



Original Article:

Palmaris Longus Muscle in the South Indian Population – A Cadaveric Study

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Abstract: Introduction: Palmaris longus, one of the superficial flexor muscles of the anterior compartment of the forearm is the most variable muscle of the upper limb. Purpose: To note the variations of palmaris longus for tendon grafts. Methods: Forty formalin-fixed upper limb specimens of South Indian population were dissected to note the variations of Palmaris longus muscle. Results: Out of the forty upper limb specimens, two variants of the palmaris longus were noted. In one specimen, a reversed palmaris longus was noted. It had a long tendinous origin with a muscle belly and a short flat tendon at insertion. The tendon inserted partly into the flexor retinaculum and partly into palmar aponeurosis. In another specimen, apart from the normal palmaris longus muscle, an additional smaller muscle was noted. It was the Palmaris profundus. This muscle took origin in the form of a tendon from the middle of the shaft of the radius, continued as a muscle belly and then terminated as a tendon which later inserted into the flexor retinaculum, close to the tendon of palmaris longus muscle. At its insertion, the superficial palmar branch of radial artery hooked it. The anterior interosseous nerve supplied the Palmaris profundus. Conclusion: These variations are worthy to be noted for tendon grafts.

Key Words: Anterior interosseous nerve, graft, palmaris longus, tendon, upper limb

Introduction:

Palmaris longus (PL), a superficial muscle of the flexor compartment of the forearm is phylogenetically classified as a retrogressive muscle i.e. a muscle with a short belly and a long tendon and is often described as one of the most variable muscles in the human body.(1-3) PL arises in common with the other superficial flexors from the medial epicondyle of humerus and forms a long slender tendon. The tendon lies medial to the flexor carpi radialis and passes superficial to the flexor retinaculum and continues with central part of palmar aponeurosis. PL is innervated by the median nerve and it is a

weak flexor of the wrist joint. Numerous variations of the PL have been reported in both morphology and number.(1,2,4) PL is significant as it can be used in procedures like tendon transfers and grafts such as ptosis correction, lip augmentations.

The present study aimed to note the absence and structural variations of PL muscle.

Materials and Methods

The study was conducted under the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. In this study, forty formalin-fixed upper limb specimens of South Indian population were dissected and observed. We noted the gross structural variations of the PL. The variant muscles were measured using a digital caliper (Aerospace 150 mm) with a resolution of 0.01 mm and photographed with camera resolution 0.9MP1504 × 608.

Results

Out of the forty upper limb specimens, the absence of PL was observed in 6 specimens. Besides an absence of PL in one of the left upper limb specimen of a male cadaver, a reversed palmaris longus (RPL) with a long tendon of origin (proximal tendon) and a short tendon of insertion (distal tendon) was noted (Fig. 1).

The proximal tendon was 11.6 cm long, and the distal tendon was 0.9cm long. The maximum width of the muscle belly was 2.4 cm. The second variation noted in a right upper limb specimen belonging to a male cadaver was that, apart from the normal PL, a Palmaris profundus (PP) was observed (Fig. 2). This specimen also exhibited a proximal tendon of origin and a distal tendon of insertion. The proximal tendon took origin from the anterolateral aspect of the middle of the shaft of the radius at the point where the pronator teres muscle inserted. It measured 3.76 cm (Fig. 3).

The muscle belly of PP passed medially deep to the tendon of flexor carpi radialis and superficial to the flexor digitorum superficialis and lied lateral to the tendon of normal PL. This tendon inserted into the flexor retinaculum. It measured 1.4 cm. The maximum width of the muscle belly was 0.98 cm. At its insertion, the distal tendon was hooked by the superficial branch of radial artery which was contributing to the superficial palmar arch (Fig. 4). The anterior interosseous nerve innervated PP.



Fig 1. Left upper limb showing Flexor carpi radialis (FCR), Reversed palmaris longus (RPL), Flexor digitorum superficialis (FDS), T1 – proximal tendon of RPL, T2 – distal tendon of RPL, Flexor retinaculum (FR), Palmar aponeurosis (A).



Fig 2. Right upper limb showing Flexor carpi radialis (FCR), Palmaris longus (PL), Pronator teres (PT), Palmaris profundus (PP), Flexor retinaculum (FR), Palmar aponeurosis (A), white arrow – anterior interosseous nerve supplying PP.

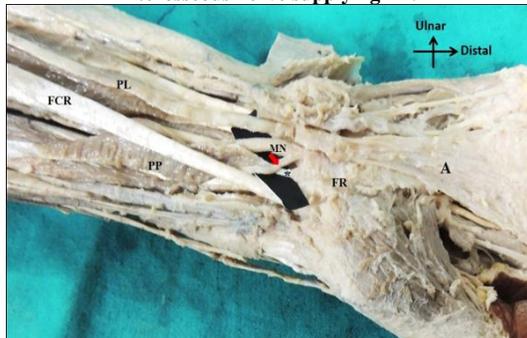


Fig 3. Right upper limb showing Flexor carpi radialis (FCR), Palmaris longus (PL), Palmaris profundus (PP), Median nerve (MN), Flexor retinaculum (FR), Palmar aponeurosis (A), red arrow – anterior interosseous nerve supplying PP, * - tendon of PP.

Discussion

PL is a phylogenetically degenerated metacarpophalangeal flexor.(5) Initially, this muscle was thought to be a flexor of the proximal phalanges passing just above the flexor digitorum superficialis and splitting around them to be attached to the proximal phalanges.(6)

PL could vary in its morphology and number and this has been reported by many authors earlier.(1,3,4,7,8) The variations reported ranged from an absence of PL which is a known fact (9) to the presence of a proximal tendon or it may have a central belly which is fleshy with proximal and distal tendons, it may be digastric or fleshy throughout or its tendon may be split and sometimes it may degenerate to such an extent that it may be simply represented by a tendinous band.(8) When it is tendinous proximally and has a fleshy distal belly, it is called reverse palmaris longus or palmaris longus inversus.(10) Our case reports a similar finding where the muscle presented a proximal tendon, an intervening muscle belly that continued to form a flat aponeurosis. Cope et. al., reported a case of right-sided, RPL with median nerve compression in an eighty-year-old female cadaver who had worked as a machine operator for 45 years.(10) In that case, the proximal tendon was 9 cm long whereas in our case it was 11.6cm long. Knowledge of the length of the variant muscles tendon would aid the surgeon in case of requirement of a tendon graft. Murabit et al., reported a similar finding of an RPL and stated in a few cases it could divide into separate muscular slips and get attached to flexor retinaculum, or onto the flexor carpi radialis tendon and volar carpal ligament. The muscle belly of an RPL could undergo hypertrophy due to repetitive actions and along with the unyielding nature of the antebrachial fascia, could lead to effort related compartment syndrome.(11) The absence of PL has been described as ranging from a high of about 25% to 16% in white Caucasians (12-14) which is what we found 15%, to a low of 4% in mongoloids.(15,16)

Another rare variation is the PP muscle. This was described by Bergmann et al, in 1988 as an additional muscle in the anterior forearm compartment taking origin from the radius along its lateral edge and along its course passes lateral to the flexor digitorum superficialis and beneath the pronator teres. The tendon passes beneath the flexor retinaculum and broadens in the palm of the hand and finally inserts into the deep side of the palmar aponeurosis.(17) Pirola et al, proposed three main subtypes of PP based on its origin from the radius, the flexor digitorum superficialis and from the ulna.(18) According to Stark et. al., PP takes origin from the middle of the shaft of radius along its anterolateral aspect and its insertion is into the palmar aponeurosis.(19) The present case was partially like this case. The PP had a similar origin. The muscle belly passed obliquely superficial to the flexor digitorum superficialis but deep to the tendon of flexor carpi radialis and then formed a tendon lateral to the tendon of PL. The PP tendon is finally inserted onto the flexor retinaculum. It must be noted that PP in our study, was seen in the presence of normal PL. The innervation of PP was by the anterior interosseous nerve, and the superficial branch of the radial artery hooked around this muscle close to its insertion. The presence of PP along with this relation of the superficial branch of the radial artery being reported is rare.

There have been many studies conducted and review of literature done in the absence of PL nationwide and it has been studied keeping in mind the gender, age, and laterality to draw a conclusion if there is any incidence with relation to these factors. Our study lacks in this aspect, however, the two variants observed were seen in male cadavers, RPL in the left upper limb and the PP noted in the right upper limb.

RPL has been associated with the compression of median nerve in patients performing repetitive work tasks.(20-22) Patients with reversed palmaris longus will present with pain and swelling in the wrist. Such patients may also complain of compartment syndrome as in carpal tunnel and Guyon's canal.(23)

Insertion of the PP may cause compression of the median nerve producing carpal tunnel-like syndrome.(24) In the present case, a similar insertion was observed which could lead to compression of the median nerve. In addition to this,

since the superficial branch of radial artery hooked around the insertion of the muscle, there could be features of ischemia due to compression of this vessel and could lead to reduced arterial supply to the distal extremity. This may cause numbness and tingling sensation of the hand.

The knowledge of these variations is important for surgeons in procedures like tendon transfers and grafts such as ptosis correction, lip augmentations. The PL is frequently used as a donor tendon for ligament reconstruction including elbow, wrist and so on.(25) Reconstruction procedures pertaining to the upper limb can be done using tendon autografts and hence this tendon can be harvested without risk of compromising the function of the hand and wrist. Here in this case since the PP is present, it could be used for these reconstructive procedures. The tendon of PL measures approximately 15cm and is considered long enough for a graft. Occasionally, there may be a double tendon or multiple insertions. PL may be valuable for palm-to fingertip tendon reconstructions since it is in the same field of surgery and is easily accessible. It has also been used in a variety of reconstructions related to the elbow and metacarpophalangeal joints.(26)

The evolutionary process of PL is simple and explained on the basis that we inherited the muscle through common descent and various animals with which we share a common ancestor (such as the orangutan) still actively utilize this muscle. It is an active muscle in arboreal primates used for prehensile progression from tree to tree.(21) However close primate relatives (such as the chimpanzee and gorilla) also do not actively utilize this muscle, and hence they also demonstrate the same variability.(27)

Sludging of blood in low flow states has been implicated as a cause of thrombosis and embolism.(28) Thus, in the case where the superficial palmar branch of radial artery was hooking around the tendon of PP, there could be sluggish blood flow leading to thrombus formation. This could lead to ischemia of the hand and further complications.

Thus, the knowledge of such variations is not only important for surgeons but should also be borne in mind by the radiologist as a diagnosis related to pathology around the wrist joint is difficult due to a large number of muscles seen in this region.(29)

However, some of the unanswered questions related to the incidence of absence of PL and the occupation or daily activity of an individual need to be explored and would probably give a better understanding if there is any significance of PL being a retrogressive muscle.

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