



## “PREVALENCE AND MORPHOLOGY OF PALMARIS LONGUS AND HARVESTING ITS TENDON FOR RECONSTRUCTIVE SURGERY – A CADAVERIC STUDY.”

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### ABSTRACT

**Introduction:** Palmaris longus is often described as one of the most variable muscles in the human body and is phylogenetically classified as a retrogressive muscle. Being a primitive muscle, its fibro-fascial distal component along with the palmar aponeurosis represents phylogenetic degeneration. Palmaris longus is one of the most desirable tendons in reconstructive surgery, as it is a superficial muscle that makes the process of harvesting easier and safer. The study aims to know the prevalence and morphology of the Palmaris longus muscle and to determine the proximal incision site for harvesting the tendon of Palmaris longus. **Materials and methods:** **Source of data:** A study was conducted on 100 upper limbs (50 right and 50 left) from embalmed cadaver allotted for 1st MBBS students. **Method:** Dissection and observation of the status of prevalence and morphology of Palmaris longus muscle were done and this data was used to frame the site of incision for harvesting its tendon. **Results:** The data of prevalence in which out of 100 upper limbs, 90 limbs showed normal morphology and 10 limbs (5 right and 5 left) showed complete agenesis. The mean belly length, belly width and tendon length, tendon width on both limbs were tabulated. Based on the observations a formula to determine the proximal incision site was derived. **Conclusion:** The variations of Palmaris longus is more common, the surgeons should have proper knowledge about prevalence, morphology and site of incision for harvesting Palmaris longus tendon for reconstruction surgeries.

**KEYWORDS :** Palmaris longus, Tendon harvest, reconstructive surgeries.

### INTRODUCTION:

Among the vertebrates, Palmaris longus is restricted to mammals and well developed in species with weight-bearing gait.<sup>[1]</sup> Palmaris longus arises from the medial epicondyle of the humerus with additional muscular inputs from intermuscular septa and antebrachial fascia. It is an expandable muscle with a short belly and long tendon.<sup>[2]</sup>

The tendon is harvested as follows, a short transverse incision is made directly over the tendon just proximal to the flexion crease of the wrist. A second transverse incision is made over the tendon at the junction of the middle and proximal thirds of the forearm. The tendon is identified and divided and the segment to be used as a graft is withdrawn.<sup>[3]</sup>

Intra-operatively second transverse incision may not be accurate for all the patients who require Palmaris longus tendon graft for reconstruction surgeries, which lead to multiple transverse incisions to reach the musculo-tendinous junction of palmaris longus muscle. Hence in our study, we have made an effort to formulate a proximal incision site of the Palmaris longus tendon on the forearm to avoid multiple incisions.

Palmaris longus tendon is used for a wide variety of reconstructive applications including lip augmentation, palm-to-finger grafts, eyelid reconstruction and ligament reconstructions of joints.<sup>[3]</sup> For this surgeons should have proper knowledge about the prevalence, morphology, tendon length, width and method of harvesting the Palmaris longus tendon.<sup>[4]</sup>

The objective of the present study was to know the prevalence and morphology of Palmaris longus muscle and correlate these to determine the proximal incision site on the forearm to harvest the tendon of Palmaris longus.

### MATERIALS AND METHODS:

**Inclusion criteria** - All the upper limbs available during the study period.

**Exclusion criteria** – Specimens with gross deformities and surgeries were excluded.

The study was conducted on 100 upper limbs (50 right and 50 left) from embalmed cadaver allotted for 1st MBBS students and disarticulated limbs, with age ranging from 60-80yrs for the duration of 2 years in the Department of Anatomy, J.J.M. Medical College, Davangere.

Dissection was done as per Cunningham's Manual of Practical Anatomy<sup>[5]</sup> Observation of the status of morphology and prevalence of Palmaris longus was carried out on 100 upper limbs. The presence or absence of the muscle was noted, measurements of length and width of the tendon and belly using measuring tape were recorded. The length of the belly was measured from the medial epicondyle of humerus to the most proximal aspect of the tendon and the length of the tendon was measured from the most proximal aspect of the tendon to the point of insertion of palmaris longus. The width of the belly and tendon was taken at their widest parts. The length of forearm from medial epicondyle of humerus to midpoint of proximal flexion crease of the wrist was recorded in all the limbs. Photographs of specimen were taken.

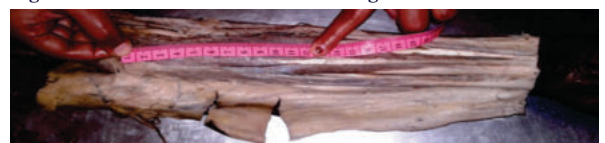
The collected data were analyzed to determine the proximal incision site for harvesting the tendon of Palmaris longus from the medial epicondyle of humerus.

### OBSERVATIONS AND RESULTS:

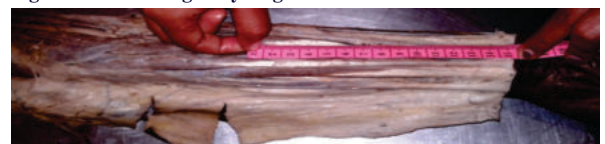
Among 100 upper limbs, the Palmaris longus muscle was present in 90 limbs (90%) and absent in 10 limbs (5 on right side and 5 on left side) refer figure 1.



**Figure 1: Shows Absence of Palmaris longus muscle**



**Figure 2: Measuring Belly length**



**Figure 3: Measuring Tendon length**

Morphological measurements of Palmaris longus were observed in figures 2,3 and tabulated in Table I below.

**Table I - Following observations were recorded on Palmaris longus muscle**

	Right limb (mean in cm)	Left limb (mean in cm)	p-value
Belly length	9.32	8.6	0.016
Belly width	1.12	1.06	0.000
Tendon length	14.7	16.16	0.004
Tendon width	0.36	0.35	0.051
Total length	24.4	24.6	0.002

Table I shows a significant difference in belly length, tendon length and total length between right and left limbs.

On Right side - Ratio of Belly length: Tendon length = 1:1.57  
 On Left side - Ratio of Belly length: Tendon length = 1:1.87

The mean length of the forearm on right limb was 24.5cm and its correlation co-efficient r was 0.827. The mean length of the forearm on left limb was 24.7cm and its correlation co-efficient r was 0.924. P-value was found to be 0.005. The correlation between right limb and left limb is significant at 0.01.

A statistically significant correlation was found in the length of the Palmaris longus tendon and length of the forearm in both right limb (r=0.36, p<0.05) and left limb (r=0.428, p<0.01).

Based on the above results we derived the formula to determine proximal incision site for harvesting the tendon of Palmaris longus as follows:

**Derivation of formula-**

Total muscle length(TML) = Belly length(BL) + Tendon length(TL)

From our study,

On Right side - Ratio of Belly length: Tendon length = 1:1.57

On Left side - Ratio of Belly length: Tendon length = 1:1.87

**If Belly length is taken as 'x'**

1) On Right side

BL : TL = x : 1.57x

TML = x + 1.57x

TML = 2.57x

As TML equals forearm length(FL)

FL = 2.57x

X =  $\frac{FL}{2.57}$

2.57

'C' is constant = 2.57 for Right limb

Hence X =  $\frac{FL}{C}$

C

2) On Left side

BL : TL = x : 1.87x

TML = x + 1.87x

TML = 2.87x

As TML equals forearm length(FL)

FL = 2.87x

X =  $\frac{FL}{2.87}$

2.87

C' is constant = 2.87 for Left limb

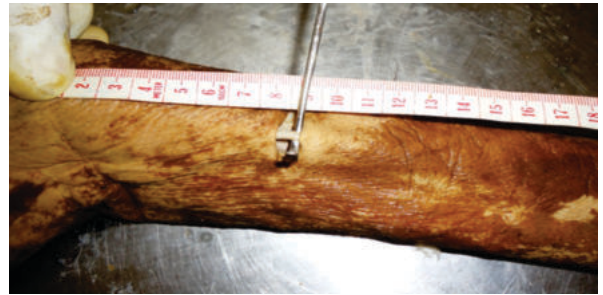
Hence X =  $\frac{FL}{C}$

C

**Site of incision:**

Before taking the proximal transverse incision to harvest the tendon, forearm length (FL) is measured, 'x' value has to be calculated by using the above formula with constant C = 2.57 on right side and C = 2.87 on left side. The incision has to be taken at 'x' value distance from the medial epicondyle on the forearm, medial to midline.

Using the above formula, we calculated the proximal site of incision in few limbs and made incisions. They confirmed our results. (Refer Fig 4)



**Figure 4: Shows Site of incision in forearm**

**DISCUSSION:**

The prevalence of Palmaris longus in our study was found to correlate with study done by Sebastin SJ et al.<sup>[6]</sup> but values were lower than theirs. In our study, 90% showed the presence of the muscle, whereas a study conducted by Sebastin SJ et al.<sup>[6]</sup> showed 94.3%, Karuppiah P et al.<sup>[7]</sup> showed 96.6% and Lalit M et al.<sup>[8]</sup> showed 88.7%. Our study showed 5% absence of Palmaris longus on both right and left side which was higher than Reimann AF et al.<sup>[9]</sup>, but lower than the Venter G et al.<sup>[4]</sup> (Refer Table II)

**Table II - Comparison between the results of studies conducted on the prevalence of Palmaris longus**

Authors	Total sample	Present	Absent	
			Left	Right
Reimann AF et al.[9]	362	302 (83.4)	13 (3.6)	17 (4.7)
Vanderhooft E[19]	186	156 (83.9)	0	4 (2.2)
Sebastin SJ et al.[6]	418	394 (94.3)	12 (2.9)	5 (1.2)
Venter G et al.[4]	317	248 (78)	20 (6.3)	17 (5.4)
Lalit M et al.[8]	62	55(88.7)	3(4.8)	2(3.2)
Karuppiah P et al.[7]	60	58(96.6)	1(1.6)	1(1.6)
Mathew A J et al.[15]	48	39(81.2)	2(4.16)	2(4.16)
Present study	100	90 (90)	5 (5)	5 (5)

Our study showed tendon length ranged from 110-220mm, tendon width ranged from 3-8mm, belly length ranged from 40-150mm and belly width ranged from 5-20mm which approximated the measurements of Venter G et al.<sup>[4]</sup> Total length ranged from 230-300mm which approximated the measurement of Stecco C et al.<sup>[10]</sup> (Refer Table III)

**III) Comparison between the results of studies conducted on the morphology of Palmaris longus**

Authors	Total sample	Present	Absent	
			Left	Right
Reimann AF et al.[9]	362	302 (83.4)	13 (3.6)	17 (4.7)
Vanderhooft E[19]	186	156 (83.9)	0	4 (2.2)
Sebastin SJ et al.[6]	418	394 (94.3)	12 (2.9)	5 (1.2)
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Mathew A J et al.[15]	48	39(81.2)	2(4.16)	2(4.16)
Present study	100	90 (90)	5 (5)	5 (5)

Many researchers have studied the morphology of Palmaris longus, but not much work has been done on tendon width, forearm length on right and left side and its correlation. Our study showed a significant difference in belly length, tendon length, total length and length of the forearm on right and left sides (Refer Table I) whereas a study conducted by Lalit M et al.<sup>[11]</sup> showed Palmaris longus tendon length on the left side (15.69cm±1.33cm) was slightly more than the right side (15.62cm±1.48cm)<sup>[9]</sup> whereas the study conducted by Venter G et al.<sup>[4]</sup> showed no significant difference in any morphological measurements between right and left limbs.

A systematic review conducted by Yammine K and Eric M<sup>[12]</sup> showed that mean Palmaris longus tendon length was 13.9±2.6cm, mean forearm length was 26.08±1.39cm and also showed a significant correlation between length of Palmaris longus tendon and forearm, which is approximately similar to our study.

Study conducted by Ito M et al.<sup>[13]</sup> and Jain DKA et al.<sup>[14]</sup> showed a statistical significant correlation between the lengths of palmaris longus tendon and forearm which was similar to our study.

Ito M et al. mentioned in their study that Palmaris longus tendon has been often used as tendon graft for reconstructive surgeries like chronic flexor tendon injury, reconstruction of collateral ligaments of fingers, thumb and elbow. For such procedures, if the length of Palmaris longus tendon is known pre-operatively to harvest the graft which would help the surgeon to pre-operatively plan the reconstructive surgeries.<sup>[13]</sup>

Palmaris longus tendon graft is not always of appropriate length for long defects hence length of Palmaris longus tendon has to be assessed before harvesting. Few authors have correlated length of Palmaris longus tendon and forearm to determine the tendon length pre-operatively to harvest graft whereas our study in addition we have framed the formula  $x=FL/C$  where  $C = 2.57$  for right limb,  $C = 2.87$  for left limb and  $x$  is the site of incision on the forearm from the medial epicondyle to reach musculo-tendinous junction without multiple transverse incision and achieve maximum tendon length.

Many studies were conducted in literature to know the morphology and prevalence but nowhere they have correlated these to determine the proximal incision site to harvest this tendon.

### CONCLUSION:

We believe that our study helps orthopaedic surgeons to be aware of the variations, prevalence, morphology of Palmaris longus and to determine the accurate site of proximal incision for harvesting the tendon of Palmaris longus. It is also clear that morphology of Palmaris longus is significantly different between right and left side. The tendon length on left side is greater than right side. Hence surgeons should prefer left limb to harvest tendon when longer tendon is required for graft.

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