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Median Nerve Variation.

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ABSTRACT

The median nerve is a nerve in humans and other animals in the upper limb. It is one of the five main nerves originating from the brachial plexus. The median nerve is formed from contributions from the lateral and medial cords of the brachial plexus, originating from ventral roots of C5, C6 & C7 (lateral cord) and C8 & T1 (medial cord). The present study was done by dissecting forearm and palm in the human cadaver available in the Institute of Anatomy, Madras medical college, Chennai. In the present study on 15 specimens of upper limb the accessory muscular branch to thenar muscles is seen in 20%. Of which in 10% the accessory branch to the thenar muscles is arising proximal to the flexor retinaculum from the main nerve trunk. In 5% the accessory branch to the thenar muscles is arising distal to the flexor retinaculum from the proper digital branch to the lateral sides of the thumb.

Keywords: Recurrent muscular branch, flexor retinaculum, median nerve.

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INTRODUCTION

The median nerve receives fibers from roots C6, C7, C8, T1 and sometimes C5 [1]. It is formed in the axilla by a branch from the medial and lateral chords of the brachial plexus, which are on either side of the axillary artery and fuse together to create the nerve anterior to the artery. The median nerve is closely related to the brachial artery with in the arm. The nerve enters the cubital fossa medial to the brachialis tendon and passes between the two heads of the pronator teres. It then gives off the anterior interosseus branch in the pronator teres. The nerve continues down the forearm between the flexor digitorum profundus and the flexor digitorum superficialis [1]. The median nerve emerges to lie between the flexor digitorum superficialis and the flexor carpi ulnaris muscles which are just above the wrist. At this position, the nerve gives off the palmar cutaneous branch that supplies the skin of the central portion of the palm. The nerve continues through the carpal tunnel into the hand, lying in the carpal tunnel anterior and lateral to the tendons of the flexor digitorum superficialis. Once in the hand, the nerve splits into a muscular branch and palmar digital branches. The muscular branch supplies the thenar eminence while the palmar digital branch supplies sensation to the palmar aspect of the lateral 3 ½ digits and the lateral two lumbricals [2]. After receiving inputs from both the lateral and medial cords of the brachial plexus, the median nerve enters the arm from axilla at the inferior margin of the teres major muscle. It then passes vertically down and courses with brachial artery on medial side of arm between biceps brachii and brachialis. At first lateral to the artery and lies anterior to the elbow joint, it then crosses anteriorly to run medial to the artery in the distal arm and into the cubital fossa. Inside the cubital fossa the median nerve passes medial to the brachial artery, in front of the point of insertion of the brachialis muscle and deep to the biceps. The median nerve gives off an articular branch in the upper arm as it passes the elbow joint. A branch to pronator teres may arise from the median nerve immediately proximal to the elbow joint. The median nerve arises from the cubital fossa and passes between the two heads of before emerging between flexorpronator teres. It then travels between flexor digitorum superficialis and flexor digitorum profundus or digitorum superficialis and flexor pollicis longus. The unbranched portion of the median nerve (which arises from the cubital fossa) innervates muscles of superficial and intermediate groups of the anterior(flexor) compartment except flexor carpi ulnaris. The median nerve does give off two branches as it courses through the forearm: The anterior interosseous branch courses with the anterior interosseous artery and innervates all the muscles of the deep group of the anterior compartment of the forearm except the medial (ulnar half,which is supplied by ulnar nerve) half of flexor digitorum profundus and flexor carpi ulnaris muscle. It ends with its innervation of pronator quadratus.

The palmar cutaneous branch of the median nerve arises at the distal part of the forearm. It supplies sensory innervation to the lateral aspect of the skin of the palm (but not the digits) [3]. The median nerve enters the hand through the carpal tunnel, deep to the flexor retinaculum along with the tendons of flexor digitorum superficialis, flexor digitorum profundus, and flexor pollicis longus.

MATERIAL AND METHODS

The present study was done by dissecting forearm and palm in the human cadaver available in the Institute of Anatomy,Madras medical college,Chennai. A total number of 15 specimens were studies in the present work.

Dissection method was employed for the study. On the Flexor aspect of forearm 'H' shaped incision was made from 3 cms. Proximal to elbow joint to wrist joint, the vertical incision was continued up to the third metacarpohalangeal joint. A horizontal incision was made along the roots of finger. The skin flaps were reflected medially and laterally. Superficial fascia and deep fascia were identified and cleaned in forearm and palm.

Observations

In the present study on 15 specimens of upper limb the accessory muscular branch to thenar muscles is seen in 20%. Of which in 10% the accessory branch to the thenar muscles is arising proximal to the flexor retinaculum from the main nerve trunk. In 5% the accessory branch to the thenar muscles is arising distal to the flexor retinaculum from the proper digital branch to the lateral sides of the thumb. Shows accessory thenar branch arising from the main ltrunk. It is passing superficial to flexor retinaculaum to supply the thenar musucles. Recurrent muscular branch from the lateral terminal branch of the median nerve is also

present.Shows accessory thenar branch arising from the proper digital branch to lateral side of the thumb. Recurrent muscular branch from the lateral terminal branch of the median nerve also present.

DISCUSSION

Poisel described the following variations in the thenar branch in his study of 100 cadavers ,ligament type in 46%,sub ligament in 31% and transligaments in 23% [8].

W Henry, Hollinshead, Keith L Moore, Grays, Richard S Snell have described that the recurrent muscular branch is given off just distal to the flexor retinaculum [1-3].

Lanz U described about the accessory branches to the thenar muscles in 246 hands.The accessory branch arises distal to the flexor retinaculum in 73% and proximal to flexor retinaculum in 1.6% [5].

Mehmet Alp and et al in his study on 144 hands observed accessory thenar nerve in 8.3% [4].

Median nerve palsy is often caused by deep, penetrating injuries to the arm, forearm, or wrist. It may also occur from blunt force trauma or neuropathy.[1] Median nerve palsy can be separated into 2 subsections—high and low median nerve palsy. High MNP involves lesions at the elbow and forearm areas. Low median nerve palsy results from lesions at the wrist. Compression at the different levels of the median nerve produce variable symptoms and/or syndromes. The areas are:

Underneath Struthers' ligament
Passing by the bicipital aponeurosis (also known as lacertus fibrosus)
Between the two heads of the pronator teres

Compression in the carpal tunnel causes carpal tunnel syndrome [4].

Because lesions to different areas of the median nerve produce similar symptoms, clinicians perform a complete motor and sensory diagnosis along the nerve course. Decreased values of nerve conduction studies are used as indicators of nerve compression and may aid in determining the localization of compression. Palpation above the elbow joint may reveal a bony consistency. Radiography images may show an abnormal bony spur outgrowth (supracondyloid process) just proximal to the elbow joint. Attached fibrous tissue (Struthers' ligament) may compress the median nerve as it passes underneath the process [3]. This is also known as supracondylar process syndrome. Compression at this point may also occur without the bony spur; in this case, aponeurotic tissue found at the location of where Struthers' ligament should be is responsible for the compression [4]. If patients mention reproduction of symptoms to the forearm during elbow flexion of 120–130 degrees with the forearm in maximal supination, then the lesion may be localized to the area underneath the lacertus fibrosus (also known as bicipital aponeurosis) [7]. This is sometimes misdiagnosed as elbow strain and medial or lateral epicondylitis [8]. A lesion to the upper arm area, just proximal to where motor branches of forearm flexors originate, is diagnosed if the patient is unable to make a fist. More specifically, the patient's index and middle finger cannot flex at the MCP joint, while the thumb usually is unable to oppose. This is known as hand of benediction or median claw hand. Another test is the bottle sign—the patient is unable to close all their fingers around a cylindrical object [3]. Carpal tunnel syndrome (CTS) is caused by compression of the median nerve as it passes under the carpal tunnel.[10] Nerve conduction velocity tests through the hand are used to diagnosis CTS. Physical diagnostic tests include the Phalen maneuver or Phalen test and Tinel's sign. To relieve symptoms, patients may describe a motion similar to "shaking a thermometer", another indication of CTS [4]. Pronator teres syndrome (also known as pronator syndrome) is compression of the median nerve between the two heads of the pronator teres muscle.[12] The Pronator teres test is an indication of the syndrome—the patient reports pain when attempting to pronate the forearm against resistance while extending the elbow simultaneously. The physician may notice an enlarged pronator teres muscle. Tinel's sign the area around the pronator teres heads should be positive[1] The key to discerning this syndrome from carpal tunnel syndrome is the absence of pain while sleeping. More recent literature collectively diagnose median nerve palsy occurring from the elbow to the forearm as pronator teres syndrome. In uncooperative patients, the skin wrinkle test offers a pain-free way to identify denervation of the fingers. After submersion in water for 5 minutes, normal fingers will become wrinkled, whereas denervated fingers will not. In "Ape hand deformity", the thenar muscles become paralyzed due to impingement and are

subsequently flattened. This hand deformity is not by itself an individual diagnosis; it is seen only after the thenar muscles have atrophied. While the adductor pollicis remains intact, the flattening of the muscles causes the thumb to become adducted and laterally rotated. The opponens pollicis causes the thumb to flex and rotate medially, leaving the thumb unable to oppose. Carpal tunnel syndrome can result in thenar muscle paralysis which can then lead to ape hand deformity if left untreated. Ape hand deformity can also be seen in the hand of benediction deformity.

One way to prevent this injury from occurring is to be informed and educated about the risks involved in hurting your wrist and hand. If patients do suffer from median nerve palsy, occupational therapy or wearing a splint can help reduce the pain and further damage. Wearing a dynamic splint, which pulls the thumb into opposition, will help prevent an excess in deformity. This splint can also assist in function and help the fingers flex towards the thumb. Stretching and the use of C-splints can also assist in prevention of further damage and deformity. These two methods can help in the degree of movement the thumb can have. While it is impossible to prevent trauma to your arms and wrist, patients can reduce the amount of compression by maintaining proper form during repetitive activities. Furthermore, strengthening and increasing flexibility reduces the risk of nerve compression.

Depending on the severity of the lesion, physicians may recommend either conservative treatment or surgery. The first step is simply to rest and modify daily activities that aggravate the symptoms. Patients may be prescribed anti-inflammatory drugs, Physical or Occupational therapy, splints for the elbow and wrists, and corticosteroid injections as well [5]. This is the most common treatment for CTS. Especially involving compression at the wrist, such as in CTS, it is possible to recover without treatment. Physical therapy can help build muscle strength and braces or splints help recover [4]. In pronator teres syndrome, specifically, immobilization of the elbow and mobility exercise within a pain-free range are initially prescribed. However, if the patient is not relieved of symptoms after a usual 2 to 3 month refractory period, then decompression surgery may be required [5]. Surgery involves excising the tissue or removing parts of the bone compressing the nerve.Many tendon transfers have been shown to restore opposition to the thumb and provide thumb and finger flexion. In order to have optimal results the individual needs to follow the following principles of tendon transfer: normal tissue equilibrium, movable joints, and a scar-free bed. If these requirements are met then certain factors need to be considered such as matching up the lost muscle mass, fiber length, and cross-sectional area and then pick out muscle-tendon units of similar size, strength, and potential excursion.For patients with low median nerve palsy, it has been shown that the flexor digitorum superficialis of the long and ring fingers or the wrist extensors best approximate the force and motion that is required to restore full thumb opposition and strength. This type of transfer is the preferred method for median nerve palsy when both strength and motion are required. In situations when only thumb mobility is desired, the extensor indicis proprius is an ideal transfer. For high median nerve palsy, the brachioradialis or the extensor carpi radialis longus transfer is more appropriate to restore lost thumb flexion and side-to-side transfer of the flexor digitorum profundus of the index finger are generally sufficient. To restore independent flexion of the index finger could be performed by using the pronator teres or extensor carpi radialis ulnaris tendon muscle units. All of the mentioned transfers are generally quite successful because they combine a proper direction of action, pulley location, and tendon insertion [6]. There are multiple naturally occurring anomalies of the median nerve [3]. Bifurcation of the median nerve typically occurs after the nerve exits the carpal tunnel; however, in a small percentage (5%-10%) of individuals, the median nerve bifurcates more proximal in the carpal tunnel, wrist, or forearm [2].

During gestation, a median artery that serves the hand retracts. However, in some individuals the median artery does not retract and follows the course next to the median nerve into the hand.[8] Martin-Gruber anastomoses can occur when branches of the median nerve cross-over in the forearm and merge with the ulnar nerve to innervate portions of the forehand.

Riche-Cannieu anastomoses can occur when there is connection between recurrent branch of the median nerve and deep branch of the ulnar nerve of the hand [7].

In high median nerve palsy patients, recovery time varies from as early as four months to 2.5 years. Initially, patients are immobilized in a neutral position of the forearm and elbow flexed at 90° in order to prevent further injury [10]. Additionally, gentle exercises and soft tissue massage are applied. The next goal is strengthening and flexibility, usually involving wrist extension and flexion; however, it is important not to

overuse the muscles in order to prevent re-injury [9]. If surgery is required, post operative therapy initially involves decreasing pain and sensitivity to the incision.

CONSLUSION

Median nerve as per description in most of the established text and reference books gives recurrent muscular branch to the thenar muscles. Its lesion or injury will cause physical disability affecting work ability of person. Median nerve is often injured at the wrist, accidentally or in attempted suicide. In such cases, patient is asked to abduct or oppose thumb against tight resistant the thenar muscles can be felt to contract, if nerve is intact. Impairment of function affect not only prospects of employment but also a wide range of every day task which we take for granted such as doing up laces and buttons, screwing the lids of jars. It is extremely important clilnically to preserve the function of hands. Knowledge of variable anatomy of the nerve could help to avoid incomplete decompression at operations for carpal tunnel entrapment and injury to thenar branch of the nerve. The possibility of double thenar innervation must be considered in preoperative evaluation and in the follow up of median nerve injuries. Hence, the accessory muscular branches to thenar muscles should be reviewed before undertaking any treatment or surgical procedure. This will help the patient in getting effective treatment and helps in avoiding post surgical complications.

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