Long Abductor Digiti Minimi Muscle: Variation of the Hypothenar Muscles and Clinical Consequences

CHRISTIAN ALBRECHT MAY

Department of Anatomy, TU Dresden, Dresden, Germany

INTRODUCTION

Although not frequently mentioned in common Anatomy textbooks, variations of the abductor digiti minimi muscle are said to be common and might appear in up to 47% of the normal population (Harvie et al., 2004; recent review by Fadel et al., 2017). Most anatomical identifications were single reports (old reports are listed in Bergman et al., 2015); two dissection studies (29 donors by Dodds et al., 1990; 20 donors by Murata et al., 2004) revealed different variations of aberrant respectively prolonged muscle fibers of the abductor digiti minimi muscle. Variations also appear in the shape of the flexor digiti minimi muscle, which is the most inconstant of all hypothenar muscles (Murata et al., 2004; Claassen et al., 2013). Supernumerary muscles were randomly reported and often associated with the flexor digiti minimi due to their tendon insertion at the proximal phalanx (Morrison, 1916; Martin, 1981; Wahba et al., 1998; Soldado-Carrera et al., 2000; Wingerter et al., 2003; Bakinde et al., 2005; Georgiev et al., 2007; Ardouin et al., 2014; Günenç Befler et al., 2015). In only one case, the tendon of the additional muscle reached the distal phalanx (Greiner, 2008).

To study the frequency of additional hypothenar muscle bundles in a white German population and to distinguish their possible affiliation within the hypothenar, we initiated a study involving both hands of 38 human donors of two consecutive dissection courses.

RESULTS

Hypothenar Muscle Variation

The opponens digiti minimi and the abductor digiti minimi were constantly present. The postulated variation of the abductor digiti minimi muscle from the

18 male, age range 69–98 years at death). They were part of the donor program of the Department of Anatomy, TU Dresden, Germany, and had given their written consent to use their bodies for the purpose of science and education after death. They had suffered from various diseases, but in their medical history no pathologies of the hypothenar region were documented. The cadavers were fixed within 24 to 92 hr after death with arterial infusion of a mixture of formalin, glycerine, and alcohol (10% formaldehyde). The fixation process continued approximately for 1 year.

In 19 donors (10 female, age range 82–105 years at death; 9 male, age range 69–92 years at death), a semiquantitative evaluation of the variation of the hypothenar muscles was performed.

MATERIALS AND METHODS

The hypothenar region was studied in 38 human donors (20 female, age range 72–105 years at death; 18 male, age range 69–98 years at death). They were part of the donor program of the Department of Anatomy, TU Dresden, Germany, and had given their written consent to use their bodies for the purpose of science and education after death. They had suffered from various diseases, but in their medical history no pathologies of the hypothenar region were documented. The cadavers were fixed within 24 to 92 hr after death with arterial infusion of a mixture of formalin, glycerine, and alcohol (10% formaldehyde). The fixation process continued approximately for 1 year.

In 19 donors (10 female, age range 82–105 years at death; 9 male, age range 69–92 years at death), a semiquantitative evaluation of the variation of the hypothenar muscles was performed.

Key words: Hypothenar; variation; human; muscle

© 2019 The Author. Clinical Anatomy published by Wiley Periodicals, Inc. on behalf of American Association of Clinical Anatomists.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.
literature could not be confirmed in our sample. In contrast, the flexor digiti minimi showed a high variation in its shape and convergence to the other two muscles (Fig. 1). In most cases (22 of 38; 58%), the flexor digiti minimi formed one belly, which was individual in 13 cases (34%) or attached to either the abductor digiti minimi (6 cases; 16%) or the opponens digiti minimi (3 cases; 8%). In eight cases (21%), the flexor digiti minimi formed two separate bellies. Usually both bellies were well developed but either one belly or the whole flexor digiti minimi muscle was merged with either the opponens digiti minimi or the abductor digiti minimi muscle. In one case, the second belly merging with the opponens digiti minimi muscle was only poorly developed. A complete missing flexor digiti minimi muscle was observed in eight cases (21%).

Comparing the left and right side of individual donors, 10 of the 19 donors had a similar muscle arrangement on both sides, while 9 of the 19 donors showed a side difference (7 of them showed a difference between one and two muscle bellies; only 2 donors showed a difference between no flexor digiti minimi muscle on the right hand and either one or two bellies on the left hand). There was no significance or tendency for left/right side preference of any variation; there was also no difference between male and female donors.

Fig. 1. Variation in the appearance of the flexor digiti minimi muscle (F.d.m.; asterisk): (a) One belly of the F.d.m., between the Abductor digiti minimi (A.d.m.) and Opponens digiti minimi (O.d.m.). (b) Two bellies of the F.d.m. join each the A.d.m. and the O.d.m. (c) Absence of a F.d.m. [Color figure can be viewed at wileyonlinelibrary.com]

Fig. 2. Supernumerary hypothenar muscle (asterisk) at the left forearm of a 92-year-old woman. The muscle belly continues into a long tendon (circles) running parallel with the abductor digiti minimi muscle. In the lower photo, the muscle belly is flapped over to the ulnar side. [Color figure can be viewed at wileyonlinelibrary.com]

Fig. 3. Supernumerary hypothenar muscle (asterisk) at the left forearm of a 91-year-old woman. The muscle belly merges with the fibers of the abductor digiti minimi muscle (cross). The flexor digiti minimi (circles) origins separately and is flapped distally in the lower photo to better show the connection between the supernumerary muscle fibers and the abductor digiti minimi. [Color figure can be viewed at wileyonlinelibrary.com]
Supernumerary Hypothenar Muscles

Only 2 of 76 hands of 38 human donors (2.6% in the white German population studied) revealed a unilateral additional muscle located in the distal antebrachium joining the hypothenar muscles. Both donors were female. Case 1 (92 years old at death, left hand): the origin of the additional muscle was at the palmar antebrachial fascia with a short tendon-like connective tissue (Fig. 2). A palmaris longus was not present, and the palmaris brevis was well developed. The additional muscle fibers were located in the distal forearm between the superficial flexor digitorum and the flexor carpi ulnaris muscle. They formed a tendon at the level of Guyon’s canal which followed the abductor digiti minimi muscle on its radial side. Case 2 (91 years old at death, left hand): a similar muscle as in Case 1 was observed in the left forearm (Fig. 3). This time, it joined/merged the abductor digiti minimi muscle without forming its own distinct tendon.

DISCUSSION

Our study and observation of the hypothenar muscles confirmed the high variability of the flexor digiti minimi appearance (already introduced in the 19th century by Henle, 1858) but did not support common variations in the abductor digiti minimi, which might be of a more secondary appearance (Fadel et al., 2017).

Concerning the supernumerary hypothenar muscles, they could be assigned to either the flexor digiti minimi (ulnar belly) or the abductor digiti minimi. Their position seems always ulnar and superficial of the flexor retinaculum, eventually crossing to the radial side in the distal forearm. Even if these muscles are more often assigned to the flexor digiti minimi in the literature due to their individual tendon, their metacarpal course is always parallel with the abductor digiti minimi. Introducing a proper anatomical name for most of the supernumerary hypothenar muscles described here, and in the literature, would be beneficial for surgical applications. We propose the term long abductor digiti minimi muscle, which forms two subgroups with either its own tendon along the main abductor digiti minimi muscle or an amalgamation with the proximal abductor digiti minimi muscle fibers. This would take into account that the flexor digiti minimi is absent in about one-fifth of all humans and forms an inconstant intermediate between the ulnar oriented abductor digiti minimi and the more oblique oriented opponens digiti minimi. The main orientation toward the abductor digiti minimi is also supported by older ontogenic investigations (Frazer, 1908) and with modern dissecting methods (Homma and Sakai, 1992).

REFERENCES

Ardouin L, Lecooq FA, Le Nen D, Herrou P. 2014. An ultrasound diagnostic aid in hand surgery: observation on a supernumerary muscle in the wrist. Chir Main 33:401–403.
Bakinde N, Yotovski P, Voigt T, Rager G. 2005. Accessory muscle in the hypothenar region: a functional approach. Ann Anat 187:149–152.
Bergman RA, Affi AK, Miyachi R. 2015. Illustrated encyclopedia of human anatomic variation. http://www.anatomyatlases.org/ [accessed 2015].
Claassen H, Schmitt O, Schulze M, Wree A. 2013. Variation in the hypothenar muscles and its impact on ulnar tunnel syndrome. Surg Radiol Anat 35:893–899.
Dodds GAII, Hale D, Jackson WT. 1990. Incidence of anatomic variants in Guyon’s canal. J Hand Surg Am 15:352–355.
Fadel ZT, Samargandi OA, Tang DT. 2017. Variations in the anatomic structures of the Guyon canal. Plast Surg 25:84–92.
Frazer JE. 1908. The derivation of the human hypothenar muscles. J Anat Physiol 42:326–334.
Georgiev GP, Jelev L, Surchev L. 2007. Undescribed variant muscle—“deep abductor-flexor” of the little finger, in relation to ulnar nerve compression at the wrist. Ann Anat 189:276–282.
Greiner TM. 2008. An additional flexor of the fifth digit: flexor digiti minimi longus. Clin Anat 21:792–793.
Günenc Belfer C, Sargon MF, Ergakmak B. 2015. An accessory flexor digiti minimi brevis or flexor digiti minimi longus? Anatomy 9:45–47.
Harvie P, Patel N, Ostlere SJ. 2004. Prevalence and epidemiological variation of abnormal muscles at Guyon’s canal. J Hand Surg Br 29:26–29.
Henle J. 1858. Handbuch der systematischen Anatomie des Menschen. Erster Band, dritte Abteilung, Muskellehre. Vieweg and Sohn, Braunschweig.
Homma T, Sakai T. 1992. Thenar and hypothenar muscles and their innervation by the ulnar and median nerves in the human hand. Acta Anat 145:44–49.
Martin AH. 1981. An accessory hypothenar muscle. Plast Reconstr Surg 67:219–220.
Morrison JT. 1916. A palmaris longus muscle with a reversed belly, forming an accessory flexor muscle of the little finger. J Anat Physiol 50:324–326.
Murata K, Tamai M, Gupta A. 2004. Anatomic study of variations of hypothenar muscles and arborization patterns of the ulnar nerve in the hand. J Hand Surg 29:500–509.
Soldado-Carrera F, Villar-Corominas N, Rodríguez-Baeza A. 2000. An accessory belly of the abductor digiti minimi muscle: a case report and embryologic aspects. Surg Radiol Anat 22:51–54.
Wahba MY, Singh GD, Lozanoff S. 1998. An anomalous accessory flexor digiti minimi profundus muscle: a case study. Clin Anat 11:403–409.
Wingerter S, Gupta S, Le S, Shamasunder S, Bernstein R, Rabitalle W, Kukuyeva Y, Downie S. 2003. Unusual origin of the flexor digiti minimi brevis muscle. Clin Anat 16:531–533.