



Assessment of Presence or Absence of Plantaris Tendon in Iranian Population and Evaluation of the Relationship Between Presences or Absence of this Tendon with Palmaris Longus Tendon and Fifth Superficial Flexor Tendon

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Abstract

Introduction: The Plantaris muscle is located in the leg located in the superficial posterior compartment muscles and some individuals do not have it. The present study was undertaken to evaluate the variation of absence in Plantaris muscle, its characteristics and the possible relation with variations of Palmaris longus and fifth superficial flexor digitorum in the hand.

Purpose: Determine intrareader and interreader reliability of HVA and IMA both pre-operative and postoperative.

Materials and Methods: 83 fresh cadavers, meeting the criteria among those referred to our legal medicine center in Kerman, Iran from early 2010 to late 2011 were chosen and included in the study. Dissection was performed on them and the results were recorded in a questionnaire including presence or absence, length and width of the aforementioned tendons. The suitability of the Palmaris and Plantaris tendons was assessed based on the criteria that has been accepted and previously described.

Results: F8 of the 83 cadavers showed variations. One cadaver did not have the Plantaris tendon in either of the legs and on did not show it unilaterally which means present in 80 (96.3%) and absent in 3 (3.7%), bilateral absence in two (2.3%) and unilaterally in one (1.2%). Palmaris longus was absent in 6 cadavers (7.2%), 4 bilateral (4.8%) and 2 (2.3%) unilateral. Among all the cadavers, the fifth flexor digitorum superficialis Bilateral was absent in 3, one unilateral (1.2) and 2 bilaterally ((2.3%). There was no statistically significant relationship ($p < 0.05$) among the presence of Palmaris longus, plantaris and fifth superficial flexor. The plantaris tendon by far showed better characteristics for graft than the Palmaris tendon.

Conclusions: According to the results of the present study, considering the Plantaris tendon for graft harvest seems logic, noting its high percentage of presence and better characteristics.

Keywords: Plantaris Tendon; Palmaris Longus Tendon; Fifth Superficial Tendon; Graft

Introduction

Palmaris Longus is one of the most variable muscles in human body, and from the developmental point of view is among evolutionary ones, as it is absent in many people. It has a very long tendon inserting on the palmar aponeurosis [1]. The tendon is a good choice in tendon grafting, considering its characteristics of presence, diameter and length, and the fact that its harvest does not affect the function of the hand [2]. Another muscle that may be or may not be present in all people is Plantaris, which 10% lack [3], and is another good choice for tendon grafting procedures [4]. Finally, there is the fifth superficial flexor digitorum, which may be functionally or anatomically absent in some [5-7]. In this study, we

assessed the variations of presence or absence of these tendons in an Iranian population and the relationship among these variations.

Materials and Methods

This was a cross sectional study performed on fresh (at most 3 days post mortem) cadavers referred to legal (forensic) medicine centre Kerman, Iran between April 2010 and October 2011. The dissection was performed only after written consent of the relatives. A small longitudinal incision was made in the distal wrist crease bilaterally. The next incisions were made behind both ankle medially and distally. The presence or absence of the tendons was assessed and registered. Assessment of fifth FDS tendon was made

utilizing small incisions in the palm at the base of the fifth finger. In case of presence of Palmaris nad/otr Plantaris tendons second incisions were made proximally in the forearm and leg and the musculotendinous junction found and the length of the tendon measured. The tendon diameter at this point was determined by colles. After all the incisions were sutured with Nylon 3-0. For determining the suitability of a tendon for tendon grafting, the principles describe d by other authors were used: at least 30 cm length and 1.5 cm diameter or at least 15 cm length and 3 mm of diameter [8,9].

We used SPSS 22 and inserted the data in cod sheets and master sheets for analysis. Mean and frequency were used for quantitative and qualitative data, respectively. Comparison between two groups utilised T-test and for qualitative comparison, Chi square was used. The 95% confidence intervals were computed and the results were shown in tables and graphs. P was considered significant if less than 0.05.

Results

In this study 83 cadavers referred to out centre were dissected and the following results were registered:

Of the total 83, 63 cadavers were male and 20 female (76 and 24% respectively), with a mean age of 18 to 73 (35.6 ± 11.99).

Two (2) cadavers lacked the Plantaris tendon bilaterally (2.4%) and one did not have it in the right side only (1.2%). Therefore, the unilateral presence of the tendon was in 96.5%, and bilateral presence in 96.3%, which means that 96.5% of the cadavers had the tendon in at least one side and 96.3% in both sides.

Tendon length was 119 to 290 (241.5 ± 46.34) mm in the right side and 118 to 290 (241.4 ± 45.24) mm in the left side. The diameter was 4 to 8 (5.98 ± 2.88) mm in right and 2 to 7 (5.77 ± 2.57) mm in the left leg.

Palmaris Longus was present in 77 cadavers bilaterally (92.7%), but one cadaver did not have it in left and another one in right side (1.2% respectively) and four did not show the tendon bilaterally (4.8%). The tendon length was 90 to 150 (120.3 ± 10.98) mm in the right and 94 to 150 (120.66 ± 10.98) mm in left side. The mean diameter of the tendon was 5.25 ± 0.945 (3 to 7) mm in the right and 4.91 ± 1.40 (4 to 7) mm in the left side.

Of the 83 cadavers, fifth FDS was absent anatomically in two bilaterally and in one unilaterally (right side), 2.4 and 1.2% respectively. The tendon diameter was 3 to 7 (3.81 ± 0.97) mm in the left and 3 to 7 (3.86 ± 0.98) mm in right hand.

The variation of absence of the tendons is depicted in table 1 and 2.

	Absent	Mean Length (cm)	Mean diameter (mm)	Suitable for grafting (%)
Plantaris	3.6%	4.83 ± 23.39	2.46 ± 5.7	97.5
Palmaris Longus	7%	11.2 ± 39.82	4.1 ± 1.1	97.5
Fifth FDS	1.3%	-	3.00 ± 0.91	-

Table 1: The results of the study in 176 upper and 176 lower limbs.

	Bilateral present	Unilateral presence	Bilateral absence
Plantaris	80(96.3%)	1 (1.20%)	2(1.23%)
Palmaris Longus	76(91.5%)	1 (1.20%)	4 (4.81%)
Fifth FDS	81 (97.5%)	1 (1.20%)	1(1.20%)

Table 2: Absence or presence of tendons in the cadavers.

No significant correlation was found among the height of the cadaver and length or diameter of the tendons (r < 0.5 and p > 0.05), but the correlation between diameter and the length of the tendons was significant (r > 0.6 and p < 0.001). In other words, the longer the tendon the greater was the diameter. Again the correlation among length and diameters of the Palmaris and Plantaris tendons was statistically significant (r=0.5 and p < 0.001). No correlation was found among absence or presence of the three tendons, so that absence of one would predict the others.

The characteristics of the cadavers with variation are shown in table 3.

Cadaver number	Right Plantaris	Left Plantaris	Right Palmaris	Left palmaris	Right Fifth FDS	Left Fifth FDS
4	+	+	-	-	+	+
13	+	+	-	-	+	+
26	+	+	+	+	-	-
43	+	+	-	-	+	+
45	+	+	+	-	-	-
64	-	+	+	-	-	+
68	-	-	-	-	+	+
73	-	-	+	+	+	+

Table 3: Characteristics of cadavers with abnormalities.

Based upon the mentioned criteria only 2 of the 169 Palmaris longus tendons were suitable for grafting (1.18%), as they met the minimum length of 15 cm, while 168 of the 172 Plantaris tendons met criteria and were suitable for grafting procedures (97.5%).

Discussion

Up to the best of our knowledge, this is the first that assesses the variations of Plantaris tendon in Iranian populations. In fact, we found only one in Asian populations [10]. Perhaps the significant finding of the present study is the very low incidence of absence of this tendon in the population. We reached upon 3.5% absence of the tendon, which is the lowest in such studies, except one [11].

Plantaris variations have not been a matter of much attention. In fact, its absence in 10% has been the only variation noted in anatomy textbooks [12,12]. The significance of this tendon is in its role in tendon grafting and so the surgeon would be aware of and have a good estimation of its presence in the body. Actually it is impossible to determine its presence by physical examination, and sonography has been proposed for the purpose [14,15], though the only certain way is dissection and examination by direct observation. Two separate studies reached upon the figures 6% absence [16,17] and another found 19% [18]. In one study on 30 cadavers, 29 had the tendon [11].

Contrary to Plantaris tendon, Palmaris Longus has been the subject of many studied, perhaps because one can easily palpate it and is available for examination. Some studies have been performed on Cadavers [19,20] and many other studies have clinically assessed the presence of the tendon [21-25]. The present study was performed on cadavers and we found a very low incidence of tendon absence, which is in concordance with some other [17]. Perhaps the most important finding of the present study was the emphasis on variable incidence of presence or absence of the tendons in different populations.

At least one study, on a limited number of cadavers [20] has concluded that the fifth FDS was present in all human hands [7], which was not verified by others [5,6] and even one concise observation on 70 cadavers showed its absence in one [26]. In the present study we found it absent in 3 of 176 hands. Some hand surgeons that use this tendon for grafting, have never encountered its absence, but the corresponding author, a hand surgeon has seen accidentally three cases of its anatomical absence during surgery for other reasons. Noting that functional absence of this tendon has been depicted in a much higher percent of the population [27-29], it can be concluded that anatomical absence variation exists, though it is much less common.

11% of Plantaris tendons had a less than 2mm diameter in one study [30], though the present study found none with such characteristic. In addition, we noted a lack of correlation among the height of the cadaver and the diameter and length of the tendon. On the other hand there was a correlation between diameter and length of the tendon, the longer the tendon the wider it will be.

In the present study, we did not find a relation among presence or absence of the mentioned tendons. This is in concordance with the findings of another study on palmaris and Plantaris [31-33], but the very low incidence of tendons absence in the present study necessitates a new study with a very larger sample size.

Conclusion

Based upon the findings of the present study it seems that Plantaris tendon is a better choice for tendon grafting, considering its higher incidence of presence and better characteristics.

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