STUDY OF PALMARIS LONGUS TENDON AMONG THE UNDERGRADUATE MEDICAL STUDENTS

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ABSTRACT

Palmaris longus is a thin fusiform shaped muscle which terminates as a long slender tendon and enters the palmar aponeurosis of the hand. It is also one of the most variable muscles in the body. The main objective of this study was to detect its tendon in both hands and to compare and analyse it in relation to gender and hand dominance. An observational, descriptive study was conducted over a period of 11 months from October 2021 – August 2022 in the Department of Human Anatomy of Nepal Medical College and Teaching hospital, Gokarneshwor – 8, Kathmandu, Nepal. Following tests were conducted for its detection. 1. Schaeffer's, 2. Thompson's, 3. Mishra's test I, 4. Mishra's test II and Pushpakumar's test. The results obtained showed that presence of left palmaris longus was more in left handed individuals which was statistically significant with p – value of 0.025. Similarly, presence of right palmaris longus was more in right hand dominant participants. Among the left hand dominant participants, left palmaris longus agenesis was more common in female which was also found to be statistically significant with p-value of 0.009. The knowledge regarding the palmaris longus tendon is of growing interest to surgeons these days for its augmentation, ptosis correction and in facial paralysis management. It gains its importance for autograft as it fulfills the requirement of length, diameter and availability. Hence the study regarding the palmaris longus tendon in relation to its hand dominance and gender can be helpful to surgeons working in various fields.

KEYWORDS

Agenesis, autograft, palmaris longus tendon

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INTRODUCTION

Palmaris longus (PL) is a thin fusiform shaped muscle that is found between the flexor carpi radialis and flexor carpi ulnaris muscles of forearm. It terminates as a long slender tendon which becomes flat and enters the palmar aponeurosis of the hand anterior to the flexor retinaculum.[1] It is a small vestigeal muscle and also one of the most variable muscles in the body varying in position, having duplication and containing accessory slips.[2] It can exist in many forms or totally can be absent in human which might be due to evolution of human over thousand of years.[3]

Among vertebrates the PL is restricted to the mammals and is well developed in species with weight bearing gait. It is always present in orangutans but is variably absent in chimpanzees and gorillas.[4] The PL muscle has great clinical importance and is classified phylogenetically as a retrogressive muscle.[5] Morphogenetically its tendon and muscles are developed and regulated by a HOX gene.[6]

The PL is a weak flexor of the wrist joint and also tenses the palmar fascia.[7] The presence or absence of PL muscle had no effect on grip strength.[8] There is a presumption that the prevalence of PL differs between right handed and left handed individuals. Left hand dominance is less common than right hand dominance. About 8-15 % of population are left handed.[9] The prevalence of innate left handedness is 9.4 % in male and 7.4 % in female.[10]

It is also a great landmark to identify the median nerve during surgeries.[11] Its variations cause a variety of clinical syndromes such as carpal tunnel syndrome, Guyon's syndrome, compartment syndrome of forearm or wrist.[12] In addition to its high presence in most population its superficial location makes it a favoured donor for tendon and joint reconstructive surgeries.[13]

There are different tests to detect the presence of PL in living. The first such test was described by Schaeffer in 1909.[14] Other tests were later described by Thompson, Mishra, Pushpakumar, Gangata and many others.[15]

The PL muscle is often used in surgery because it is considered as an accessory muscle and is not essential for normal function of the hand.[16] It is also a suitable donor in all age groups because it is completely developed at birth.[17] The knowledge regarding the PL muscle is of growing interest to surgeons these days for its augmentation or escalation, ptosis correction and in facial paralysis management[18] and can also be used in opponensplasty to restore the function of thumb which result from the carpal tunnel syndrome.[19] It has also received the attraction of urosurgeons as it was also used for glans penis coronaplasty.[20]

The study on PL tendon gains its importance for autograft as it fulfills the requirement of length, diameter and availability without producing any deformity.[21] Hence the study regarding the PL tendon in relation to its hand dominance and gender can be helpful to surgeons and clinicians working at various fields.

MATERIALS AND METHODS

The study was carried out after getting an ethical approval from Instituional Review Committee of Nepal Medical College Teaching Hospital, Gokarneshwor – 8, Kathmandu, Nepal (Ref. No: 037 – 078/079). An observational descriptive study was conducted over a period of 11 months from October 2021 – August 2022 in the Department of Human Anatomy of Nepal Medical College and Teaching hospital, Gokarneshwor-8, Kathmandu, Nepal. The study included 507 undergraduate medical students out of which 274 (54 %) were female and 233 (46%) students were male. Only the students who were willing to participate in the study and without having any deformity of upper limb were included in the study. The students who were not willing to participate in the study and those students having obvious hand and wrist deformities, previous hand and wrist injuries and surgeries were excluded from the study. Informed consent was taken prior to initiation of the study. First the study subjects were tested for hand dominance and the prevalence of presence and absence of PL were detected by doing following tests.

1. *Schaeffer's test* – The subject was asked to oppose the thumb to little finger and then slightly flex the wrist as shown in the Fig. 1.

2. *Thompson's test* – The subject was asked to make a fist then flex the wrist and finally the thumb was opposed and flexed over the fingers as shown in Fig. 2.

Fig. 1: Presence of PL tendon by Schaeffer's test

Fig. 2: Presence of PL tendon by Thompson's test

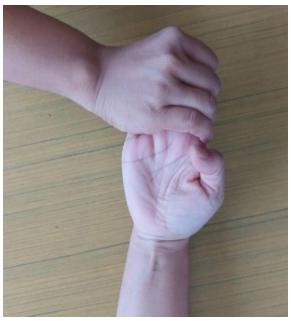

Fig. 3: Presence of PL tendon by Mishra's test I

Fig. 4: Presence of PL tendon by Mishra's test II

Fig. 5: Presence of PL tendon by Pushpakumar's test

3. *Mishra's test I* – The metacarpo - phalangeal joints of all fingers were passively hyperextended by the examiner and the subject was asked to actively flex the wrist as shown in Fig. 3.

4. *Mishra's test II* – The subject was asked to abduct the thumb against resistance with the wrist in slight palmar flexion as shown in Fig.4.

5. *Pushpakumar's test* – The subject was asked to fully extend the index and middle fingers and flexion of the ring and little fingers were done and thumb was opposed and flexed as shown in Fig. 5.[3]

The obtained datas were entered and were analysed by using a statistical tool as SPSS version 16 and findings were illustrated in a tabular form. Chi – square test was used for calculating the p – value and p – value of less than 0.05 was considered statistically significant.

RESULTS

The study included 507 undergraduate medical students. Out of which 274 students (54.0%) were female and 233 (46.0%) students were male. The age of the students ranged between

Table 1: Distribution of palmaris longus according to gender

		Palmaris longus				Total
		Bilateral (-)	Bilateral (+)	Left (+)	Right (+)	
Sex	Female	39 (14.2%)	202 (73.7%)	12 (4.4%)	21 (7.7%)	274 (54.0%)
	Male	25 (10.7%)	180 (77.2%)	14 (6.0%)	14 (6.0%)	233 (46.0%)
Total		**64 (12.6%)**	**382 (75.4%)**	**26 (5.1%)**	**35 (6.9%)**	**507 (100.0%)**

absent: (-), present: (+)

Table 2: Distribution of left palmaris longus in left hand dominance

		Left palmaris longus		Total
		+	-	
Left handed	+	23 (65.7%)	12 (34.3%)	35 (6.9%)
	-	384	88	472 (9.0%)
Total		**407**	**100**	**507 (100.0%)**

p-value= 0.025, *absent: (-), present: (+)*

Table 3: Distribution of right palmaris longus in right hand dominance				
		Right palmaris longus		Total
		+	-	
Right handed	+	382 (75.3%)	90 (17.7%)	472 (93.0%)
	-	27	8	35 (6.9%)
Total		**409**	**98**	**507 (100.0%)**

absent: (-), present: (+)

18 to 23 years with the mean age of 20.66 years. Out of 507 students, 35 (6.9%) were left handed and 472 (93.1%) students were found to be right handed.

Among the 274 female participants enrolled in the study, 39 (14.2%) had bilateral absence of palmaris longus and 202 (73.7%) had bilateral presence of palmaris longus. Similarly, palmaris longus was found to be present in 12 (4.4%) individuals in left side and 21 (7.7%) individuals in right side. Out of 233 (46.0%) male students, 25 (10.7%) had bilateral absence of palmaris longus and 180 (77.2%) had presence of palmaris longus bilaterally. Likewise, 14 (6%) male students had presence of palmaris longus in both left and right side as shown in Table 1.

Out of 507 students, 35 (6.9%) were found to be left handed and 472 (93.0%) students were right handed. Among the 35 left handed individuals, left palmaris longus was present in 23 (65.71%) individuals and was absent in 12 (34.3%) individuals. Hence in left handed individuals, presence of left palmaris longus was more and was found to be statistically significant with p – value of 0.025 as shown in Table 2. Among the 472 (93.0%) right hand dominant participants, presence of right palmaris longus was more as shown in Table 3.

Among the 35 left hand dominant participants, 22 (62.8%) were female and 13 (37.1%) were male participants. Out of 22 left handed female participants, left palmaris longus was absent in 10 (45.4%) individuals and was present in 12 (54.5%) individuals. Similarly, out of 13 left handed male, left palmaris longus was absent in two (15.4%) individuals and was present in eleven (84.6%) individuals. Hence in present study left palmaris longus agenesis was more common in female left handed individuals as compare to male as shown in Table 4. and was found to be statististically significant with p-value of 0.009.

Regarding the right hand dominant participants, 252 were female and 220 were

Table 4: Gender wise distribution of left palmaris longus in left hand dominance					
Gender			**Left palmaris longus**		**Total**
			+	-	
Female	Left handed	+	12 (54.5%)	10 (45.4%)	22 (100.0%)
			199	53	252
	Total	-	211	63	274
Male	Left handed	+	11 (84.6%)	2 (15.4%)	13 (100.0%)
		-	185	35	220
	Total		**196**	**37**	**233**

p-value= 0.009, *absent: (-), present: (+)*

Table 5: Gender wise distribution of right palmaris longus in right hand dominance					
Gender			**Right palmaris longus**		**Total n(%)**
			+	-	
Female	Right handed	+	204 (80.9%)	48 (19.0%)	252 (100.0%)
		-	17	5	22
	Total		221	53	274
Male	Right handed	+	178 (80.9%)	42 (19.1%)	220 (100.0%)
		-	10	3	13
	Total		**188**	**45**	**233**

absent: (-), present: (+)

male participants. Among the right handed female participants, right palmaris longus was absent in 48 (19.0%) individuals and was present in 204 (80.9%) individuals. Similarly among right handed male participants, right palmaris longus was absent in 42 (19.1%) individuals and was present in 178 (80.9%) individuals.

DISCUSSION

The most common anatomical anomaly of PL muscle is its agenesis. The presence or absence of palmaris longus muscle appears to be hereditary and its genetic transmission is not very clear though the hand dominance is found to be largely determined by genetics.[16]

In the present study, the prevalence of bilateral absence of palmaris longus muscle was 12.6%. In one of the study carried out in Greece where 32 different studies were assessed to determine the presence of palmaris longus tendon and the results showed that the prevalence of its absence ranged between 1.5% (Zimbabwe) to 63.9 % (Turkey).[27] Similarly, 75.3% participants were found to have bilateral presence of PL as similar to the study performed by Nasir *et al*.[28]

Though several studies were found to be conducted regarding the agenesis of palmaris longus tendon worldwide, only few studies have shown its association with hand dominance. The present study aimed to determine the distribution of palmaris longus tendon in relation to gender and hand dominance where 54.0% participants were female and 46.0% participants were male and among them 93.0% were right handed and 6.9% were left handed similar with the study conducted in Uganda.[15]

Identification of PL is extremely important to clinicians during the administration of drugs like corticosteroids in carpal tunnel syndrome and can also be used in median nerve wrist blocks.[18] Various alternative tests were described by some authors to demonstrate the presence of the PL tendon[22] and some authors have also confirmed that Schaeffer's test best demonstrates the palmaris longus tendon for clinical testing likewise in present study.[15,31]

According to the current knowledge PL agenesis is more common in female than in male. The present study demonstrated that bilateral absence of PL tendon was common in female (14.2%) than in male (10.7%) and these findings coincided with findings of various studies conducted among different populations.[18,23,26,29]

In relation to the handedness, left palmaris longus agenesis was more common in female left handed individuals (45.4%) than in male (15.4%) which was similar with the studies conducted in Serbia and Greece.[24,27] The similar study had also stressed to the fact that there was a strong correlation between palmaris longus agenesis and left hand dominance.[33]

Presence of right palmaris longus was more in right hand dominant participants (80.9%) and presence of left palmaris longus was more in left hand dominant participants. These findings were also determined by the study conducted in East Africa and concluded that palmaris longus tendons were more likely to be present in dominant hand and absent in non – dominant hand.[2] This could be because of the fact that the dominant hand is more involved in day to day activities which could make the tendon more prominent and hence can be visualized clearly. Although many studies on palmaris longus have found its agenesis, some studies had also observed its variation in its insertion and found that it was bifurcated in left forearm and trifurcated in right side.[25]

Though the evolutionary changes made PL a retrogressive degenerating muscle it still becomes one of the favourite tendons for the surgeons to be used in graft because of its adequate length, width and easy availability.[34]

Some researchers had also reported the similar studies in cadavers[30] and some had used magnetic resonance imaging (MRI) technique where they finally came with the conclusion that the mean width of tendons calculated by MRI were similar with those reported by cadaveric studies.[32]

But in the present study, only the physical examination tests were included and the confirmation by MRI could not be done as by other authors as it was not cost – effective and more time consuming hence the study was not generalized. As the clinical tests performed were examiner based, the variations seen may lead to misinterpretation of an existing muscle as absent and this being the only limitation of the present study.

To conclude it finally, the results of present study showed the presence of PL tendon in dominant hand. Based on gender and handedness, there is high incidence of agenesis of PL tendon in female left handed individuals.

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REFERENCES

1. Pai MM, Prabhu LV, Nayak SR *et al*. The Palmaris longus muscle: its anatomic variations and functional morphology. *Rom J Morphol Embryol* 2008; 49: 215-7.
2. Kigera JWM, Mukwaya S. Frequency of agenesis Palmaris longus through clinical examination – An East African study. *Plos One* 2011; 6: 1-3.
3. Yong MW, Yusof N, Rampal L, Arumugam M. Prevalence of absence of Palmaris longus and its association with gender, hand dominance and absence of flexor digitorum superficialis tendon to little finger among Malay population. *J Hand Surg Asian Pac* 2017; 22: 484-9.
4. Anjelini Junior LC, Angelini FB, De Oliviera BC, Soares SA, Anjelini LC, Cabral RH. Use of the tendon of the Palmaris longus muscle in surgical procedures: study on cadavers. *Acta Ortop Bras* 2012; 20: 226-9.
5. Yammine K. Clinical prevalence of Palmaris longus agenesis: a systematic review and meta-analysis. *Clin Anat* 2013; 26: 709-18.
6. Hall BK, Miyake T. All for one and one for all: condensations and the initiation of skeletal development. Bioesssays 2000; 22: 138-47.
7. Gangata H, Ndou R, Louw G. The contribution of the Palmaris longus muscle to the strength of thumb abduction. *Clin Anat* 2010; 2: 431-6.
8. Sebastin SJ, Lim AY, Bee WH *et al*. Does the absence of Palmaris longus affect grip and pinch strength?. *J Hand Surg Br* 2005; 30: 406-08.
9. Hardyck C, Petrinovick LF. Left Handedness. *Psychol Bull* 1977; 84: 385-404.
10. Galobardes B, Bernstein MS, Morabia A. Can the declining prevalence of left- handedness with age be due to smoking? *Eur J Public Health* 2001; 11: 352-3.
11. Natsis K, Didagelos M, Manoli S *et al*. Fleshy Palmaris longus muscle – a cadaveric finding and its clinical significance: a case report. *Hippokratia* 2012; 16: 378–80.
12. Murabit A, Gnarra M, Mohammed A. Reversed Palmaris longus muscle: anatomical variant – case report and literature review. *Can J Plast Surg* 2013; 21: 55-6.
13. Shenoy RM. Two new clinical tests for Palmaris longus. *Indian J Plast Surg* 2018; 51: 321.
14. Schaeffer JP. On the variation of the Palmaris longus muscle. *Anat Rec* 1903; 3: 275-8.
15. Kigera JWM, Mukawaya S. Clinical Assessment of the Palmaris longus – Accuracy of common tests. *Ann Afr Surg* 2012; 9: 104-7.
16. Sebastin SJ, Puhaindran ME, Lim AY *et al*. The prevalence of absence of the Palmaris longus – a study in a Chinese population and a review of the literature. *J Hand Surg* 2005; 30: 525-7.
17. Jordan R, Anderson RL. Obtaining fascia lata. *Arch ophthalmol* 1987; 105: 139-40.
18. K Devi Sankar, P Sharmila Bhanu, Susan P John. *Indian J Plast Surg* 2011; 44: 134-8.
19. Park IJ, Kim HM, Lee SU, Lee JY, Jeong C. Opponenplasty using Palmaris longus tendon and flexor retinaculum pulley in patients with severe carpal tunnel syndrome. *Arch Orthop Trauma Surg* 2010; 130: 829-34.
20. Salgado CJ, Licata L, Fuller DA, Chen HC. Glans penis coronaplasty with Palmaris longus tendon following total penile reconstruction. *Ann Plast Surg* 2009; 62: 690-2.
21. Chu PJ, Lee HM, Hou YT, Hung ST, Chen JK, Shih JT. Extensor tendons reconstruction using autogenous Palmaris longus tendon grafting for rheumatoid arthritis patients. *J Orthop Surg Res* 2008; 3: 1-17.
22. Kumar P. Alternative tests to demonstrate the presence of Palmaris longus. *Plast Reconstr Surg* 2004; 114: 71-2.
23. Kapoor SK, Tiwari A, Kumar A, Bhatia R, Tantuway V, Kapoor S. Clinical relevance of Palmaris longus agenesis: common anatomical abbreviation. *Anat Sci Int'l* 2008; 83: 45-8.
24. Eric M, Krivokuca D, Savovic S, Leksan I, Vucinic N. Prevalence of the Palmaris longus through clinical evaluation. *Surg Radiol Anat* 2010; 32: 357-61.
25. Sunil VSP, Rajanna S, Gitanjali HT, Kadaba JS. Variation in the insertion of Palmaris longus tendon. *Singapore Med J* 2015; 56: 7-9.
26. Hadi SA, Masri DP. Palmaris longus absence in six largest Indonesian ethnicities and its relationship with gender, ethnicity and hand dominance. *Med J Indonesia* 2015; 24.
27. Ioannis D, Anastasios K, Konstantinos N, Lazaros k, Georgios N. Palmaris longus muscle's prevalence in different nations and interesting anatomical variations: review of the literature. *J Clin Med Res* 2015; 7: 825-30.
28. Nasiri E, Pourghasem M, Moladousi H. The prevalence of the absence of the Palmaris longus muscle tendon in the north of Iran: a comparative study. *Iran Red Crescent Med J* 2016; 18: 1-7.
29. Sharma N, Parajuli B, Pandey N, Shah RP. Prevalence of absence of Palmaris longus tendon in Nepalese population. *J Univers Coll Med Sci* 2019; 7: 33-6.
30. Yammine K, Eric M. Morphometric analysis and surgical adequacy of Palmaris longus as a tendon graft. A systematic review of cadaveric studies. *Surg Radiol Anat* 2020; 42: 259-67.
31. Boltuch DA, Marcotte MA, Treat CM, Marcotte LA. The Palmaris longus and its association with carpal tunnel syndrome. *J Wrist Surg* 2020; 9: 493-7.
32. Kikano R, Charbel C, Assi C, Yammine Y. Prevalence, variants and morphometrics of palmaris longus tendon: a magnetic resonance imaging study. *Surg Radiol Anat* 2021; 43: 749-53.
33. Ablodazaden LF, Ashoori K, Dahmardehei M. Prevalence of Palmaris longus agenesis in a hospital in Iran. *Arch Iran Med* 2013; 16: 187-8.
34. Park S, Shin Y. Results of long term follow –up observations: blepheraoptosis correction using the Palmaris longus tendon. *Aesthetic Plast Surg* 2008; 32: 614 -9.