



Clinical Significance of a Duplicated Palmaris Longus Muscle with One Reversed Muscle: A Case Report

Adegbenro Omotuyi John Fakoya^{1*}, Jordan D'Souza², Andrea Mary Thomas Kallumadyil², Tess McClenahan², Allyson Talaroc², Ananya Vungarala², Abayomi Gbolahan Afolabi¹, Thomas McCracken¹, David Otohinoi³

¹Department of Anatomy, University of Medicine and Health Sciences, Basseterre, St. Kitts and Nevis; ²Medical student, University of Medicine and Health Sciences, Basseterre, St. Kitts and Nevis; ³Department of Research, All Saints University College of Medicine, Arnos Vale, St. Vincent & Grenadines

Abstract

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***Correspondence:** Adegbenro Omotuyi John Fakoya, Department of Anatomy, University of Medicine and Health Sciences, Basseterre, St. Kitts and Nevis. E-mail: gbenrofakoya@gmail.com

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BACKGROUND: Multiple variations of the palmaris longus (PL) muscle are reported throughout literature and include variations such as double muscle bellies, inversion of muscle belly and tendon, and the absence of the muscle. The muscle functions as a weak flexor of the wrist. It originates from the medial epicondyle of the humerus, projects as a superficial muscle of the anterior compartment of the forearm, lies over the transverse carpal ligament, and inserts into the palmar aponeurosis.

CASE REPORT: Routine dissection of the right forearm of a 70-year-old Caucasian male revealed a rare duplicated PL muscle with the medial PL muscle being reversed. The left forearm appeared normal, with no such variations. The cadaver showed no significant pathological findings due to this variation. Innervation and vasculature of the variant muscle appeared normal.

CONCLUSION: The PL muscle is highly variable, and clinicians need to be aware of its many possible presentations due to its involvement in surgery, symptomatic clinical presentations, and as an anatomical landmark.

Introduction

The palmaris longus (PL) is a superficial muscle of the anterior compartment of the forearm. Its muscle body originates at the medial epicondyle of the humerus and projects over the transverse carpal ligament to insert its tendon into the palmar aponeurosis [1]. The PL is located superficially to the flexor digitorum, medial to the flexor carpi radialis, and lateral to the flexor carpi ulnaris [2].

Through comparative anatomy, the common function of the PL among human and non-human primates is to flex the wrist. The strength of the muscle decreases as you progressively compare the ancestral genera of primates to more derived primate species, supporting claims of phylogenetic regression of the PL through evolution [2], [3]. Subsequently, in the evolutionarily derived human primate, the PL muscle is less developed and is one of the most morphologically variable muscles of the upper limb [4], [5].

Reimann *et al.* documented most variations of the PL [6]. The most common variation of the PL is bilateral

or unilateral agenesis. Around the world, the prevalence rate of absence ranges from 1.5% to 63.9% [7]. Although, the absence of PL is not easily noticed by individuals due to the compensatory flexors in the anterior compartment of the forearm [8]. Other frequently observed variations of the PL include bifurcation of the distal tendon, bifurcation of the proximal insertion, insertion into adductor pollicis brevis, and multiple reversed heads [4], [9]. These observations provide insight into the vast potential of variations possible of the PL as its function continues to regress through primate evolution.

Variations in the distal aspect of the PL are clinically significant due to its proximity to both the median and ulnar nerve. Compression of the median and ulnar nerve by the PL can lead to symptoms of carpal tunnel syndrome and Dupuytren's contracture, respectively [5], [10]. Furthermore, awareness of different variations is essential to prevent misidentification and accidental damage to the muscles of the forearm during surgical exploration [5].

The purpose of this case report is to explore a rare unilateral PL variation: The duplication of the PL, where one is normal, and one is reversed. To the best

of our knowledge, this exact variation has only been documented once in the literature [3]. This case report will furthermore attempt to describe the PL variation and hypothesize possible clinical significance by examining the current literature.

Case Report

The PL variation was found during the dissection of a 70-year-old Caucasian male cadaver, at the University of Medicine and Health Sciences, St. Kitts. During dissection, the left upper limb was deskinning from the shoulder down to the distal portion of the antebrachium. Removing the superficial fascia revealed the double PL variation in the anterior compartment. Furthermore, one of the two muscle heads was reversed (Figure 1).



Figure 1: Unilaterally duplicated palmaris longus variation with one reversed muscle. FCR: Flexor carpi radialis, L-PL: Lateral palmaris longus, M-PL: Medial palmaris longus, ME: Medial epicondyle

The lateral muscle head resembled a normal PL muscle; a short proximal tendon originating on the medial epicondyle, a short muscle belly, and a long distal tendon inserting onto the palmar aponeurosis [11] (Figure 1). In contrast, the reversed (medial) PL had a long proximal head originating on the medial epicondyle, a short muscle belly, and a short distal tendon inserting into the palmar aponeurosis (Figure 2).

Despite having a PL variation, the vasculature and innervation of the muscles were normal, consisting of branches of the ulnar artery and the median nerve, respectively [12].

Discussion

Agenesis occurs in about 10% of the world's population, despite the variation observed among different races and genders [6]. As noted in Table 1, the variation discussed in this case report has only been documented once.

The cadaver's left forearm presented with a duplicate PL muscle with its medial head in reversed

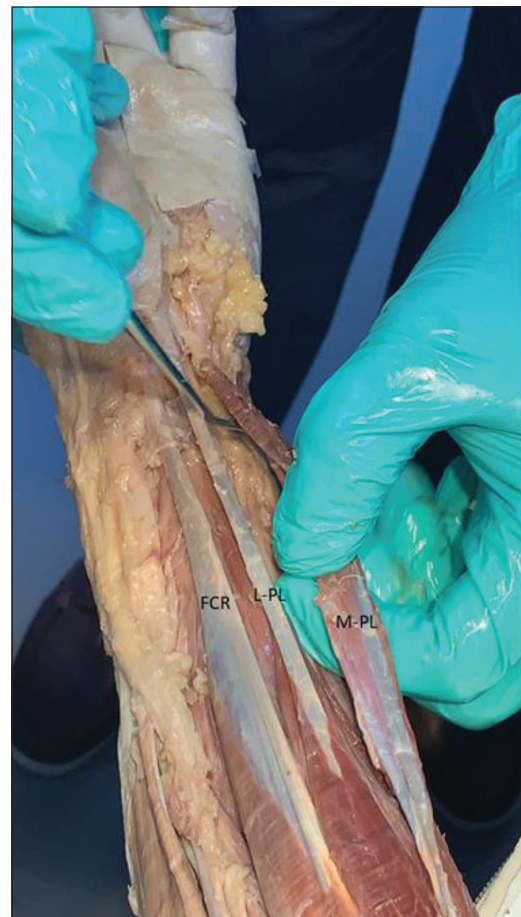


Figure 2: Distal tendons of the reversed palmaris longus muscles; the lateral muscle having a completely tendinous insertion and the other a musculotendinous insertion. FCR: Flexor carpi radialis, L-PL: Lateral palmaris longus, M-PL: Medial palmaris longus

Table 1: Documented variations of the palmaris longus muscle

Palmaris longus variations	References
Agensis	Reimann <i>et al.</i> (1944) Troha <i>et al.</i> (1990) Ceyhan and Mavt (1997) Thompson (2001) Sebastin <i>et al.</i> (2005) Kapoor <i>et al.</i> (2008) Pai <i>et al.</i> (2008) Kigera and Mukwaya (2011)
Duplication/triplication	Yammine (2013) Macalister (1875) Reimann <i>et al.</i> (1944) Mori (1964) Georgiev <i>et al.</i> (2009)
Reversed muscle-tendon orientation	Macalister (1875) Meyer and Pflaum (1978) Giunta <i>et al.</i> (1993) Ninkovic <i>et al.</i> (1995) Depuydt <i>et al.</i> (1998) Pai <i>et al.</i> (2008) Georgiev <i>et al.</i> (2009) Tcoon <i>et al.</i> (2017)
Duplication/triplication with reversed muscle-tendon orientation	Bhashyam <i>et al.</i> (2017) Schlafly and Lister (1987) Yildiz <i>et al.</i> (2000) Natsis <i>et al.</i> (2007) Salgado <i>et al.</i> (2012) Longhurst <i>et al.</i> (2019)
Duplicate PL with reversal of muscle-tendon orientation in one muscle	Pai <i>et al.</i> (2008)
Digastric muscle	Our study
Reversed PL with abductor digiti minimi	Macalister (1875)
PL with the intermediate orientation of muscle	Georgiev and Jevlev (2017)
PL profundus	Kachlik <i>et al.</i> (2016)
Multiple tendinous insertions of PL	Floyd <i>et al.</i> (1990) – bilateral Dyreby <i>et al.</i> (1982)
	Kumar <i>et al.</i> (2006)

PL: Palmaris longus

position. This variation was unilateral, as there were no observations of anomalies in the right PL. PL variations may result in carpal tunnel syndrome by compression of the median nerve due to the PL's close relationships to the transverse carpal ligament and median nerve [14]. Thus, the proximity of the reversed muscle head to the wrist may have elevated the risk of carpal tunnel syndrome in this cadaver from possible compression of the transverse carpal ligament, median nerve, and other contents of the carpal tunnel.

The variation of the PL may have compromised its function as a weak flexor of the wrist. However, because other muscles of the anterior forearm compartment can flex the wrist, it is unlikely that this action was altered. Neither head appeared atrophied on observation; therefore, it is likely the muscles performed their normal function, with neither muscle head favored over the other.

In case reports of pain during physical activity, such as swimming, due to the reversal of the PL, surgical resection relieved the pain entirely after failed attempts of non-operative therapies [15]. Considering our cadaver presented with one head reversed and one head in the normal position, it is unclear whether it would have caused pain during physical activity involving frequent flexion of the wrist.

While the PL muscle may have originally been involved with flexion of the metacarpophalangeal joints, its current mechanical role is that of a collateral wrist flexor [16]. The nominal wrist flexor role makes the PL a popular tendon graft source. The variation discussed

in this case report presents an additional source for tendon grafts.

Conclusion

The case described above is the second case of its type. It is imperative for surgeons and other health-care providers to be aware of possible complications regarding common variations of the PL as it is clinically important for tendon grafting in surgery, symptomatic clinical presentations, and an anatomical landmark.

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