

Introducing a supernumerary muscle in the anterior compartment of the hand: A cadaveric study

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SUMMARY

Many muscular variations of the upper extremity have been reported. The majority of these variations are associated with forearm muscles. However, the muscular variations of the hand are uncommon. In the current study we found a unique supernumerary muscle in the right hand of a middle-aged male cadaver. This muscle originated from the one of the tendons of flexor digitorum superficialis (FDS) muscle that goes to the index finger and then traversed 5 cm distally to attach the same tendon. The knowledge of muscular variations is very essential for surgeons and clinicians to plan the standard surgical approaches.

Key words: Supernumerary muscle – Hand – Cadaver – Flexor digitorum superficialis

INTRODUCTION

The delicate muscles of the hand have complex performances that are specific to humans (Lee et al., 2014; Rothwell, 2012). From a clinical perspective, awareness of variations and of anatomical relations of the hand muscles is very important (Sookur et al., 2008; Triandafilou and Kamper, 2012). Previous studies have been reported numerous muscular variations of the human upper

limb (Catli et al., 2012; Nayak et al., 2008; Pai et al., 2008). Most of these variations are associated with muscles of the flexor and extensor compartments of the forearm (Abdolreza et al., 2015; Casal et al., 2011). Furthermore, variations of the flexor digitorum superficialis (FDS) muscle are one of the commonest in humans (Tan et al., 2009). FDS variations are very important because of the crossing the carpal tunnel and the area of the hand. Many variations in this muscle have been classically reported: absence of tendons, connections between the neighboring muscles, and, very rarely, the whole muscle is digastric. Moreover, in some ethnic groups a deep layer of the FDS is always made up by a digastric muscle proposed to be termed flexor digastric of the index finger (Le Double, 1897; Yamada, 1986; Dixit and Kakar, 2010). The FDS is characterized by two groups of muscles in the lower vertebrates. In the first group, it arises from the forearm and is extended to the palmar region. In the second group it passes from the palmar region to the fingers. Additionally, in the lemurs, the FDS is fused with the flexor digitorum profundus (D'Costa et al., 2006). There are different types of muscular variations, such as muscular agenesis (Boudokhane et al., 2017), accessory muscle (Hasan et al., 2014), absence of part of the muscle (Loukas et al., 2006), aberrant origin or insertion of the muscle (Agarwal et al., 2016; Rao et al., 2007), or an additional head of muscle (Mas et al., 2006), etc. In most cases, these variations are asymptomatic (Bernardes et al., 2016;

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Abdolreza et al., 2015). However, in some cases, the muscular variations can produce symptoms that range from mild to severe (Sookur et al., 2008; Ray et al., 2015). In the case of accessory or supernumerary muscles, the emergence of the clinical symptoms can be caused by pressure on the neurovascular structures (Veas et al., 2016). In this cadaveric study, we describe a rare supernumerary muscle that arose from the one of the tendons of the FDS muscle in the anterior compartment of the hand.

CASE REPORT

During routine dissection of a middle-aged male cadaver in the dissection hall of the Anatomy Department (Kerman University of Medical Sciences), while the anterior compartment of the right hand was dissected, a solitary supernumerary muscle was observed that arose from the anterior surface of one of the tendons of the FDS muscle that inserts to the second finger (index finger) and reconnects to the aforementioned tendon (proximal to the second metacarpophalangeal joint) at a distance of about 1.5 cm before connecting (Fig. 1). This supernumerary muscle originated from the FDS tendon shortly after exiting the carpal tunnel. The length of this supernumerary muscle was about 5 cm. Also, between its origin and insertion, the muscle was firmly attached to the tendon by connective tissue and innervated by means of a branch of the median nerve. Additionally, the superficial palmar arch was situated more superficial to the supernumerary muscle. Moreover, a main branch of the median nerve traversed on the ulnar side of this supernumerary muscle (Fig. 1).

COMMENTS

Knowledge of anatomical variations in the human body are clinically very important to reduce potential injuries during surgery. In the present study, we described a muscular variation in the anterior compartment of the hand. A supernumerary muscle that arises from the transverse carpal ligament and ends into the superficial tendon of the index finger at the level of the metacarpophalangeal joint has been reported previously by Bergman et al., which they have termed palmar flexor digitorum superfi-

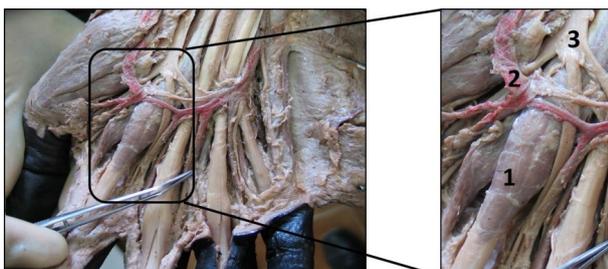


Fig 1. Anterior view of the right hand. Supernumerary muscle (1), superficial palmar arch (2), trunk of the median nerve (3).

cialis accessories (Bergman et al., 2015). Furthermore, Anita et al. have described a bilateral case of accessory belly of FDS; the bellies originated at the junction of upper 2/3 and lower 1/3 of the forearm and then traversed in the carpal tunnel and rejoined with the tendon of FDS at the level of the first lumbrical muscle origin (Anita et al., 2012). Moreover, D'Costa et al. reported an accessory belly replacing the tendon of FDS (in the carpal tunnel) to the index finger that innervated by a branch of the median nerve (D'Costa et al., 2006). Previous studies have also discovered variation of the portion of FDS to the fifth finger, or lack a tendon (Gonzalez et al., 1997).

Georgiev and Jeleu (2011) have reported an ectopic flexor digiti minimi that originated from the tendon of the flexor carpi radialis muscle. Also, they noted that this aberrant muscle can compress the ulnar nerve and cause the clinical symptoms. A previous study found an unusual abductor digiti minimi muscle during carpal tunnel decompression (Slavchev and Georgiev, 2013). Burlakoti et al. (2013) reported the variation of 3rd and 4th lumbrical muscles. Furthermore, Natsis et al. (2011) found an accessory 4th dorsal interosseous muscle during cadaveric dissection. Supernumerary muscles and muscle agenesis are very important from the Phylogenetic perspective (Diogo et al., 2009).

Diogo et al. (2012) reviewed the homologies of primate and human muscles, and reported that homologies of some accessory muscles of the human forearm and hand have been seen in the Chimpanzee and Loris monkey. Presence of a supernumerary muscle in the vicinity of a nerve may cause pressure neuritis (George and Nayak, 2008). There are numerous studies that have discussed the abnormality of the muscular pattern of the upper limb, and subsequently its clinical significance (Veas et al., 2016; Hasan et al., 2014; Nayak et al., 2008). In the meantime, the majority of reported variations are associated with the palmaris longus muscle (Abdolreza et al., 2015; Nayak et al., 2008). The anatomical variations can be detected by means of medical imaging devices (CT scan, MRI, etc.) in living people and via dissection in cadavers (Stein et al., 2011). In relation to the appearance of variations of FDS, rearrangement, division or migration of the primitive muscle have been theoretically proposed by Mainland (1927). As the muscular anomalies reported here are closely related to the carpal tunnel, they may be symptomatic, probably causing carpal tunnel syndrome. From the clinical perspective, identification and knowledge of muscular variations, especially in the hand region, are necessary for surgical procedures planning.

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REFERENCES

- ABDOLREZA B, SAMERE DS, MOHAJER AJ, HASAN VS, MASSOOD E (2015) The prevalence of palmaris longus absence in the city of Kerman in Iran and the relevance of age, gender and body side. *IJCRR*, 7: 45.
- AGARWAL J, ARORA N, AGARWAL A (2016) Variation in the insertion of biceps brachii muscle: A case report. *SRMS J Med Sci*, 1.
- ANITA T, KALBANDE S, ASHA K, DOMBE D, JAYASREE N (2012) A unique variation of flexor digitorum superficialis muscle and its clinical significance. *J Life Sci*, 4: 39-43.
- BERGMAN RA, AFIFI AK, MIYAUCHI R (2015) Illustrated encyclopedia of human anatomic variation: opus I: muscular system: alphabetical listing of muscles. Psoas Minor. Viewed from <http://www.anatomyatlases.org/AnatomicVariants/MuscularSystem/Text/P/Psoas.shtml> (accessed in July, 2014).
- BERNARDES A, MELO C, PINHEIRO S (2016) A combined variation of Palmaris longus and Flexor digitorum superficialis: Case report and review of literature. *Morphologie*, 100: 245-249.
- BOUDOKHANE S, KALAI A, HMIDA B, JELLAD A, FRIH ZBS (2017) An unusual cause of talipes equinovarus: agenesis of leg muscles. *Am J Phys Med Rehabil*, 96(5): e95, doi: 10.1097/PHM.0000000000000648.
- BURLAKOTI A, MASSY-WESTROPP N, WECHALEKAR H (2013) Variant third and fourth lumbrical muscles of the left hand. *Int J Anat Var*, 6: 93-95.
- CASAL D, PAIS D, BILHIM T, RIBEIRO V, CUNHA S, DAMASIO C, FERNANDES R, ALMEIDA MA, ERSE GOYRI-O'NEILL J (2011) A rare variation of the extensor indicis proprius tendon with important clinical implications. *J Morphol*, 28(3): 208-211.
- CATLI MM, OZSOY U, KAYA Y, HIZAY A, YILDIRIM FB, SARIKCIOGLU L (2012) Four-headed biceps brachii, three-headed coracobrachialis muscles associated with arterial and nervous anomalies in the upper limb. *Anat Cell Biol*, 45: 136-139.
- D'COSTA S, NAYAK SR, SIVANADAN R (2006) Anomalous muscle belly to the index finger. *Ann Anat*, 188: 473-475.
- DIOGO R, ABDALA V, AZIZ M, LONERGAN N, WOOD B (2009) From fish to modern humans—comparative anatomy, homologies and evolution of the pectoral and forelimb musculature. *J Anat*, 214: 694-716.
- DIOGO R, RICHMOND BG, WOOD B (2012) Evolution and homologies of primate and modern human hand and forearm muscles, with notes on thumb movements and tool use. *J Hum Evol*, 63: 64-78.
- DIXIT SG, KAKAR S (2010) An uncommon variation of flexor digitorum superficialis indicis, a case report: Anatomical and clinical relevance. *Clin Anat*, 23: 889-890.
- GEORGE BM, NAYAK SB (2008) Median nerve and brachial artery entrapment in the abnormal brachialis muscle—a case report. *Neuroanatomy*, 7: 41-42.
- GEORGIEV GP, JELEV L (2011) An aberrant flexor digiti minimi brevis manus muscle. *J Hand Surg*, 36: 1965-1967.
- GONZALEZ M, WHITTUM J, KOGAN M, WEINZWEIG N (1997) Variations of the flexor digitorum superficialis tendon of the little finger. *J Hand Surg*, 22: 277-280.
- HASAN R, FERNANDO EDPS, SALVIN KA, DILSHANI WMS, Niwunhella NADP, PERERA AAMMSL, WIJE-SUNDARA WMRD (2014) Accessory muscle in the flexor compartment of the forearm: A case report. *Book of Abstracts, Annual Research Symposium 2014*. <http://repository.kln.ac.lk/handle/123456789/4950>. LE DOUBLE A-F (1897) Tome second: Muscles de la hanche. In: *Traité Des Variations Du Système Musculaire de l'homme et de Leur Signification Au Point de Vue de l'anthropologie Zoologique*. Schleicher Frères, Paris, pp 99-107.
- LEE S, LANDERS KA, PARK H-S (2014) Development of a biomimetic hand exotendon device (BiomHED) for restoration of functional hand movement post-stroke. *IEEE Trans Neural Syst Rehabil Eng*, 22: 886-898.
- LOUKAS M, SOUTH G, LOUIS R, FOGG Q, DAVIS T (2006) A case of an anomalous pectoralis major muscle. *Folia Morphol*, 65: 100.
- MAINLAND D (1927) An uncommon abnormality of the flexor digitorum sublimis muscle. *J Anat*, 62: 86.
- MAS N, PELIN C, ZAGYAPAN R, BAHAR H (2006) Unusual relation of the median nerve with the accessory head of the biceps brachii muscle: an original case report. *Int J Morphol*, 24: 561-564.
- NATSIS K, TSAKOTOS G, VLASIS K, KOEBKE J (2011) The cadaver of a Caucasian man with a supernumerary fourth dorsal interosseous muscle in the right hand: a case report. *J Med Case Rep*, 5: 393.
- NAYAK S, KRISHNAMURTHY A, PAI MM, PRABHU LV, RAMANATHAN LA, GANESH KUMAR C, THOMAS MM (2008) Multiple variations of the extensor tendons of the forearm. *Rom J Morphol Embryol*, 49: 97-100.
- PAI MM, PRABHU LV, NAYAK S, MADHYASTHA S, RAJANIGANDHA VADGAONKAR, KRISHNAMURTHY A, KUMAR A (2008) The palmaris longus muscle: its anatomic variations and functional morphology. *Rom J Morphol Embryol*, 49: 215-217.
- RAMESH RT, VISHNUMAYA G, PRAKASHCHANDRA SHETTY K, SURESH R (2007) Variation in the Origin of Sternocleidomastoid Muscle. *Int J Morphol*, 25(3): 621-623.
- RAY B, SAXENA A, NAYAK S, PUGAZHENDI B, GAYATHRI B (2015) Morphometry and anatomical variations of flexor digitorum superficialis. *J Morphol*, 32: 8-11.
- ROTHWELL JC (2012) *Control of human voluntary movement*, Springer Science & Business Media.
- SLAVCHEV SA, GEORGIEV GP (2013) Aberrant abductor digiti minimi muscle found during open surgical decompression of the carpal tunnel: case report. *Rev Arg Anat Clin*, 5: 88-91.
- SOOKUR PA, NARAGHI AM, BLEAKNEY RR, JALAN R, CHAN O, WHITE LM (2008) Accessory muscles: anatomy, symptoms, and radiologic evaluation 1. *Ra-*

diographics, 28: 481-499.

STEIN JM, COOK TS, SIMONSON S, KIM W (2011) Normal and variant anatomy of the wrist and hand on MR imaging. *Magn Reson Imaging C*, 19: 595-608.

TAN JS, OH L, LOUIS DS (2009) Variations of the flexor digitorum superficialis as determined by an expanded clinical examination. *J Hand Surg*, 34: 900-906.

TRIANDAFILOU KM, KAMPER DG (2012) Investigation of hand muscle atrophy in stroke survivors. *Clin Biomech*, 27: 268-272.

VEAS JR, CONRADS PR, SILVA JB, ROMÁN-VEAS J, RUIZ-CONRADS P, BRAGA-SILVA J (2016) Accessory muscles: a cause of nerve compression in the distal forearm. Case report and literature review. *Int J Morphol*, 34(1): 97-101.

YAMADA TK (1986) Re-evaluation of the flexor digitorum superficialis. *Acta Anat Nippon*, 61: 283-298.