

Prevalence of the Absence of Palmaris Longus Muscle in Endemic Hungarian Villages in Transcarpatia

Barkáts, Norbert¹

Introduction

The first report of the absence of Palmaris longus muscle (PLM) was made in 1559 by Colombos in *De Re Anatomica Libri*. The prevalence of the absence of the muscle was extensively studied by the author at that time.

Nowadays studies of PLM often attempt not only to show the percentage of its absence, but also to find correlation between the prevalence of PLM absence and other anatomical or physiological anomalies [1].

The present study examines people from endemic Hungarian villages of Transcarpathia, Ukraine, who led a strongly isolated form of life in the past and still lives in a relative isolation from other nationalities and ethnic groups of the region.

The palmaris longus muscle is one of the superficial slender muscles of the forearm that acts on the skin and distal digital webs. It is a phylogenetically degenerate muscle, and it functions as a metacarpophalangeal joint flexor [2]. During its phylogenetic degeneration the PLM lost its importance, and its functioning became unnecessary for the proper function of human hand. Probably this is one of the main causes of its great variability and frequent absence because even without it the human palm can function perfectly.

According to the studies done up to date it is believed that agencies of this muscle are filogenetically retrogressive and will gradually lose its function totally [14].

It can be stated that the PLM is one of the most variable muscles in the human body, and its agenesis is apparently considered the most frequent anatomical variation [3].

¹ Barkáts Norbert, II. Rákóczi Ferenc Kárpátaljai Magyar Főiskola, Biológia Tanszék. E-mail: barkatsn@gmail.com

Many authors suggest that there is a relation between the prevalence of frequency of the PLM agenesis in the subjects and the affiliation of the subjects to different ethnic groups [4].

The Palmaris longus muscle is a muscle of key importance in reconstructive surgery since its tendon is considered to be a dispensable tendon and its absence does not significantly affect the function of the wrist. It fulfils the necessary requirements of length, diameter and availability, and can be used without producing any functional deformity in reconstruction surgery [6]. It is therefore very useful in orthopaedics, hand and reconstructive surgery. It is commonly used by hand surgeons for tendon transfers [7], second stage tendon reconstruction, pulley reconstruction as well as tendon grafting. [8] Plastic surgeons also utilize the palmaris longus muscle in restoration of lip and chin defects [9], lip and commissure reconstruction [10], ptosis correction [11] [12], and in the management of facial paralysis [13].

Differences in prevalence of PLM absence can be observed in different populations in relevant literature dealing with this topic.

Özcan Hiz et al in 2011 in his study with Turkish population registered 15.1% of total PLM agenesis [25]. Sandeep J Sebastin et al in 2006 in their work with Chinese population the result of the overall prevalence of absence of the PLM was 4.6% [1]. L. A. Enye et al in 2010 in his work with Nigerian population got 12.6% of total PLM agenesis [8]. Godwin O Mbaka and Adedayo B Ejiwunmi in 2009 in their study of Yoruba found 6.7% of total PLM agenesis [28]. Oluyemi Kayode A. et al in 2008 in their study with Nigerian population got 31.25% of total PLM agenesis [2]. SA Roohi et al in 2007 in Malaysia found that Palmaris longus is absent in Malays in 11.3%. In Indians it is as high as 10.7%, and among the Chinese it had the lowest absence rate of PLM 6% [17]. Nilton Alves et al in 2011 in Chinese population observed 20% of total PLM agenesis [16]. N W Thompson et al in 2001 in Northern Ireland found 25% of total PLM agenesis [29]. Pawan Agarwal in 2010 in the study of Indian population got 20.2% of total PLM agenesis [30]. O. Ceyhan and A. Mavt in 1997 in their study of Turkish population got 63.8% of total PLM agenesis [14]. K Devi Sankar et al in 2011 in Andhra population found overall agenesis 28.0% [31]. S. Oladipo et al in 2009 studied the Nigerian Edo tribes where overall agenesis was only 0.17% [32]. Sudhir K. Kapoor et al in 2008 in Indian population found 17.2% of total PLM agenesis [5]. Troha F. in 1990 did a study with North American Caucasians where overall absence of PLM was 5.5% [6]. Ozkan Kose in 2009 in Turkish population found overall absence of PLM 26.6 % [24].

Until now, no relevant research with the Hungarian population of Transcarpatia has been carried out.

Material and Method

358 subjects of Hungarian population including 174 males and 184 females of random age groups from endemic Hungarian villages of Transcarpathia, Ukraine, south from Vynohradiv, in villages Akli (Okli – Окли), Aklihegy (Okli Hed' – Окли Гедь), Gyula (Dyula – Дюла) and Újakli (Nove Klypove – Нове Клинове) near the Ukrainian-Romanian border were randomly sampled.

The total Hungarian population of villages is 2522 people, [19] which means, if we consider the region as a homogenous cluster the results were reached with the accuracy of 95% level of confidence and +/- 4.8% sample error.

The peculiarity of the Hungarian villages of Transcarpathia, Ukraine is that in the result of geopolitical changes in the region, starting from the first half of the 20th century they existed in isolation not only from other ethnic groups and nationalities, but their inhabitants were also separated from other representatives of the Hungarian nation. This led to the formation of an endemic Hungarian population in these villages. In some regions this isolation led even to inbreeding. Unfortunately, no reliable data is available about the level of inbreeding in these villages.



Fig. 1. Geographical location of the studied area

During the study, the villages of Akli, Aklihegy, Gyula and Újakli were considered as a single unit since they are strongly connected with social, administrative, infrastructural, geographical, historical, and religious bounds. This results in mixing the population of these villages through marriages. Marriages in which one of the spouses comes from any other village to this closed community are relatively rare nowadays.

The circumstances mentioned above make this region a very interesting ground for any morphological population study.

The tests on the subjects were done in the following way:

The voluntary subjects were asked to perform tests to confirm or refute the presence of PLM. During the research, five main tests described in literature were used, namely Thompson's, Shaffer's, Pushpakumar's, Mishra's 2, Mishra's 1. During each test palpation was performed to be certain about correct results. Performing the palpation during each test was necessary because of the obesity of some subjects. This made it impossible to see the Palmaris longus muscle during all tests, though it was present. Although during the tests many cases were observed, when PLM was absent, Flexor carpi radialis, or tendons of Flexor digitorum superficialis were manifested in a way they could have been easily mistaken with Palmaris longus muscle if not for the palpation.

1. 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 [20].
2. Standard test (Schaeffer's test): The subject is asked to oppose the thumb to the little finger and then flex the wrist [21].
3. Pushpakumar's "two-finger sign" 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 [22].
4. Mishra's test II: The subject is asked to abduct the thumb against resistance with the wrist in slight palmar flexion [23].
5. Mishra's test I: The metacarpo-phalangeal joints of all fingers are passively hyperextended by the examiner and the subject is asked to actively flex the wrist [23].
6. Palpation: the wrists of every subject were examined by using the sense of touch (palpation) during each of five previous tests, to insure the trustworthiness of results.

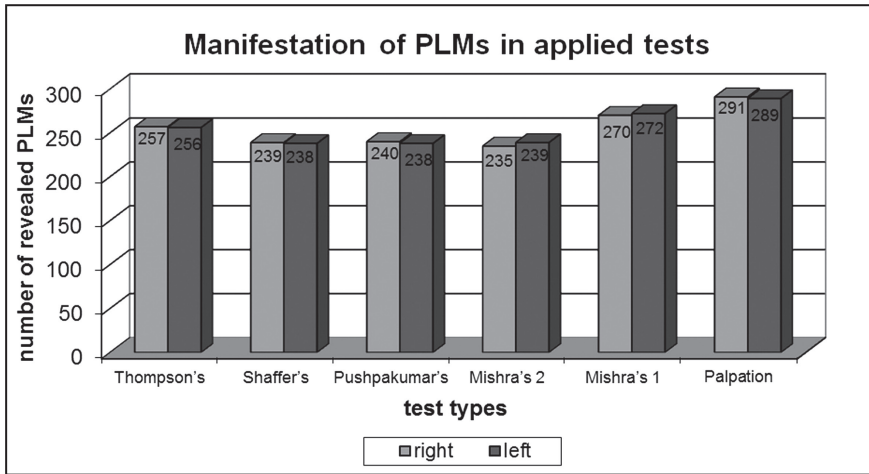


Fig. 2. The number of revealed PLMs by each test

The PLM tendon was considered to be present in the cases where it could be visualized or palpated at least in one of the five tests, and it was considered absent when it could not be palpated and visualized in any of the tests.

The obtained and evaluated data is presented in the results.

Results

In the present research, 358 subjects were examined, 174 males and 184 females respectively. All the subjects were Hungarians by nationality.

Palmaris longus muscle was found to be absent in 91 subjects (25.42%).

Out of this:

Unilaterally PLM was absent in 39 subjects (10.89% of all examined subjects), including 19 (5.30% of all examined subjects) on the right hand, 14 women (3.91% of all examined subjects, 7.60% of all women), and 5 (1.40% of all subjects, 2.87% of all men) men, and 20 (5.58% of all subjects) on the left hand 9 women (2.51% of all subjects, 4.89% of all women) and 11 men (3.07% of all subjects, 6.32% of all men).

Bilateral absence was found in 52 subjects (14.53% of all subjects) from these 35 women (9.77% of all subjects, 19.02% of all women) and 17 men (4.75% of all subjects, 9.77% of all men).

Table 1.

Absence	Unilateral	Bilateral	Right hand	Left hand
Men	16	17	5	11
Women	23	35	14	9
Men+Women	39	52	19	20

The following diagram shows the relation in PLM agenesis to the sex of the subject. The prevalence of PLM agenesis is significantly larger among women than men.

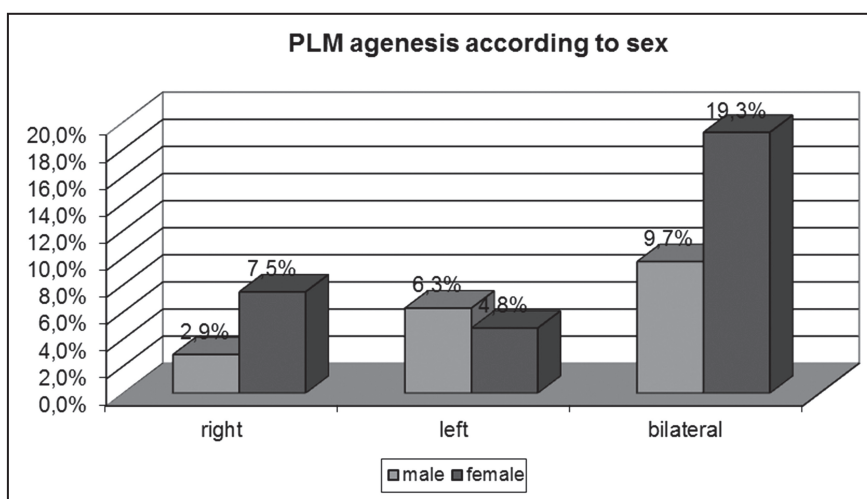


Fig. 3.

If we look only at all cases where PLM agenesis was found, we can see that out of 91 subjects (100%) women make 58 in number (63.74%), men are 33 (36.36%). Bilateral agenesis was found in 52 cases (57.14%), while unilateral in 39 (42.86%).

Unfortunately, in the region it was impossible to estimate the prevalence of the Palmaris longus in relation to the hand dominance, since every examined patient claimed to be right-handed.

Discussion

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. [6, 18].

During the research it turned out that 25.42% of subjects showed absence of PLM. This means that approximately every fourth person in this region is missing Palmaris longus muscle. This means that surgeons treating patients with injuries that need tendon grafts should be ready to use an alternative way in case the patient has no Palmaris longus muscle.

The attempt to estimate of the prevalence of the Palmaris longus in relation to the hand dominance failed, since every examined patient claimed to be right-handed. It was caused by cultural and religious background, as a left-handed man is considered to be a bad omen, or even to be in connection with the Devil, so all the people were forced to use their right hands already in the childhood.

In every examined subject bilaterally PLM is absent in 14.53%, 5.30% on the right hand, and 5.58% on the left hand. From the results it can be clearly seen that the bilateral agenesis of Palmaris longus muscle is more frequent than the unilateral agenesis. 63.74% of all agenesis cases is bilateral and only 42.86% is unilateral.

This proportion is very similar to the one Kose et al [24] got in their study with Turkish population: bilateral absence 15.04%, absence on rite hand 4.5%, on the left hand 7.04%, in total 26.6%.

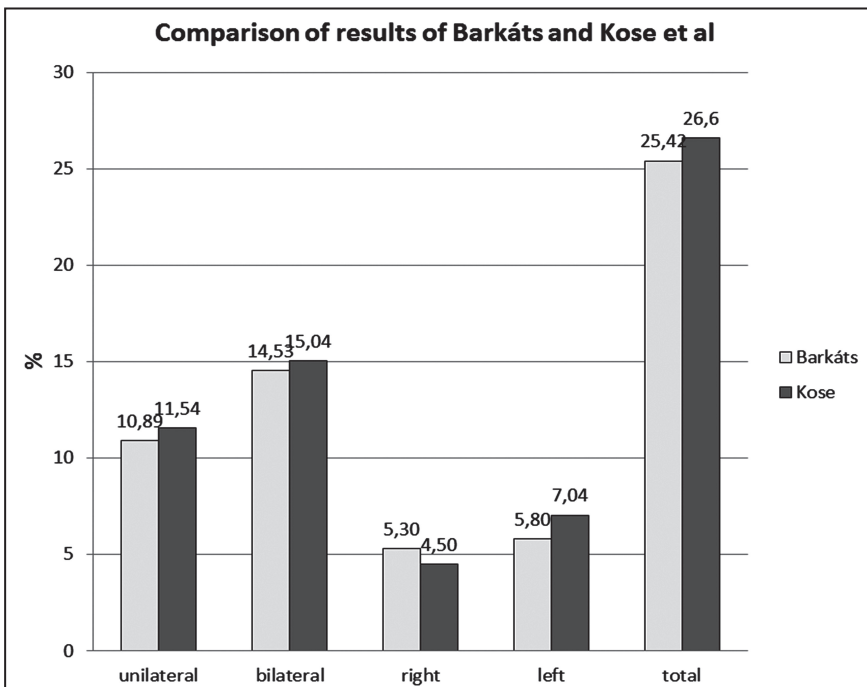


Fig. 4.

This similarity in proportion of PLM absence can be explained with the multiple connections of Turkish and Hungarian ethnic groups in the past.

The first big connection of two groups was during the migration of Hungarians from the land of their origin to their current home. By some historians during this period there was not only a simple connection between Hungarians and Turks, but the Hungarian ethnic group itself was created by the fusion of tribes of Sabir-Huns and Onogur-Turks. When Constantin IV writes about Hungarians, he calls them Türks. However, this point of view nowadays is strongly oppressed by the Hungarian Academy of Science [27].

The second big connection happened during the Turkish invasion when one third of the land of Hungary was occupied by the Turkish invaders. This occupation lasted for more than one and a half century, and could have played some role even in the similarity of results of revelation of PLM absence between Hungarian and Turkish populations.

This study covers only a small endemic group of the Hungarian population. This could be one of the reasons of similarity between the results of Kose et al [24] and the results acquired in the present study.

The following factors could also play a role in the similarity between the results of this work, and the results of Kose et al [24]:

1. The isolation of these villages could result in the preservation of original Hungarian genome that may preserve the features once inherited from the Turks.
2. The similarities may be the result of an inbreded endemic population, which produced features similar to the ones in Turkish population.
3. The similarities might appear as a simple random coincidence.

The analogy in the agenesi of PLM between results of studied Turkish and Hungarian population brings up the question, what was the prevalence of absence of PLM in Hungarian tribes arriving to the Pannonian Basin. Unfortunately, archaeologists cannot give an answer to this question as the muscular system is usually not preserved in archaeological findings. The only known object remaining from that time on which the study of PLM could be performed is one of the greatest relics of Hungary, the right hand of Stephen I of Hungary, the first king of Hungary. The relic is known under the name 'The Holy Right'. No references were found about attempts to study the presence of PLM or any other anatomical or anthropological peculiarities of 'The Holy Right'.

Conclusion

Among the Hungarian population of the villages of Akli, Aklihegy, Gyula and Újakli the total rate of Palmaris longus muscle agenesis was 25.42%. This cannot be considered an unusually high rate amongst Caucasian people. However, the rate in which the bilateral and unilateral agenesis is manifested is not common. It appears mainly in Turkish population [15, 24, 25].

This similarity may be caused by three factors:

1. Kinship between Turkish and Hungarian people.
2. Inbreeding in the villages.
3. Random coincidence.

In humans the absence of Palmaris longus muscle appears to be hereditary but its genetic transmission is yet not clear [18, 26]. Therefore, based on the acquired results it cannot be stated which of the options mentioned above is correct.

In conclusion, further studies among Hungarian population are needed to achieve unequivocal results.

References

- Sebastin S. J., Lim A. Y. T., Wong H. B. Clinical Assessment of Absence of the Palmaris Longus and its Association With Other Anatomical Anomalies – A Chinese Population Study. *Ann. Acad. Med. Singapore.*, 2006; 35:249-253.
- Kaydone A. O., Olamide A. A., Blessing, I. O., Victor O. U. Incidence of palmaris longus muscle absence in Nigerian population. *Int. J. Morphol.*, 2008; 26(2):305-308.
- Gray H., Goss C. M. *Anatomia*. 28^a ed. Rio de Janeiro, Guanabara Koogan, 1977.
- 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.*, 1944; 89(4): 495-505.
- 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.*, 2008; 83(1):45-48.
- Troha F., Baibak G. J., Kelleher J. C. Frequency of the palmaris longus tendon in North American caucasians. *Ann. Plast. Surg.*, 1990; 25:477-478.

In Sok Yi, Keykhosrow Firoozbakhsh, Racca J., Yuji Umeda, Moheb S. Moneim. Treatment of Scapholunate Dissociation With Palmaris Longus Tendon Graft: A Biomechanical Study. *The University of Pennsylvania Orthopaedic Journal*, 2000; 13:53-59.

Enye L. A., Saalu L. C., Osinubi A. A. The Prevalence of Agenesis of Palmaris Longus Muscle amongst Students in Two Lagos-Based Medical Schools. *Int. J. Morphol.*, 2010; 28(3):849-854.

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.*, 2000; 2:53-56.

Ahmed Bahaa El-Din. Total Lower Lip and Commissure Reconstruction Using a Composite Radial Forearm Palmaris Longus Free Flap. *Egypt. J. Plast. Reconstr. Surg.*, 2007; 31(1):73-78.

Kurihara K., Kojima T., Marumo E. Frontalis suspension for blepharoptosis using palmaris longus tendon. *Ann. Plast. Surg.*, 1984; 13:274-278.

Naugle T. C. Jr., Faust D. C. Autogenous palmaris longus tendon as frontalis suspension material for ptosis correction in children. *Am. J. Ophthalmol.*, 1999; 127:488-489.

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.*, 1998; 124:1390-1392.

Ceyhan O, Mavt A. Distribution of agenesis of Palmaris longus muscle in 12 to 18 years old age groups. *Indian J. Med. Sci.*, 1997; 51:156-60.

Gangata H. The clinical surface anatomy anomalies of the Palmaris longus muscle in the Black African population of Zimbabwe and a proposed new testing technique. *Clin. Anat.*, 2009; 22:230-235.

Alves N., Ramírez D., Figueiredo Deana N. Study of Frequency of the Palmaris Longus Muscle in Chilean Subjects *Int. J. Morphol.*, 2011; 29(2):485-489.

Roohi S. A., Choon-Sian L., Shalimar A., Tan G. H., Naicker A. S. A Study on the Absence of Palmaris Longus in a Multiracial Population, *Malaysian Orthopaedic Journal*, 2007; 1(1):26-28.

Thompson N. W., Mockford B. J., Cran G. W. Absence of the palmaris longus muscle: a population study. *The Ulster Medical Journal*, 2001; 70(1):22-24.

Molnár J., Molnár D. I. Kárpátalja népessége és magyarsága a népszámlálási és népmozgalmi adatok tükrében. Uzhgorod, PoliPrint, 2005.

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

Schaeffer J. P. On the variations of the palmaris longus muscle. *Anat. Rec.*, 1909; 3:275-278.

Pushpakumar S. B., Hanson R. P., Carroll S. The 'two finger' sign. Clinical examination of palmaris longus (PL) tendon. *Br. J. Plast. Surg.*, 2004; 57:184-185.

Mishra S. Alternative tests in demonstrating the presence of palmaris longus. *Indian J. Plast. Surg.*, 2001; 34:12.

Kose O., Adanir O., Cirpar M., Kurklu M., Komurcu M. The prevalence of absence of the palmaris longus: a study in Turkish population. *Arch. Orthop. Trauma Surg.*, 2009; 129(5):609-611.

Hiz Ö., Ediz L., Fethi Ceylan M., Gezici E., Gülcü E., Erden M. Prevalence of the absence of palmaris longus muscle assessed by a new examination test (Hiz-Ediz Test) in the population residing in the area of Van, Turkey. *Journal of Clinical and Experimental Investigations*, 2011; 2(3):254-259.

Wehbe M. A., Mawr Bryn. Tendon graft donor sites. *J. Hand Surg.*, 1992; 17-A:1130-1132.]

Bakay K. Kik vagyunk? Honnan jöttünk? Budapest, Püski kiadó, 2004.

[28] Mbaka G. O., Ejiwunmi A. B. Prevalence of palmaris longus absence – a study in the Yoruba population. *Ulster Med. J.*, 2009; 78(2):90-93.

Thompson N. W., Mockford B. J., Cran G. W. Absence of the palmaris longus muscle: a population study. *The Ulster Medical Journal*, 2001; 70(1):22-24.

Agarwal P. Absence of the palmaris longus tendon in Indian population. *Indian Journal of Orthopaedics*, 2010; 44(2):212-215.

Sankar K. D., P. Bhanu Sh., John S. P. Incidence of agenesis of palmaris longus in the Andhra population of India. *Indian Journal of Plastic Surgery*, 2011; 44(1):134-138.

Oladipo S. G., Blessing C. D., Ugboma A. H. Frequency Of Agenesis Of The Palmaris Longus Muscle In Nigerians. *The Internet Journal of Biological Anthropology*, 2009; 3(2).

MONOGRAPHIAE COMAROMIENSES 9.



Kinga Horváthová – István Szököl
**Kontrola a hodnotenie
žiackych výkonov**
v národnostných školách na Slovensku

UNIVERZITA J. SELYEHO – SELYE JÁNOS EGYETEM

