

# High origin of the third digital branch of the median nerve

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## Abstract

During a routine cadaveric dissection, we came across an anatomical variation at the level of the right forearm of a 77-year-old Caucasian male cadaver. Proximal to the superior border of the flexor retinaculum, we observed the median nerve giving a separate branch. It was the third common palmar digital nerve running distally from the ulnar side of the median nerve and coursing through the flexor digitorum superficialis muscle. In the distal part of the palm, it was divided into two proper palmar digital nerves for the adjacent sides of middle and ring fingers.

**Keywords:** carpal tunnel; entrapment neuropathy; median nerve variations; third common digital nerve

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## Introduction

Distal to the transverse carpal ligament, the median nerve flattens and divides into the lateral and medial branches. The lateral branch gives the first common palmar digital nerve and one proper palmar digital nerve to supply the thumb and radial side of the index finger. The medial branch divides into two common palmar digital nerves, second and third, to supply the adjacent sides of the index, middle, and ring fingers. They also supply the first and second lumbrical muscles with separate twigs. Usually, the digital nerves pass distally deep to the superficial palmar arch and its digital vessels.

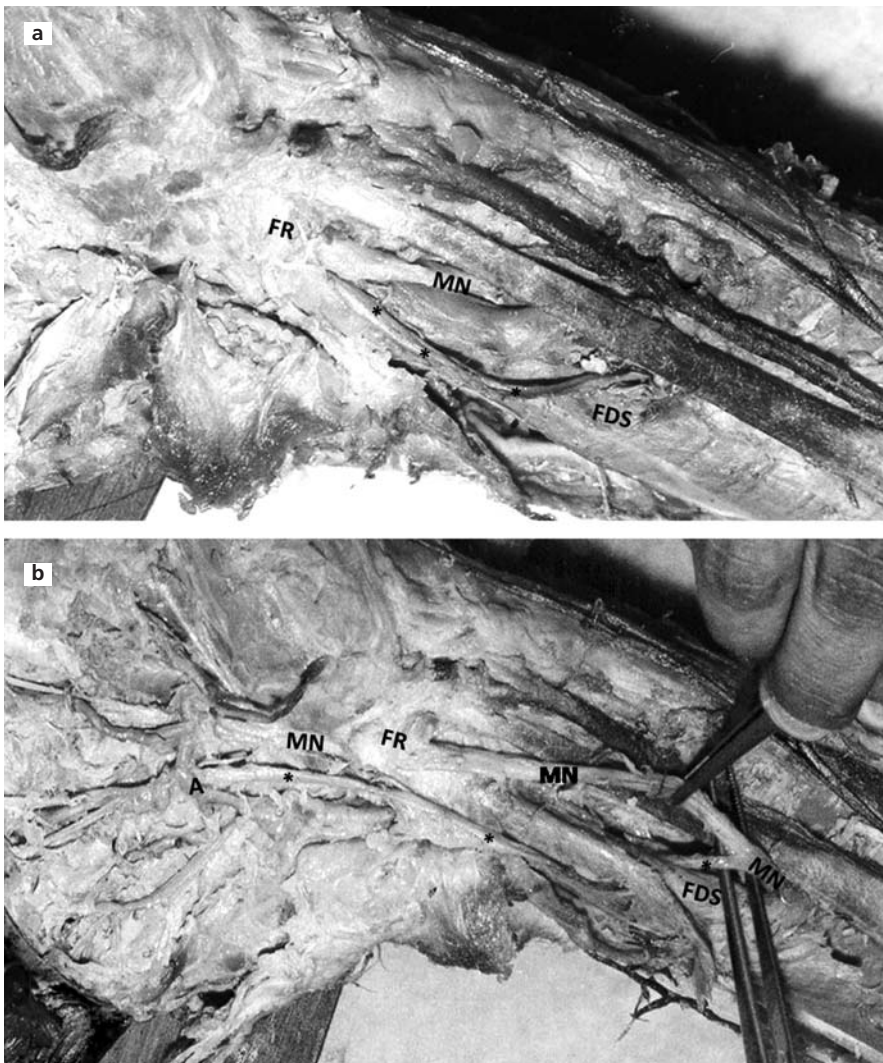
The high division of the median nerve is an anatomical variation reported in the literature with an incidence of 3%.<sup>[1–3]</sup> This variation is often combined with the presence of the median artery.<sup>[2,4–7]</sup> However, high division of the median nerve does not always co-exist with the median artery. A transmuscular course of a median nerve branch in the forearm has also been described in the literature and it has been associated with entrapment neuropathy with symptoms resembling carpal tunnel syndrome.<sup>[8]</sup> In the present study, we present a similar case of high division of the median nerve accompanied by a transmuscular course of one branch.

## Case Report

During a routine dissection of the right upper limb of a 77-year-old Greek male cadaver, we came across an anatomical variation of the median nerve in the forearm (**Figure 1**). There were no signs of trauma or previous surgery in the right upper limb. After the elevation of palmaris longus at the level of its musculotendinous junction, 7.3 cm proximal to the upper border of the flexor retinaculum, we observed the median nerve giving rise to a separate branch. It was the third common palmar digital nerve which ran distally from the medial side of median nerve coursing through the flexor digitorum superficialis muscle. The nerve passed under the flexor retinaculum in the carpal tunnel, located between the flexor digitorum superficialis muscle and the ulnar artery. In the distal part of the palm, it pursued a course deep to the superficial palmar arch and divided into two proper palmar digital nerves for the adjacent sides of middle and ring fingers. The corresponding two digital arteries were located deep to both of the proper palmar digital nerves. This unusual branch of the median nerve also supplied the third lumbrical muscle, just before its division into the proper palmar digital nerves.

## Discussion

According to the literature, the median nerve may be associated with several variations, such as unusual communica-



**Figure 1.** (a, b). Two levels of dissection. The median nerve (MN) at the right forearm was giving an atypical ramus (\*). That ramus was the third common palmar digital nerve and ran distally through the flexor digitorum superficialis muscle (FDS), under the flexor retinaculum (FR) medial to the MN, and in the palm deep to the superficial palmar arch (A). The nerve was divided into two proper palmar digital nerves for the adjacent sides of middle and ring fingers.

tions with other nerves,<sup>[9]</sup> splitting of the median nerve<sup>[9,10]</sup> and atypical muscle innervation.<sup>[11]</sup> The high division of the median nerve is an anatomical variation which has been reported in the literature with an incidence of 3%.<sup>[1-3]</sup>

Lanz<sup>[5]</sup> classified variations of the median nerve into four groups: 1) division into a thenar branch; 2) accessory branches of the median nerve in the distal portion of the carpal tunnel; 3) a far proximal division in the nerve track occurring at the level of the forearm; 4) accessory branches that leave the nerve trunk proximal to the carpal tunnel. Lanz reported the incidence of the high division of the median nerve as 2.8%.<sup>[5]</sup> This entity may often be associated with other anatomical variations as well.<sup>[5,9,12-15]</sup> Usually, it is accompanied by the presence of a persistent median artery. Knowledge of this fact could help orthopedic surgeons to avoid damage of the coexisting persistent median artery. In our case, there was no

persistent median artery or any other concomitant variation.

Sundaram et al.<sup>[9]</sup> described a variation of the median nerve in which the nerve split 5 cm proximal to the flexor retinaculum. The split portion of the median nerve continued distally as the third common palmar digital nerve, which passed anterior to the long flexor tendons, and just proximal to the space between middle and ring finger it was divided into two proper palmar digital nerves. Barbe et al.<sup>[1]</sup> found a unilateral variation of the median nerve in 27 out of 75 hands (36%), and a bilateral variation in only one hand. These variations included either subligamentous or transligamentous branching of the thenar branch (Lanz Type I; 33%), as well as a high division of the median nerve in two hands (Lanz Type III; 2.6%).

Another relative classification system was reported by Engineer et al.<sup>[16]</sup> who identified three types of origin of the third common digital nerve: type I originating proximal to the distal edge of the transverse carpal ligament (15%); type II originating distal to the transverse carpal ligament but proximal to the superficial palmar arch (70%); and type III originating distal to the transverse carpal ligament and at or distal to the superficial palmar arch (15%). The median nerve variation in our case fits better to Lanz type III, while Engineer et al.'s classification does not include the variation in our case.<sup>[16]</sup>

Agarwal et al.<sup>[17]</sup> presented a relatively high incidence of median nerve variations (50% of 52 cadaveric hands) with high division of the median nerve (into medial and lateral branches and early branching of the second common digital nerve) in 11.53%.

The course of the third common digital nerve through the flexor digitorum superficialis muscle, as we noticed, could lead to entrapment neuropathy with symptoms resembling carpal tunnel syndrome. Indeed, Fernandez-Garcia et al.<sup>[8]</sup> presented a case of a high division of median nerve which had one branch passing through the flexor digitorum superficialis tendon of middle finger causing nerve compression during muscle contraction and resulting in pain and dysesthesia of the middle finger, falsely mimicking carpal tunnel syndrome symptomatology.

Palmer and Toivonen<sup>[18]</sup> mentioned that the common digital nerve of the third web space was the most frequently injured nerve branch during carpal tunnel release, regardless of the surgical method (open or endoscopic). When a high division of the median nerve is encountered during surgical release, both branches should be decompressed.<sup>[19]</sup> Moreover, in some cases a split median nerve has forced surgeons to switch to open release from endoscopic surgery.<sup>[20]</sup>

A high division of the median nerve may predispose to compression in the carpal tunnel because of its relatively higher cross sectional area compared to a single median nerve.<sup>[5]</sup> Two other studies<sup>[21,22]</sup> demonstrated a high division of the median nerve in the carpal tunnel in 36 (19%) of 194 wrists and 32 (19%) of 170 patients. There were also cases with bilateral median nerve variations causing a bilateral carpal tunnel syndrome.<sup>[23]</sup> However, patient data derived from a recent combined clinical, electrophysiological and ultrasonographical approach highlight that bifid median nerve is not an independent risk factor for carpal tunnel syndrome development.<sup>[24]</sup> In clinical cases that present a variation similar to our case, great care should be taken in decompression of the carpal tunnel, since the third common digital nerve will be present as an individual structure within the tunnel.

In conclusion, the surgical procedure is not complicated *per se*, but the variations of the median nerve, which make it risky. In cases with variations similar to the one reported above, carpal tunnel release might not lead to complete relief symptoms. On the other hand, there is an increased risk of iatrogenic injury to the supernumerary nerve branch that courses through the carpal tunnel.

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