

## **Persistent Median Artery in the Carpal Tunnel: Anatomy, Embryology and Clinical Significance**

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**Abstract:** The median artery is the main source of blood for the forearm in intrauterine life. During the process of development the median artery gets obliterated and supplies the median nerve. Variation of persistent median artery and its accompanying with the median nerve in the carpal tunnel is one of the important anatomic variations of the upper limb. Thrombosis of the artery inside the carpal tunnel may cause carpal tunnel syndrome. The present variation of persistent median artery inside the carpal tunnel was observed in a 28 year old female during magnetic resonance imaging of the wrist. The artery is originated from the ulnar artery and passes through the forearm accompanying the median nerve and then enters the carpal tunnel. The diameter of artery inside the carpal tunnel was 2 mm. Median artery thrombosis in this kind of variation can cause compression on the median nerve and symptoms of carpal tunnel syndrome. Doppler ultrasound is recommended to be used to diagnose vascular thrombosis in the carpal tunnel.

**Keywords:** Carpal Tunnel Syndrome, Axillary Artery, Median Nerve.

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### **INTRODUCTION**

The median artery is the main source of blood for the forearm in intrauterine life [1]. This artery is originated from the axis artery. Axis artery is responsible for vascular supply the upper limb bud during embryonic period. The proximal part of the axis artery forms the axillary and brachial arteries. The distal part creates the anterior interosseous artery. Median and anterior interosseous arteries are the main sources of hand blood supply [2]. At the end of the second month of intrauterine life, median artery gradually loses its importance by formation of radial and ulnar arteries in the forearm and remains as a small artery to supplies the median nerve [3]. Median artery can be originated from the anterior interosseous, common interosseous and ulnar arteries [4]. Very rarely it takes origin either from brachial artery or radial artery.

The median nerve and long flexor tendons of the forearm course through carpal tunnel. Compression of the median nerve in the wrist can occur during a number of different conditions such as arterial thrombosis, tendosynovitis, ganglion cysts or excessive fat. Persistent median artery and its presence in the carpal tunnel is one of the rare vascular variations in the upper limb. Upper extremity vascular variations are caused by anomalies during the formation of blood vessels.

The persistence of a median artery has been shown to be a contributing cause of a number of

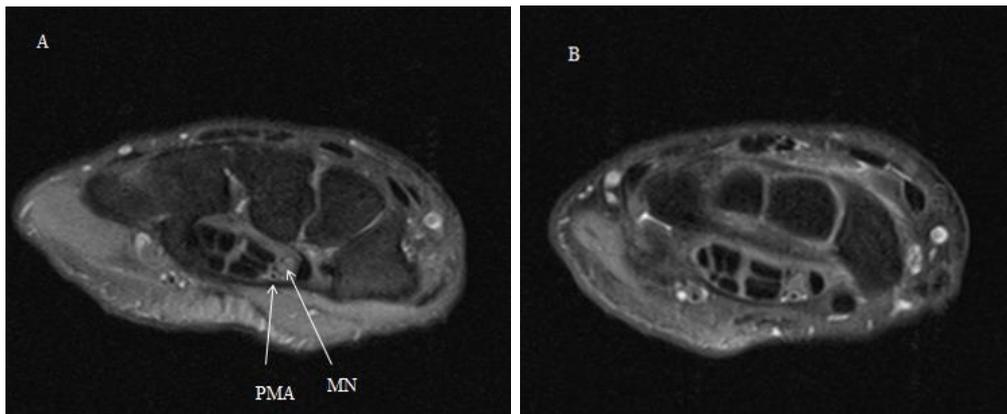
entrapment neuropathies including carpal tunnel syndrome, pronator teres syndrome, and anterior interosseous nerve syndrome [5,6].

### **CASE PRESENTATION**

The variation was observed during the MRI of the wrist a female patient aged 28 years with pain in wrist and numbness in fingers at the Medical Imaging Department of the Khatam Al-Anbia Hospital. According to the images of axial sections, there is an artery accompanying the median nerve in the left wrist carpal tunnel.

In this study, wrist MRI performed on a high field 3 Tesla MRI scanner (Siemens Magnetom Trio) using TSE sequence with the following parameters in axial view: A 100×100 cm FOV, 24 sections that were 3 mm thick, a repetition time of 3000 ms, an echo time of 12 ms, and matrix of 512×512.

Investigation of the artery in other views showed that the patient suffers from the variation of persistent median artery. The median artery is originated from the ulnar artery and descended to the wrist on the superficial aspect of flexor pollicis longus and deep to flexor digitorum superficialis. Then, it enters the carpal tunnel along with the median nerve and participates in feeding the fingers. The median artery diameter inside the carpal tunnel was equal to about 2 mm. Variation of persistent median artery was not observed in the opposite side of the wrist.



**Fig-1: MR images of the left wrist in the axial view in two different sections. Persistent median artery (PMA) and median nerve (MN) are observed in the carpal tunnel.**

## DISCUSSION

Upper extremity vascular anomalies are common. Such anomalies are of great importance clinically for surgeons. According to literature, prevalence of persistent median artery ranges from 1.5 to 27.1 percent [7]. The differences between these variations perhaps is related to a number of factors including racial difference among populations or developmental difference between adults and neonates. Kopuz *et al.* [8] studied neonate cadaver to observe variation of persistent median artery. The results strengthened this theory that the median artery regresses at during the perinatal period and early infancy. In this study, incidence of the variation was 20 percent [8]. Natsis K *et al.* [9] conducted a study on adult cadaver and found a variation of 2.78 percent [9]. According to Rodriguez *et al.* [2] the persistent median artery in adults may persist in two different patterns including antebrachial pattern in which the artery remains in the forearm and Palmar pattern in which the artery continued to the palms and usually terminates as the main blood supply to the index and long fingers. The antebrachial pattern is more prevalent and the term persistent median artery refers to the palmar type of the median artery. Variation of persistent median artery is independent of other vascular variations of the upper limb. But, it is more likely to occur in the absence of the radial or ulnar arteries [2]. The median artery is most often found terminating in a digital artery supplying the thumb and index fingers. It has also been found to contribute to the superficial palmar arch [10]. Persistence of the median artery may also occur in conjunction with anomalies of the median nerve, but this is rarer. Several authors have described division of the median nerve by the persistent median artery [11, 12].

According to several studies on the diameter of median artery in this type of variation, artery diameter ranges from 0.8 to 3 mm. According to Claassen *et al.*, the median artery diameter in 4 cadavers with this type of variation was between 1.5 to 2 mm [13, 14].

Persistent median artery may cause different neuropathies including carpal tunnel syndrome, pronator teres syndrome and anterior interosseous nerve syndrome in adult. The most severe cases of carpal tunnel syndrome may require surgery to decrease the compression of the median nerve and restore its normal function. Aneurysm and arterial thrombosis in persistent median artery variation can cause compression on the median nerve. In patients with a large median artery, arterial thrombosis can cause carpal tunnel syndrome with sudden symptoms treated with surgical removal of arterial thrombosis [15, 16]. In addition, in cases where the median artery is not anastomosis connected with ulnar and radial arteries and superficial palmar arch, ischemia may occur in the event of damage to median artery.

## CONCLUSION

One of the important vascular variations in upper extremity is the lack of regression of the median artery and its presence in the carpal tunnel. Presence of persistent median artery usually will be asymptomatic but may cause symptoms of carpal tunnel syndrome or pronator teres syndrome when subjected to compression. In patients with sudden symptoms of carpal tunnel syndrome, the presence of median artery variation should be considered as a cause of these symptoms. Doppler ultrasound is recommended to be used to evaluate the vascular thrombosis.

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