



“Study of anatomical variations of plantaris muscle in cadavers”.

Anatomy

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ABSTRACT

Background: The plantaris muscle consists of a small, thin muscle belly, and a long thin tendon. The aim of this study was to identify the agenesis and the variations of its origin and insertion.

Materials and Methods: The present study was conducted by the Department of Anatomy, TSM Medical College & Hospital, Lucknow. The plantaris muscle was dissected in 15 adult embalmed cadavers (30 lower limbs), 4 females and 11 males, the average age of the cadavers was between 40-70 years.

Result: In our present study mean length of the muscle belly was 7.59 cm, mean girth of muscle belly was 0.42 cm and mean length of the tendon was 32.37 cm. Agenesis of plantaris was observed bilaterally in a male cadaver, with the incidence of 6.66%.

Conclusion: Earlier it was thought that the plantaris muscle is vestigial and degenerating structure. Recent studies revealed that it can be used as an autograft material in plastic & reconstructive surgeries.

KEYWORDS:

Plantaris muscle, Autograft, Agenesis

Introduction:

The plantaris muscle consists of a small, thin muscle belly, and a long thin tendon. Plantaris muscle rests between soleus and gastrocnemius muscle. Plantaris muscle along with the gastrocnemius muscle and soleus muscle, known as triceps surae. The muscle originates from the lateral supracondylar line 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} Its nerve supply is by the tibial nerve, a branch of sciatic nerve. Frequently it is mistaken by the medical students as nerve that's why it is also known as "Freshman nerve".³ Plantaris muscle may originate from the oblique popliteal ligament. Interdigitations with the lateral head of the gastrocnemius and a fibrous extension of the muscle to the patella are not unusual.⁴ Standard textbooks also mention that the muscle may be absent (10%) or double.⁵ Accurate anatomical knowledge of plantaris muscle is an important tool for the clinical diagnosis of muscle rupture and interpretation of MRI scan.⁶ The tendon of plantaris muscle can be used as an excellent graft material in plastic & reconstructive surgeries.^{7,8}

Material and Methods:

The present study was conducted by the Anatomy Department of TSM Medical College & Hospital, Lucknow. The Plantaris muscle was dissected in 15 adult embalmed cadavers (30 limbs), 4 females and 11 males, the average age of the cadavers was between 40-70 years. Each muscle was identified and carefully traced to avoid any harm to its surrounding structures. We first performed the blunt dissection followed by fine dissection. The origin, insertion and its nerve supply was carefully noted down and documented. The length, breadth and thickness of plantaris muscle and tendon were measured using Vernier's calliper, divider, measuring scale and cotton thread. Each muscle belly was carefully measured from its origin to the myotendinous junction and for the tendon from the myotendinous junction to its point of insertion. We also noted down the presence and absence of the Plantaris muscle as well as any variations in the origin, insertion or duplication muscle.

Results:

The Plantaris muscle was dissected in 15 adult embalmed cadavers

(30 limbs), 4 females and 11 males, the average age of the cadavers was between 40-70 years. In our present study mean length of the muscle belly was 7.59 cm, mean girth of muscle belly was 0.42 cm and mean length of the tendon was 32.37 cm.

In present study, we applied the Nazeer et al (2013) classification.

The origin pattern was identified:

Type I: Supracondylar ridge and oblique popliteal ligament;

Type II: Supracondylar ridge, lateral condyle and capsule of the knee joint,

Type III: Supracondylar ridge and lateral condyle of femur,

Type IV: Supracondylar ridge, lateral condyle, capsule of knee joint and lateral patellar ligament,

Type V: Lateral condyle of femur only,

Type VI: Supracondylar ridge and interdigitations with lateral head of gastrocnemius.

The insertion pattern identified:

Type I: To Calcaneum medial to Achillis tendon,

Type II: Fan shaped expansion superficial to the Achillis tendon,

Type III: Fan shaped expansion deep to Achillis tendon,

Type IV: Fan shaped expansion deep to Achillis tendon and flexor retinaculum,

Type V: With Achillis tendon to the calcaneum

In present study, we observed that all the dissected muscles were of normal origin and insertion. In present study we did not find any accessory muscle or slips or duplication. All plantaris muscle were supplied by the tibial nerve. Observations of the present study is mentioned in table 1, 2 and 3.

Table 1: Frequency of agenesis of Plantaris muscle

Right side				Left Side			
Metho ds	Agenes is	Presen ce	%	Metho ds	Agenes is	Presen ce	%
Dissect ion	UL=00 BL=01(male)	28	6.66	Dissect ion	UL=00 BL=01 (male)	28	6.66

Table 2: Frequency and percentage of origin of Plantaris muscle (n=28)

Type of origin	Frequency	%
Type 1	7	25.0
Type 2	5	17.8
Type 3	13	46.4
Type 4	2	7.1
Type 5	1	3.6
Type 6	0	0.0

Table 3. Frequency and percentage of insertion of Plantaris muscle (n=28)

Type of insertion	Frequency	%
Type 1	21	75.0
Type 2	3	10.7
Type 3	1	3.6
Type 4	2	7.1
Type 5	1	3.6

Discussion:

Glissan was the pioneer who performed the repair of a ruptured coracoclavicular ligament, and repair of a slipping patella by Gallie's technique in 1932 by using plantaris tendon as a living suture. He also explained that the plantaris can be used for hernia repair due to its property of lateral stretching.⁹ Jeffrey et al reported that Plantaris can be used as an autogenous donor graft for heart valve repair.¹⁰

A previous study revealed that the plantaris muscle is sometimes double and absent in 10% of cases.¹¹ Soubhagya et al observed that there was an additional tendon of the Plantaris muscle arising from the fascia covering the popliteus muscle that joined the tendon of the Plantaris muscle during routine dissection. Both the tendons then merged to form a single tendon that was attached to the tendocalcaneus. The plantaris originated from the capsule of the knee joint and the lateral head of the gastrocnemius. In the same limb, it was entrapped between the tibial nerve and its branch to the soleus muscle. The origin of an additional tendon of the plantaris muscle from the fascia covering popliteus was a rare occurrence. Knowledge of such type of variations is very important specially for the surgeons performing tendon transfer procedures and clinicians while diagnosing the muscle tears.¹²

A retrospective study of MRI of knee of 1,000 cases was performed on patients having acute or chronic knee symptoms revealed that there was presence of an accessory plantaris muscle in 63 out of 1000 patients. Origin of 62 muscle out of 63 of the accessory plantaris muscles merged with the origin of the normal plantaris muscle while one patient had its origin from the lateral head of the gastrocnemius muscle. These accessory plantaris muscles inserted into the iliotibial tract, lateral patellar retinaculum or the iliotibial band.¹³

Conclusion:

In various reconstructive surgeries, the tendon of plantaris can be used as an autograft due to its high tensile strength and stretchable nature. There is no any residual deformity in the donor. The knowledge about variations of plantaris muscle is an interesting topic for most of the clinicians, surgeons, radiologists and anatomists.

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