Reversed palmaris profundus muscle variation

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Abstract
The palmaris profundus is a variant muscle in the forearm which might lead to carpal tunnel syndrome. Due to its variable origins, courses and insertions, it has been classified into subtypes previously, and its often very close relation to the median nerve has been highlighted. Dissection of a male cadaver now uncovered a new reversed variant of this muscle which does not match any of the already described subtypes because of its unique origin from the proximal ulnar shaft and its less pronounced spatial relation to the median nerve. This case shows that there are still unknown variations, which a surgeon may come across during carpal tunnel surgery or any other surgery of the forearm and which may lead to median nerve compression.

Case Report
During the regular dissection course for medical students, which comes into existence in cooperation with the voluntary and non-profit body donation program of the University of Kiel, a new muscle variation was found in the left forearm of an adult, Caucasian, male cadaver, aged 89 years. Examination of the upper extremities showed a typical flexor digitorum superficialis and profundus, flexor carpi radialis and ulnaris, pronator teres and palmaris longus muscle on both sides. On the left side, however, an additional muscle was detected, with a fleshy muscle belly in the distal portion of the forearm,
near to the flexor retinaculum, which measured 7.5 cm in length, 2 cm in width and was 0.6 cm thick. It was located between the tendons of the flexor digitorum superficialis

Figure 1. a) Coexistence of the reversed palmaris profundus (PP) and palmaris longus muscles (PL). b) Distal muscle belly (PP), proximal tendon (T), PP attachment to the flexor retinaculum (FR) (arrows) and surrounding anatomical structures, tendons of the flexors digitorum profundus (FPM), digitorum superficialis (FSM) and carpi radialis muscles (FRM). c) Insertion of the PP into the FR and the dorsal side of the palmar aponeurosis (PA) (arrows; FR and PA have been reflected to display the deep/dorsal sides); asterisk: PP tendon passing deep to the FR through the carpal tunnel. The median nerve (MN) runs singularly deep to the PP. d) The proximal tendon (T) of PP arises from the proximal ulna as a slim structure (arrows; see also Fig. 2B).

Figure 2. a) The palmaris profundus (PP) and its innervation by a nerve branch (NB) splits off at the level of the proximal ulna (asterisk) of and relation to the median nerve (MN); proximal right, distal left. Proximal tendon of PP (T), flexor digitorum superficialis muscle (FSM), intermuscular septum (IS); the IS is attached to the tendon and feeds fibers into it. b) Display of the situation in A with a slightly different angle; the NB joins the T before entering the muscle belly. Arrows indicate the connection between T and IS.

and flexor digitorum profundus muscle and showed a long proximal tendon running down from the origin of the muscle at the ulna (Figure 1). The tendon measured 13.5 cm in length and originated at the proximal volar side of the ulna shaft and received additional collagen fibers from the intermuscular septum during its course (Figure 2). Distally the muscle belly formed a sliver that fed a part of its fibers to the flexor retinaculum on the radial side of the forearm. However, the main portion of its fibers passed through the carpal tunnel and inserted into the palmar aponeurosis from the deep side (Figure 1).

The median nerve was running separately and did not share a fascial sheath with the tendon, as previously reported by Sahinoglu et al. [9]. A thick nerve branch split off the median nerve instead, at the level of the elbow, and innervated the muscle (Figure 2). The median nerve itself followed its normal anatomical course, while the additional nerve branch joined the proximal tendon, running with it enclosed in a single fascial sheath until it inserted proximally into the muscle belly.

Discussion

The palmaris profundus is a very rare muscle, which is variable in its insertion, but especially variable in its origin. The muscle can either insert into the palmar aponeurosis, the flexor retinaculum or both with singular or multiple attachments, as the literature shows [5, 9–11]. Most of the case reports describe a palmaris profundus muscle with a proximal muscle belly and a distal tendon or a centered
Reversed palmaris profundus

References


Figure 3. Illustration of the subtypes of the palmaris profundus muscle based on the work by Yoshida et al. (1983). The pre-existing subtypes I-IV have been complemented by the new subtype V from this case report. I: Palmaris profundus longus. II: Palmaris profundus radialis with one common tendon inserting into the dorsal side of the flexor retinaculum. III: Palmaris profundus ulnaris. IV: Palmaris profundus radialis with two separate tendons inserting into the deep side of the flexor retinaculum. V: Palmaris profundus inversus ulnaris proximalis, which originates in form of a proximal tendon at the distal ulna shaft and inserts into the dorsal side of the flexor retinaculum and the palmar aponeurosis.

As mentioned above there have been several reports showing a common course of the median nerve and the palmaris profundus tendon and several studies even demonstrated that this rare muscle variation can be encased in a common fascial sheath with the median nerve. An existence of a common sheath results in closer relationship of the two different structures and therefore increases the risk of median nerve irritation even more. In our case the palmaris profundus did not share a common sheath with the median nerve. Especially its long proximal tendon was separated from it, but in close relation to the median nerve (Figure 1). Due to the unknown medical history of the body donor it is impossible to tell if the person suffered from median nerve compression. The reversed structure of the muscle and its attachment to the proximal ulnar shaft shows that there are more variants in origin, insertion, course, and relation to the median nerve than there are described so far (Figure 3). Furthermore it shows that there are still undiscovered variations of the palmaris profundus muscle a surgeon may come across during surgery of the forearm.

Acknowledgement

Our thanks to the body donors of the voluntary and non-profit body donation program at CAU Kiel for their invaluable contribution and to Stefanie Gundlach, Thomas Benecke and Arndt Gundlach for their excellent technical assistance in the gross anatomy lab.

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