Clinical Research

Palmaris longus absence in six largest Indonesian ethnicities and its relationship with gender, ethnicity, and hand dominance

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ABSTRAK

Latar belakang: *Tendon palmaris longus (PL) sering digunakan sebagai tandur dalam prosedur transfer dan rekonstruksi tendon. Absensi PL merupakan variasi normal pada tubuh manusia, dengan prevalensi yang berbeda pada setiap populasi; 42,4% pada populasi Serbia dan 4,0% pada populasi Korea. Penelitian ini bertujuan untuk mengetahui prevalensi absensi PL pada populasi Indonesia dengan keanekaragaman etnis dan juga menilai hubungannya dengan jenis kelamin dan sisi tangan dominan.*

Metode*: Penelitian potong-lintang ini dilakukan pada enam etnis di Indonesia dengan jumlah responden 1230. Absensi PL dinilai dengan uji Scaeffer dan dikonfirmasi dengan uji Mishra dan Thompson. Hubungan antara absensi PL dengan etnis, jenis kelamin, dan sisi tangan dominan ditentukan dengan uji chi-kuadrat.*

Hasil: *Prevalensi absensi PL pada keseluruhan populasi Indonesia adalah 10,41% (37,5% bilateral dan 62,5% unilateral). Prevalensi absensi PL yang tertinggi dijumpai pada etnis Batak dan Madura (15,5%), diikuti etnis Sunda (11,8%), etnis Jawa (10,0%), Betawi (6,0%), dan terendah pada etnis Minang (4,1%), perbedaan ini bermakna secara statistik (p = 0,008). Jenis kelamin wanita menunjukkan prevalensi absensi PL yang sedikit lebih tinggi (wanita 10,7% dan laki-laki 10,2%), namun perbedaan ini tidak bermakna secara statistik.*

Kesimpulan*: Prevalensi absensi PL pada populasi Indonesia sebesar 10,4%, terdapat hubungan yang bermakna antara absensi PL dengan etnis, namun tidak terdapat hubungan yang bermakna dengan gender. Ahli bedah hendaknya memperhatikan data ini dalam merencanakan tindakan rekonstruksi yang melibatkan tandur PL pada populasi di Indonesia.*

ABSTRACT

Background: Palmaris longus (PL) tendon is often used as graft in tendon or ligament reconstruction. PL absence is a normal variation in human body. Its prevalence was different in various population. Serbian population had an absence rate of 42.4%, but in the Korean population it was only 4.0%. This study aimed to determine the prevalence of PL absence in various ethnic of Indonesian population and its relationship with gender and side of hand dominance.

Methods: We conducted a cross-sectional study in 1230 people from six ethnicities in Indonesia. The absence of PL was determined by Schaeffer test and confirmed with Mishra and Thompson test. Data collection was performed by a single examiner in various cities in Indonesia. The relationship between PL absence with ethnicity, gender, and hand dominance were determined by Chi-square test.

Results: Prevalence of PL absence in overall Indonesian population was 10.4% (bilateral 37.5% and unilateral 62.5%). The highest were in Batak and Madura ethnicities (15.5%), followed by Sunda (11.8%), Java (10.0%), Betawi (6.0%), and the lowest was Minang ethnicity (4.1%) (p = 0.008). Prevalence of PL absence in female and male were 10.7% 10.2%, respectively, p > 0.05).

Conclusion: Compared to range of prevalence in other countries in the world, prevalence of PL absence in Indonesian population was moderate (10.4%). There was significant difference found between ethnicity, but not in gender. Surgeon should consider this data when planning for reconstruction procedures using PL graft in Indonesian population.

Keywords: ethnicity, gender, hand dominance, palmaris longus, palmaris longus absence, Schaeffer test

pISSN: 0853-1773 • eISSN: 2252-8083 • http://dx.doi.org/10.13181/mji.v24i1.1191 • Med J Indones. 2015;24:24-9
• Received 21 Jan 2015 • Accepted 15 Mar 2015

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Palmaris longus (PL) is one of the muscles in flexor muscles group of human forearm. This muscle's function is to assist flexion of the wrist. The origin of this muscle at medial epicondyle of the humerus and the insertion is at the flexor retinaculum / palmar aponeurosis. PL innervated by median nerve.[1] PL role in influencing the strength of the hand is not yet determined. In individuals who have unilateral PL, the strength of the hand in that side is stronger than the other side in which PL is absence.[2]

PL tendon is often used in reconstructive procedures in various fields of surgery. PL is used in orthopedics as a graft in the tendon transfer and tendon reconstruction. It is also used as a guide to find median nerve.[3,4] Other fields of surgery also uses palmar longus in reconstructive procedures. It is used in plastic surgery for lip augmentation and reconstruction, in eye surgery for correction of ptosis, and in ear nose throat surgery for reconstruction of facial paralysis.[5-7]

In Cipto Mangunkusumo National Central Hospital, especially in Department of Orthopaedic and Traumatology, we handled many cases related to the PL. From 2010 to 2012, there were 27 cases of PL tendon rupture, two reconstructive procedures using PL tendon graft and two tendon transfer using PL. In PL tendon rupture, it was found that 15 cases (55%) coincided with rupture of the median nerve. It is caused by PL anatomical position which adjacent to median nerve. There was also facial reanimation procedure in cranial nerve VII paralysis done using PL as a graft, it was used to suspend paralyzed lip.

PL was not found in every individual, some epidemiological studies in various countries showed highly variable results regarding the absence of PL. This was influenced by genetic factors and heredity, but the exact mechanism was not clear.[8]

Failure in identification of PL in surgical procedures may lead to iatrogenic median nerve injury. The median nerve is the most important structures which prone to injury in procedures involving PL, this is caused by it anatomical position which adjacent to median nerve. Weber and Mackinnon[9] report a median nerve injury in the reconstruction of medial ulnar collateral ligament reconstruction using PL graft. The graft harvested was turned out to be median nerve, causing iatrogenic complications. Other similar case was reported by Toros, et al[10] in which iatrogenic median nerve injury occured in reconstruction of thumb carpometacarpal arthritis. Several other cases of iatrogenic injury were also reported by Vastamäki,[11] Geldmacher,[12] and Kovácsy.[13] This showed that it is important for surgeon to know the phenomenon PL absence and its careful identification before performing related surgical procedures.

Although medical procedures involving the use of PL graft are widely performed, but the clinical data of PL in Indonesia has not been studied previously. The lack of reference data in the health and medicine is one of the weaknesses of Indonesia compared to other more developed countries. To prevent morbidity caused by errors in the identification of PL, the authors interested in conducting study which aim is to determine the absence of PL in six largest ethnic of Indonesia. The relationship between PL absence to gender and hand dominance would also be determined.

METHODS

This study was conducted to find the relationship between absence of PL to gender, ethnicity, and dominant hand side. This study was an observational study with cross-sectional design using unpaired categorical variables.[14,15] The subjects were Indonesian population from six largest ethnic group according to Central Bureau of Statistics (Badan Pusat Statistik) data in 2010, ie Javanese, Sundanese, Batak, Madura, Betawi, and Minang. These ethnic groups represent 67.9% of Indonesian population. Based on the study design, the sample size was determined using the following formula.[15-16]

$$n1 = n2 = \frac{\{Z\alpha\sqrt{2PQ} + 2\beta\sqrt{P1Q1 + P2Q2}\}^2}{P1 - P2}$$

The parameters were:
P1 = Proportion of PL absence from previous study, ie 0.113 in Malaysian Malay population[17]
P2 = Proportion of significant PL absence which was determined in this study, ie 0.25
From the calculation using the above formula and applying in the following equation:

$$n1 = n2 = \frac{(1.96\sqrt{2x0.82x0.818} + 0.84\sqrt{0.113x0.887 + 0.25x0.75})^2}{(0.25 - 0.113)^2}$$

We obtained the minimum number of subjects for each ethnic group was 123 subjects.

Sampling was done on April to August 2014. In this study, non-probability sampling method was used, ie proportional consecutive sampling, in which the subjects in every ethnic were taken randomly and sequentially by researchers according to the inclusion and exclusion criteria. The number of subjects in each ethnic was adjusted to their proportion in the Indonesian population according to 2010 Central Bureau of Statistics data.[15,16,18]

Inclusion criteria were native Indonesian, more than 10 year old from ethnicities of either Javanese, Sundanese, Batak, Madura, Betawi, or Minang with both parents came from the same ethnicity. Exclusion criteria were those who do not have complete extremity, musculoskeletal disease or injury in upper extremity, history of severe trauma in upper extremity, and history of surgery in upper extremity.

Data was obtained by questionnaire and physical examination and documented in photographs. To the subjects, we explained about the purpose of this study and obtained informed consent if they agreed to participate. In this study, physical examination was conducted to determine the absence of PL by inspection and palpation using Schaeffer Test. If PL was not identified, we performed other tests such as Mishra I Test, Mishra II Test, Thompson Test, Pushpakumar's two fingers sign, Four finger sign, Lotus sign, Bhattacharya Test and Gangata Test (Figure 1).

Data would be presented using tables and graphs and analyzed using SPSS for Windows version 17.0. Chi-square test was performed to determine the relationship between the dependent and independent variables. The result was considered statistically significant if the p value < 0.05. This study protocol had been approved by The Ethical Committee of Faculty of Medicine, Universitas Indonesia (No. 202/H2.F1/ETHICS/2014).

RESULTS

Data was obtained by taking samples in several cities in Indonesia, which were Jakarta, Pemalang, Bandung, Bogor, Depok, Bukittinggi, and Padang. There was 1230 subject, which characteristics were summarized in table 1. Age distribution in this study was almost even in the range of 11 to 45 year old, there was only a few subjects whose age more than 50 year old. The minimal age of subjects was 11 years old according to the inclusion criteria of this study, the oldest subjects in this study was 84 years old.

It was shown that there was variation in the absence of PL in various ethnicities. Ethnic group

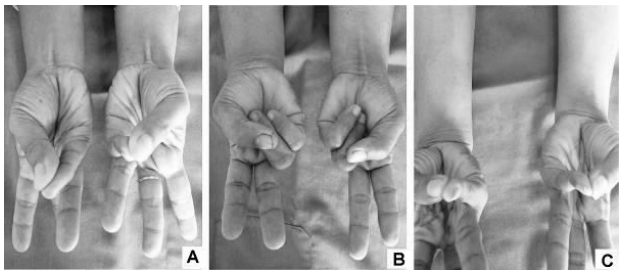

Figure 1. Physical examination of palmaris longus (PL) tendon. (a) Schaeffer test showed bilateral presence of PL, (b) Two finger sign showed absence of right PL, (c) Schaeffer test showed bilateral PL absence

Table 1. Relationship between characteristics of subjects, absence of PL, and ethnicity

Ethnic	Gender		Mean age	Hand dominance	
	Male	Female		Right	Left
Javanese	268	224	38.4	486	6
Sundanese	192	54	34.6	243	3
Batak	46	77	39.3	118	5
Madura	58	65	25.9	121	2
Betawi	71	52	33.8	114	9
Minang	64	59	25.3	116	7
Total	**699 (56.8%)**	**531 (43.2%)**	**34.7**	**1198 (97.4%)**	**32 (2.6%)**

with the highest absence were Batak and Madura (15.5% and 15.5%), the lowest was ethnic Minang (4.1%). It was also shown that unilateral PL absence was more frequent compared with bilateral PL absence. Absence of PL in each gender were shown in table 2. Unilateral absence of PL in each gender was more than bilateral absence. In Chi-square test, there was no significant relationship between gender and absence of palmaris longus (p = 0.743). Unilateral absence of PL in left and right handed subject were shown in table 2. In subject with left hand dominance, absence of unilateral PL was only found on one subject, which is on the right hand. Thus, statistical analysis for this variable could not be done.

Table 2. Relationship between the absence of PL to gender, ethnic group, and hand dominance

Risk factors	Palmaris longus present	Palmaris longus absent			Total	p
		Unilateral	Bilateral	Total		
Gender						p = 0.743
Male	628 (89.8%)	45	26	71 (10,2%)	699 (100%)	
Female	474 (89.3%)	35	22	57 (10,7%)	531 (100%)	
Ethnic						p = 0.008
Javanese	443 (90.1%)	33	16	49 (10.0%)	492 (100%)	
Sundanese	217 (88.2%)	16	13	29 (11.8%)	246 (100%)	
Batak	104 (84.6%)	12	7	19 (15.5%)	123 (100%)	
Madura	104 (84.6%)	10	9	19 (15.5%)	123 (100%)	
Betawi	116 (94.3%)	2	5	7 (5.7%)	123 (100%)	
Minang	118 (95.9%)	1	4	5 (4.1%)	123 (100%)	
Hand dominance						n/a*
Right	1075 (89.7%)	Right: 44 Left: 35	44	123 (10,3%)	1198 (100%)	
Left	27 (84.4%)	Right: 1 Left: 0	4	5 (15,6%)	32 (100%)	

*Statistical analysis could not be done because small number of subject with left hand dominance

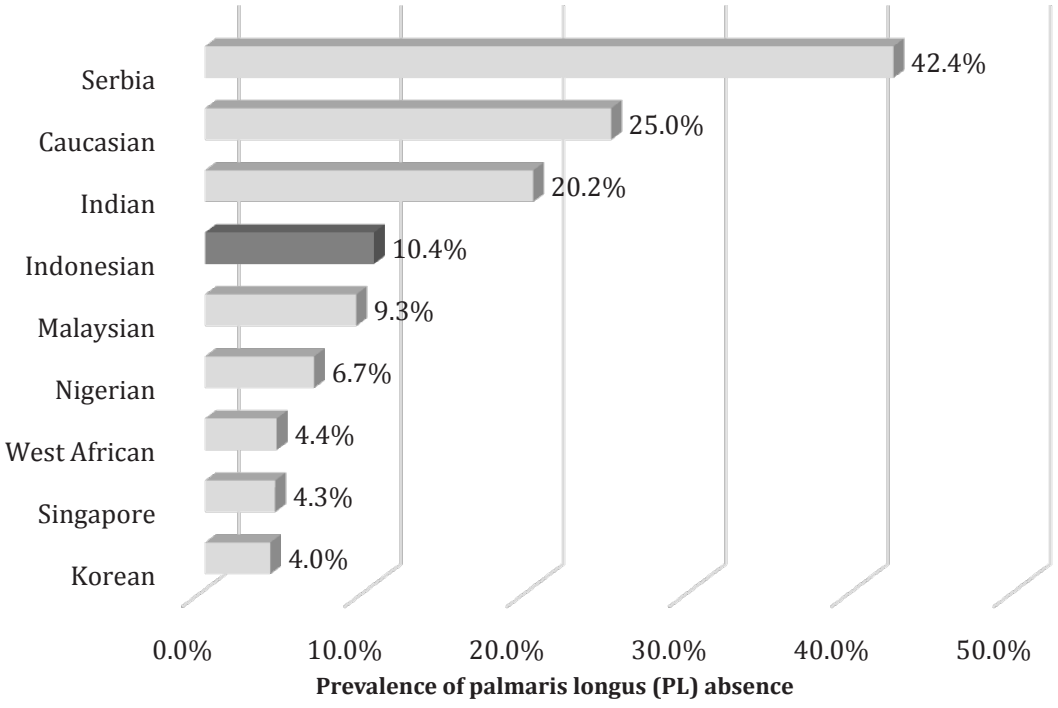

Figure 2. Prevalence of PL absence in Indonesian population compared to other population

In this study, statistical analysis was performed to determine factors associated with the absence of PL. In Chi-square test, there was a statistically significant relationship between the absence of PL and ethnicity (p = 0.008). It mean that there was significant difference in the absence of PL between six major ethnic group in Indonesia with the most found in Batak and Madura and the least found in Minang ethnicity.

DISCUSSION

This study showed that the rate of absence of PL in Indonesian population is was different from other populations in the world. In nearby populations related historically with Indonesia, Malaysian Malay ethnic group, the rate of PL absence was 11.3%.[17] It was found that the rate of PL absence in Indonesian population was not much different which was 10.4%. However, when compared to other studies in countries far away from Indonesia, it was quite different. In caucasian (Northern Ireland), the absence rates was 25%,[4] in Serbia it was 42.4%,[2] in India it was 20.2%,[19] while in the East Africa and Korea the rate of PL absence were lower (4.0% and 4.4% respectively).[20,21] Figure 2 described the incidence of PL absence in Indonesian population compared to other populations in the world.

This study also shows that the absence of PL varied in each ethnic studied. The lowest was ethnic of Minang and the highest was ethnic of Batak and Madura. The combined prevalence of PL absence in Indonesia's six largest ethnic was 10.4%, it may represent for the people of Indonesia as Indonesia's six largest ethnic groups comprised 67.9% of overall population of Indonesia. The rest of Indonesia's population was composed of 32.1% other diverse ethnic group (more than 1300 ethnic groups).

The difference in the absence of PL among ethnic groups in this study was statistically significant. Similar multi-ethnic study was done among three main ethnic in Malaysia, which were Malay, Indian, and Chinese. In this study they found no significant relationship.[17] Especially for Betawi, even though included in ethnic group according to Central Bureau Of Statistics in 2010, historically this ethnic was a mixture of several ethnic group. The difference between PL absences with ethnicity indicated that the formation of PL in human body was influenced by genetic factors.

The difference between PL absence between male and female in this study did not differ significantly with 0.5% more female than male. In many studies in other countries, there was more percentage of PL absence in men than women, although not statistically significant. In Malaysian population[17] and Lagos, Nigeria[22] there was higher PL absence in woman by 4.3% and 2.8%, while in other populations there was more PL absences in male. Caucasian population in Northern Ireland had larger males proportion who had absence of PL which was 8.7% more than females,[4] similar situation was also found in East African (1.0% more males than females),[21] Indian population (8.8% more males than females),[19] Korean population (1.4% more males than females),[20] and in Yoruba population in Nigeria (0.5% more males than females).[23] In those studies, there was no significant association between prevalence of PL absence with gender.

During analysis of the association between unilateral PL absence with hand dominance side, we could not obtain sufficient number of subjects. The population with the left hand dominant was only 2.6% from the overall study subjects. In these subjects, there was only one subject who had unilateral absence of PL, thus no conclusions could be drawn about their association. On the right-handed subjects, the unilateral absence of PL mostly found also on the right hand (55.7%). The scarcity of subjects with left hand dominant could be caused by cultural value and customs of Indonesian people who think that the left hand is worse than the right hand, so many children who were born with left hand dominance, were instructed by their parents to always use the right hand. A research by Kigera and Mukwaya[21] in East Africa showed that the absence of PL was more frequent on non-dominant hand. Other study by Erić, et al[2] showed a significant association that the absence of PL was more frequent in non-dominant hand.

In conclusion, the prevalence of palmaris longus absence in six largest ethnicity of Indonesian population was 10.4%. There was significant association between prevalence of PL absence and ethnicity. Prevalence of PL absence in six largest ethnic groups in Indonesia were 10.0%

in Javanese, 11.8% in Sundanese, 15.5% in Batak, 15.4% in Madura, 5.7% in Betawi, and 4.1% in Minang. There was no association between PL absence and gender.

Orthopaedics, plastic, eye surgeon, and other experts who may use palmar longus as graft or perform operations on the forearm should know and consider the phenomenon of PL absence to avoid iatrogenic complications. Further research on PL absence can be done using other modalities such as magnetic resonance imaging (MRI), ultrasound, or cadaveric study to identify PL more accurately.

Acknowledgment
I would like to give special thanks to my colleagues at Department of Orthopaedic and Traumatology, Cipto Mangunkusumo Hospital for supporting this study.

Conflict of interest
The authors affirm no conflict of interest in this study.

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