

Variations in the absence of the palmaris longus muscle in a multiethnic population of Malaysia: An epidemiological study

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Abstract: Palmaris longus (PL) is the most variable muscle in the human body. The anatomy of PL is of interest due to its role in reconstructive plastic surgeries as a donor for transplant. The present study was conducted to determine the incidence of unilateral and bilateral agenesis of PL. A total of 610 participants 287 males and 323 females belonging to 20 – 70 years were used to access the PL tendon using tendon examination techniques, Schaeffer's test and Thompson's test. The collected data were processed, computed and analyzed by using SPSS software version 22. The agenesis of PL with gender and ethnicity were assessed using Chi-square tests with a statistical significance of $p < 0.05$. The participants are 184 Malays, 167 Chinese, 167 Indians and 92 from other races. The overall absence of palmaris longus was found in 62 (10.2%) of cases, unilateral absence in 46 (7.5%) of cases and bilateral absence in 16 (2.6%) of cases. The agenesis was 11.1% in males and 9.3% in females. Malay race had the highest prevalence of agenesis of PL with 10.3%, followed by the Indian race with 9.0% and the Chinese race with 7.2%.

Key Words - Muscle agenesis, Malaysian population, Palmaris longus,

I. Introduction

Palmaris longus is a superficial muscle of the forearm with a short muscle belly and a long tendon that is only exclusive in mammals [1]. The palmaris longus is one of the four superficial muscles that flexes the wrist [2]. The muscle is said to be the most variable muscle in the human body as it is frequently absent on one or both sides of the arm. It can be considered to be a dispensable muscle because its absence in the arm does not affect the function of the wrist significantly [3].

Absence of palmaris longus exposes the median nerve making it the most superficial structure in the wrist placing the median nerve at a large risk of injuries by trauma or surgical incision which can affect the pronator teres, flexor carpi radialis and the flexor digitorum superficialis which could impair the flexion of the wrist [4]. It is more common to have the absence among the females with 4.4% and 1.3% among the males for the 3 races [3]. The Chinese population in Singapore had only a prevalence of 4.5% whereby bilateral absence was 1.2% and unilateral absence was 3.3% [5]. The Korean population had an overall prevalence of 4.1% of the absence of the palmaris longus [6, 7]. Among the Indian population in Gujarat, 16.0% of the population had an absence of the palmaris longus whereby 6.5% was unilateral and 9.5% was bilateral [8]. Another study on the Gujarat population in India had also showed that 13.08% of the population had an overall agenesis of the palmaris longus. 5.06% of the population had unilateral absence whereas 8.02% had bilateral absence [9]. About 16.25% of the population in Central India had an absence of the palmaris longus which 6.25% had bilateral absence and 10.0% had unilateral absence [10].

There was a 21.0% of the Andhra population of India that showed absence of the Palmaris longus and 7.0% for the males. 19.7% of the participants had unilateral absence whereas 8.3% of the participants had bilateral absence [11]. The Indian population of India showed a prevalence of 27.44% of the absence of the palmaris longus. They had 16.9% of prevalence of the unilateral absence of the palmaris longus and 10.52% of the bilateral absence of the palmaris longus [12]. Another study on the Indian population of India had about 16.0% prevalence where the muscle was absent among male participants only and 38.0% prevalence among female participants only. A total of 26.5% of the population showed absence of the palmaris longus with 18.3% having unilateral absence and 8.2% having bilateral absence [13].

25.0% of the Caucasian population of the Northern Ireland showed absence in the palmaris longus. 16.3% of the Caucasian population of the Northern Ireland had unilateral absence whereas 8.7% of them had bilateral absence [14]. The White and Hispanic population had higher prevalence of the absence of the palmaris longus with 2.5% and 8.6% respectively compared to the African Americans with 0.45% and Asians with 0.19%

^[15]. Ethiopian population showed a prevalence of 15.3% of absence of the palmaris longus. 7.2% of the prevalence was unilateral absence and the rest was bilateral absence ^[16].

The overall prevalence of palmaris longus agenesis was 24.6% in Jizani population at Saudi Arabia. Right sided absence was more common among the male Jizani population whereas left sided absence was more prevalent in females ^[17]. In a hospital in Iran, a study has been done on the participants and 22.8% of the participants showed an absence in the palmaris longus. The prevalence for unilateral absence is 16.1% whereas for bilateral absence was 6.7% ^[18]. In the southern part of Iran, a population study had shown that 30.7% of the population there had an absence in the palmaris longus with 19.5% bilateral absence and 11.2% unilateral absence. It was more prevalent in females as 38.6% of the participants that had absence were females compared to men with only 22.7% ^[19]. There was a more frequent agenesis of the palmaris longus in woman with 29.7% compared to man which was 21.1% ^[20]. In Sulaimani, 7.3% of the population had bilateral absence whereas 11.0% of the population had unilateral absence ^[21]. Unilateral absence was about 21.6% whereas bilateral absence was about 15.9% of the population of Serbia. This brings it to a total of 37.5% prevalence of the absence of the palmaris longus ^[22].

The total prevalence of the absence of the palmaris longus was only 3.1% among the Ghanaian population. There was also a higher frequency of palmaris longus absence in females compared to males ^[23] in Ghanaian population. The Nigerian population had shown an outstanding 31.25% of the absence of the palmaris longus whereby 12.5% were unilateral and 18.75% were bilateral absence ^[24]. The females showed a higher percentage of prevalence of the absence of the palmaris longus compared to males ^[25] in Nigerian population. The unilateral absence among the Yoruba tribe members were 5.4% while the bilateral absence was about 1.5% ^[26]. Another study in the Yoruba tribe was done and the absence was also 6.7% of the population ^[27]. In east Africa, the overall rate of absence was 4.4%. They had a unilateral absence prevalence of 3.3% and bilateral absence of 1.1% ^[28]. It was found that there was a total of 15.9% of the population that had the absence of the palmaris longus by using the Schaeffer's test and 15.1% for the new Hiz-Ediz test ^[29]. Another study done on aborted fetuses in Turkey showed that there was an absence of 37.93% of the fetuses ^[30].

II. Objective

The objective of this is to determine the prevalence of the absence of the palmaris longus in Malaysian population and to compare its absence among the three races.

III. Methodology

A study on a sample of 610 participants both males and females, age ranging from 20 years to 70 years old taken randomly by convenience method from the various races of Malaysian population was conducted. Among the wide range of tests that are used to identify the palmaris longus, the two most traditional and easy tests which are Schaeffer's test ^[31] and Thompson's test ^[32] were used for the present study.

The information about the participant's name, gender, age, ethnicity and the present or absence of palmaris longus muscle is recorded. For absence of palmaris longus unilateral absence/ bilateral absence is also recorded. Data were processed, computed and analyzed by using SPSS software version 22. The associations between absence of palmaris longus with gender and ethnicity were assessed using Chi-square tests using a statistical significance of $p \leq 0.05$.

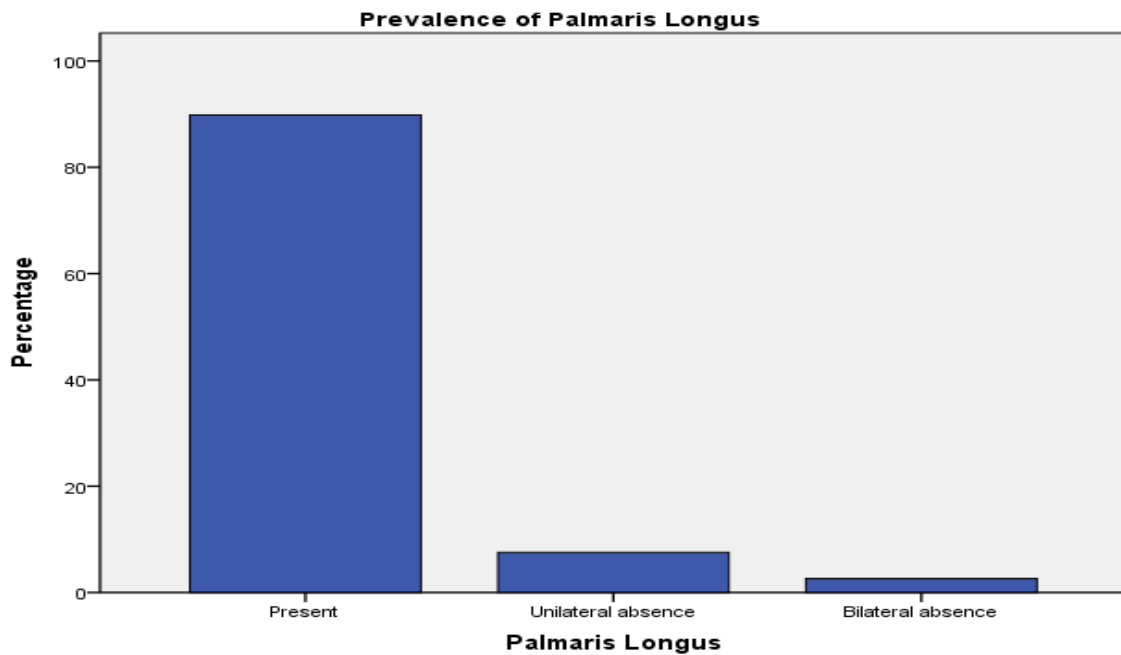
IV. Results

In this study, 610 participants who are composed of 287 males and 323 females took part. The mean ages of the participants were 25.81 years with a standard deviation of ± 11.665 years. The Palmaris longus was found absent in 62 (10.16%) participants with 46 (7.54%) participants having unilateral absence and 16 (2.62%) participants with bilateral absence. (Table I, Fig.1)

Table. I

| | Prevalence |
|------------------|------------|
| Overall Presence | 89.84% |
| Overall Absence | 10.16% |

Fig.1

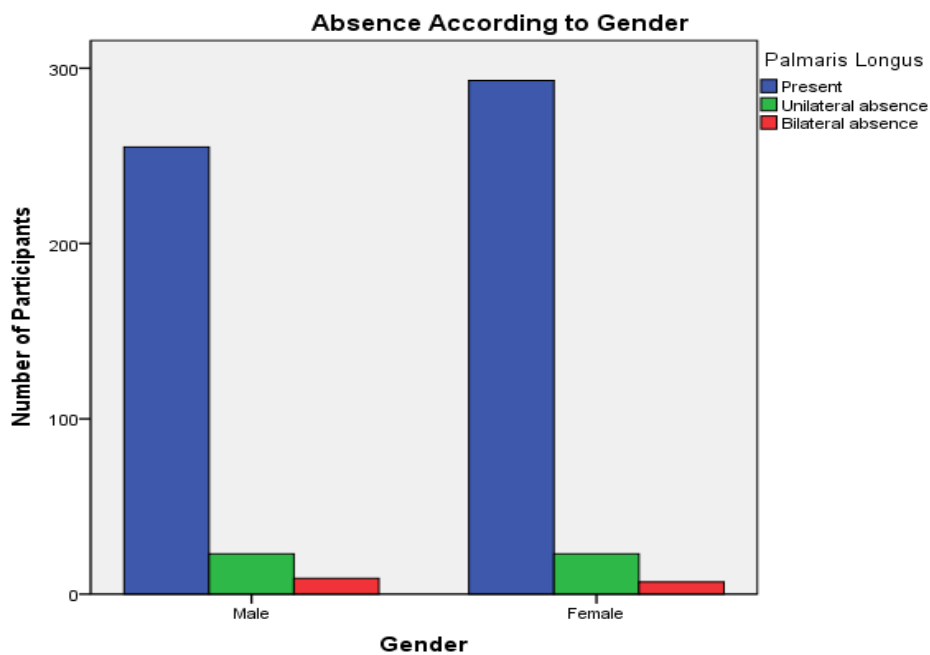


Among the 287 male participants, the total absence of the palmaris longus was 32 participants (11.1%) and among the 323 female participants, the total absence was 30 participants (9.3%). In males, 23 of them have been unilaterally absent (8.0%) and 9 of them bilaterally absent (3.1%). In females, 23 of them have been unilaterally absent (7.1%) and 7 of them bilaterally absent (2.2%). (Table II, Fig.2)

Table. II

| | Present | Unilateral absence | Bilateral absence |
|--------|---------|--------------------|-------------------|
| Male | 88.9% | 8.0% | 3.1% |
| Female | 90.7% | 7.1% | 2.2% |

Fig.2



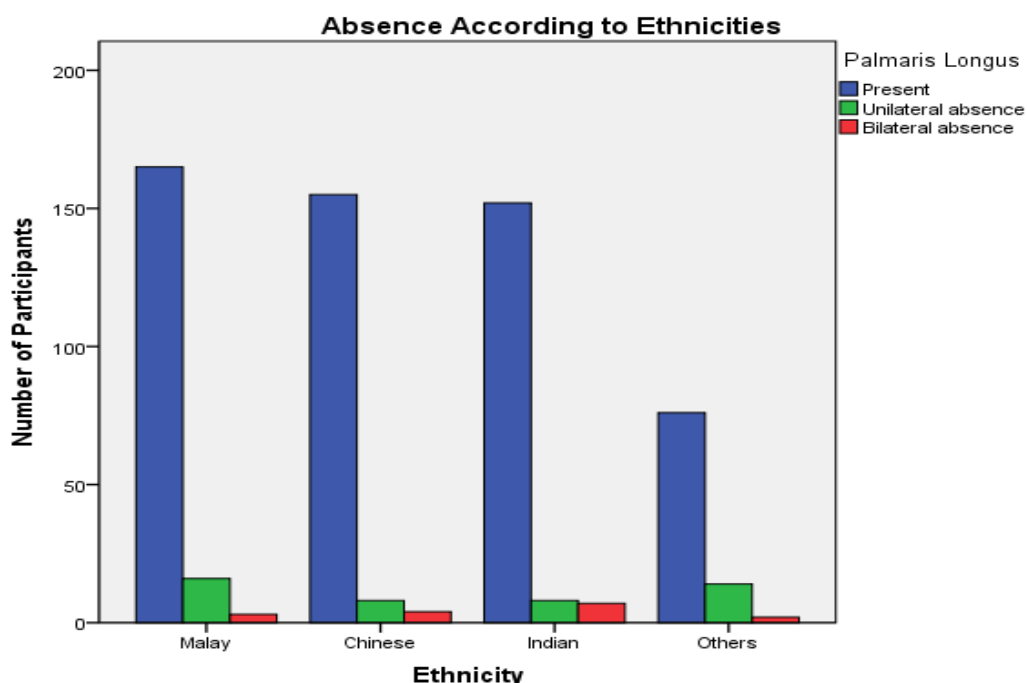
Significance $p < 0.683$.

Of the 610 participants according to their ethnicity, 184 of them were Malay, 167 were Chinese, 167 were Indian and 92 of them were other races. Among the 184 participants in the Malay ethnic group, 19 of them presented with a total absence of the palmaris longus (10.3%) with 16 of them having unilateral absence (8.7%) and 3 of them having bilateral absence (1.6%). The Chinese ethnic group had a total absence of the palmaris longus of 12 people (7.2%) out of 167 participants with 8 of them having unilateral absence (4.8%) and 4 of them having bilateral absence (2.4%). The Indian ethnic group had a total absence of the palmaris longus of 15 people (9.0%) out of 167 participants with 8 of them having unilateral absence (4.8%) and 7 of them having bilateral absence (4.2%). The Other races had a total absence of the palmaris longus of 16 people (17.4%) out of 92 with 14 of them having unilateral absence (15.2%) and 2 of them having bilateral absence (2.2%). (Table III, Fig.3).

Table. III

| | Present | Unilateral absence | Bilateral absence |
|---------|---------|--------------------|-------------------|
| Malay | 89.7% | 8.7% | 1.6% |
| Chinese | 92.8% | 4.8% | 2.4% |
| Indian | 91.0% | 4.8% | 4.2% |
| Others | 82.6% | 15.2% | 2.2% |

Fig.3



Significance $p < 0.030$.

V. Discussion

Palmaris longus is said to be the most variable muscle in the human body as it is frequently absent on one or both sides of the arm [3].

The prevalence of absence of the Palmaris longus has been extensively studied following the first report of its absence in the year 1559 by Colombos in De Re Anatomica Libri [10]. Different tests have been described to determine the presence of palmaris longus muscle [29]. In the detection tests, differing results were obtained because each test varied in their method and effectiveness for detecting muscles that were in close relation to the palmaris longus [6]. Differences in incidence of agenesis of palmaris in different races have been documented [10].

Prevalence of 27.44% of the absence of the palmaris longus, 16.9% of prevalence of the unilateral absence of the palmaris longus and 10.52% of the bilateral absence of the palmaris longus [12] have been documented in Indian population. In another study, 25% of the Caucasian population of the Northern Ireland had absence in the palmaris longus whereby 16.3% of the Caucasian population of the Northern Ireland has unilateral absence whereas 8.7% of them have bilateral absence [14]. In a previous study on the Malaysian population, absence of the palmaris longus unilaterally is more prevalent than bilateral absence being 6.4% and

2.9% respectively^[3]. The unilateral absence had a higher prevalence compared to bilateral absence which is in line with our present study.

However, there are some studies which have found a higher bilateral absence compared to unilateral absence in the Northern Borneo population^[2]. A study in Korea had also showed a higher bilateral absence compared to unilateral absence^[6]. There is a higher rate absence of palmaris longus (11.1%) in males compared to females (9.3%) in our present study. However many studies such as the one in Brazil whereby there are more frequent agenesis of the palmaris longus in woman with 29.7% compared to man which is 21.1%^[20]. In the southern part of Iran, it was more prevalent in females as 38.6% of the participants that had absence were females compared to men with only 22.7%^[19].

However, there are contradicting reports such as the study in East Africa that had showed a higher prevalence of absence in the males compared to the females^[28]. In another study on Malaysian population, it is more common for the palmaris longus to be absent amongst the Malay race with 11.3% which is the highest prevalence of palmaris longus absence, followed by the Indians with 10.7% and lastly with 6.0% among the Chinese population^[3]. The Malays had the most absence of the palmaris longus among the 3 main races in Malaysia, followed by Indians and lastly the Chinese participants with the least absences^[3].

For harvesting the tendon graft, the surgeon should examine all possible tendon donors preoperatively, and one's suspicion might be heightened by knowing the patient's ethnicity. In a study by Soltani et al^[15] there was highest rates of absence, in both Hispanic and non-Hispanic subsets. Our results show significant absence with ethnicity. However, our results are not significant for the gender, because p value is more than 0.05 regarding absence according to gender ($p < 0.683$). The absence according to ethnicity however was significant ($p < 0.030$). This means that both males and females will have an equal opportunity of getting an agenesis of the palmaris longus.

VI. Conclusion

The prevalence of unilateral absence is higher than the bilateral absence in Malaysia. Males had a higher prevalence of palmaris longus compared to females. Among the races in Malaysia, the Malay race had the highest prevalence of absence of palmaris longus, followed by the Indian race and lastly Chinese race. However, there was no statistically significant correlation between the tendon absence and gender. It is significant with the ethnicity.

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