

Anatomical aberration of palmaris longus agenesi s muscle through clinical examination in relation to gender and hand dominance

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Abstract

Objective: To determine the frequency of agenesi s of palmaris longus muscle and its association with gender and hand dominance.

Method: The cross-sectional descriptive study was conducted at the Bahria University Medical and Dental College, Karachi, from March 2021 to November 2021, and comprised medical students of either gender from 1st, 2nd and 3rd year of studies. Clinical examination of palmaris longus was done by using the classic Schaeffer's test, and it was confirmed using the Thompson's test. The agenesi s of palmaris longus muscle and its association with gender and hand dominance was also tested. Data was analysed using SPSS 23.

Results: Of the 200 participants, 114(57%) were female and 86(43%) were male. The overall age range was 18-23 years. Of the total, 195(97.5%) subjects were right hand dominant and 5(2.5%) were left hand dominant. Agenesi s was found in 67(33.5%) subjects with no significant difference in terms of gender or hand dominance ($p>0.05$). Statistically significant difference ($p=0.01$) was found related to bilateral agenesi s.

Conclusion: Bilateral agenesi s was found significantly more in females compared to the males, while palmaris longus agenesi s and hand dominance had no significant association.

Keywords: Anatomical, Aberration, Palmaris longus, Agenesi s, Clinical examination, Gender, Hand dominance. (JPMA 73: 74; 2023) DOI: 10.47391/JPMA.6251

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Introduction

Originating from the medial epicondyle of humerus, palmaris longus (PL) is a fusiform muscle which is present medial to flexor carpi radialis and passes into the hand over the flexor retinaculum.¹ After passing anterior to it, some of the muscle fibres separate out and blend with the retinaculum itself. Later, on entering the hand, the muscle becomes flattened and eventually merges with palmar aponeurosis.² Being a weak flexor of the wrist, it also contributes to the abduction of thumb.¹ Because of its superficial location, easy accessibility and considered a well-developed muscle, it is thought to be one of the most significant muscles used for orthopaedic and reconstructive surgeries.^{2,3} It is used by surgeons for the repair of flexor and extensor tendons, repair of flexor pollicis longus, mallet finger repair, correction of ptosis, augmentation of lips and management of facial paralysis. Orthopaedic surgeons also make use of the muscle for joint arthroplasty of carpometacarpal joint.² However, it is also the most common muscle which exhibits anatomical variations, like being double, or split, upturned, with two bellies or may even be completely absent altogether.^{2,3}

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Due to its significant role as a graft in reconstructive surgeries, it is important to know its morphological variations. These deviations can include fusion of the muscle with neighbouring muscles, presence of an additional belly, an unorthodox course of the tendon, difference in its origin and insertion by multiple tendons.^{3,4} The muscle, due to its variations, is also reported in literature to have a protective role over median nerve.³

Globally, a 15% prevalence of agenesi s of PL tendon was noted in population. However, this differs in different ethnic groups. Lowest prevalence of 0.6% was observed in South Korean population, followed by 1.5% in Africans.⁵ Another study reported the absence of PL ranging between 1.5% and 63.9% people.⁶ A meta-analysis observed a 10.3% absence of PL tendon, with the highest prevalence of 24.7% in people of European descent.³ A study conducted on Pakistani population reported the absence of muscle to be associated with the non-dominant hand.⁷ A Turkish study mentioned no association between the agenesi s of the muscle and the hand dominance.⁶ A multiracial study conducted in Malaysia observed that people of Indian origin exhibited the highest prevalence of absence of PL muscle, followed by Malays and the Chinese. The presence or absence of the muscle is easily detected by means of the standard Schaeffer's test.⁸ A cadaveric study reported that bilateral

absence of PL was more common compared to unilateral agenesi.⁴ Fidan et al. endorsed similar results in Turkish population in both genders.⁵ However, Mahmood et al. reported unilateral absence of the muscle to be more common in individuals living in Islamabad.⁷ Researchers have reported the association of agenesi of PL more commonly with females compared to males.⁸ A Pakistani study also observed the prevalence of absence of the muscle to be more in females in comparison with males.⁷ However, Fidan et al. observed no statistically significant differences between the genders.⁵

Variability also exists in terms of unilateral agenesi between the male and female genders. Keracan et al. reported the left agenesi to be more in males compared to females,⁶ while a study conducted on fetuses reported more right-sided agenesi in males against more left-sided agenesi in females.⁴ Knowledge about the prevalence of PL muscle is a useful tool and thus insight about its prevalence is an aid for the surgeons. Literature search shows that there exists anatomical variability and knowing the distinctiveness between the genders can facilitate the surgeons to practice reconstructive surgeries and grafting with ease. The current study was planned to determine the frequency of agenesi of PL muscle and its association with gender and hand dominance.

Subjects and Methods

The cross-sectional descriptive study was conducted at the Bahria University Medical and Dental College (BUMDC), Karachi, from March 2021 to November 2021. After approval from the institutional ethics review committee, the sample size was calculated using OpenEpi version 3 calculator based on population prevalence 18.9%,⁹ estimated population size 750, margin of error 5% and confidence interval (CI) 95%. The participants of research were recruited by convenience non-probability sampling. The sample comprised medical students of either gender aged 18-23 years from 1st, 2nd and 3rd year of studies who had no abnormality, disease of upper limb or previous surgeries. Those who had undergone surgeries or had deformities of the forearm were excluded.

After taking informed consent, each participant was tested for the presence or absence of PL tendon in both the forearms. The clinical examination was done using the Schaeffer's test which is considered the gold standard in detecting the tendon of PL muscle.⁸ The agenesi was confirmed by Thompson's test.¹⁰⁻¹² The PL tendon was considered to be present if it was visible by any of the two tests. In order to perform the Schaeffer's test, the participants were asked to oppose the thumb against the

little finger along with flexion at the wrist joint. In case of presence, the tendon becomes visible medial to the tendon of flexor carpi radialis (Figure-1). Thompson's test was performed by making a fist with thumb covering the fingers along with flexion at the wrist joint.⁹ The details of agenesi and presence of tendons in both the forearms were noted in the proforma.

Data was analysed using SPSS 23. The agenesi of PL muscle and its association with gender and hand dominance was tested using chi-square test. The categorical variables were expressed as frequencies and percentages. $P < 0.05$ was considered statistically significant, while $p < 0.001$ was regarded as highly significant.

Results

Of the 200 participants, 114(57%) were female and 86(43%) were male. Of the total, 195(97.5%) subjects were right hand dominant and 5(2.5%) were left hand dominant. Agenesi was found in 67(33.5%) subjects with no significant difference in terms of gender (Figure-2) or

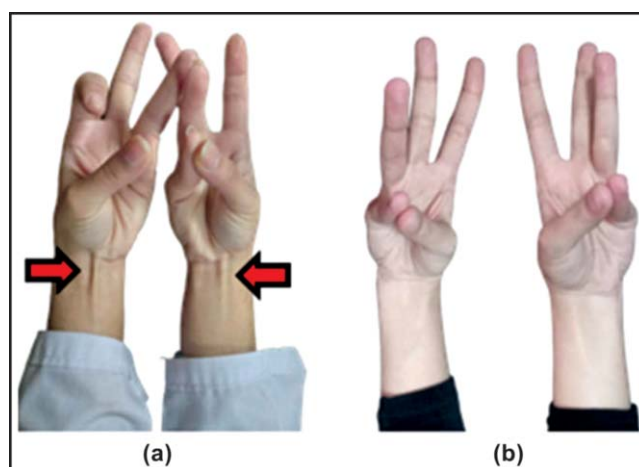


Figure-1: (a) Bilateral presence of palmaris longus tendon visible by Schaeffer's test. (b) Bilateral agenesi of palmaris longus in a study subject.

Table-1: Gender comparison regarding prevalence and agenesi of palmaris longus muscle (n= 200).

Types of agenesi	Observation	Gender		p value
		Male (n=86)	Female (n=114)	
Right agenesi	Yes	11 (12.8%)	9 (7.9%)	0.18
	No	75 (87.2%)	105 (92.1%)	
Left agenesi	Yes	7 (8.1%)	8 (7.01%)	0.48
	No	79 (91.9%)	106 (93%)	
Bilateral agenesi	Yes	8 (9.3%)	24 (21.1%)	0.01*
	No	78 (90.7%)	90 (78.9%)	
Bilateral presence	Yes	60 (69.8%)	73 (64%)	0.24
	No	26 (30.2%)	41 (36%)	

p value significant < 0.05*, highly significant: < 0.001**

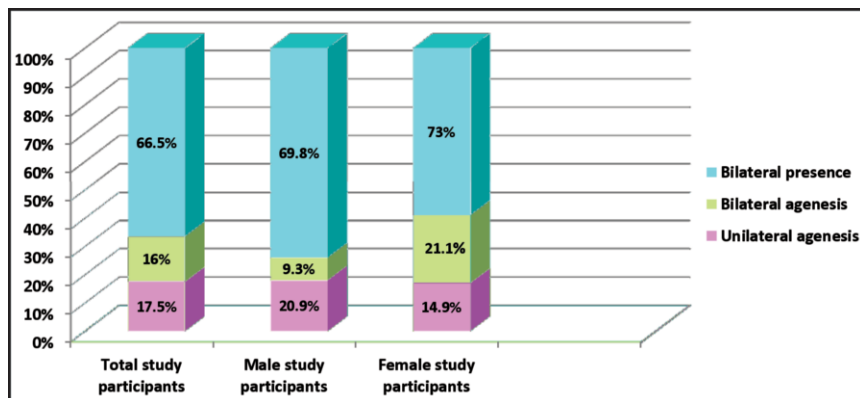


Figure-2: Gender and laterality.

hand dominance ($p > 0.05$). Statistically significant gender-based difference ($p = 0.01$) was found related to bilateral agenesis (Table). Overall, 35 (17.5%) subjects had PL tendon in one of the forearms, while 133 (66.5%) subjects had PL in both the arms.

Among the females, right-sided PL absence of tendon was found in 9 (7.9%), while on the left side it was 8 (7%). Among the male participants, right-sided agenesis was observed in 11 (12.8%) compared to 7 (8.1%) on the left side.

Among the right hand dominant individuals, 20 (10.3%) had right-sided agenesis, while 14 (7.2%) had left-sided agenesis. Among the left hand dominant participants, none had right-sided agenesis compared to 1 (20%) with left-sided agenesis. In terms of bilateral agenesis, 30 (15.4%) subjects were right hand dominant, while 2 (40%) were left hand dominant.

Discussion

In the present study, the overall frequency of agenesis was 33.5%. This is in line with other studies conducted in Iran (33.7%), Egypt (33.95; 34.3%) and Turkey (31.05%).¹³⁻¹⁶ Another study conducted in Serbia documented higher prevalence of agenesis (52.3%),¹⁷ while a research in Nigeria mentioned the frequency to be only 3.7%.¹⁸ The similarity in prevalence of agenesis could be due to the similar geographical location and the dissimilarity to that of Serbian and Nigerian studies could be due to the differences in structural anatomy of people living in various regions of the world.

The current study showed more agenesis in females compared to the males. Comparable results were documented by a study conducted in Malaysia.⁸ A study in Bhairawaha, Nepal also mentioned similar results.¹⁹ Contrasting results with more agenesis in males against the females were documented in a research conducted in south-eastern Europe.¹⁷ This could be explained by the

fact that Asian morphology of structures differs with that of other regions of the world. In the current study, in terms of laterality among the study subjects, unilateral agenesis was observed to be more (17.5%) compared to bilateral agenesis (16%). Studies in Nepal documented parallel results, with 11.1% and 8.2% compared to bilateral absence of 3.7% and 3.5%.^{19,20} Contrary to the current results, several studies showed more bilateral agenesis compared to unilateral absence.^{12,21,22} The present study showed that among the females,

bilateral agenesis was more compared to unilateral absence, while among the males, unilateral absence was recorded more compared to bilateral absence. Similar results were reported from Tehran,¹² while a study in Kerman, mentioned contrary results.¹³ A study conducted in Poland on human foetuses highlighted that there existed morphological distinctiveness that led to structural variability in the PL tendons.⁴

Overall agenesis in terms of sides showed more right-sided agenesis compared to the left-sided agenesis. Similar results were documented by earlier studies.^{15,23} In contrast, other studies showed more left-sided agenesis.^{8,10,14} Within each group of males and females, both genders had more right-sided absence. Jha et al. documented more left-sided agenesis for females,²⁰ while Abdolreza et al. mentioned more left-sided agenesis for males while in females there was more right-sided agenesis.¹³ A study in Ukraine documented interesting facts, highlighting the variability in terms of PL agenesis. The agenesis has differed among the Ukrainian individuals born before 1945 and those born after that point, suggesting that agenesis pattern is changing with time.²⁴

The current results showed no association between agenesis and hand dominance. Similarly a Turkish research also mentioned no correlation between dominant hand and agenesis.⁶ A study in Malaysia documented that there was no significant association between hand dominance and PL absence.²⁵ Contrary to the current results, Jha et al. and Mehmood et al. mentioned that agenesis was more commonly reported on the non-dominant hand.^{7,20} Eric et al. also found the association to be statistically significant.¹⁴

The current study aimed at determining PL agenesis and its association with gender and hand dominance in the best possible way during the coronavirus disease-2019 (COVID-19) pandemic. However, there are few limitations. The research was conducted at a single centre. In future,

multi-centre researches with larger sample sizes should be done to validate the current findings. Studies should be done in various regions across the country to ascertain the prevalence on the national scale. The findings of such future studies from Pakistani population should then be included in anatomy and surgery textbooks as a clinical correlate so that doctors in the region may be able to carry out the grafting procedures keeping in mind the frequency of agenesi in the local setup.

Conclusion

Overall agenesi in females was more than in males. The right and left sided agenesi was more in males compared to females. Bilateral agenesi was significantly more in females compared to the males. There was no significant association between PL agenesi and hand dominance.

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Conflict of Interest: One of the co-authors was part of the ethics review committee which approved the study.

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