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Bilateral Partial Fusion of the Plantaris Muscle With the Lateral Head of the Gastrocnemius Muscle and a Right-Sided Nerve Variation: A Case Report

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Abstract

The plantaris muscle (PM) is a part of the superficial muscles of the posterior compartment of the calf. It has a short belly and a long tendon and has been described as a vestigial muscle, although its status remains debatable. The morphology, including the origin and insertion of this muscle, varies significantly. These variations may result in neurovascular compression and disturbed biomechanics of the leg.

During routine dissection of the back of the leg for MBBS first-year students, the author observed an unusual fusion of the PM with the lateral head of the gastrocnemius bilaterally in a female cadaver of 56 years. In addition, on the right side, the nerve to the lateral head of the gastrocnemius arising from the tibial nerve traveled superficial to the PM and ended in the gastrocnemius muscle 7 cm below the popliteal fossa. The fusion of the PM to the lateral head of the gastrocnemius is reported, but bilateral occurrence of such variation is rare. Also, a variant course of the nerve to the lateral head of the gastrocnemius is rarely reported.

This aberrant fusion of the PM may be the cause of posterior calf pain syndromes and may be misinterpreted as partial tears and soft tissue lesions on radiographs. The comprehension of these variations is essential for surgeries in the back of the leg, such as selective neurotomy and botulinum toxin injection, and for management of disturbed gait, along with avoiding misinterpretation of radiographs.

Categories: Anatomy

Keywords: fusion, gastrocnemius, neurotomy, plantaris muscle, tibial nerve, variation

Introduction

The plantaris muscle (PM) is a part of the superficial compartment of the calf with a short muscle belly and a long, slender tendon. The muscle arises from the lateral supracondylar line of the femur, cranial and medial to the lateral head of the gastrocnemius muscle, along with the oblique popliteal ligament in the posterior aspect of the knee [1]. After origin, the PM passes caudally and medial to the lateral head of the gastrocnemius muscle. The tendon begins at the point where the soleus muscle originates from the tibia in the lower limb. The tendon of the PM courses caudally, remaining medial to the Achilles tendon, and gains insertion into the calcaneus bone either independently or in common with tendo-calcaneus. Sometimes it is observed that there is rupture of the Achilles tendon, but the tendon of the PM remains uninjured [1].

As the action of the PM is considered, it is responsible for a plantar flexion of the ankle along with the gastrocnemius, but this function of the PM is of little importance. However, the PM is comprised of a large number of muscle spindles, and so the muscle has more importance as a proprioceptive organ [2]. This is a classical description of the PM, but variations in the morphology of the PM, like variant origin, insertion, course, and also its absence, are documented in the literature [3]. There are studies reporting PM with multiple muscle bellies [4,5]. The authors of the present study found partial fusion of PM with the lateral head of the gastrocnemius muscle bilaterally in a cadaver, which is a rare finding, as unilateral fusion is more common compared to bilateral fusion, and scanty literature describes such variation of the PM.

In standard conditions, the nerve to the gastrocnemius arises from the tibial nerve and courses deep to the PM and lateral head of the gastrocnemius, innervating it. But we found an abnormal course of the nerve to the lateral head of the gastrocnemius muscle, which may affect interventions like selective neurotomy and botulinum toxin injection, as these procedures involve the nerve to the lateral head of the gastrocnemius, and if this variation is not known, it may lead to failure of the procedure. So the case is important. The aim of the study is to elaborate on the aforementioned aberrant variations and to correlate them with clinical implications.

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Case Presentation

The posterior compartment of the thigh, along with the popliteal fossa, of a formalin-fixed female cadaver aged 56 years was dissected in the Department of Anatomy of Graphic Era Institute of Medical Sciences (GEIMS), India, following the standard dissection technique described in Cunningham's manual [6]. On reflecting the lateral heads of the gastrocnemius muscle laterally on both the right and left sides, the PM was found to be fused with the gastrocnemius muscle on both sides (Figures 1, 2).

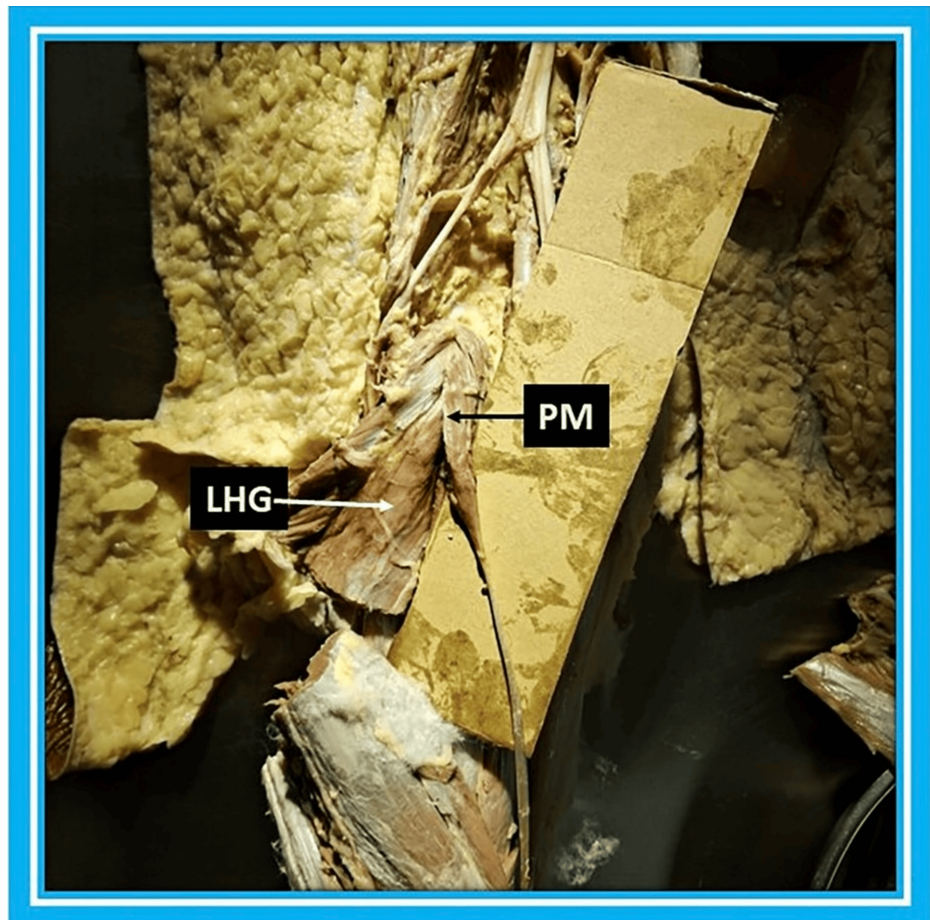


FIGURE 1: Fusion of the plantaris muscle with the lateral head of the gastrocnemius muscle on the left side

PM: plantaris muscle; LHG: lateral head of gastrocnemius

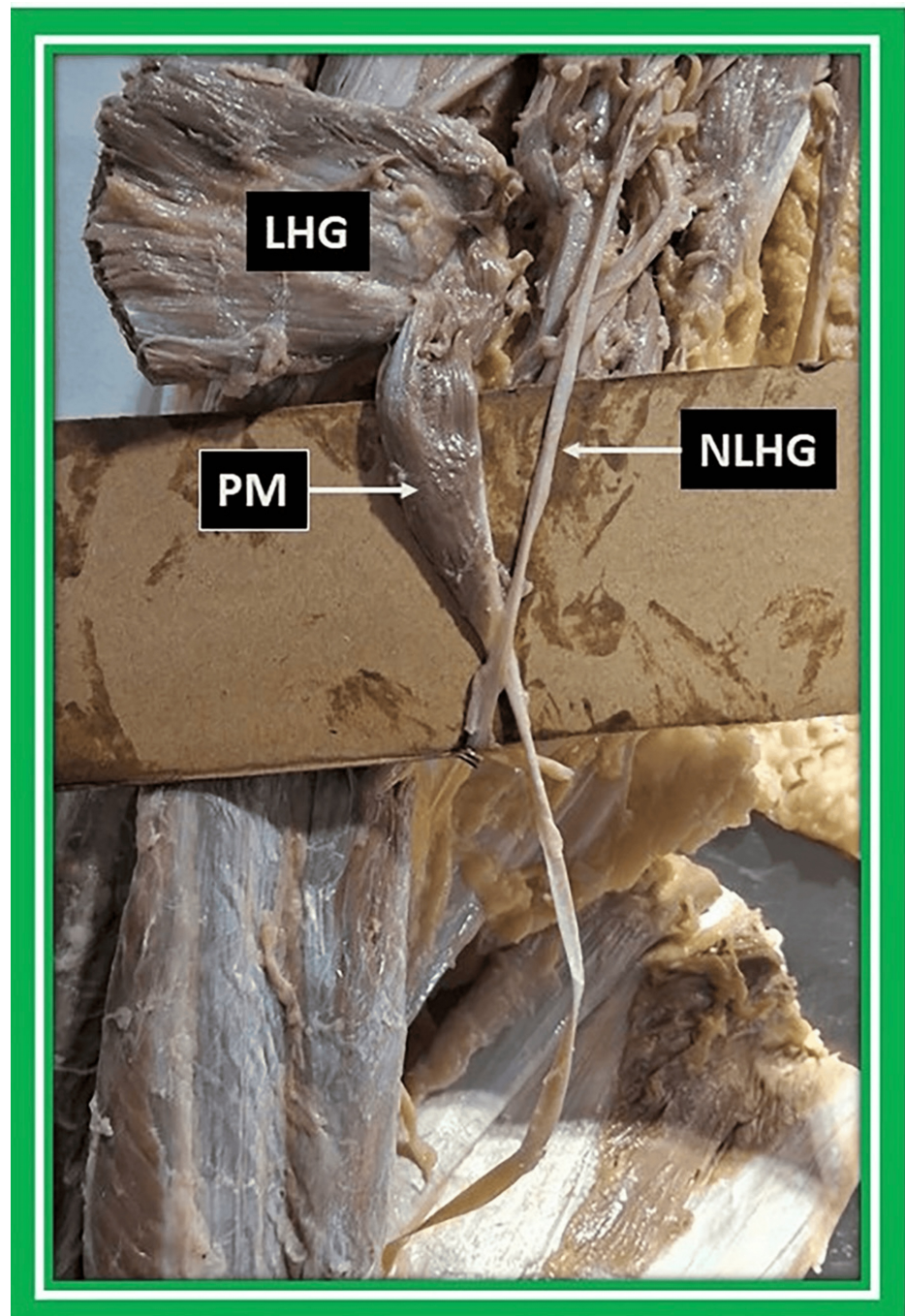


FIGURE 2: Fusion of the plantaris muscle with the lateral head of the gastrocnemius muscle on the right side, along with an aberrant course of the nerve to the lateral head of the gastrocnemius

PM: plantaris muscle; LHG: lateral head of gastrocnemius; NLHG: nerve to lateral head of gastrocnemius

While trying to separate the PM, the fibers of both the plantaris and gastrocnemius muscles were observed to blend with each other. The length and width of the fused part of the PM were 5.5 cm and 2.5 cm, respectively. In addition, on the right side, one branch from the tibial nerve arising in the middle of the popliteal fossa was observed traveling on the superficial surface of the PM, and lower down, this branch entered the lateral head of the gastrocnemius muscle 7 cm below the popliteal fossa (Figure 2). The diameter of this nerve was 0.7 cm. As this branch innervates the gastrocnemius muscle, it must be the nerve to the lateral head of the gastrocnemius muscle. Such variation of the nerve to the gastrocnemius muscle coursing on the superficial surface of the PM is rarely observed.

The body was obtained from a non-government organization (NGO) in India by the institute with the

consent that the cadaver be used for teaching and research purposes. The study was approved by the ethical committee of the institute vide no. GEU-GEIMS/IEC/2026/698 dated 25/02/2026

Discussion

The morphology of PM is documented, and it is grouped into three classes depending on its origin, cranial attachment, and relationship with surrounding structures [7]. In Type I, the PM originated from the lateral supracondylar ridge, lateral condyle of the femur, and knee joint capsule as usual, but in the same type, the PM was found to be fused with the lateral head of the gastrocnemius, as in the present case. In the present case, the length and width of the fused part of the PM were 5.5 cm and 2.5 cm, respectively. These morphometric data reveal that fusion between the PM and lateral head of the gastrocnemius is significant. Unilateral fusion of the PM with the gastrocnemius is reported, but bilateral fusion of these muscles is less documented. Type I was found to occur in 73.07% of individuals [8]. It is observed in 68.18% of the Korean population [7]. Also, on the right side, we observed a nerve originating from the tibial nerve in the middle of the popliteal fossa coursing superficial to the PM and supplying the gastrocnemius, which is not reported in the literature, as far as is known to the authors.

The vestigial nature of the PM is debatable, as is evidenced by the fact that this muscle with multiple heads has been reported by a few authors [5]. The accessory heads of the PM are clinically important, as these may cause nerve compression [5]. But in our case, no such aberrant head of the PM was detected.

Implications of unusual fusion of plantaris muscle with lateral head of gastrocnemius muscle

Fusion of the PM with the lateral head of the gastrocnemius muscle may increase the strength along with contributing to a wider range of motion during muscle action, augmenting the stability of leg movements [9].

But aberrant fusion of the PM with the gastrocnemius may hinder usual gliding of the plantaris tendon between the gastrocnemius and soleus muscles, altering the transmission of force to the ankle and knee joints and augmenting the tension in the musculo-tendinous unit [4]. This changed anatomy may be the cause of posterior calf pain syndromes where the muscle fibers are observed to be torn at the junction of the fused muscle fibers [10]. In addition, increased stress due to cranial fusion may augment the squeezing force medially on the tendo-calcaneus, culminating in tendinopathy of the tendon [11]. Besides, fusion of the PM with the gastrocnemius may be confused with a partial tear or soft-tissue lesion on ultrasonography or magnetic resonance imaging, leading to misdiagnosis. Thus, complete comprehension of this variation is of utmost use to radiologists for correct interpretation of radiographs and to surgeons performing surgical interventions in the posterior compartment of the calf along with harvesting the plantaris tendon to avert iatrogenic injury [12,13].

Implications of an abnormal course of nerve to the lateral head of the gastrocnemius muscle

In standard conditions, the nerve to the lateral head of the gastrocnemius lies deep to the plantaris and gastrocnemius muscles, but in the present case, it is observed traversing the superficial surface of the PM and then entering the lateral head of the gastrocnemius muscle, innervating the muscle. Such variation is rarely described.

The gastrocnemius and soleus muscles form the outline of the calf, but sometimes these pose aesthetic problems, which can be corrected by procedures like liposuction, total or partial resection of the gastrocnemius muscle, selective neurotomy [14], botulinum toxin injection [15], and radiofrequency volume reduction. But hypoesthesia, defective leg function, and compensatory muscular hypertrophy are the main repercussions after the procedures, creating discomfort for patients. All the aforementioned postoperative complications may be due to injury from the abnormal course of the nerve to the lateral head of the gastrocnemius observed in the present case, which can be averted with sound knowledge of nerve variation observed in the present case.

Conclusions

The PM normally remains separate from the gastrocnemius muscle. But sometimes it gets fused with the lateral head of the gastrocnemius muscle. The literature describes the fusion of the PM with the lateral head of the gastrocnemius. But scanty literature is available on the bilateral fusion of the lateral head of gastrocnemius with the PM. In addition, the abnormal course of the nerve to the lateral head of the gastrocnemius has not been described so far. Hence, the case is important, and detailed information about the morphological variation of the PM, along with the varied course of the nerve to the lateral head of the gastrocnemius, will be useful to clinicians, including plastic surgeons, for successful outcomes of surgical procedures in the calf.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Rajani Singh, Kishore C. Thakur

Acquisition, analysis, or interpretation of data: Rajani Singh, Kishore C. Thakur

Drafting of the manuscript: Rajani Singh, Kishore C. Thakur

Critical review of the manuscript for important intellectual content: Rajani Singh, Kishore C. Thakur

Supervision: Rajani Singh, Kishore C. Thakur

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References

1. Standring S: Lower limb in Gray's Anatomy . The Anatomical Basis of Clinical Practice. 42nd edition. Elsevier, India; 2021. 1420.
2. Berthold DP, Willinger L, Muench LN, et al.: Visualization of proximal and distal Kaplan fibers using 3- - dimensional magnetic resonance imaging and anatomic dissection. *Am J Sports Med.* 2020, 48:1929-36. [10.1177/0363546520919986](https://doi.org/10.1177/0363546520919986)
3. Park KR, Cho J, Choi YJ, et al.: Complex variations of plantaris muscle origin, course and insertion: a cadaveric case report. *Anat Biol Anthropol.* 2020, 33(3) :143-7.
4. Heo Y, Lee H, Hwang SJ: Bicipital origin and the course of the plantaris muscle . *Anat Cell Biol.* 2021, 54:289-91. [10.5115/acb.21.086](https://doi.org/10.5115/acb.21.086)
5. Zielinska N, Maślanka K, Węgiel A, Kurtys K, Olewnik Ł: Never undescribed before, four-headed plantaris muscle. *Folia Morphol (Warsz).* 2024, 83:942-6. [10.5603/fm.98753](https://doi.org/10.5603/fm.98753)
6. Koshi R: Cunningham's Manual of Practical Anatomy . Oxford University Press, Oxford, UK; 2017.
7. Lee H, Heo Y, Kim D, Hwang SJ: Morphological classification of the plantaris muscle origin: a cadaveric study. *Sci Rep.* 2025, 15:38527. [10.1038/s41598-025-18762-9](https://doi.org/10.1038/s41598-025-18762-9)
8. Nayak SR, Krishnamurthy A, Ramanathan L, et al.: Anatomy of plantaris muscle: a study in adult Indians . *Clin Ter.* 2010, 161:249-52.
9. Freeman AJ, Jacobson NA, Fogg QA: Anatomical variations of the plantaris muscle and a potential role in patellofemoral pain syndrome. *Clin Anat.* 2008, 21:178-81. [10.1002/ca.20594](https://doi.org/10.1002/ca.20594)
10. Tsakotos G, Triantafyllou G, Koutserimpas C, Piagkou M: A bilateral gastrocnemius tertius coexisting with a unilateral two-headed plantaris muscle. *Anat Cell Biol.* 2024, 57:459-62. [10.5115/acb.24.038](https://doi.org/10.5115/acb.24.038)
11. Gonera B, Kurtys K, Paulsen F, et al.: The plantaris muscle - anatomical curiosity or a structure with important clinical value? - A comprehensive review of the current literature. *Ann Anat.* 2021, 235:151681. [10.1016/j.aanat.2021.151681](https://doi.org/10.1016/j.aanat.2021.151681)
12. Olewnik Ł, Zielinska N, Karauda P, Tubbs RS, Polguy M: A three-headed plantaris muscle: evidence that the plantaris is not a vestigial muscle?. *Surg Radiol Anat.* 2020, 42:1189-93. [10.1007/s00276-020-02478-8](https://doi.org/10.1007/s00276-020-02478-8)
13. Hawi J, El Ahmadi C, Aboul Hosn S, El Masri J, Ouaini N: Rare bilateral variations in the origin of the plantaris muscle: a case report and literature review. *Cureus.* 2024, 16:e74668. [10.7759/cureus.74668](https://doi.org/10.7759/cureus.74668)
14. Tsai FC, Mardini S, Fong TH, Kang JH, Chou CM: Selective neurectomy of the gastrocnemius and soleus muscles for calf hypertrophy: an anatomical study and 700 clinical cases. *Plast Reconstr Surg.* 2008, 122:178-87. [10.1097/PRS.0b013e3181774199](https://doi.org/10.1097/PRS.0b013e3181774199)
15. Lee HJ, Lee DW, Park YH, Cha MK, Kim HS, Ha SJ: Botulinum toxin a for aesthetic contouring of enlarged medial gastrocnemius muscle. *Dermatol Surg.* 2004, 30:867-71; discussion 871. [10.1111/j.1524-4725.2004.30255.x](https://doi.org/10.1111/j.1524-4725.2004.30255.x)