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Original Research Paper

Anatomy

ABSENCE OF THE PLANTARIS MUSCLE TENDON IN THE POPULATION OF GWALIOR REGION OF MADHYA PRADESH-A CADAVERIC STUDY

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ABSTRACT Plantaris is the largest muscle in mammals other than primates. It runs alongside the gastrocnemius complex, and continues along the medial aspect of the Achilles tendon before inserting onto the greater tuberosity of the calcaneus.The Plantaris muscle is vestigial in human beings and has much clinical importance. It is known to present several anatomical variations in terms of its occurrence, origin, course, relation with surrounding neurovascular structures and insertion. It may be absent unilaterally or bilaterally. The Plantaris muscle may be absent in 7-10% of human population. Despite its vestigial nature, injury to Plantaris muscle can present a diagnostic challenge among clinicians and radiologists. Surgical importance of the muscle lies in successful use of its tendon for reconstructive surgeries. Significant variations were observed in 10 cadavers in the present study, which was absence of plataris tendon unilaterally or bilaterally. In 3 cadavers plantaris tendon was absent bilaterally, in 5 cadavers plantaris tendon was absent in right side and in 2 cadavers plantaris tendon was absent in left side. Percentage of absent plantaris tendon in present study is – **17.1 %**

KEYWORDS : Plantaris muscle, Variations, Lower limb

INTRODUCTION

The Plantaris is a small muscle that courses along the posterior aspect of the leg as a part of the posterosuperficial compartment of the calf. Often thought of as a vestigial, accessory muscle, the Plantaris muscle is absent in only 7-20% of limbs.1 It is the muscle of flexor compartment of leg, lying in between the Gastrocnemius and Soleus muscles. The plantaris muscle is characterised by morphological variability, both for origin and insertion, and sometimes may be absent. Its strength allows the ligament to be used for reconstruction of other tendons and ligaments.

Plantaris arises from the lower third of lateral supracondylar ridge and adjoining popliteal surface of femur.[2]

The plantaris muscle consists of a small, thin muscle belly and a long thin tendon (approximately 2-4 inches long) that forms part of the posterosuperficial compartment of the calf. The muscle belly crosses the popliteal fossa inferomedially.6 Plantaris is fusiform muscle with long slender tendon and intervenes between gastrocnemius and soleus.[2]

The fleshy belly accompanies the lateral head of gastrocnemius and ends into an elongated slender tendon which passes downward and medially between gastrocnemius and soleus and blends with the medial margin of tendocalcaneus.2 On cadaveric dissection, this long, slender tendon is easily mistaken for a nerve and hence has been dubbed by some the "freshman's nerve."14 Plantar aponeurosis is estranged part of the plantaris.[6]

The myotendinous junction occurs approximately at the level of the origin of the soleus muscle from tibia in the proximal part of the leg. Subsequently, it continues inferiorly along the medial aspect of the Achilles tendon up to its insertion on the calcaneum. Finally, it gets inserted either independently or in association with Achilles tendon on calcaneus3. The long, thin tendon of plantaris is humorously called the freshman's nerve.4 Plantaris muscle is known as vestigial muscle in human as its distal attachment has shifted secondarily well short of plantar aponeurosis to calcaneus due to process of evolution for erect posture and bipedal locomotion4. The plantaris become vestigial as the foot is evolved for long-distance walking and running. The muscle was useful to other primates for grasping with their feet.6 Plantaris may also provide proprioceptive feedback information to the central nervous system regarding the position of the foot.8 In recent years it has been proposed that the rupture of the muscle should be classified under the term 'tennis leg'.[13]

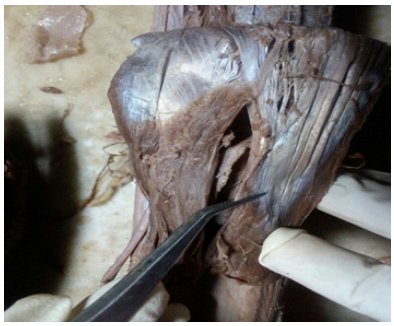
Material and Method

The routine dissection of 76 lower limbs (Rt. and Lt.) of 38 cadavers, were performed by two observers in last five years during undergraduate practical teaching of students in the department of Anatomy of G.R. Medical college, Gwalior(M.P.) to find out the variations in the plantaris muscle. The cadavers were tagged as C1-C38. Dissections were done on both the lower limbs of the 38 cadavers. Variations were observed in 10 cadavers. Sites of dissection with variation in plantaris muscle were properly cleaned and photographed for research and study purposes.

Small slip of Plantaris muscle with gastrocnemius muscle and absent plantaris tendon

Photo 1- Dissection of the cadaver showing small slip of plantaris muscle with lateral head of gastrocnemius muscle and absence of long thin tendon.

Photo 2- Deep (Anterior) aspect of gastrocnemius muscle showing absence of plantaris muscle tendon.



Result

Seventy six lower limbs of thirty eight cadavers were dissected by two observers.

In the present study results are not striking but interesting in Anatomical and Clinical perspectives as more other previous studies have shown the closely similar results.

There was absence of plantaris muscle bilaterally in Cadaver 7(C7), cadaver 21(C21) and Cadaver 34(C34).

In Cadaver 4(C4), cadaver 15 (C15), cadaver 26(C26), cadaver 29 (C29) and cadaver 30(C30) plantaris muscle was absent unilaterally in right lower limbs. Plantaris muscle is present normally in left sided lower limbs in all these cadavers.

In Cadaver19 (C19) and Cadaver (C36) plantaris muscle was absent unilaterally in left lower limbs. Plantaris muscle is present normally in right sided lower limbs in these cadavers.

Table 1- Results of the present study in tabulated form.

Sample size	Absence of plantaris tendon in both lower limbs.	Absence of plantaris tendon in right sided lower limbs.	Absence of plantaris tendon in left sided lower limbs.	Total variations
38 Cadavers	3 cadavers	5 cadavers	2 cadavers	10 cadavers
76 lower limbs	6 lower limbs	5 lower limbs	2 lower limbs	13 lower limbs

Discussion

Anatomical variations of the Plantaris muscle are not uncommon. A number of muscles in the human body are thought to be vestigial, either by virtue of being greatly reduced in the size compared to the homologous muscles in other species, by having become principally tendonous, or by being highly variable in their frequency within or between populations. The Plantaris muscle is known to exhibit variations. Standard textbook of anatomy has reported the fact, that the muscle may be sometimes absent or it may be double.14 This is supported by our observations which showed that the Plantaris muscle was shown to have a variable anatomy, which is absence of plataris tendon unilaterally or bilaterally. In 3 cadavers plantaris tendon was absent bilaterally, in 5 cadavers plantaris tendon was absent in right side and in 2 cadavers plantaris tendon was absent in left side. Percentage of absent plantaris tendon in present study is – 17.1 % Despite of its vestigial nature, documentation of anatomical variation of Plantaris muscle is clinically important. The muscle may get injured during surgical procedures because of its superficial attachment with the fascia of the leg and its long tendon resembling to nerve.15 The tendinous injury of the Plantaris muscle is also important since it is associated with hemorrhage and edema.16 The plantaris muscle has been used as a excellent graft for tendon repair injuries.1 Studies have described anatomical procedure of using a free plantaris tendon graft for reconstruction of the anterior talofibular and calcaneofibular ligaments.17 The tendon of the Plantaris muscle is used successfully for flexor tendon replacement in hand.[18]

Considering the above facts, the importance of the Plantaris muscle cannot be undermined. Therefore, knowledge of anatomical variations of the Plantaris muscle is important for physiotherapists, plastic surgeons, clinicians and radiologists.

Table 2: Showing comparison between present and other previous studies.

Author	place	Total No of lower limbs	No. of lower limbs with absent plantaris tendon	Percentage of absent plantaris tendon
Mohite S et al[9]	Maharashtra (India)	40	9	22.5%
Mobin N[10]	Karnataka (India)	60	3	3.33%
Jain R et al[11]	Bangalore (India)	50	5	10%
Olewnik L et al[12]	Poland	130	14	10.8%
Barman A et al[19]	Assam (India)	32	4	12.5%
Ahmad N et al [20]	Karnataka (India)	50	2	4%
Prakash S et al[21]	Rajasthan (India)	50	5	10%
Present study	**Gwalior (India)**	**76**	**13**	**17.1 %**

Conclusion

The absence of the Plantaris muscle unilaterally or bilaterally may be of academic interest. In order to avoid any inadvertent injury during surgical operations, variation of the Plantaris must be borne in mind. Knowledge of anatomical pattern of the Plantaris tendon is important for plastic surgeons, clinicians, radiologists and physiotherapists and its importance cannot be undermined.

Competing interests

The authors declare that we have no competing interests.

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