An Unusual Variant Innervation of Third Lumbrical Muscle Purely From Median Nerve in an Adult Cadaver in Middle East: A Case Report

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Abstract: Very few sporadic reports have been found in past. Most of the cases were found in association with median- ulnar anastomosis. Here we describe an unusual finding of third lumbrical muscle in hand which was supplied purely from branch arising from common digital nerve branch of medial ramus of median nerve, in an adult male cadaver. Such variation has never been reported in past in this region. Such variations are seen due to rerouting of nerve fibers at various levels. Knowledge of such variations on the part of the surgical team is extremely important to avoid iatrogenic complications and improve the prognosis of median nerve decompressions. Awareness would help surgeon to clinicians and hand surgeons while dealing with the hand during various surgical procedures such as muscle flap transplant or various graft surgeries.
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1. Introduction

Hand is a prehensile organ with several intrinsic muscles responsible for highly specialized and intricate movements which is attributed to a great neuromuscular coordination and larger functional area for hand in motor and sensory cortices of the cerebral hemispheres. Among all the muscles of hand, the lumbricals though small in size have a significantly greater role to play in the specialized movements of fingers. Magnitude of evolution of intrinsic hand muscles is an indirect index of civilization of human race. It may be attributed to the fact that lumbricals contributed to the grasping ability of human, hence during phylogeny there must have occurred a great adaptation in evolution of human hand. The precise movements which are required during its evolution are contributed by the intrinsic muscles especially lumbricals. (1)

Lumbrical muscles are four small fasciculi which arise from the tendons of flexor digitorum profundus. First and second lumbricals are innervated by the median nerve, C8 and T1, and the third and fourth lumbricals by the deep terminal branch of the ulnar nerve, C8 and T1. Lumbricals contain many muscle spindles and have a long fiber length, therefore play a role in proprioception.(2)

2. Case Report

The purpose of present commentary is to report a case of an unusual innervation of third lumbrical muscle by median nerve which was encountered during routine cadaveric dissection of 49 yr old male cadaver who died of myocardial infarction. The rare finding was seen on right side with nerve to third lumbrical originating from common digital nerve from medial ramus of median nerve. Strikingly, no communication between median and ulnar nerve was seen in arm or forearm and hand. The nerve to first lumbrical muscle (L1), second lumbrical muscle (L2) and third lumbrical muscle (L3) were named as N1, N2 and N3 respectively. The nerve (N3) was seen to be 2.5 cm long, supplied the muscle from its superficial aspect (Figure 1, 2, 3). Fourth lumbrical was supplied by deep branch of ulnar nerve. Common digital nerveves divided into proper digital nerves for thumb index middle and half of ring finger. Median nerve supplied opponens pollicis, abductor pollicis brevis and flexor pollicis brevis in association with L1, L2 and L3. Ulnar nerve supplied adductor pollicis, along with palmar and dorsal interossei muscles. There were no other significant variations noticed on left side.

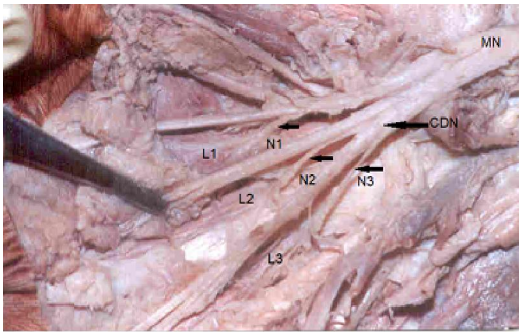
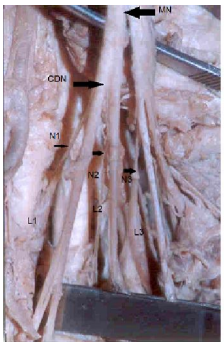


Figure 1



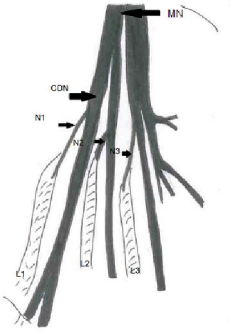


Figure 2 and Figure 3: Diagramatic Representation of Figure 2

Figure 1, 2 and 3 Showing:
First lumbrical Muscle (L1); Second lumbrical Muscle (L2); Third lumbrical Muscle (L3); Common Digital Nerve (CDN); Median Nerve(MN). N1- Nerve to L1, N2-Nerve to L2, N3- Nerve to L3

3. Discussion

Principal mechanical actions of the lumbricals (MP joint flexion, PIP and DIP joint extension) are duplicated to some extent by synergistic interosseous muscles and extrinsic muscles. Lumbrical muscles have the greatest density of mechanoreceptors of any muscle, and proposed that they may play a critical role in proprioception in addition to their function as IP joint extensors. (3)

During surgical procedures of hand, 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 knowledge. (4)

When the radius and ulna chondrify, by stage 17, the branched tips of the radial, median and ulnar nerves have migrated to the distal hand plate. (3) Significant variations in nerve patterns may result from altered signaling between mesenchymal cells and neuronal growth factors. (5)

Sunderland and Ray (1946) found 0.25% hands in which the third lumbrical was innervated by the median nerve rather than the ulnar nerve.(6)

Lauritzen et al in 1996 reported all cases with median nerve supplying first and second lumbrical and third Fourth lumbrical muscle by deep branch of ulnar nerve. They described 44% with one nerve branch, 33% with multiple branches innervating lumbricals. Multiple innervation was frequently found in the second and fourth lumbricals. Diameters of the nerves innervating the lumbricals ranged from 0.30 to 1.86 mm, with a mean of 1.17 mm (SD 0.47 mm). (7)

Desjacques et al in 1980 described finding that innervation of the first two lumbricals arises from the digital nerves indicates that the description of the digital nerves as purely sensory is incorrect. They emphasized resulting compound action potential (motor plus sensory) rather than a purely sensory potential nerve conduction testing in stimulation over the lumbricals in nerve conduction studies. Sparing of the innervation to the lumbrical muscles in carpal tunnel syndrome was described. (8)

Yates et al in 1981 described that branches to the lumbricals are more dorsal and therefore better protected from direct compression due to funicular position of: the lumbrical motor axons within the median nerve in the wrist. Unlike the motor branches to the thenar muscles which are superficial (palmar) and hence subject to compression against the flexor retinaculum. They emphasized persistent lumbrical activity may interfere with motor testing of the thenar muscles in response to supramaximal median nerve stimulation. (9)

Afroz et al in 2014 reported 5.5% cases second lumbrical was solely supplied by a branch from the deep branch of ulnar nerve. The third lumbrical was supplied by median nerve 1.85% cases. (10)

Mehta et al in 1961 reported 1.3% cases with dual innervations of L1 and L2 and in 7.4% casesadditional branch to 3rd lumbrical came from median nerve. They described branches arising from the loop between the superficial branch of UN and the MN to innervate L3.(11)

Hur et al in 2016 noticed frequent dual innervation of the third lumbrical was observed in 64.0% cases, L1 and L2 in 4% cases. The third lumbrical was innervated by a branch arising from the median nerve (MN) distal to site at which the superficial branch of the ulnar nerve joins the MN in 34% cases. In 6% cases, L1, L2, and L3 were innervated by the MN. Deep branch of UN innervated L3 and L4 in 88% cases. (12)

Oh et al. reported that the MN innervated the FDP muscles of digits 4 and 5 in 92% and 56% of cases. (13)

Kaur et al 2016 reported median nerve was innervating the third lumbrical in 3(5%) hands and second lumbrical was supplied by two branches from median nerve in 2(3.3%) hands.(14)

Particularly in light of the increasing number of nerve conduction studies, knowledge of normal and variant anatomic features has become more important than in the past. Knowledge about innervation would aid in correct explanation of results during motor testing of thenar and hypothenar muscles. Variations in nerve supply of lumbricals is extremely important while interpreting variant symptomatology in carpal tunnel syndrome and contracture syndromes.

4. Conclusion

Variations in innervation of third lumbrical and have a lot of clinical implications. At present, every practicing radiologist and surgeon must have in-depth knowledge of such variations for better understanding of structures in operative field. Further research about their presence especially in cases of median –ulnar anastomosis can provide new insights and reasons for occurrence. Intra operative surfacing of these surprises during various decompression nerve surgeries and flap transplants should be kept in mind. Knowledge would provide correct explanation of results during electrophysiological studies.

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