



Case Report

# Carpal Tunnel Syndrome Secondary to Acute Thrombosis of Persistent Median Artery and Review of the Literature

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## Abstract

Carpal tunnel syndrome (CTS) is the neuropathy of the upper extremity most commonly encountered in Plastic Surgery. We present herein a case of a twenty-eight-year-old manual worker who presented with acute carpal tunnel syndrome caused by thrombosis of a persistent median artery. During surgical exploration, a bifid median nerve was also present. Knowledge about the existence of this anatomic variation is important in order to prevent inadvertent injury. We further discuss the possible causes of CTS as well as other neurovascular anomalies that can lead to median nerve compression.

◆ Carpal Tunnel Syndrome, Persistent Median Artery, Bifid Median Nerve, Acute Neuropathy

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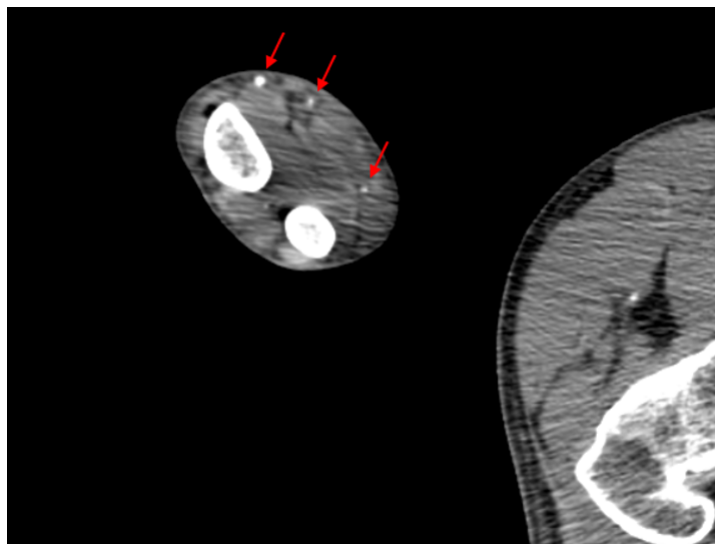
## Introduction

Symptoms of carpal tunnel syndrome (CTS) are a frequent complaint faced by plastic surgeons, with a prevalence of 1% to 3% (1). This syndrome involves the compression of the median nerve at the level of the wrist, leading to numbness of the volar surface of the thumb, index, middle and radial half of the ring finger, as well as general thenar weakness (2). Most commonly it presents indolently; however, cases of acute or subacute CTS have been reported (3). Pathophysiology involves reduced space and increased pressure within the carpal tunnel. Tenosynovitis, excessive fat, ganglion cysts, tumors, synovial hypertrophy, trauma, as well as anatomic variations involving muscles, bones, nerves, and vessels have all been implicated (4). We report herein a case of persistent median artery with thrombosis causing carpal tunnel symptoms associated with a bifurcated median nerve.

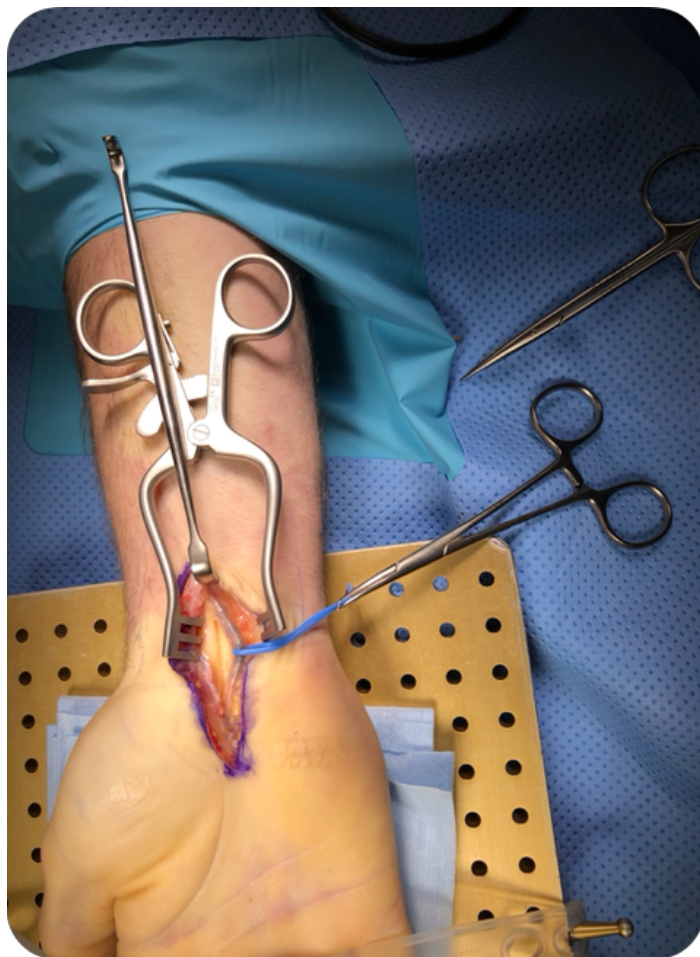
## Case Report

A healthy twenty-eight-year-old, right-hand dominant welder, presented with ongoing pain on the palmar side of the right distal wrist for three days, associated with edema, erythema and decreased strength. He was referred by his general practitioner to the senior author. An urgent doppler-ultrasound was performed which revealed a thrombosed median artery. An angioscan of the right upper extremity was ordered to better assess the vascularity of the hand (Figure 1). The latter revealed acute thrombosis of the median artery over 2.5 cm, beginning at the distal pronator quadratus muscle and ending past the distal end of the hook of the hamate. A patent aberrant ulnar artery originating from the axillary artery was also identified on the scan. Both palmar arches were normally perfused by the radial and ulnar artery.

On the basis of these findings, the patient was diagnosed with subacute CTS secondary to acute thrombosis of a persistent median artery. Options were discussed, and surgical intervention was chosen. Ligation and excision of the thrombosed segment of the persistent median artery was performed in addition to carpal tunnel release. Incidentally, during surgical intervention, a bifid median nerve was also identified (Figure 2). The surgery was uneventful and the patient's clinical symptoms resolved shortly after surgery. At his two-week follow-up, the patient had no symptoms and was able to return to work without sequelae.



**Figure 1.** Carpal tunnel release with a thrombosed PMA (blue Surgical Loop) and bifid median nerve.

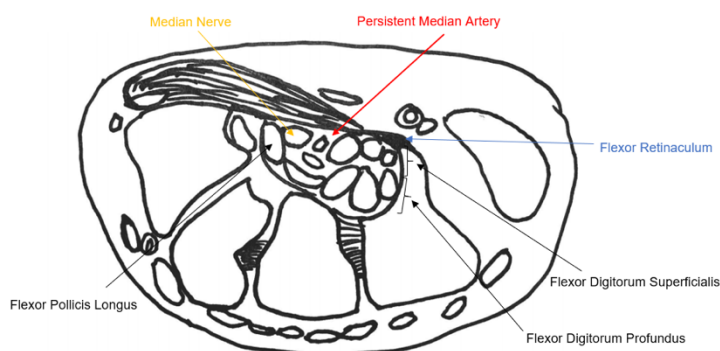


**Figure 2.** Carpal tunnel release with a thrombosed PMA (blue Surgical Loop) and bifid median nerve.



## Discussion

The patient presented with a persistent median artery, an anatomic variation with a reported prevalence ranging from 1% to 23% ; with bilateral cases described in 5.8% of the population (5,6). The median artery originates from the axillary artery and normally involutes in the second embryonic month by undergoing apoptosis during the radial and ulnar arteries' development (5) (Figure 3). Some individuals maintain their median artery throughout their lifetime without becoming symptomatic; most present as a fibrotic thread or a minuscule vessel (7). Studies have shown that a thrombosed persistent median artery can cause increased pressure within the tunnel leading to median nerve compression (8). Thrombosis is due to various etiologies such as infection, trauma, rheumatoid disease, or repetitive movements of the wrist (3).



**Figure 3.** Carpal tunnel release with a thrombosed PMA (blue Surgical Loop) and bifid median nerve.

In the case presented, the patient worked as a welder and the likely cause of thrombosis was therefore daily repetitive movements. The coexistence of a persistent median artery and a bifid median nerve in the carpal tunnel occurs more frequently as compared to the presence of a persistent median artery alone(7). Although rare, pre-operative knowledge of these anatomical variations is important for surgeons treating CTS in order to prevent major bleeding and nerve injury. In the setting of acute CTS without trauma, the differential diagnosis of median artery thrombosis should be considered. Doppler ultrasound is considered a good screening and diagnostic method (10). As in the case presented, the median artery is most often located deep to the transverse carpal ligament. It can also be found superficially between the transverse carpal ligament and the palmar aponeurosis, where it is then at risk during carpal tunnel release (5). An angioscan is a valuable tool in identifying the position of the median artery while providing information on the anatomy of the palmar

arches. Usually, the superficial palmar arch is formed with the ulnar artery and the superficial palmar branch of the radial artery. Multiple variations have been well described by Coleman and Anson, including the radio-median-ulnar variation with an incidence ranging from 1% to 6% (2,11).

Although no variations in the palmar arch were present in this case, in others, the median artery originating from the superficial palmar arch can be the only source of finger perfusion. In this case, the incidental finding on the angioscan was a superficial ulnar artery with origin from the axillary artery, running superficially in the forearm (1). The superficial ulnar artery has been identified in 0.93% to 1.6% of individuals and may be seen with a persistent median artery.<sup>1</sup> Some cases described in the literature were treated with anticoagulant therapy and complete remission of the clinical symptoms ,as well as acceptable recanalization of the persistent median artery, were achieved.<sup>4</sup> The use of anticoagulant therapy is nevertheless associated with risks such as bleeding complications. In light of the patient's low surgical risk, severity of his symptoms, large area of thrombosis of the persistent median artery, and adequate perfusion to his hand/digits without the median artery, we elected to perform surgical excision of the thrombosed median artery as described by Barfred et al (9).

The patient also had a bifid median nerve, discovered during surgical intervention. Anatomic variation of this nerve was first described by Lanz in 1977. As reported in the study, 2 to 26% of individuals have a variation in the median nerve; the median nerve has either a) accessory branches distally or proximally to the carpal tunnel b) a thenar (motor) branch with a different course, or c) a median nerve that divides higher up in the forearm.<sup>6</sup> The latter anomaly occurs with an incidence of 2.8%.<sup>12</sup> The bifurcation of the median nerve is normally found proximal to the transverse carpal ligament or within the carpal tunnel itself. A bifid median nerve can be isolated, accompanied with a persistent median artery, or with an accessory muscle belly of the long finger flexor superficialis (5). The compression of a bifid median nerve within the carpal tunnel leading to CTS is facilitated due to the larger cross-sectional area compared to a classic median nerve.<sup>1</sup> Bifid median nerve has, however, been reported to be as frequent in the general population without CTS than in patients afflicted with the disease, and hence is not considered a risk factor for CTS.

## Conclusion

As highlighted through the case, persistent median artery with acute thrombosis may be a cause of CTS. The case described is an interesting example of the importance of considering structural anomalies when faced with acute CTS. We have also demonstrated the utility of the angioscan in the evaluation of vascular variations. Furthermore, Doppler ultrasound is a non-invasive and a rapid diagnostic tool when examining patients presenting with possible CTS. Surgical intervention in which the thrombosed segment of the persistent median artery was resected, and release of carpal tunnel performed led to complete resolution of symptoms.

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