

Variations of Thenar Branch of Median Nerve in the North Indian Population

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ABSTRACT

Introduction: Inadvertant injury to median nerve during carpal tunnel surgery can be minimized if anatomy is understood, variations recognized and adequate exposure is achieved. Adequate decompression of compromised structure and preservation of recurrent motor branch are of paramount concern in carpal tunnel surgery.

Material and Methods: The present study was conducted on 60 upper limbs of 30 well embalmed adult human cadavers at the Government Medical College, Amritsar. The whole course of the thenar branch of median nerve was exposed.

Aim of Study: Aim of the study was to understand normal pattern of thenar nerve including variations in its formation and in its branching pattern which would form useful data for hand surgeons doing open/endoscopic carpal tunnel release.

Results: We found variations of thenar nerve in 18 (30%) out of 60 hands. Accessory thenar nerve was found in 5 (8.3%) hands, origin of thenar nerve in carpal tunnel in 12 (20%) hands, multiple thenar branches was seen in 1 (1.8%) hand.

Clinical Significance: The variations of median nerve in hand

and their incidence will aid the surgeon in avoiding iatrogenic complications and improve the success rate of median nerve decompressions.

Keywords: Thenar nerve, Hand variations, Carpal tunnel, Median nerve, Accessory thenar nerve, Opponens pollicis.


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INTRODUCTION

Knowledge of the anatomy of thenar branch of median nerve is important in surgery of the palmar aspect of hand. Carpal tunnel syndrome is the most common entrapment neuropathy of the upper extremity. It is usually chronic and disabling peripheral neuropathy, characterized by nocturnal hand discomfort, paresthesia of the fingers in the distribution of the median nerve & thenar muscle atrophy. Bilateral involvement can be encountered in 8-50% of patients.¹

Although non operative intervention is the preferred initial method of treatment of Carpal Tunnel Syndrome but surgery is often necessary². Therefore, adequate decompression of compromised structure and preservation of recurrent motor branch (thenar nerve) are of paramount concern in carpal tunnel surgery³. To prevent thenar branch injury during wrist surgery, knowledge of ramification pattern of thenar branch before entering the thenar fascia with the distribution of terminal branches in thenar musculature and meticulous dissection is required⁴. With the growing popularity of limited incisions and endoscopic decompression, knowledge of various anomalies of median nerve and its branches at wrist takes on added importance².

Past research studies have reported the fact that variant nerve sharing abnormal origin, course and distribution are more prone to

accidental injuries and entrapment neuropathies. During surgical procedures of carpal tunnel, a surgeon is exposed to topographical anatomy of the neural structures and awareness of variations may be of immense clinical help. Better understanding and correct interpretation of clinical neurophysiology can only be possible with prior academic knowledge⁵. The variations and their incidence will aid the surgeon in avoiding iatrogenic complications and improve the success rate of median nerve decompressions. To sum up, the present study has been undertaken to understand normal pattern of thenar branch of median nerve including variations in its origin and in its branching pattern.

MATERIALS & METHODS

The present study was conducted on 60 upper limbs of 30 (M:F::28:2) well embalmed adult human cadavers at the Government Medical College, Amritsar, Punjab, India. The dissection of the palm was done meticulously to expose the thenar branch of median nerve and the muscles it supplies as per the dissection steps given in Cunningham's Manual of Practical Anatomy⁶. Skin of the hand was reflected. The aponeurosis was turned distally by separating its edges from thinner deep fascia covering thenar and hypothenar muscles and palmaris longus

tendon was separated from surface of flexor retinaculum. Superficial palmar arch immediately deep to the palmar aponeurosis was exposed and the thenar branch of the median nerve was followed from its origin to termination. The thenar muscles were carefully isolated preserving their nerve supply and taking care to dissect all the branches & show their anatomical relationships.

RESULTS

Normally the median nerve pass through the carpal tunnel deep to the flexor retinaculum.⁷⁻⁹ This standard course was observed in all the 60 specimens of the present study as there was no case in which median nerve traversed flexor retinaculum or passed superficial to it.

a) Number of Thenar Nerves:

In the present study single thenar nerve was seen in 54 (90%) limbs which originated from the lateral terminal branch of median nerve. An additional accessory thenar nerve was seen in 5 (8.3%) limbs and it originated from 1st proper palmar digital nerve (Fig 1). In one limb (1.8%) there were multiple branches piercing thenar fascia (Fig 2).

b) Site of origin:

Out of 54 limbs with single thenar nerve, in forty three limbs (79.6%) it originated just distal to the flexor retinaculum from lateral branch. In 11 (20.3%) it originated in the carpal tunnel from main trunk of median nerve.

Out of 5 hands with two thenar nerves ie. one thenar and one accessory thenar nerve, the thenar nerve in 4 (80%) hands originated distal to flexor retinaculum and in 1(20%) hand (26MR) within the carpal tunnel. All accessory thenar nerves originated

from 1st proper palmar digital nerve distal to flexor retinaculum (Fig 1). In one hand (7ML) (1.6%) multiple (5) thenar branches were seen all distal to flexor retinaculum (Fig 2).

c) Muscles supplied:

The single thenar nerve in all the limbs supplied all the three thenar muscles viz. Opponens pollicis, Abductor pollicis brevis, Flexor pollicis brevis. When there was an additional accessory thenar nerve (in 5 limbs) the main thenar nerve supplied twigs to all three muscles again. But the accessory thenar nerve supplied only opponens pollicis (Fig 1). In the single hand where thenar nerve divided into five twigs; one twig supplied abductor pollicis brevis, two to Flexor pollicis brevis and two to opponens pollicis (Fig 2). Thus whenever an additional supply is there, it is for opponens pollicis. In one case with multiple branches, the additional supply was for opponens pollicis and flexor pollicis brevis.

d) Nerve supply of individual muscles:

As far as individual muscles are concerned, the APB was supplied by a single thenar nerve in all hands. Superficial head of FPB was supplied by single nerve in fifty nine hands and two nerves in one hand. OP was supplied by single branch in 54 cases. OP had dual innervation from thenar branch and accessory thenar nerve in five specimens. In one hand, thenar nerve divided into five branches before piercing thenar fascia and supplied OP (2 branches), superficial head of FPB (2 branches) and APB (1 branch) (Fig 2). In the present study, number and origin of the digital branches of median nerve was same as described in the standard textbooks in all the limbs.⁷⁻⁹ There was no variation in the territory of supply as in all the cases digital branches of median nerve innervated lateral 3½ fingers.

Table 1: Number of Nerves Supplying Individual Thenar Muscles

Muscle	Hands With Single Nerve	Hands With Two Nerves
Abductor Pollicis Brevis	60	0
Flexor Pollicis Brevis (superficial head)	59	1(in case of multiple branches)
Opponens Pollicis	54	6 (5 ATN + 1 in case of multiple branches)

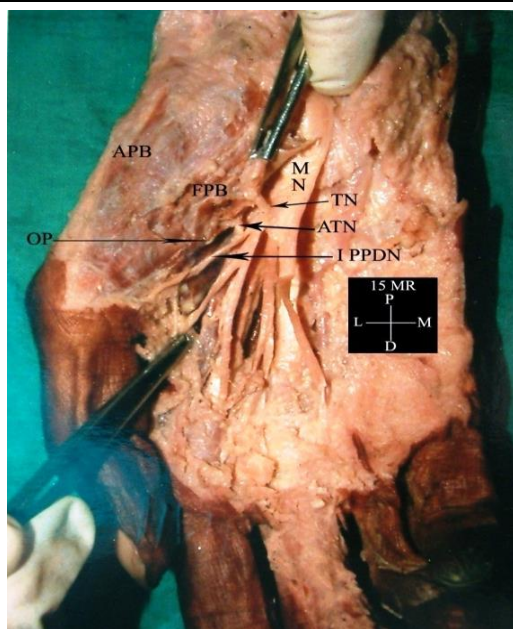


Fig 1: Accessory Thenar Nerve (ATN) originating from first proper palmar digital nerve (I PPDN) and supplying Opponens Pollicis (OP). (MN-Median nerve, TN-Thenar nerve, APB-Abductor pollicis brevis, FPB-Flexor pollicis brevis)

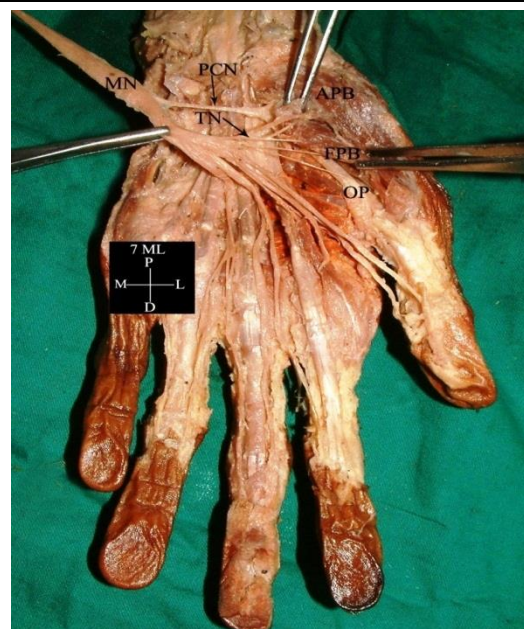


Fig 2: Multiple branches of thenar nerve (TN), piercing thenar fascia. (APB-Abductor pollicis brevis, FPB-Flexor pollicis brevis, OP-Opponens pollicis, MN-Median nerve, PCN-Palmar cutaneous nerve)

DISCUSSION

Importance of the muscular branch of median nerve in hand is unquestionable. Since it innervates the muscles of the thenar eminence it is responsible for the efficiency of the thumb and multiple activities of the hand.

a) Number of thenar nerves: Depending upon the number of thenar branches arising from the median nerve and entering the thenar fascia Alp et al⁴ classified thenar branches into four types:

Classification of the thenar branches (Alp et al ⁴)		
Type I	Thenar branch piercing thenar fascia as a single trunk	84%
Type II	Two Branches piercing thenar fascia	13.2%
Type III	Three branches piercing thenar fascia	2.1%
Type IV	Four branches piercing thenar fascia	0.7%

According to this classification, type I with single thenar nerve was seen in 54 (90%) limbs of the present study while type II was seen in 5 (8.3% limbs). In the latter case where two thenar branches were seen the additional one was arising from first proper palmar digital nerve. In one limb multiple (5) thenar branches arose which is not classified in Alp et al⁴ classification. So it can be added as Type V.

b) Site of origin: Siverhus et al³ considered anatomy of thenar branch of median nerve to be classical or typical if recurrent branch emerges from median nerve just distal to flexor retinaculum. Any other variation from the classic course was recorded as an anomaly.

Table II compares the incidence of clinical pattern and the anomalous pattern of origin of thenar branch of median nerve as observed by earlier authors.

Table II: Percentage of Classic and Anomalous Patterns of Thenar Branch of Median Nerve

Authors Name	Classic Pattern (%)	Anomalous Pattern (%)
Mumford et al(1987) ¹⁰	80	20
Siverhus et al(1989) ³	86	14
Olave et al(1996) ¹¹	80	20
Alp et al(2005) ⁴	84	16
Present Study(2008)	80	20

As evident from the Table II results of our study are in consonance with Mumford et al¹⁰ and Olave et al¹¹. Thenar branch originating in the carpal tunnel has been reported as 66.7%¹², 20%¹⁰ and 18.3%¹¹.

In our study it was 20% which is in consonance with the findings of Mumford et al¹⁰ and Olave et al¹¹. We agree with most of the referenced authors that this nerve is derived from the lateral division of the median nerve.⁷⁻⁹ Accessory thenar branch has been reported to originate from palmar digital nerve in 32.2% or from collateral radial nerve of index finger in 25%^{13,14}.

But in our study in all the 5 cases it originated from the 1st proper palmar digital nerve. Accessory thenar nerve has been reported by many anatomists being 38.3%, 8.3%, 75%^{4,10,11} and in present study it was 8.3% which is in agreement with study of Alp et al⁴.

c) Nerve supply of different muscles: Whenever an additional thenar nerve was present, it supplied opponens pollicis which thus was supplied by two nerves. Opposition is an evolutionary achievement in human hand not seen in lower primates. An additional supply for this in some limbs may indicate that it may develop more in coming generations.

CLINICAL SIGNIFICANCE

Compression of median nerve at wrist is most common entrapment neuropathy of the upper extremities. Adequate and safe decompression of median nerve can best be ensured by achieving complete visualization of median nerve and its variants. Werschkul¹⁵ has pointed out that "blind" sectioning of flexor retinaculum can risk damaging anomalous recurrent branches of median nerve. Concern has been expressed that injury to these variants may occur when endoscopic techniques at the wrist do not provide adequate visualization.

CONCLUSION

To summarize the classical pattern of single thenar branch of median nerve is seen in 90% limbs with an additional accessory nerve in 8.3%. Whether single or double it arises just distal to flexor retinaculum in 80% limbs and in carpal tunnel in 20%. If it is single, it gives twigs to all three thenar muscles but when double the second nerve goes only to opponens pollicis. In the sole limb with five branches, additional branches supply opponens pollicis and flexor pollicis brevis. As far as palmar digital branches are concerned, no variations could be found.

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