

Prevalence of agenesis of the palmaris longus muscle in Brazil and its clinics correlation

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Abstract

Introduction: The palmaris longus muscle it is considered one of the most variable muscles in the human body, and its agenesis is the most frequent anatomic variation. The aim of this study was to determine the prevalence of unilateral and bilateral agenesis of palmaris longus muscle for the subjects in the city of Jataí, Goiás. **Material and methods:** 740 subjects, 279 men and 461 women, in the age of 10-70 years old, were observed through clinical inspection in both forearms to absence of the tendon of palmaris. The data were described in percentage values and the absence of the muscle was analyzed statistically (Chi square test; $P < 0.05$). **Results:** The bilateral presence was identified in 73.5%, the absence on the left side in 7.8%, on the right in 6.5% and bilateral absence was observed in 12.2% of subjects. Among women and men the percentage values was 9.3%, 7.3%, 13.1% and 5.4%, 5%, 10.7%, respectively to agenesis in left side, in right side and bilateral agenesis. The unilateral/bilateral agenesis was more frequent in women (29.7%) than in men (21.1%; $P < 0.05$). Bilateral absence was 12.4% in right handed subjects and 9.1% in left handed subjects ($P > 0.05$). Left and right handed subjects showed absence of muscle similar in both forearms ($P > 0.05$). **Conclusion:** most subjects studied showed bilateral presence of palmaris longus muscle, the agenesis was significantly more common in women and with similar percentage in right and left handed subjects.

Keywords: palmaris longus muscle, agenesis, sex, motor dominance.

1 Introduction

Palmaris longus is often described as one slender and fusiform muscle, with a short belly proximally and a long tendon (10-12 cm) which passes anterior (superficial) and distally in forearm of the upper limb of humans and disposed medial to flexor carpi radialis. This muscle had origin in the medial epicondyle of the humerus with insertion predominantly into central palmar surface of the aponeurosis and flexor retinaculum. It is innervated by median nerve and irrigated by branches from anterior ulnar recurrent arteria (MOORE and DALLEY, 2007).

This muscle is one of the most variable in the human body and had been phylogenetically classified as a retrogressive muscle (KOO and ROBERTS, 1997). In humans, palmaris longus muscle (PLM) is often absent on one or both sides. In addition, the muscle may be also double, tendinous, split, incomplete, digastrics or exhibit anomalous insertions (KOO and ROBERTS, 1997; TÉLLEZ and ACUÑA, 1998; KAWASHIMA, KIKUSHIMA, YOKOTA et al., 2002). The PLM that is tendinous in its upper part and muscular in its lower part was named as reversed palmaris longus (SCHUURMAN and GILS, 2000).

In the last times, this muscle has attracted the attention of clinicians. There is a growing interest in the existence of the muscle because its tendon is reported to be most frequently harvested for reconstructive plastic and hand surgery (HIRAYAMA, ATSUTA and TAKEMITSU, 1986). The length of this tendon, had been described how correspond to 58% and 59% of forearm length in men and women, respectively (MOBARAKEH, PASHA and

MOAGHARI, 2008). It had been used as tendon grafts for reconstruction of ruptured ligaments but also may be detached from its distal fixation and rejoined to the insertion of the tendons of others paralyzed muscles of the forearm, to recovery loose movements (ZEYBEK, GURUNLUOGLU, CAVDAR et al., 1998). Furthermore, the tendon, in various combinations is used to large variety of surgical procedures which included increase of the lips (DAVIDSON, 1995) correction of ptosis (NAUGLE and FAUST, 1999) and the restoration of facial paralysis (ATIYEH, HASHIM, HAMDAN et al., 1998).

The prevalence of palmaris longus agenesis is little studied in Brazil and has not been reported in Goiás state population. Then, considering the importance of provide anatomic data that could serve as subside to clinical applications, the aim of this study was to determine the prevalence of unilateral and bilateral absence of palmaris longus for the subjects in the city of Jataí, in the state of Goiás, Brazil.

2 Material and methods

The sample population included 740 subjects, men and women, from 10-70 years old, born in the state of Goiás and resident in Jataí and who agreed to participate. Individuals with a history of injury, disease or abnormality at least one upper limbs, which make difficult or impossible the performance of flexion of the fingers and wrist, were excluded from the study. Hand dominance was recorded for each subject.

Accordinging Sebastin, Lim and Wong (2006) the presence or absence of the tendon of PLM was observed through clinical inspection in both forearms. The subject was initially asked to do the standard test for the assessment of the palmaris longus tendon. For this, the subject was asked to oppose the thumb to the little finger and then flex the wrist (Figure 1a). If the tendon was not visualized or palpable, three additional tests were done to confirm the absence:

- Thompson’s test: The subject is asked to make a fist, then flex the wrist and finally the thumb is opposed and flexed over the fingers (Figure 1b);
- Mishra’s test II: The subject is asked to abduct the thumb against resistance with the wrist in slight palmar flexion (Figure 1c); and
- Pushpakumar’s method: The subject is 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 (Figure 1d).

The data were described in percentage values and the palmaris longus agnesis was analyzed statistically through SPSS software (version 17.0). Chi square test was used to analyze the significance of the difference between frequencies of qualitative variables, PLM agnesis/presence *vs* hand dominance and PLM agnesis/presence *vs* sex of subject. Statistical significance was set at $P < 0.05$.

3 Results

Our results showed that the bilateral presence of the PLM was identified in 544 subjects (73.5%), the absence on the left side was observed in 58 subjects (7.8%), on the right side in 48 subjects (6.5%) and the bilateral absence was observed in 90 subjects (12.2%). These data showed 14.3% of cases with unilateral agnesis and 12.2% of cases with bilateral agnesis of PLM.

Were inspected the forearms of 279 men and 461 women. The data with percentual values of presence/absence of the PLM according to sex are shown in Figure 2a. The results showed that unilateral/bilateral agnesis of PLM is more frequent in women (29.7%) than in men (21.1%; $P < 0.05$; Figure 2a).

Right hand dominance was observed in 696 (94.05%) subjects while the left hand dominance was observed in 44 (5.95%) subjects. Bilateral absence of palmaris longus tendon was 12.4% in right handed subjects and 9.1% in left handed subjects ($P > 0.05$). In right and left-handed subjects, absence of palmaris longus tendon was similar in both sides ($P > 0.05$; Figure 2b).

4 Discussion

Skeletal muscles originate from the mesoderm of the myotomes of the somites. The myoblasts of hypaxial domain

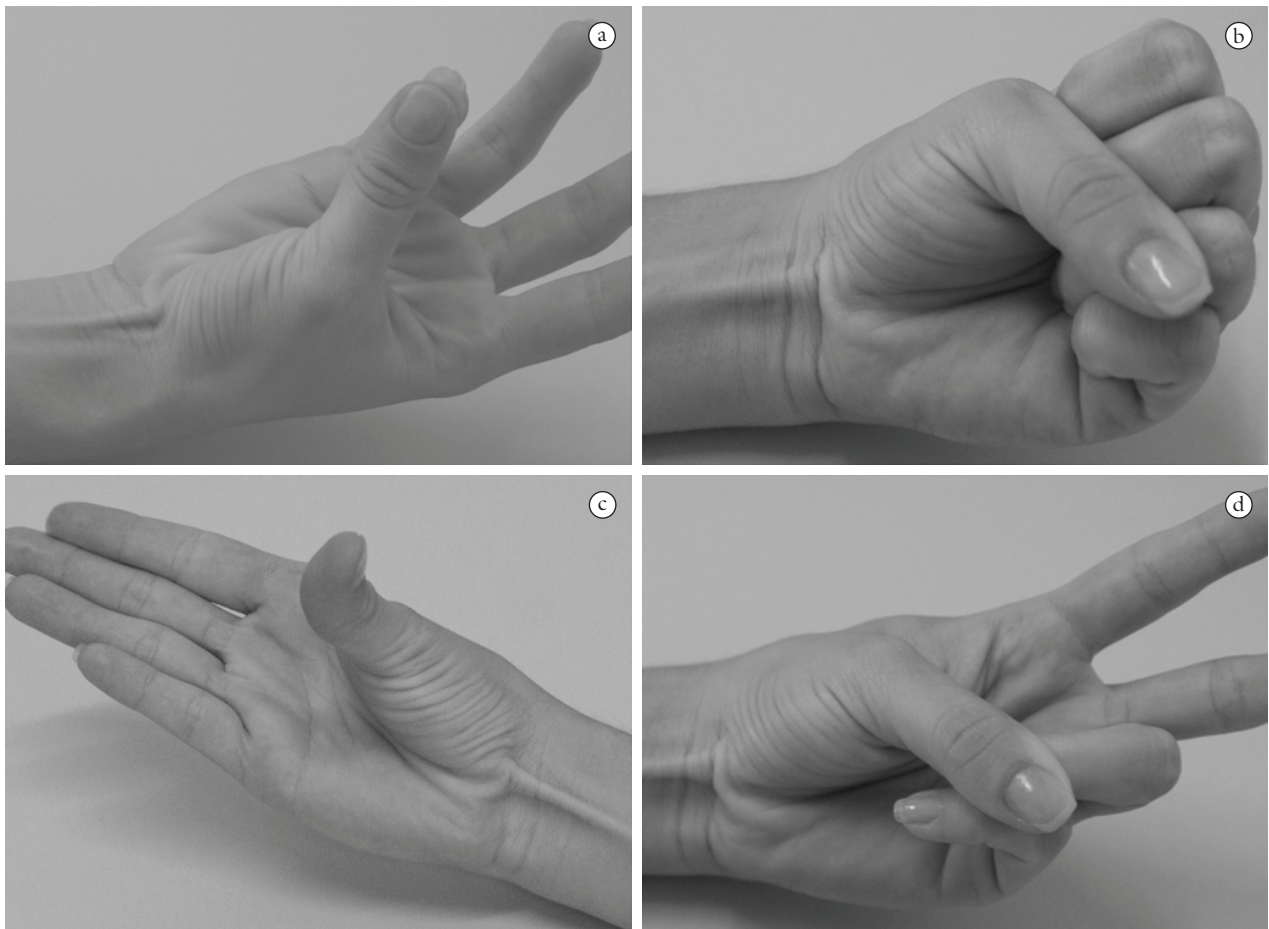


Figure 1. Image showing different tests used for visualize or palpable the palmaris longus tendon. In a) Standard test, in b) Thompson’s test, in c) Mishra’s test II, in d) Pushpakumar’s method.

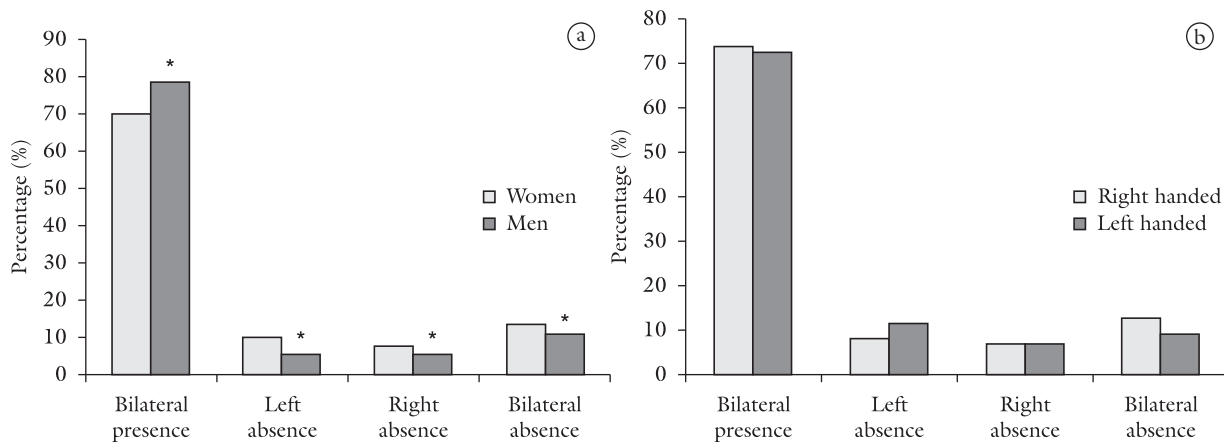


Figure 2. Graphs showing percentage of presence/absence of the palmaris longus muscle in men and women (a) and in right and left handed subjects (b). * $P < 0.05$ women *vs* men, to bilateral presence, right absence, left absence and bilateral absence of PLM.

unite each other and originate to the myotubes, which migrate to the periphery, forming striated skeletal muscle cells differentiated of appendicular muscles. Together, these muscle cells establish contact with the motor nerve endings (HUGHES, 2001).

All precursors in the body have an intrinsic program allowing them to differentiate into muscle. However, this process is controlled and may suffer interference by environmental signals. During early embryogenesis, these signals are located in the ectoderm and the absence of this leads to premature differentiation of the muscles precursors. This premature differentiation results in extra muscle not able to develop, so result in absence or underdevelopment muscular (AMTHOR, CHRIST and PATEL, 1999). About it, different authors had suggests a possible correlation between hereditary factors and the absence of PLM muscle in human (DANFORTH, 1924; GARCIA, MARQUES, SANTOS et al., 2005).

Functionally, the PLM is described as a weak flexor of the wrist and a tensor of the palmar aponeurosis (STANDRING, 2007). In addition, different studies had showed that this muscle also contribute to thumb abduction. This movement of thumb abduction is important to opening the hand to pick up a cup by its sides, opening up scissors, striking a key on a piano or on a keyboard of the computer with the thumb and playing other musical instruments (GANGATA, NDOU and LOUW, 2010). Therefore it is suggested that individuals with unilateral absence (14.3%) or bilateral PLM (12.2%) could presented functional deficits in practice of these activities.

In human cases of agenesis of palmaris longus muscle, others tendon of easy access can replace it in surgical clinical procedures, such tendon/ligament reconstruction. These muscles included the plantaris, tibial muscles, extensor digitorum (brevis and longus), extensor digit minimi, patellar tendon, gracilis and semitendinosus (SIMPSON, HERTZOG and BARJA, 1991; WEHBE, 1992; VIEGAS and CAMANHO, 2003; JAGODZINSKI, BEHFAR, HURSCHLER et al., 2004; CAPPELLINO, PAOLUCCI, ZANGRANDO et al., 2011; SILVA, GAZZALLE, ALVAREZ et al., 2011).

The variability in the prevalence of PLM agenesis among various ethnic groups has been established, and the surgeon's awareness of the prevalence in a population or ethnic group is important and desirable.

Although the PLM is congenitally absent in nearly 15% of individuals worldwide (SEBASTIN, PUHAINDRAN, LIM et al., 2005; MOORE and DALLEY, 2007) there is a wide variation in the frequency of its absence among the different population groups. Studies showed that the incidence of muscle absence is 1.02% in a Ugandan population (IGBIGBI and SSEKITOLEKO, 1998), 3.4% in Japanese (ADACHI, 1909), 4.6% in Chinese (SEBASTIN, PUHAINDRAN, LIM et al., 2005), 6.7% in Nigeria (MBAKA and EJIWUNMI, 2009), 20.2% in Indians patients (AGARWAL, 2010), 24% in North American Caucasians (TROHA, BAIBAK and KELLEHER, 1990), 25% in Nigerian population (WEHBE, 1992), 26.6% in Turkish population (KOSE, ADANIR, CIRPAR et al., 2009) and 38.6% in Bahraini population of Arabian region (SATER, DHARAP and ABU-HIJLEH, 2010).

In Brazil, data shows the prevalence of PLM agenesis as 14% in state of Paraná (GARCIA, MARQUES, SANTOS et al., 2005) and 47% in state of Pernambuco (SILVA, CAMPINA, MAGALHÃES et al., 2010). Thus, the prevalence of that agenesis found in our study was 26.5% for subjects of Goiás, is within the range values described in Brazil.

In our study, unilateral agenesis (14.3%) was more common than bilateral agenesis (12.2%). These results are in agreement to different data (GARCIA, MARQUES, SANTOS et al., 2005; SEBASTIN, PUHAINDRAN, LIM et al., 2005; SILVA, CAMPINA, MAGALHÃES et al., 2010). As in our results, different studies showed that the percentage of the absence of the PLM is higher in woman (SATER, DHARAP and ABU-HIJLEH, 2010; GOSCICKA, STEPIEN and GOSCICKA, 1981). However, there are studies with conflicting results that do not show these differences between men and women (GARCIA, MARQUES, SANTOS et al., 2005; SEBASTIN, PUHAINDRAN, LIM et al., 2005; AGARWAL, 2010).

The data about hand dominance and PLM absence also showed variability among different authors. The results of Eric, Koprivic, Vucinic et al. (2010) showed that unilateral

tendon absence was more common on the non-dominant hand, even that a right-sided absence was more common in left handed persons while the left-sided absence was more common in right handed persons. In our study, the results indicate that left handed subjects showed higher prevalence of absent on the left side and lower percentage of bilateral absence, when compared with right handed subjects. In addition, in right handed subjects the absence of PLM was similar in both sides of forearm (6.5% on the right side and 7.6% on the left side). To Brazilian subjects, similar to our results, Garcia, Marques, Santos et al. (2005) described that right and left handed subjects showed higher percentage of absence of PLM on the left side.

Then, seem clear that a standard prevalence and sex and dominance correlations of absence of the PLM cannot be applied to all populations, indicating that the absence of the muscle probably have be multifactorial with regional characteristics and hereditary correlation, which require further studies.

5 Conclusion

In conclusion, most subjects studied showed bilateral presence of palmaris longus muscle, the agensis was significantly more common in women and with similar percentages in right and left handed subjects.

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