The Prevalence of Agenesis of Palmaris Longus Muscle amongst Students in Two Lagos-Based Medical Schools

Prevalencia de Agenesia del Músculo Palmar Largo entre Estudiantes en Dos Escuelas Médicas en Lagos

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SUMMARY: Palmaris longus (PL) muscle, although of little functional use to the human upper limb, assumes great importance when used as a donor tendon for transfer or transplant. The surgeon's awareness of the incidence in a population is therefore desirable. In the present study, 500 Medical students (242 males and 258 females) of ages 16 to 40 years from both College of Medicine of the University of Lagos, Idi-Araba and Lagos State University College of Medicine, Ikeja were examined for the presence or absence of the PL tendon, using the conventional (Schaffer's) test. The prevalence and pattern of PL agenesis was further analyzed statistically for differences in the prevalence or pattern of PL agenesis with regard to body side or sex. The prevalence of PL agenesis was found to be 12.6% (8% Unilateral and 4.6% Bilateral). Out of those with unilateral agenesis, 20 (4%) had left-sided agenesis and 20 (4%) had right-sided agenesis. Although female subjects had a prevalence of agenesis of PL tendon (Unilateral and Bilateral combined) of 36 out of 258, (13.95%) while in male subjects this prevalence was 23 out of 242 (9.5%). The prevalence of PL muscle agenesis in this study was found to be much higher than the reported average for blacks (2-3%).

KEY WORDS: Prevalence; Agenesis; Palmaris longus.

INTRODUCTION

The history of the concept and contents of the human anatomical variations is the history of the anatomy itself, or, more accurately, the history of the search for the establishment of the canon of the normal structure and composition of the human body. Normal means "within the normal range of variation" (Moore, 1989). However, it is commonly known that individuals of the same species are never exactly alike. Both the body as a whole and its internal organs and parts show certain flexibility of size, form, structure and position (Arey, 1940).

The palmaris longus muscle has been well studied following the first report of its absence in 1559 by Colombos in *De Re Anatomica Libri* (Schaeffer, 1909; Thompson *et al.*, 2001). It is one of the most variable muscles in the human body (Brones & Wilgis, 1978). It varies in the incidence of its absence, form, attachment, duplication and its ability of having accessory slips and substitute structures (Reimann *et al.*, 1944).

The palmaris longus muscle is a slender, fusiform shaped muscle arising from the common flexor origin of the medial epicondyle of the humerus, passing between the flexor carpi radialis and flexor carpi ulnaris muscles, it ends as a slender, flattened tendon passing superficially over the transverse carpal ligament and inserting into the palmar aponeurosis (Roohi *et al.*, 2007). The action of the palmaris longus muscle is to weakly flex the wrist and tense the palmar aponeurosis, synergized by flexor carpi radialis, flexor carpi ulnaris and flexor digitorum superficialis muscles. It is supplied by the median nerve.

Palmaris longus tendon is considered a dispensable tendon because its absence does not significantly affect the function of the wrist. It is therefore very useful in orthopaedics, hand and reconstructive surgery. It is commonly used by hand surgeons for tendon transfers, second stage tendon reconstruction, pulley reconstruction as well as tendon grafting. Plastic surgeons also utilizes the

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palmaris longus muscle in restoration of lip and chin defects (Carroll *et al.*, 2000), ptosis correction (Kurihara *et al.*, 1984; Naugle & Faust, 1999), and in the management of facial paralysis (Atiyeh, *et al.*, 1998).

Despite the obvious clinical importance of this muscle, there is a dearth of information in the literature on its prevalence in our population. The aims of the present study were therefore to determine the prevalence of unilateral and bilateral absence of palmaris longus muscle amongst students in medical schools based in Lagos state and to also evaluate the associations between palmaris longus muscle agenesis and sex of the subject, as well as side of the limb.

MATERIAL AND METHOD

This study was a descriptive survey of medical students in Lagos state to determine the prevalence of the absence of PL. The sample was obtained by simple random sampling, with student nominal roll as the sampling frame. A sample of 500 students (males and Females) from both University of Lagos College of Medicine and Lagos State University College of Medicine was obtained. Ethical permission to carry out this research was sorted and granted from the institutions research and ethics committees. Individuals with physical disability (including those resulting from trauma, be it spine, lower or upper limb), any prior surgery (to upper or lower limb) and any upper limb injuries were excluded from the study.

Each subject was asked to complete a general identification questionnaire and examined for the presence or absence of the palmaris longus tendon. This was achieved by clinical inspection of the volar aspect of the wrist and by performing the Schaeffer's test (Schaeffer) which is the standard test for the assessment of the palmaris longus tendon. Each of the subjects was asked to oppose the thumb to the little finger and then flexes the wrist slightly.

The palmaris longus tendon was labelled as present in the limb if the prominent tendon is visible and or palpable (Fig.1). If the Schaeffer's test failed to demonstrate a PL tendon, it was considered absent (Fig. 2). Four additional tests were done to confirm the absence.

1. Thompson's test: (Thompson *et al.*, 1921). The subjects were asked to make a fist and then flex the wrist and finally the thumb is opposed and flexed over the fingers (Fig. 3).
2. Mishra's test 1 (Mishra, 2001). The metacarpophalangeal joints of all fingers were passively

hyperextended by the examiner and the subjects were asked to actively flex the wrist (Fig. 4).

3. Mishra's test 2 (Mishra). The subjects were asked to abduct the thumb against resistance with the wrist in slight palmar flexion (Fig. 5).

4. Pushpakumar's "two-finger sign" method (Pushpakumar *et al.*, 2004). The subject was asked to fully extend the index finger and middle finger, the wrist and other fingers are flexed and finally the thumb is fully opposed and flexed (Fig. 6).

Statistical analysis. All data were compiled and analyzed on an IBM compatible computer, employing Epi-info 2000 software. All data were expressed as mean $\pm$ SD. Univariate and bivariate analyses were performed to assess the association between absence of the PL tendon and body side, sex and hand dominance. A value of $p < 0.05$ was considered to indicate a significant difference between groups (Duncan, 1957).

RESULTS

A total of 500 medical, dental and pharmacy students were included in this study. There were 242 (48.4%) male and 258 (51.6%) female subjects. The age of the subjects ranged from 16 to 40 years, the average age was 21.3 years.

Out of 500 subjects examined, at least one palmaris longus tendon was present in 477 subjects (95.4%) and both the tendons were present in 437 (87.4%). Out of those with unilateral agenesis, 20 (4%) had left-sided agenesis and 20 (4%) had right-sided agenesis. Hence, unilateral agenesis was seen to be the same on both sides of the limb (Table I).

Although, female subjects had a prevalence of agenesis of palmaris longus tendon (unilateral and bilateral combined) of 36 out of 258 (13.95%) while in male subjects this prevalence was 27 out of 242 (11.16%). The difference however was not statistically significant ($p > 0.05$).

The proportion of subjects with unilateral and bilateral agenesis were comparable (40 subjects (8%) had unilateral agenesis and 23 (4.6%) had bilateral agenesis), the pattern of agenesis of palmaris longus was different in the two sexes. Female subjects had unilateral absence of palmaris longus more commonly; 23 (8.9%) compared to 13 (5.04%) who were bilateral, whereas unilateral absence was the common pattern for male subjects (17 (7.02%) unilateral; 10 (4.13%) bilateral).

Fig. 1. Schaffer's (1909) technique for assessment of the PL. It involves opposition of the thumb to the little finger and flexion of the wrist.

Fig. 2. Schaffer's test in a subject with an absence of PL tendon.

Fig. 3. Thompson's (1921) technique for assessing PL. It involves flexion of the fingers to form a fist followed by flexion of the wrist and finally the thumb is opposed and flexed over the fingers.

Fig. 4. Mishra's (2001) first test for demonstrating PL. It involves passive hyperextension of the metacarpophalangeal joints followed by resisted active flexion at the wrist.

Fig. 5. Mishra's (2001) second test for demonstrating the PL. It involves the resisted abduction of the thumb.

Fig. 6. Pushpakumakar's (2004) two finger sign method. It involves extension of the index and mild finger with flexion of the other fingers at the wrist followed by opposition and flexion of the thumb.

Fig. 7. Schaffer's test in a subject with an absence of PL demonstrating prominence of the flexor carpi radialis which could be mistaken for the palmaris longus tendon.

Table I. Palmaris longus muscle agenesis according to sex and limb laterality. * Indicates significant reduction ($p < 0.05$) when compared to values on the same roll. ** Indicates significant increment ($p < 0.001$) when compared to values on the same column.

Agenesis	Male (%)	Female (%)	Total (%)
Left	6 (1.2)*	14 (2.8)	20 (4)
Right	11 (2.2)	9 (1.8)*	20 (4)
Bilateral	10 (2)*	13 (2.6)	23 (4.6)
No	215 (43)**	222 (44.4)**	437 (87.4)**

In all subjects who demonstrated an absence of the PL with the standard technique (63) all the other four techniques were used to confirm the absence. The results of the other four (4) techniques all concurred with the standard technique.

DISCUSSION

Palmaris longus muscle is one of the most variable muscles in the body. Although the tendon is of little functional use to humans, it finds varied use as a donor tendon. It is of importance, besides the hand surgeon, to the plastic surgeon, ophthalmologist (Bachelor & Jobe, 1980) as well as the otolaryngologist (Song & Bromberg, 1974). Many surgeons agree that the palmaris longus tendon is the first choice as a donor tendon because it fulfills the necessary requirements of length, diameter and availability, and can be used without producing any functional deformity (Troha *et al.*, 1990).

Palmaris longus agenesis has been the subject of several studies, both cadaveric and in vivo. Prevalence of its agenesis has been variously reported to be from 3% in black people to 64% in Turkish people (Sebastin *et al.*, 2005). Even the textbooks differ in the reported prevalence of Palmaris longus agenesis (Connolly & Kilgore, 1977; Pratt *et al.*, 1995; Van de Graft, 1995). Hence it is clear that a generalized figure cannot be applied to all populations. This means that it is important to be aware of the prevalence of Palmaris longus agenesis in the population being treated (Sebastin *et al.*, 2005).

The present study evaluated the agenesis of palmaris longus muscle amongst students in medical schools in Lagos State. Furthermore the data was assessed for any association with laterality of the limb or sex of the subjects. In addition, the data was compared the with previous reports in the literature.

While there is no documented data amongst Nigerian subjects, the average prevalence of palmaris longus agenesis in Black subjects has been reported to be 2.0% (Igbigbi & Ssekitoaleko, 1998) and 3.0% (Sebastin *et al.*).

From the result of numerous previous studies investigating the prevalence of palmaris longus muscle absence it has been reported that bilateral absence occurs in 8 to 16% of individuals, with unilateral absence occurring in 4 to 14% (Vanderhooft, 1996). In the present study however, bilateral absence was found to be 4.6% while unilateral was 8%. This is at variance with the findings of Igbigbi & Ssekitoaleko who reported a 2.0% unilateral absence amongst 245 Ugandan subjects.

Some authors have reported the incidence of agenesis to be higher in female subjects and on the left side (Schaeffer; Reimann *et al.*; Kapoor *et al.*, 2008). In the present study, females were found to have a higher incidence of both unilateral and bilateral agenesis (36 (13.95%)) combined compared to the male (27 (11.2%)). This agrees with Thompson *et al.* (2001), Vanderhooft, and Troha *et al.*, who also reported similar associations for sex.

We used the conventional method of examination of palmaris longus tendon. Although alternative methods of examination of this tendon have been described (Thompson *et al.*, 1921; Mishra; Pushpakumar *et al.*), they offer no definitive advantage over the conventional method (Oudit *et al.*, 2005). The conventional method was therefore preferred because it is fairly easy and reproducible, when used for a large number of subjects as in the present study.

In conclusion therefore, the 12.6% prevalence of palmaris longus tendon agenesis observed amongst students in medical schools in Lagos-State fairly approximates the 15% prevalence often reported in the literature, and much higher than the average reported prevalence in black people (2-3%). The present study therefore, adds to the body of evidence suggesting that palmaris longus absence could be race dependent.

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RESUMEN: El músculo palmar largo (PL), aunque de poco uso funcional en el miembro superior humano, asume gran importancia cuando se utiliza como un tendón donante para la transferencia o trasplante. El cirujano ha tomado conciencia que la incidencia en una población es por tanto deseable. En el presente estudio, 500 estudiantes de medicina (242 hombres y 258 mujeres) de 16 a 40 años, de la Facultad de Medicina de la Universidad de Lagos (Idi-Araba) y la Facultad de Medicina de la Universidad Estatal de Lagos (Ikeja) fueron examinados para evaluar la presencia o ausencia del tendón del PL, utilizando la prueba convencional (Schaffer's). La prevalencia y el patrón de agenesis del PL fueron determinados para analizar diferencias estadísticas en la prevalencia o patrón de agenesis del PL con respecto al lado del cuerpo o sexo. Se encontró una prevalencia de agenesis del PL de 12,6% (8% y 4,6% unilateral y bilateralmente). De los sujetos con agenesis unilateral, 20 (4%) eran en el lado izquierdo y 20 (4%) en el lado derecho. Las mujeres tuvieron una prevalencia de agenesis del tendón del PL (unilaterales y bilaterales combinadas) en 36 de 258 (13,95%), mientras que en los hombres esta prevalencia fue en 23 de 242 (9,5%). La prevalencia de agenesis del músculo PL en este estudio se encontró mucho más alto que el promedio reportado para los negros (2-3%).

PALABRAS CLAVE: Prevalencia; Agenesia; Músculo palmar largo.

REFERENCES

- Arey, L. B. *Developmental anatomy*. Philadelphia and London, W. B. Saunders Company, 1940. p.123-5.
- Atiyeh, B. A.; Hashim, H. A.; Hamdan, A. M.; Kayle, D. I. & Mousharafieh, R. S. Lower reconstruction and restoration of oral competence with dynamic palmaris longus vascularized sling. *Arch. Otolaryngol. Head Neck Surg.*, 124:1390-2, 1998.
- Bachelor, E. P. & Jobe, R. P. The absent lateral canthal tendon: reconstruction using a Y graft of palmaris longus tendon. *Ann. Plast. Surg.*, 5:362-8, 1980.
- Brones, M. F. & Wilgis, E. F. Anatomical variations of the palmaris longus causing carpal tunnel syndrome. Case reports. *Plast. Reconstr. Surg.*, 62:798-800, 1978.
- Carroll, C. M.; Pathak, I.; Irish, J.; Neligan, P. C. & Gullane, P. J. Reconstruction of total lower lip and chin defects using the composite radial forearm-palmaris longus tendon free flap. *Arch. Facial Plast. Surg.*, 2:53-6, 2000.
- Connolly, W. B. & Kilgore, E. S. Jr. *Tendons*. In: The Hand: Surgical and nonsurgical management. Kilgore, E. S. & Graham, W. P. (Eds.) Philadelphia, Lea and Febiger, 1977. p.162-210.
- Duncan, D. B. Multiple range tests for correlated and heteroscedastic means. *Biometrics*, 13:164-76, 1957.
- Igbigbi, P. S. & Ssekitoileko, H. A. Incidence of agenesis of the palmaris longus muscle in Ugandans. *West African J. Anat.*, 6:21-3, 1998.
- Kapoor, S. K.; Tiwari, A.; Kumar, A.; Bhatia, R.; Tantuway, V. & Kapoor, S. Clinical relevance of palmaris longus agenesis: Common anatomical aberration. *Anat. Sci. Int.*, 83:45-8, 2008.
- Kurihara, K.; Kojima, T. & Marumo, E. Frontalis suspension for blepharoptosis using palmaris longus tendon. *Ann. Plast. Surg.*, 13:274-8, 1984.
- Mishra, S. Alternative tests in demonstrating the presence of palmaris longus. *Indian J. Plast. Surg.*, 34:12, 2001.
- Moore, K. L. Meaning of "normal". *Clin. Anat.*, 2:235-9, 1989.
- Naugle, T. C. Jr. & Faust, D. C. Autogenous palmaris longus tendon as frontalis suspension material for ptosis correction in children. *Am. J. Ophthalmol.*, 127:488-9, 1999.
- Oudit, D.; Crawford, L.; Juma, A. & Howcroft, A. The "four-finger" sign: to demonstrate the palmaris longus tendon. *Plast. Reconstr. Surg.*, 116(2):691-2, 2005.
- Pratt, N. E. *Surface anatomy of upper extremity*. In: Rehabilitation of the Hand Surgery and Therapy. Hunter, J. M.; Mackin, E. J. & Callahan, A. D. (Eds). 4th Edition. St. Louis, Mosby, 1995. pp.41-50.
- Pushpakumar, S. B.; Hanson, R. P. & Carroll, S. The 'two finger' sign. Clinical examination of palmaris longus (PL) tendon. *Br. J. Plast. Surg.*, 57:184-5, 2004.

Reimann, A. F.; Daseler, E. H.; Anson, B. J. & Beaton, L. E. The palmaris longus muscle and tendon. A study of 1600 extremities. *Anat. Rec.*, 89:495-505, 1944.

Roohi, S. A.; Choon-Sian, L.; Shalimar, A.; Tan, G. H. & Naicker, A. S. A study on the absence of palmaris longus in a multi-racial population. *Malaysian Orthopaedic Journal* 1(1):26-8, 2007.

Schaeffer, J. P. On the variations of the palmaris longus muscle. *Anat. Rec.*, 3:275-8, 1909.

Sebastin, S. J.; Puhaindran, M. E.; Lim, A. Y.; Lim, I. J. & Bee, W. H. The prevalence of absence of the palmaris longus: A study in a Chinese population and a review of the literature. *J. Hand Surg. (Br)*, 30:525-7, 2005.

Song, I. C. & Bromberg, B. E. Pharyngo-palatoplasty with free transplantation of the palmaris longus. *Br. J. Plast. Surg.*, 27:337-43, 1974.

Thompson, J. W.; McBatts, J. & Danforth, C. H. Hereditary and racial variations in the musculus palmaris longus. *Am. J. Phys. Anthro.*, 4:205-20, 1921.

Thompson, N. W.; Mockford, B. F. & Cran, G. W. Absence of the palmaris longus muscle: a population study. *Ulster Med. J.*, 70:22-4, 2001.

Troha, F.; Baibak, G. J. & Kelleher, J. C. Frequency of the palmaris longus tendon in North American Caucasians. *Ann. Plast. Surg.*, 25:477-8, 1990.

Van de Graft, K. M. *Muscular system. In: Human Anatomy*. 4th Edn. Van de Graft, K. M. (Ed.). Brown, Iowa, C Brown Publishers, 1995. pp.224-82.

Vanderhooft, E. The frequency and relationship between the palmaris longus and plantaris tendons. *Am. J. Orthop.*, 25:38-41, 1996.

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