CASE REPORT

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A unique case of mid-tendon palmaris longus muscle – dissection presentation and literature review

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SUMMARY

The palmaris longus (PL) muscle is one of five muscles that originates from the common flexor tendon, which attaches at the medial epicondyle of the humerus, and has its own insertion distally into the palmar aponeurosis. Although the PL contributes minimal biomechanical function, its wide anatomic variation can produce pathologies in the forearm and wrist such as median nerve entrapment. The present work describes a unique case of a PL distally migrated muscle belly with wide tendon both proximal and distal not noted in other anatomical or surgical reference materials. Herein, the current case is compared to previously reported PL variations and their documented frequencies by region and ethnicity. Key findings include several studies showing Caucasian populations with greater than 25% frequencies of absent PL, compared to 4-6% in African regions. Potential explanations for this finding include evolutionary adaptations associated with manual labor and need for increased grip strength. In addition, the considerations of abnormal PL in surgical procedures inclusive of challenges in graft procedures that might present with such anatomic variations of the PL are examined.

Key words: Anatomy – Graft – Muscle Palmaris Longus – Dissection – Tendon – Wrist flexors

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Abbreviations:
Palmaris Longus (PL)
Flexor Carpi Ulnaris (FCU)
Flexor Carpi Radialis (FCR)

INTRODUCTION

The palmaris longus (PL) is one of five muscles that originate from the common flexor tendon, which attaches at the medial epicondyle of the humerus, and has its own insertion distally into the palmar aponeurosis. The smallest of the wrist flexors, the PL lies medial to the flexor carpi radialis (FCR) and lateral to the flexor carpi ulnaris (FCU). Although the PL contributes minimal biomechanical function, its wide anatomic variation can produce pathologies in the forearm and wrist such as median nerve entrapment (Olewnik et al., 2017). It can also cause discomfort and pain in the forearm or palm of the hand due to age related calcification. This can lead to the development of a brittle and potentially shortened PL muscle resulting in pain, and decreased range of motion (Olewnik et al., 2017). These variations include absent PL, bifurcated, and trifurcated, as well as reversed PL with a distal muscle belly (Olewnik et al., 2017; Soltani et al., 2012). Moreover, the PL assumes

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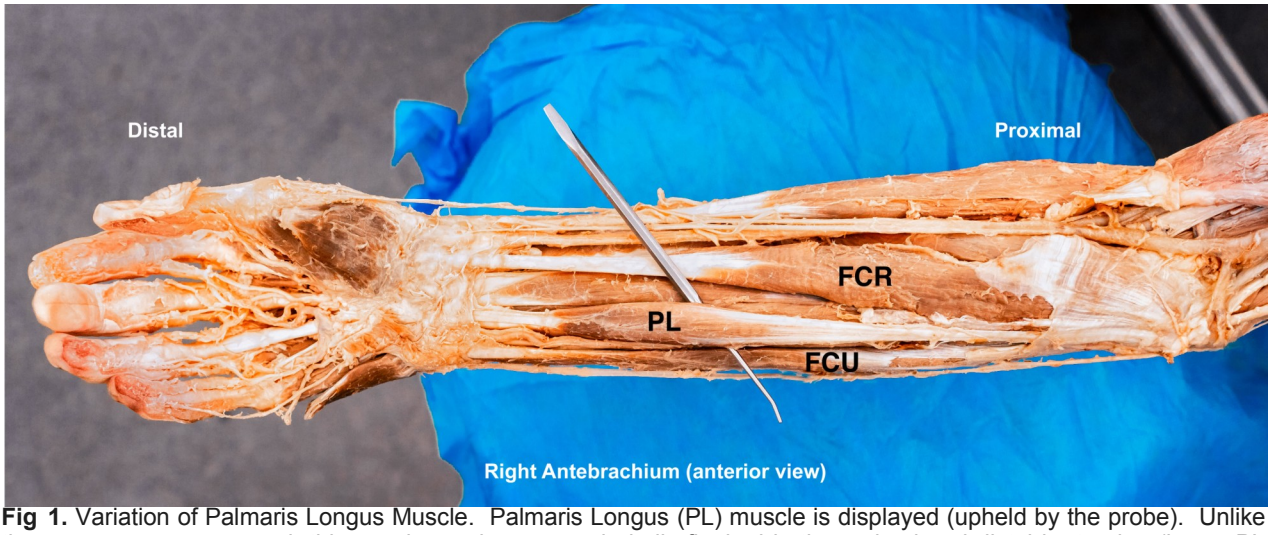

Fig 1. Variation of Palmaris Longus Muscle. Palmaris Longus (PL) muscle is displayed (upheld by the probe). Unlike the more common reversal, this specimen shows muscle belly flanked both proximal and distal by tendon (i.e., a PL distally migrated muscle belly with wide tendon both proximal and distal). FCR: flexor carpi radialis; FCU: flexor carpi ulnaris.

great importance in use as a donor tendon for transfer or transplant (Kapoor et al., 2008). Not only is it used in reconstructive hand surgery, but it also has use in cleft palate reconstructive surgeries (Ramakrishana et al., 1988). It is important to identify the morphological variation of the PL, as the quality of the harvested tendon for graft or transplant may depend on the variant of the muscle and tendon (Olewnik et al., 2018).

The present work reports a case of a unique PL with a distally migrated muscle belly and wide tendinous insertion. Further, the existing literature regarding anatomic variations of the PL, their documented frequencies, and PL considerations in surgical procedures, are discussed.

CASE PRESENTATION

Dissection of human cadaveric specimens took place at Nova Southeastern University as part of the summer anatomy fellowship for the Kiran C. Patel College of Osteopathic Medicine. A total of 20 anatomical donors were examined for reversed PL muscles, 9 females and 11 males with age range of 50-103 years (females: 77-103 years; males: 50-97 years). The donors in this cohort had a history of diabetes mellitus type II. None had a history of pathological, malignant or chronic muscle disease or disorder.

In a single 77-year-old, Caucasian male cadaver with hypertension and COPD, the right PL demonstrated a distally migrated muscle belly with tendon on either side (Fig. 1). The distal tendon of this PL is as wide as the muscle belly, with almost no tapering observed before insertion into the palmar aponeurosis. The contralateral PL was absent. Other musculature of the right and left arms appeared “grossly” normal (histologic examination was unable to be performed), with no demonstration of atrophy or distinct anatomic variation. No nerve entrapment or other pathology was observed.

DISCUSSION

Epidemiology

A literature survey was done to identify factors that correlate to variations from the normal anatomy of the PL muscle. These studies have suggested correlations of variations in the PL muscle not only between races, but also with relationship to gender, symmetry, and overall absence of the PL (Thompson et al., 2001; Mbaka and Ejiwunmi, 2009; Kigera and Mukwaya, 2011; Soltani et al., 2012). Population studies of Caucasian, Turkish, and Asian Indian subjects have documented an increased incidence of the absence of the PL muscle of 25%, 26.6%, and 28% of the respective cohorts examined (Thompson et al., 2001; Kose et al., 2008; Sankar et al., 2011). In contrast, population studies of Yoruba Nigeria, and East African peoples showed a significantly lower occurrence of the absence of the PL muscle determined to be 6.7% and 4.4% respectively (Mbaka and Ejiwunmi, 2009; Kigera and Mukwaya, 2011; Soltani et al., 2012). Soltani et al. (Soltani et al., 2012) also documented a decreased prevalence of absence of PL (or 2.9%) as compared to Caucasian and Hispanic reference groups. Since the PL assists in the flexion of the anterior forearm, it is reasonable to suggest that in populations where there is a prevalence of manual labor and activities involving handgrip and hand flexion strength, evolution of human anatomy would result in an increased prevalence of present and unique PL (Kayode et al., 2008).

One limitation in prior investigations examining factors influencing anatomical variation in, or ab-

sence of, PL muscle is that genetic data and family lineage were not studied in addition to declared ethnicity or geographic origin (Thompson et al., 2001; Mbaka and Ejiwunmi, 2009; Kigera and Mukwaya, 2011; Soltani et al., 2012). To fully evaluate and understand the statistical significance between gender and asymmetry within and between subject populations, such investigations are needed in order to formulate a complete epidemiologic picture of PL muscle variations.

Clinical Considerations

The PL tendon is often the first choice for tendon grafts needed in reconstructive surgery of the hand (Wolfe et al., 2016). Many surgeons choose this tendon because its length and diameter fit the parameters of the surgery (Sunil et al., 2015; Wolfe et al., 2016; Getzmann and Schweizer, 2018). Additionally, PL muscle and tendon can be used in surgical transposition grafting to restore partial or full function to an affected region of a patient without any loss of function of the upper extremity in the same patient (Sunil et al., 2015). This makes the PL tendon is the ideal choice for tendon grafts in replacements of long extensors and flexors of the fingers and thumb such as the extensor pollicis longus muscle (Sammer, 2014). However, distal insertion of the PL tendon can also vary, including the abductor digiti mini muscle and pairing to neighboring tendons such as the flexor carpi radialis. As such, the possibility of these anomalies also need to be taken into consideration during surgical, dissection procedures (Sunil et al., 2015).

The PL muscle has also been used in a variety of facial reconstructive surgeries. For example, cleft palate reconstructive surgeries have a high incidence of velopharyngeal incompetence. In a study of postoperative cleft palate patients who had incompetence due to failure of wall movement responsible for the closure of the velopharyngeal port, a circumferential sling pharyngoplasty was performed using a denervated PL muscle. This procedure narrowed the port circumferentially. Once these patients were reevaluated, improvement was noted (Ramakrishana et al., 1988). This wide array of use makes the PL muscle favorable in using it for reconstructive surgeries.

The counterpart of the PL muscle is the plantaris muscle, this muscle may play an important role in the development of Achilles, plantaris, or calf pain syndromes (Olewnik et al., 2018). Further sonographic classification of the plantaris tendon anatomy and motion needs to be conducted in order to classify physiologic from pathologic states. This type of classification can be extrapolated to the PL muscle (Olewnik et al., 2017). This would allow for greater use between the homologous muscles and tendons in areas such as reconstructive surgery.

Various attachments of the PL tendon can cause inflammation of the palmar aponeurosis, which mimics other processes such as Dupuytren's contracture and compression of the median or ulnar nerves (Olewnik, et al., 2017). In these cases, the variations in insertion (or distal attachment) can cause adverse effects in routine grafting procedures (Twoon et al., 2017). Thus, it is critical that surgeons do not ignore somewhat trivial, anatomic features of the PL muscle such as dimensions and distal attachments, so that surgical procedures of the upper extremity and the muscle can be modified accordingly for optimal patient outcomes. Additionally, knowledge of PL anatomy and associated anatomic variations are essential for its use as a landmark for local anesthesia of the median nerve (Twoon et al., 2017; Pires et al., 2018, Olewinik et al., 2017). Similar to recommendations for the plantaris muscle in some podiatric procedures, it may also be important to emphasize the need for sonographic classification of the PL before beginning surgery or applying anesthesia (Andring et al., 2018). This should be done to differentiate normal from pathologic findings; to fully identify anatomic variations, and to identify risk factors associated with the presentation of clinical symptoms (Getzmann and Schweizer 2018).

Surgery of the PL can also be indicated when variations are causing effort-related pain with or without median or ulnar nerve paresthesia, as seen in the case report by Getzmann and Schweizer (Getzmann and Schweizer, 2018). When medical management without surgical intervention was ineffective in treating a 14-year-old, Caucasian female for symptoms of right volar forearm pain associated with activity, surgical removal of the muscle belly from a reversed PL was done. Subsequently, this patient had resolution of symptoms, restoration of range of motion and no recurrent pain (Getzmann and Schweizer, 2018). This case reported by Getzmann and Schweizer (Getzmann and Schweizer, 2018) shows that continued study and identification of variable PL, such as the one found here, can be used to help minimize and predict procedural complications in operative patients.

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