Morphological study of plantaris tendon and its surgical perspectives

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ABSTRACT

Introduction: Plantaris tendon is a long, slender tendon having the property of stretching and can be converted into a thin sheath when stretched. The plantaris tendon has been used in various tendon repairs and also membrane created from plantaris tendon may be wrapped around tendon anastomosis.

Materials and methods: In this study of 50 embalmed lower limbs, various parameters of the plantaris tendon i.e. length, breadth, thickness were measured. Data analyzed as numbers and mean value. The unpaired t test was used to study the significance of the differences in male and females and right and left plantaris tendon.

Results: The total 25 adult cadavers studied of which 23 were males and 2 were females, out of these there were 25 left and 25 right limbs. It has been observed that the mean tendon length was more in male cadavers compared with female cadavers (33.38±7.430, 30.73±.957) whereas mean tendon breadth was slightly more in female cadavers as compared with males (. 3085±.14115, .3125±.08539). The dimension of left side tendon in length (32.97±7.209, 33.36±7.256), breadth (.2940±.11962, .3236±.15332) and thickness (.056±.0369, .080±.0951) was slightly more on the left side compared with the right side. No statistical significance was obtained in the morphology of the tendon in the context of right and left side as well as male and female.

Conclusion: As the plantaris tendon is a tensile and stretchable structure, it is used as a strong reinforcement membrane and can be useful for surgeons performing various reconstructive surgeries. In such scenario study of morphological characteristics of the tendon is of utmost importance.

Key words: Plantaris tendon, Tendon grafting, Plantaris graft

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INTRODUCTION

The origin of plantaris muscle is from the lateral supracondylar line of the popliteal surface of the femur just superior and medial to the lateral head of the gastrocnemius muscle as well as from the oblique popliteal ligament in the posterior aspect of the knee.[1,2,3] The muscle belly ranges from 7-13 cm long varying in its size and form when present, and the mean length of the tendon from its proximal insertion to its distal insertion is 43.25 cm.[4,5] The agenesis of the plantaris muscle may affect the dynamics of the knee.[6] In some cases of partial rupture of the Achilles tendon, it is also possible to use the planter tendon as a membrane. The plantaris tendon can be stretched laterally and one can convert it into a thin, continuous sheet of tough membrane to wrap around the anastomosis and provide a smooth, strong reinforcement to the suture line.[7] knowledge of the plantaris tendon length, breadth and thickness will be very much useful to plan for the tendon grafting, plastic surgery etc.

MATERIALS AND METHODS

The plantaris muscle was dissected in 50 adult limbs (46Male and 4Female) available in the department of Anatomy. Adult cadavers were preserved by the standard method of embalming for the purpose of dissection by the undergraduate medical students. After the dissection of the popliteal fossa, followed by dissection of the superficial compartment of the calf muscles, careful dissection was done for the isolation of the plantaris muscle, the muscle was identified and traced from its origin to its insertion with blunt dissection and when required with the fine dissection keeping other related structures like muscles, vessels and nerves intact. The morphology and the variations in origin and insertion were noted and documented. The length, breadth and the thickness of the tendon were measured using vernier's caliper and with the help of thread and measuring scale. The point of measurement taken for the tendon is from the myotendinous junction to its distal attachment. Data analyzed as numbers and mean value. The unpaired t test was used to study the significance of the differences in male and females and right and left plantaris tendon.

RESULTS

The total 25 adult cadavers studied of which 23 were males and 2 were females, out of these there were 25 left and 25 right limbs each belonging to the same gender. Table 1 revealed the mean tendon length, breadth and thickness in male and female cadavers. It has been observed that the mean tendon length was more in male cadavers compared with female cadavers (33.38±7.430, 30.73±.957) whereas mean tendon breadth was slightly more in female cadavers as compared with males (3085±.14115, .3125±.08539). No difference was observed in tendon thickness among both the groups. The differences observed in the morphology of the tendon in the context of gender of cadavers were statistically not significant.

Table 1: Mean tendon length, breadth and thickness in male and female cadavers

Variables	Sex	Mean	Standard Deviation	F	Significance
Tendon Length	Male	33.38	7.430	.474	.032
	Female	30.73	.957		
Tendon Breadth	Male	.3085	.14115	.399	.936
	Female	.3125	.08539		
Tendon Thickness	Male	.068	.0745	.000	.991
	Female	.068	.0499		

Unpaired t test

Table 2 describes the mean tendon length, breadth and thickness in the right and left side of cadavers. The dimension of left side tendon in length (32.97±7.209, 33.36±7.256), breadth (.2940±. 11962, .3236±.15332) and thickness (.056±.0369, .080±.0951) was slightly more on the left side compared with right side and these differ-ences were statistically not significant.

Table 2: Mean tendon length, breadth and thickness in right and left side of cadavers

Variables		Mean	Standard Deviation	F	Significance
Tendon Length	Right	32.97	7.209	.000	.850
	Left	33.36	7.256		
Tendon Breadth	Right	.2940	.11962	.800	.451
	Left	.3236	.15332		
Tendon Thickness	Right	.056	.0369	1.224	.451
	Left	.080	.0951		

Unpaired t test

DISCUSSION

The Achilles tendon and the plantaris tendon are enclosed in a common array of thin fibrous tissue, the paratendon containing blood vessels.[8] Plantaris tendon is more frequently found than Palmaris longus tendon of upper extremity and its length is longer, therefore plantaris tendon should be the tendon of choice for hand reconstruction or in case which need the long tendon graft length.[9] Glissan in 1932 was the first to utilize the plantaris tendon as a living suture for the repair of gaps in the flexor tendons of the palm, in tendon transplants above the ankle, in repair of a ruptured coracoclavicular ligament, and in repair of a slipping patella by Gallie's technique. The author also mentions that, the plantaris tendon is advantages for the hernia repair as it is having the property of lateral stretching.[10] The total mean length of the tendon in this study is found to be 33.16cm which is coinciding with the study conducted by Aragao et al in 2010 and with a differ-ence of 2cm with Surut et al in 2002.[9,11] There was no significant differences observed in the morphology of tendon in left and right side or male and females.

CONCLUSION

As the plantaris tendon is a tensile and stretchable structure, it is used as a strong reinforcement membrane and can be useful for surgeons performing various reconstructive surgeries. In such scenario study of morphological characteristics of the tendon is of utmost importance.

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