

CASE REPORT

Duplicated Palmaris Longus Muscle with Insertion onto the Transverse Carpal Ligament: A Case Report

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Abstract

The palmaris longus muscle is one of the most anatomically variable muscles in the human body, with incidence ranging from 15-63.9%. While these anatomical variations are typically benign, they are of clinical importance as they can contribute to neurovascular and biomechanical dysfunction. We report here a relatively rare

variation of a duplicated palmaris longus muscle with an insertion onto the transverse carpal ligament found during cadaveric dissection in a graduate anatomy course for physical and occupational therapy students. The prevalence of a duplicated palmaris longus is approximately 2%. While palmaris longus variations are frequently asymptomatic, a duplicated palmaris longus with an insertion onto the transverse carpal ligament may elevate the risk for carpal tunnel syndrome.

Key Words: *Anatomic variation; Clinical significance; Duplicate; Palmaris longus; Transverse carpal ligament*

Introduction

The palmaris longus muscle (PL) is a thin, superficial spindle-shaped muscle in the anterior or flexor compartment of the forearm, located between the flexor carpi ulnaris and flexor carpi radialis muscles [1-3]. It shares a common flexor origin at the front of the medial epicondyle of the humerus with the pronator teres, flexor carpi radialis, flexor carpi ulnaris, and flexor digitorum superficialis muscles. The PL typically inserts onto the apex of the

palmar aponeurosis, with occasional slips into the antebrachial fascia and flexor retinaculum [1,3]. It is innervated by the median nerve via the C7 and C8 nerve roots [1,3]. Although the PL weakly assists with wrist flexion, its primary function is to anchor the palmar aponeurosis [1,3].

The PL is one of the most anatomically variable muscles in the human body, with incidence ranging from 15-63.9% [2-4]. These variations include reversal (inversus muscle),

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duplication, triplication, bifurcation, accessory (additional) slips, and complete absence [4]. These anatomical variations tend to be more common in females and have been shown to have clinical sequelae [3,5]. An absent PL is the most common variation, with approximately 15% of people across all populations presenting without a PL on one or both sides [1,3]. The PL tendon is the most frequently harvested tendon for reconstructive plastic and hand and elbow surgical procedures due to its long, flat tendon and short muscle belly [6,7]. It is used as a surgical landmark to identify the median nerve [3]. While there are no significant differences in grip or pinch strength in subjects with or without a PL [6], other PL variations are believed to contribute to clinical syndromes. A duplicated or reversed PL can cause stress to adjacent anatomical structures, such as the median nerve, ulnar nerve, ulnar artery, anterior interosseous artery, and/or the palmar fascia [4]. These stressors may contribute to clinical syndromes including carpal tunnel syndrome and/or Guyon's canal syndrome [8,9].

A relatively rare variation of the PL is duplication, which occurs in approximately 2% of the population [2,10,11]. An even rarer variation is a PL inserting onto the transverse carpal ligament (i.e., deep flexor retinaculum), however the true incidence of such cases are unknown due to the inconsistent terminology used when describing PL insertions [11-13].

There is inconsistent terminology in the literature when reporting PL insertions as the anatomical terms 'transverse carpal ligament' and 'flexor retinaculum' are used synonymously [11-13]; however, these are distinct anatomical tissues with different histological characteristics. The flexor retinaculum is continuous with, and a reinforcement to, the antebrachial fascia. The transverse carpal ligament is histologically similar to a ligament and connects the hamate

and pisiform to the scaphoid and trapezium [14]. The present study reports a case of a duplicate PL with insertion of one slip onto the transverse carpal ligament, and insertion of the second slip onto the palmar aponeurosis, found during cadaveric dissection in a graduate anatomy course for physical and occupational therapy students.

Case Report

A female, Caucasian cadaver, with unknown cause of death, was obtained by the University of Texas at El Paso for cadaveric dissection. The cadaver exhibited no significant surgical history and presented with an average height and weight upon postmortem examination. The presence of two muscles with characteristic features of the PL was discovered during anterior forearm dissection of left upper extremity. Normal anatomy was present in right upper extremity. On the left side, both the radial and ulnar PL originated from the medial epicondyle of the humerus. The radial PL had a small, thin muscle belly, which transitioned into a long tendon at the junction of the proximal and middle thirds of the forearm and inserted onto the palmar aponeurosis (Figures 1 and 2). The ulnar PL had a thicker muscle belly, which transitioned into a broader tendon mid-way down the forearm (Figure 1) and inserted onto the transverse carpal ligament (Figure 2).

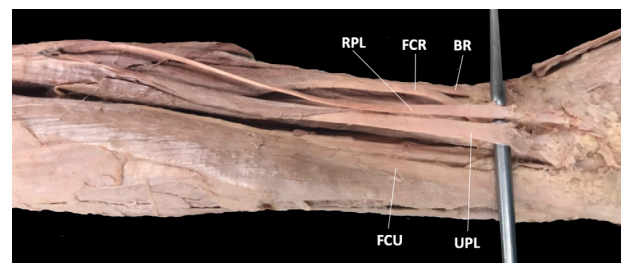


Figure 1) Dissection of the left anterior forearm highlighting the duplicated palmaris longus muscle (displayed by probe), radial palmaris longus muscle (RPL), ulnar palmaris longus muscle (UPL), brachioradialis (BR), flexor carpi radialis (FCR), and flexor carpi ulnaris (FCU).

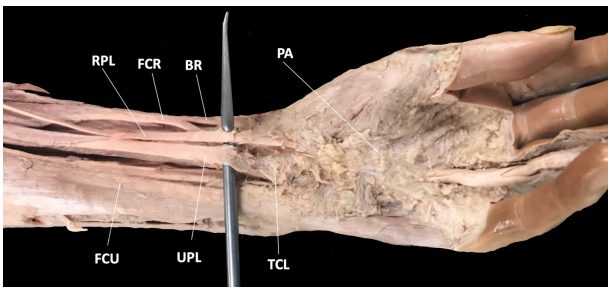


Figure 2) Dissection of the left anterior wrist highlighting the insertions of the radial palmaris longus muscle (RPL) onto the palmar aponeurosis (PA) and the ulnar palmaris longus muscle (UPL) onto the transverse carpal ligament (TCL). Brachioradialis (BR), flexor carpi radialis (FCR), and flexor carpi ulnaris (FCU) are shown.

Discussion

A duplicated PL is relatively rare, with a prevalence of approximately 2% [2,10,11]. It is possible that the true prevalence of duplicated PLs is higher than reported. Numerous variations to the insertion of the PL have been reported in the literature, including insertion onto the thenar eminence [15,16], hypothenar eminence [16], and fifth metacarpal [7]. This case reports a rare case of the PL inserting onto the transverse carpal ligament. PL variations are frequently asymptomatic and incidentally discovered either intra-operatively or post-mortemly. Symptomatic PL variations can present with neurological compromise, vascular sequelae, and biomechanical effects [4]. Although these complications are believed to be rare, PL variations should be considered in the differential diagnosis of wrist and hand syndromes. Surgeons and clinicians should be aware of these variations during surface palpation and when harvesting the PL tendon for surgical procedures. Additionally, a duplicated PL, as well as the aforementioned PL variations, may cause difficulties in radiological image interpretation [4]. The long tendon and short muscle belly of the PL indicates that it is phylogenetically a retrogressive muscle [3]. From an evolutionary perspective, the PL was well developed in mammals that used forelimbs for ambulation (i.e., orangutan) or claws for catching prey (i.e., cats). As evolution proceeds, the forelimbs become a prehensile

organ and the function of the PL is taken over by the intrinsic musculature of the hand, leading to retrogression of the PL into a small muscle belly and long tendon [17]. Its common absence is an indication of its gradual disappearance in humans [4], which may lead to more frequent variations in future generations. The retrogressive nature of the PL is concerning due to its surgical utility.

Due to the duplicated PLs and an insertion onto the transverse carpal ligament in this case, it is suspected that this anatomical variation may elevate the risk for carpal tunnel syndrome. Tension on the transverse carpal ligament with muscle contraction may directly decrease the cross-sectional area in the carpal tunnel, increasing the pressure on the median nerve [17-20]. However, this elevated risk for carpal tunnel syndrome is debatable. There is evidence that palmarly directed forces to the transverse carpal ligament can increase carpal tunnel cross-sectional area [21].

Conclusion

The PL is one of the most variable muscles in the human body. While a duplication of the PL with insertion onto the transverse carpal ligament is rare, it should be considered with any patients presenting with wrist and hand dysfunction. This variation may contribute to clinical syndromes, cause difficulties with radiological imaging interpretation, and lead to surgical challenges when harvesting the PL tendon for surgical procedures. This case reports a duplicated PL with a rare insertion onto the transverse carpal ligament.

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