***International Journal of Biomedical Research***
ISSN: 0976-9633 (Online); 2455-0566 (Print)
Journal DOI: 10.7439/ijbr
CODEN: IJBRFA

**Original Research Article**

# Prevalence of the absence of Palmaris longus muscle in the students of Kathmandu University

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## Abstract

**Background:** Palmaris longus muscle is one of the superficial muscles of flexor compartment of forearm. Its main function is to anchor the skin and fascia of the hand. It is a weak flexor of the hand at wrist and tenses the palmar aponeurosis. It is one of the most variable muscles and is phylogenetically classified as a retrogressive muscle. The agenesis of Palmaris longus ranges from 0% to 63% with an overall 16% unilateral and 9% bilateral. It is very useful in orthopedics, cosmetic, plastic and reconstructive surgery.
**Objective:** To determine the occurrence of unilateral and bilateral agenesis of Palmaris longus muscle in right and left forearms in the students of Kathmandu University.
**Materials and methods:** The study was carried out on 1020 randomly selected normal students (570 male and 450 female) with an age ranging from 18 to 25 years. The volar aspect of the wrist was inspected to find out the presence or absence of Palmaris longus tendon in its usual anatomical position by performing different tests.
**Result:** The present study showed overall agenesis of Palmaris longus in 27.65% cases. Overall agenesis in male and female was 28.42% and 26.67% respectively. Unilateral and bilateral agenesis were 77.16% and 22.84% respectively in male whereas 67.50% and 32.50% respectively in female. Left sided and right sided agenesis were 55.20% and 44.80% respectively in male whereas 53.09% and 46.91% respectively in female.
**Conclusion:** Palmaris longus is absent unilaterally in 20.20% and bilaterally in 7.45% of the population with an overall absence of 27.65%.
**Keywords:** Agenesis, flexor compartment, palmar aponeurosis, Palmaris longus, retrogressive muscle

## 1. Introduction

Palmaris longus is a slender, fusiform muscle. Its origin is from medial epicondyle of humerus, and from adjacent intermuscular septa and deep fascia. It converges on a long tendon which passes superficial to the flexor retinaculum to become a flat sheet incorporating into palmar aponeurosis. Its arterial supply is by a small branch from the anterior ulnar recurrent artery. It is innervated by median nerve. It is a phylogenetically degenerate metacarpophalangeal joint flexor. Its main function is to anchor the skin and fascia of the hand.[1] It is a weak flexor of the hand at wrist and tenses the palmar aponeurosis.[2] It also protects the median nerve which passes deep to the flexor retinaculum.[3,4] It is functionally more active in non-human primates.[5] It is fully developed at birth.[6]

It is one of the most variable muscles and is phylogenetically classified as a retrogressive muscle.[7] The prevalence of absence of the Palmaris longus was first reported in 1559.[8] It is often absent on one or both sides.[1,9] It is one of the most variable muscles in the human body.[1,9,10] Its variation depends on race, sex, and sides. The agenesis ranges from 0% to 63% with an overall 16% unilateral and 9% bilateral.[11,12] On an average 10% agenesis has been accepted universally.[13]

Palmaris longus has got a great clinical importance. It is usually applied in reconstructive surgeries, commonly used by hand surgeons for tendon transfers, second stage tendon reconstruction, pulley reconstruction as well as tendon grafts,[14] for restoration of lip and chin defects by plastic

surgeons and by ophthalmologist in ptosis correction.[3,4] In various combinations it is also used to repair oncologic defects of head and neck, arthritis of the thumb.[15] Despite the clinical importance of Palmaris longus, a very few researches have been done in Nepal. Therefore, the present study was performed to determine the incidence of unilateral and bilateral agenesis of Palmaris longus and its association with sex and side of the limb in the students of Kathmandu University, Dhulikhel, Nepal. This study would be very useful in orthopedics, cosmetic, plastic and reconstructive surgery.

## 2. Material and methods

### 2.1 Study population and sample size

The present study was cross-sectional and descriptive. The study was carried out on 1020 randomly selected normal students of various disciplines from Kathmandu University. Of the 1020 students, 570 were female and 450 were male, with an age ranging from 18 to 25 years. This study was performed after the approval of Institutional Review Committee, Kathmandu University School of Medical Sciences, Dhulikhel, Nepal. Verbal informed consent was obtained from each participant after explaining the objectives and methods of the study. Participants with a history of injury, disease or abnormality of the upper limb or upper limbs were excluded from the study.

### 2.2 The procedure to exam the presence or absence of palmaris longus

The volar aspect of the wrist was inspected to find out the presence or absence of Palmaris longus tendon in its usual anatomical position just ulnar to the flexor carpi radialis tendon. The test was performed by asking the participant to make opposition of the thumb and the little finger while flexing the wrist. During this test, if the tendon of the muscle was not visualized then four additional tests were performed to confirm its absence. Each test was performed one after another on both the forearms of each student. The tests are as follows:-

**I. Thompson test** –

Every student was asked to make a fist then flex the wrist and finally the thumb was opposed and flexed over the fingers.[16]

**II. Standard (Schaeffer's) test –**

The student was asked to oppose the thumb to the little finger and then flex the wrist.[8]

**III. Mishra's test I –**

The metacarpo-phalangeal joints of all fingers were passively hyperextended by the examiner and the student was asked to actively flex the wrist.[17]

**IV. Pushpkumar' "two finger sign" method –**

The student was asked to fully extend the index and middle finger, the wrist and other fingers are flexed and finally the thumb is fully opposed and flexed.[18]

### 2.3 Statistical analysis

Data was recorded in MS Office Excel 2013. The incidence of agenesis of Palmaris longus was analyzed by using SPSS v20. Correlation and percentage score were used to assess the association of its unilateral and bilateral agenesis of Palmaris longus in both sexes. The prevalence of unilateral or bilateral absence was presented with a 95% confidence interval. The association between absence of the Palmaris longus and body side, sex was assessed using chi-square tests. Statistical significance was set at $P<0.05$.

## 3. Results

**Table 1: Gender wise distribution of Palmaris longus agenesis and its lateralization**

| Gender | No Agenesis (%) | Agenesis (%) | Unilateral Agenesis (%) | Bilateral Agenesis (%) | Left sided Agenesis (%) | Right sided Agenesis (%) |
|---|---|---|---|---|---|---|
| | n = 1020 | | n = 282 | | n = 206 | |
| Male | 408 (71.58) | 162 (28.42) | 125 (77.16) | 37 (22.84) | 69 (55.20) | 56 (44.80) |
| Female | 330 (73.33) | 120 (26.67) | 81 (67.50) | 39 (32.50) | 43 (53.09) | 38 (46.91) |
| Total | 738 (72.35) | 282 (27.65) | 206 (73.05) | 76 (26.95) | 112 (54.37) | 94 (45.63) |
| | $\chi2 = 0.387$<br>df = 1<br>*p* value = 0.534<br>OR = 0.916<br>CI = 0.694 - 1.208 (95%) | | $\chi2 = 3.268$<br>df = 1<br>*p* value = 0.071<br>OR = 1.627<br>CI = 0.958 - 2.762 (95%) | | $\chi2 = 0.089$<br>df = 1<br>*p* value = 0.766<br>OR = 0.918<br>CI = 0.524 - 1.609 (95%) | |

$\chi2$ = Pearson Chi-square value, df = degree of freddom, p value significant at <0.01, OR = Odds Ratio, CI = Confidence interval

The present study showed overall agenesis of Palmaris longus in 282 (27.65%) cases out of total 1020 cases. Overall agenesis in male was 162 (28.42%) out of 570 male and 120 (26.67%) female out of 450 female. Unilateral and bilateral agenesis were 125 (77.16%) and 37 (22.84%) respectively in male whereas 81 (67.50%) and 39 (32.50%) respectively in female. Left sided and right sided agenesis were 69 (55.20%) and 56 (44.80%) respectively in male whereas 43 (53.09%) and 38 (46.91%) respectively in female (Table 1).

**Table 2: Frequency of absence of Palmaris longus**

| Gender | Number | Bilateral agenesis | Agenesis in left forearm | Agenesis in right forearm | Unilateral agenesis | Overall Agenesis |
|---|---|---|---|---|---|---|
| Male | 570 | 37 (6.49 %) | 69 (12.10 %) | 56 (9.82 %) | 125 (21.93 %) | 162 (28.42 %) |
| Female | 450 | 39 (8.67 %) | 43 (9.56 %) | 38 (8.44 %) | 81 (18.00 %) | 120 (26.67 %) |

Bilateral agenesis in male and female was 6.49% and 8.67% respectively. Left forearm and right forearm agenesis of male were 12.10% and 9.82% respectivley. Female forearm of left and right sides showed agenesis in 9.56% and 8.44% respectivley. Unilateral agenesis was seen in 21.93% male and 18% female. Overall agenesis in male and female was 28.42% and 26.67% respectively (Table 2).

## 4. Discussion

The prevalence of the agenesis of Palmaris longus muscle is reported about 15% in most classical anatomy textbooks.[1,19,20] However, this figure varies considerably in various geographical locations across the globe (Table No 3).

**Table: 3 Prevalence of congenital absence of Palmaris longus tendon in various studies**

| S. No. | Authors | Year | Cases studied | Unilateral Agenesis (%) | Bilateral Agenesis (%) | Overall Agenesis (%) |
|---|---|---|---|---|---|---|
| 01 | Ceyhan and Mavt [11] | 1997 | 7000 | 20.71 | 43.24 | 63.95 |
| 02 | Mobarkesh *et al* [21] | 2008 | 64 | 21.80 | 7.80 | 29.60 |
| 03 | Baral *et al* [28] | 2009 | 24 | 9.70 | 7.70 | 17.40 |
| 04 | Devi Sankar *et al* [22] | 2011 | 942 | 19.74 | 8.28 | 28.02 |
| 05 | Kocabiyik *et al* [27] | 2012 | 24 | 20.83 | 29.16 | 50.00 |
| 06 | Morais *et al* [23] | 2012 | 740 | 14.30 | 12.20 | 26.50 |
| 07 | Karim and Al-Taee [29] | 2012 | 300 | 11.00 | 7.30 | 18.30 |
| 08 | Adejuwon *et al* [24] | 2012 | 564 | 12.94 | 13.65 | 26.59 |
| 09 | Ali *et al* [30] | 2012 | 516 | 8.72 | 7.56 | 16.28 |
| 10 | Hussain and Hasan [31] | 2012 | 400 | 16.70 | 7.75 | 24.45 |
| 11 | Saxena [25] | 2013 | 426 | 18.31 | 8.21 | 26.52 |
| 12 | Kose *et al* [32] | 2013 | 240 | 14.17 | 7.08 | 21.25 |
| 13 | Berhe and Bekele [33] | 2014 | 712 | 7.16 | 8.15 | 15.31 |
| 14 | Tejaswi *et al* [26] | 2014 | 266 | 16.92 | 10.52 | 27.44 |
| 15 | Hojjatollah *et al* [34] | 2014 | 732 | 11.21 | 19.53 | 30.74 |
| 16 | Present study | 2015 | 1020 | 20.20 | 7.45 | 27.65 |

In present study, the overall prevalence of absence of Palmaris longus muscle was 27.65% which is approximately similar with the study done by Mobarkesh *et al*.,[21] Devi Shankar *et al*.,[22] Morais *et al*.,[23] Adejuwon *et al*.,[24] Saxena[25] and Tejaswi *et al*.[26] We found 20.20% unilateral agenesis which was approximately similar with the study done by previous authors viz; Ceyhan and Mavt,[11] Mobarkesh *et al*.,[21] Devi Sankar *et al*.,[22] Kocabiyik *et al*.,[27] and Saxena.[25] The present study showed 7.45% bilateral agenesis of Palmaris longus which was approximately similar with the study done by Mobarkesh *et al*.,[21], Baral *et al*,.[28] Devi Sankar *et al*.,[22] Karim and Al-Taee,[29] Ali *et al*.,[30] Hussain and Hasan,[31] Saxena,[25] Kose *et al*.,[32] and Berhe and Bekele.[33]

The prevalence of the agenesis of Palmaris longus muscle was 20.20% (unilateral), 7.45% (bilateral) and 27.65% (overall) in the present study. These findings coincided with the reports obtained by Mobarkesh *et al*.,[21] Devi Sankar *et al*.,[22] and Saxena.[25] Many studies showed that unilateral agenesis was more frequent than bilateral agenesis.[21-32] The present study also showed similar result.

Left sided agenesis was found to be more common than right sided in both male and female. Furthermore left sided agenesis was more common in female than in male.[11,22,23,25,30] Above findings were similar with the present study except left sided agenesis of male which was higher in male than female. The present study also showed more common unilateral and bilateral agenesis in male than in female (Table 2). Right sided agenesis was found to be more than left sided agenesis in male by some researchers.[21,26,29, 31,34] The present study contradicted with this result because left sided agenesis of male was found to be more in the present study. Left sided agenesis was more in female and right sided agenesis was more in male.[26,31,34] But left sided agenesis was more in both male and female in the present study.

## 5. Conclusions

In the present study, Palmaris longus is absent unilaterally in 20.20% and bilaterally in 7.45% of the population with an overall absence of 27.65%. The rate is higher than what is commonly mentioned in the literature. A sound knowledge on the anatomy and variations of Palmaris longus is great important for tendon grafts and reconstructive surgery as well as for anatomists, orthopedicians and biological anthropologists.

## Acknowledgements

We are indebted to faculties and staffs of Department of Anatomy, Kathmandu University School of Medical Sciences for their commendable efforts. We are very thankful to all the participants of the present study for their kind cooperation during the study.

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