' history of right-hand pain and paresthesias involving the palmar aspect of her thumb, index, middle and radial half of the ring fingers. Symptoms occurred after a short period of hand activity, mainly writing. Night symptoms started three weeks before the presentation and disturbed her sleep. No symptoms on the left hand. She had no co-morbidities and was not on any regular medications.

Physical examination demonstrated positive tests for CTS, including carpal tunnel compression (Durkan's), Phalen, and Tinel's tests. But no thenar atrophy or sensory deficit. However, a palpable pulse was detected on the volar aspect of both wrists midway between radial and ulnar pulses.

Nerve conduction studies revealed normal conductivity of the median nerve. A bilateral upper limb arterial duplex study showed patent brachial, ulnar, and radial arteries. However, the ulnar artery has a small caliber with a good caliber blood vessel seen in both forearm arising at the proximal forearm from the

ulnar artery and runs distally to the carpal tunnel, which represents a persistent median artery in both sides. The findings were correlated with MRI findings, which revealed a flattened median artery in the carpal tunnel (Figure 1).



**Figure 1:** Persistent median artery within the carpal tunnel at a different level of axial MRI cuts. a) proximal to the wrist joint. b, c) within the carpal tunnel. d) within the distal carpal tunnel.

### Discussion

During embryonic development, the median artery is a transient vessel responsible for the blood supply of the embryo's hand. However, it regresses around the eight weeks of gestation with the development of radial and ulnar arteries [5]. Median artery persistence to adulthood occurs in two patterns. The first patterns occur with partial involution of the median artery before reaching the wrist, called the antebrachial type. The second one occurs when the embryonic median artery persists to adulthood, and this pattern is called the palmar type. Therefore, the persistent median artery is usually called the palmar type [6].

Lanz [7] classified anatomic variations of the median nerve within the carpal tunnel into four groups: Group 1: Variations in the course of the median nerve's recurrent motor branch in relation to transverse carpal ligaments; the recurrent motor branch is 46% extraligamentous, 31% subligamentous, and 23% transligamentous. Group II: Accessory median nerve branches at the distal carpal tunnel. Group III: A median nerve division proximal to a carpal tunnel that may be associated with the median artery. In this variation, both nerves are roughly the same diameter, whereas the artery is highly variable. Because the artery has a superficial course close to the transverse carpal ligament, preoperative diagnosis of this anatomic variation may be clinically important. Group IV: Accessory median branches proximal to the carpal tunnel commonly pierce the transverse carpal ligament to join the nerve distally [8, 9].

Most persistent median arteries are bilateral, but unilateral is more common in females' left limbs [10]. The persistent median artery has variable origins and topographic course in the forearm and termination. The artery can originate from the brachial, ulnar, radial, or common or anterior interosseous arteries. In the carpal tunnel, the artery can be anterior, anterolateral, or anteromedial in relation to the nerve [11,12].

The persistent median nerve might be anastomosed with an ulnar artery to form the superficial palmar arch in the so-called

medial-ulnar type, or it terminates as common digital arteries without anastomosis with ulnar arteries. Therefore, a hand surgeon should be aware of those variations [13,14].

In most cases, a persistent median artery is asymptomatic. However, it predisposes to CTS, mainly when associated with median artery thrombosis, aneurysm, calcification, and atherosclerosis, and consequently causes median nerve compression. The persistent median artery can also predispose to proximal entrapment of the median nerve, such as anterior interosseous nerve syndrome and pronator syndrome [15]. Artery thrombosis can occur due to trauma, infection on deep fascial planes, and working with extreme hand positions.

Barbosa et al. conducted a systematic review to analyze the association between the median artery and the development of CTS. They found that the most prevalent change was the presence of median artery thrombosis, followed by the presence of a large caliber artery. Other reported causes were the association between the persistent median artery with a bifid median nerve and the concomitant double median veins associated with the persistent median artery [16].

### Conclusion

Orthopedic surgeons should be aware of the anatomical variations that could be encountered during carpal tunnel decompression. However, preoperative diagnosis of such variation may be clinically important, improving outcomes and reducing possible complications.

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