

Unilateral Absence of Plantaris muscle in Ethiopian Cadavers – a case report

¹Hafte Assefa Beyene, ²Birhane Alem Berihu, ³Yared godefa, ⁴Gebrekidan Gebregzabher

^{1,2}Lecturer at Department of Anatomy and Histology, Institute of Biomedical Sciences,
College of Health Sciences, Mekelle University- Mekelle, Ethiopia
Email: birhane.visionary27@gmail.com

³Assistant professor (DVM, MSc) of Department of physiology, Institute of BioMedical Sciences,
College of Health Sciences, Mekelle University - Mekelle, Ethiopia.
Email: godefay@yahoo.com

⁴Lecturer at Department of Biochemistry, Institute of Biomedical Sciences,
College of Health Sciences, Mekelle University - Mekelle, Ethiopia.
Email: mykidan@gmail.com

Abstract

Plantaris is the largest muscle in mammals other than primates. It runs alongside the gastrosoleus complex, and continues along the medial aspect of the Achilles tendon (AT) 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 is absent in 7–10% of the human population. Two such variations were observed unilaterally in the present report in which absence of the right plantaris muscle were seen in the right lower limb of the two cadavers. 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 surgery. Therefore, Knowledge of anatomical variations of the plantaris muscle is important for physiotherapists, plastic surgeons performing tendon transfer operations, clinicians diagnosing muscle tears and radiologists interpreting MRI scans.

KEYWORDS: Plantaris muscle, Variations, lower limb

Introduction

Plantaris is the largest muscle in mammals other than primates. It runs alongside the gastrosoleus complex, and continues along the medial aspect of the Achilles tendon (AT) before inserting onto the greater tuberosity of the calcaneus. The muscle belly is fusiform in shape passes inferomedially posterior to the knee joint and ends as a long slender tendon. It gets inserted into the tendon calcaneus or occasionally separately inserting into the medial side of the calcaneus bone. It is innervated by the tibial nerve (S1, S2). Plantaris acts as a weak plantarflexor the ankle joint and flexor of the knee joint. Plantaris may also provide proprioceptive feedback information to the central nervous system regarding the position of the foot [1]. The muscle is also reported to merge with the flexor retinaculum or with the superficial fascia of the leg. The variations of plantaris muscle are very rare and not found in the literature.

Plantaris muscle has been observed to present frequent variations in terms of its occurrence, origin, course, relation with surrounding neurovascular structures and insertion. MRI study was compared to cadaveric study to evaluate the incidence of the muscle [2]. Prevalence of accessory muscle was determined by MRI as 6.3% with no significant difference between sexes in which origin of all accessory muscles were found to be merged with normal plantaris except one which got merged with lateral head of gastrocnemius. The muscle was found to be present in all 20 legs, but having different morphology of insertion having dorsal and ventral belly of the muscle [3]. The muscle may be absent in 10% cases [4].

On rare occasions, its unilateral [5,6] and bilateral double presence [7,8] have been described. The tendon of the plantaris muscle serves as an excellent graft. Plantaris is one of the vestigial muscle and often mistaken for a nerve by new medical students and thus called the "freshman nerve". Its motor function is so minimal that its long tendon can readily be harvested for reconstruction elsewhere with little functional deficit. 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 surgery. Therefore, Knowledge of anatomical variations of the plantaris muscle is important for physiotherapists, plastic surgeons performing tendon transfer operations, clinicians diagnosing muscle tears and radiologists interpreting MRI scans.

Case report

During routine dissection for undergraduate medical students, we observed the absence of the right plantaris muscle in the right lower limb of the two embalmed male cadavers in the Department of Anatomy and Histology, Institute of Biomedical Sciences, College of Health Sciences, Mekelle University, Mekelle, Ethiopia. In the present report, During dissection of right lower limb involving the popliteal region and the posterior crural region of the male cadaver for 1st year medical students showed that the Plantaris muscle was shown to have a variable anatomy, which is absent in the right lower limb with the presence of this muscle in the left lower limb of the two cadavers (Figure 1 and 2). The photographs of the variations were taken for proper documentation and for ready reference. No other Neuro-vascular variation was observed in the same lower limb. The left lower limb of the same cadaver was also normal.

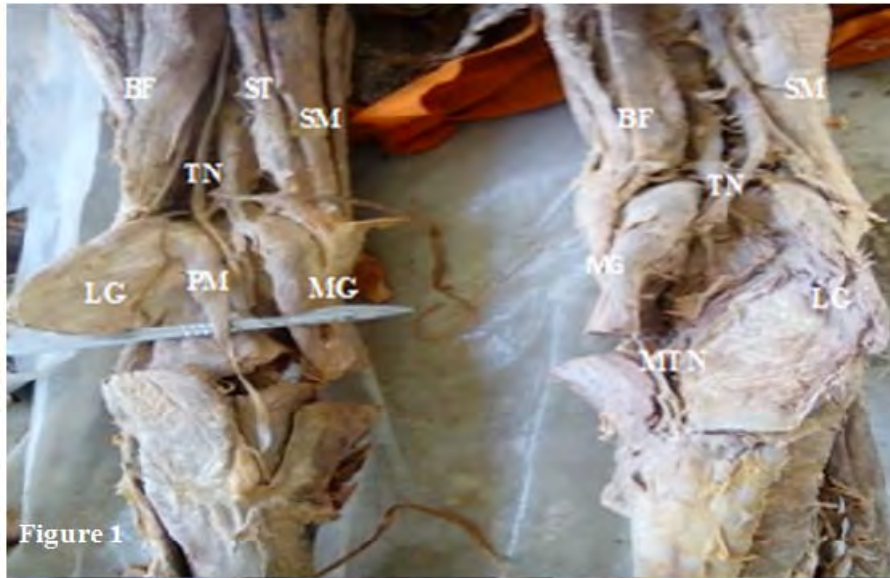


Figure 1: Dissection of the male cadavers showing the absence of the plantaris muscle in the right lower limb of the two male cadavers. ST: Semitendinosus; SM: Semimembranosus; MG: Medial head of gastrocnemius; LG: Lateral head of gastrocnemius; PM: plantaris Muscle; SOLM: Solues muscle; TN: Tibial nerve; MTN: Muscular branch of tibial nerve.



Figure 2: Dissection of the male cadavers showing the absence of the plantaris muscle in the right lower limb of the two male cadavers. ST: Semitendinosus; SM: Semimembranosus; MG: Medial head of gastrocnemius; LG: Lateral head of gastrocnemius; PM: plantaris Muscle; SOLM: Solues muscle; TN: Tibial nerve.

Discussion

Anatomical variations of the plantaris muscle are not uncommon. A Lower part of the lateral supracondylar line and the posterior surface of the lateral condyle of the femur have been considered bilaterally as the bicipital origin of the muscle [7]. A number of muscles in the human body are thought to be vestigial, either by virtue of being greatly reduced in size compared to 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 [8]. This is supported by our observation which showed that the Plantaris muscle was shown to have a variable anatomy, which is absent in the right lower limb with the presence of this muscle in the left lower limb of the two cadavers.

Despite of its vestigial nature, documentation of anatomical variation of plantaris muscle is clinically important. Variations in terms of its distinct interdigitations with lateral head of gastrocnemius or having a strong fibrous extension to patella may be responsible for patellofemoral pain syndrome [10]. 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 [9]. The tendinous injury of the plantaris muscle is also important since it is associated with hemorrhage and edema [11]. The rupture of the tendon of the plantaris muscle is often difficult to diagnose and an important finding is the presence of a tense mass between the gastrocnemius and the soleus muscle [12]. The plantaris muscle has been used as an excellent graft [13]. Studies have described anatomical procedure of using a free plantaris tendon graft for reconstruction of the anterior talofibular and calcaneofibular ligaments [14]. In the presence of other flexors like gastrocnemius and soleus muscles, the removal of plantaris muscle may not have an effect on the normal limb function. The tendon of the plantaris muscle is considered as an extremely tensile structure and has been used successfully for flexor tendon replacement in hand [15].

Considering the above facts, the importance of the plantaris muscle cannot be undermined. It has now been established through the use of magnetic resonance imaging, sonography, and surgical exploration, that injuries to this muscle may in fact occur in isolation, [16, 17, 18]. Magnetic resonance imaging and ultrasonography have been used as the primary imaging techniques for evaluation of patients with the clinical diagnosis of non-specific posterior lower leg pain. The importance of imaging patients with this condition is to rule out more serious conditions such as deep venous thrombosis [19]. Therefore, Knowledge of anatomical variations of the plantaris muscle is important for physiotherapists, plastic surgeons performing tendon transfer operations, clinicians diagnosing muscle tears and radiologists interpreting MRI scans.

Conclusion

Absence of the right plantaris muscle in the right lower limb of the two embalmed male cadaver as seen in the present case may be, of academic interest as the standard textbook of anatomy mentions less about this fact. 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 physiotherapists, plastic surgeons performing tendon transfer operations, clinicians diagnosing muscle tears and radiologists interpreting MRI scans. Considering the above facts, the importance of the Plantaris muscle cannot be undermined.

Competing interests

The authors declare that they have no competing interests.

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