

## CASE REPORT

# Accessory Lateral Head of the Right Gastrocnemius Muscle in a 65-year-Old White Male Donor

Elizabeth Maynes<sup>1</sup>, Keiko Meshida<sup>2</sup>, Maria Ximena Leighton<sup>1</sup>,  
Gary Wind<sup>1</sup>, Guinevere Granite<sup>1</sup>

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## Abstract

The three muscles that form the calf muscle or triceps surae include the soleus muscle, the gastrocnemius muscle, and the plantaris muscle. Generally, the gastrocnemius muscle consists of a larger medial head and a relatively smaller lateral head. It is responsible for plantar flexion of the foot. The lateral head arises from a small pit on the lateral condyle, just above the lateral epicondyle of the femur and the larger medial head originates from the posterior medial femoral condyle. The medial and lateral heads of the gastrocnemius muscle along with the soleus muscle combine to form the Achilles tendon, which inserts onto the posterior surface of the calcaneus. Since the gastrocnemius muscle crosses three joints including the knee

and subtalar joints, it can be vulnerable to injury, especially during movements associated with sudden and swift changes in direction. Other causes of gastrocnemius muscle injury include maximal knee extension and full ankle dorsiflexion. Since the muscle is already prone to injury, anatomical variations of the gastrocnemius muscles may be symptomatic. With muscle variations, there are potential implications and effects on the other structures within the popliteal fossa. Many different anatomical variations have been identified during routine dissections and reported in the literature. Understanding details of these variations is important for diagnostic, surgical and clinical practice and patient management. This is a report on a 65-year-old White Male cadaveric donor with an accessory lateral head of the gastrocnemius muscle found incidentally during a routine dissection.

**Key Words:** *Accessory head of the gastrocnemius muscle; Gastrocnemius muscle variations; Lower leg anatomical variations*

<sup>1</sup>Department of Surgery, Uniformed Services University of the Health Sciences, Bethesda, MD 20814, USA

<sup>2</sup>The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc., Bethesda, MD 20814, USA

\*Corresponding author: Guinevere Granite, Director of Human Anatomy, Department of Surgery, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, A3020C, Bethesda, MD, USA, Tel: 301-295-1500; E-mail: guinevere.granite@usuhs.edu

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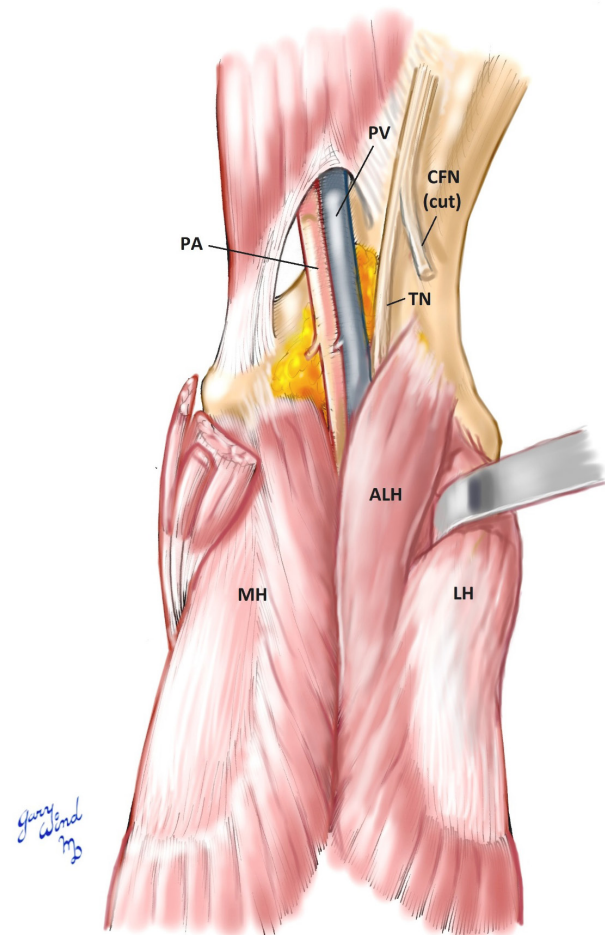


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## Introduction

Over the past twenty years, the use of more modern imaging techniques such as CT scanning, ultrasound, and magnetic resonance imaging (MRI) along with more advanced dissection techniques, have enabled the discovery and improved our understanding of muscle anatomic variations. These variations may include the absence of a muscle, supernumerary muscles, normal course deviations, alternative insertion sites and the existence of accessory muscles [1]. Generally, accessory muscles are asymptomatic and occur without complications; however, depending on the location of the variation and the type of muscle involved, there may be clinical implications. Therefore, thoroughly understanding these variations is important for diagnosis and management [2].

Accessory slips of the medial and lateral gastrocnemius muscles have been identified on routine dissections [1,3,4]. Accessory slips of the lateral head may be found on the posterior cortex of the distal femur, medial to the lateral head or coursing superficially to the popliteal vessels inserting into the lateral head of the gastrocnemius muscle (Figure 1) [1]. Both heads make up part of the popliteal fossa borders including the medial head of the gastrocnemius muscle along the inferomedial border and the lateral head of the gastrocnemius and plantaris muscles along the inferolateral border. Since the gastrocnemius muscle has an important juxtaposition near the popliteal fossa, accessory slips can have clinical implications [3]. For example, important neurovascular structures within the area may be affected by an accessory head of the gastrocnemius muscle [3]. The structures that can be affected within the



**Figure 1)** Illustrative schematic of an accessory lateral head of the right gastrocnemius muscle.

*ALH: Accessory Lateral Head of the Right Gastrocnemius Muscle; CFN: Common Fibular Nerve; LH: Lateral Head of the Right Gastrocnemius Muscle; MH: Medial Head of the Right Gastrocnemius Muscle; PA: Popliteal Artery; PV: Popliteal Vein; TN: Tibial Nerve.*

fossa include the popliteal artery, popliteal vein, tibial nerve, and the common fibular nerve [5]. The medial and lateral gastrocnemius muscles are nourished by the medial and lateral sural arteries, respectively. Both vessels branch from the popliteal artery. The nerve supply is also independent, with branches from the tibial nerve going to the medial and lateral gastrocnemius [6]. In a morphometric study of the motor branches of the tibial nerve to the gastrocnemius muscles, Hwang et al. found that the main branch of the tibial nerve innervated the medial and lateral gastrocnemius muscle approximately 3 cm above and below the popliteal crease [7]. Overall, the authors found that the nerve into

the soleus muscle originated from the nerve innervating the lateral gastrocnemius muscle 30% of the time and was 12.3 mm away from it. Therefore, surgeons should be aware of these accessory head variations, along with the different nerve configurations, in the assessment and management of patients. The use of MRI imaging has become a diagnostic tool of choice for understanding complex conditions of the knee which has further aided in the identification of accessory heads [8]. This type of imaging along with an understanding of gastrocnemius anatomical variations can help surgeons in attaining accurate diagnosis and for implementing treatment if the patient is symptomatic.

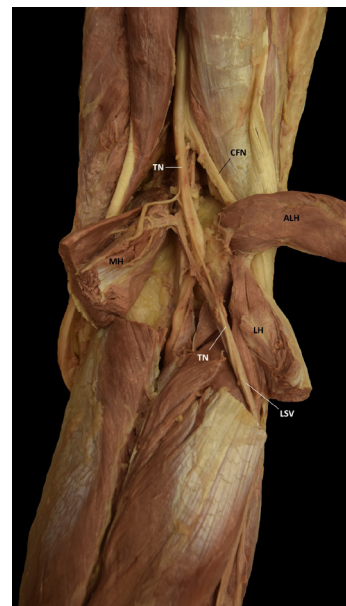
### Case Report

During routine anatomical dissection of sixty-three human donors in the 2020-2021 first-year medical gross anatomy course and 2021 graduate nursing advanced anatomy course at the Uniformed Services University of the Health Sciences, a unilateral accessory lateral head of the gastrocnemius muscle on the right side of a 65-year-old White Male cadaveric donor was identified. The cause of death was multiple sclerosis. The accessory head was found on the medial side of the lateral head, and it was approximately 9.7 cm in length. As shown in Figure 2, you can see the presentation of the muscle after the lateral cuts were made with the three heads in anatomical position. In Figure 3, the lateral head is cut and reflected laterally, and the accessory lateral head is cut and reflected superolaterally. Reflecting the muscle heads reveals the neurovascular bundle underneath and its proximity to the accessory lateral head.



**Figure 2)** Presentation of the right gastrocnemius muscle after lateral cuts but with the heads in anatomical position.

ALH: Accessory Lateral Head of the Right Gastrocnemius Muscle; CFN: Common Fibular Nerve; LH: Lateral Head of the Right Gastrocnemius Muscle; MH: Medial Head of the Right Gastrocnemius Muscle; TN: Tibial Nerve.



**Figure 3)** The reflected heads of the right gastrocnemius muscle are shown revealing their proximity to the neurovascular bundle.

ALH: Accessory Lateral Head of the Right Gastrocnemius Muscle; CFN: Common Fibular Nerve; LH: Lateral Head of the Right Gastrocnemius Muscle; LSV: Lateral Sural Vein; MH: Medial Head of the Right Gastrocnemius Muscle; TN: Tibial Nerve.

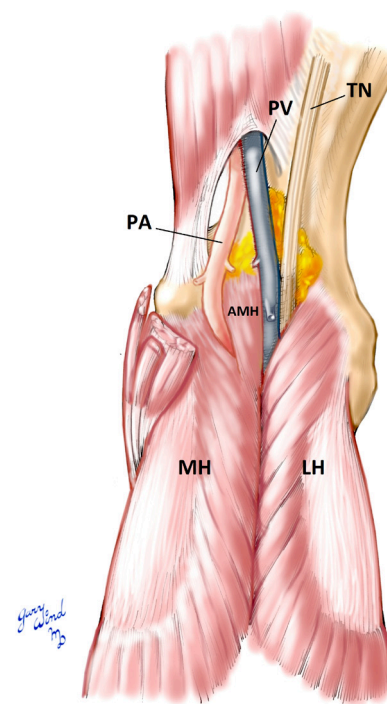
### Discussion

A third lateral head of the gastrocnemius muscle is known to be a relatively common anatomical variation. The condition may be referred to as *Gastrocnemius tertius* or *Caput tertium* [9]. Despite its prevalence, the cases reported in the literature appear to be sporadic and limited [10-16].

In a study of 1039 MRI scans of the knee, Koplak et al. assessed the presence of an anomalous third head of the gastrocnemius to determine its origin and course [4]. Of the 1,039 knees, 20 (1.9%) demonstrated an anomalous third head of the gastrocnemius muscle arising near the mid-posterior distal femur and joining the medial section of the lateral head of the gastrocnemius muscle. The size of the third head varied, and in all cases, the third head coursed lateral to the popliteal vessels—none coursed between the vessels.

One rather extreme anomaly was reported on another routine dissection. Yildirim et al. encountered a bilateral gastrocnemius tertius muscle and a unilateral accessory soleus muscle—the right gastrocnemius tertius muscle consisted of one belly, while the left had two bellies [9]. On the left side, the superficial belly of the gastrocnemius tertius muscle had its origin from an area just above the tendon of the plantaris muscle. While most accessory head variations are asymptomatic there have been cases when anomalies cause injury. There is a condition known as popliteal artery entrapment syndrome (PAES), characterized by calf claudication, and can be caused by an abnormal anatomical relationship between the vessel and nearby musculotendinous structures or surrounding muscle hypertrophy. Thus far in the literature, reports on PAES have been found to be associated with both medial and lateral heads of the gastrocnemius. Figure 4 depicts an example of an accessory medial head. Symptoms of PAES occur owing to various anomalous anatomical relationships between the muscle and arteries in the popliteal fossa, resulting in extrinsic arterial compression [17,18]. The existence of an accessory head has also been

associated with sural nerve entrapment by the gastrocnemius. The sural nerve is generally a sensory nerve; however as reported in Rodriguez et al, it may contain motor fibers resulting in alteration in the sensation of the distribution area [8]. Three cases of the popliteal vein entrapment syndrome were reported by Iwai et al. [19]. In all three cases, the third head of the gastrocnemius muscle appeared to be the cause of the condition. Partial resection of the excess muscle was sufficient to relieve symptoms.



**Figure 4)** Schematic depicting popliteal artery entrapment syndrome (PAES) involving an accessory medial head of the right gastrocnemius muscle.

AMH: Accessory Medial Head of the Right Gastrocnemius Muscle; LH: Lateral Head of the Right Gastrocnemius Muscle; MH: Medial Head of the Right Gastrocnemius Muscle; PA: Popliteal Artery; PV: Popliteal Vein; TN: Tibial Nerve.

Even without the anomalies, the gastrocnemius muscle crosses three joints including the knee and subtalar joints making it vulnerable to injury, especially in mature athletes who experience sudden and swift changes in the direction associated with muscular overstretching [20,21]. Therefore, being aware of the gastrocnemius muscle's vulnerability to injury, along with the relatively common occurrence of anatomical variations seen with this muscle, will help in the early detection of injury and management of patients.

## Conclusion

Generally, patients with accessory calf muscles are asymptomatic; however, depending on the location of the variation and the type of muscle involved, there may be clinical implications. The existence of a third accessory head of the gastrocnemius muscle may be a common anatomical variation considered in assessing patients who present with PAES. Early recognition of this anomaly through accurate diagnostic imaging can ensure patients are treated in a timely manner without complications. Overall, an understanding of these variations is important for diagnosis, surgical treatment, and management of these patients.

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## Disclaimer

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## References

1. Sookur PA, Naraghi AM, Bleakney RR, et al. Accessory muscles: anatomy, symptoms, and radiologic evaluation. *RadioGraphics*. 2008;28:481-99.
2. Vanhoenacher FM, Desimpel J, Mespreuve M, et al. Accessory muscles of the extremities. *Semin Musculoskelet Radiol*. 2018;22:275-85.
3. Guru A, Kumar N, Shetty SD, et al. Presence of third head of gastrocnemius and entrapment of the sural nerve. *Int J Anat Var*. 2013;6:194-6.
4. Koplas MC, Grooff P, Piriano D, et al. Third head of the gastrocnemius: an MR imaging study based on 1,039 consecutive knee examinations. *Skeletal Radiol*. 2009;38:349-54.
5. Agur AMR, Dalley AF. *Grant's atlas of anatomy*. (15th edn), Lippincott Williams & Wilkins, Philadelphia. 2020.
6. Buntic R. *Microsurgeon.Org: Atlas of Microsurgery Techniques and Principles*. Accessed on Dec 17, 2021. <https://www.microsurgeon.org/gastroc>.
7. Hwang K, Kim YJ, Chung IH, et al. Innervation of calf muscles in relation to calf reduction. *Ann Plast Surg* 2003;50:517-22.
8. Rodrigues V, Rao MKG, Nayak S. Multiple heads of gastrocnemius with bipennate fiber arrangement-A clinically significant variation. *J Clinical Diagn Res*. 2016;10:AD01-2.

9. Yildirim FB, Sarikcioglu L, Nakajima K. The co-existence of the gastrocnemius tertius and accessory soleus muscles. *J Korean Med Sci.* 2011;26:1378-81.
10. Tyler P, Datir A, Saifuddin A. Magnetic resonance imaging of anatomical variations in the knee. *Skeletal Radiol.* 2010;39:1175-86.
11. Shalini R, Suriyakumari KP. Third head of gastrocnemius-a case report. *Nat J Clin Anat.* 2013;2:166.
12. Ashok SA, Patel DK, Bharambe VK. A cadaveric study of Gastrocnemius muscle from point of view of entrapment syndromes. *Ind J Clin Anat Physiol.* 2017;4:407-11.
13. Ashaolu JO, Oni-Orisan OP, Ukwenya VO, et al. Variability of the morphology of gastrocnemius muscle in an african population. *Anat J Africa.* 2014;3:400-4.
14. El-Feky M. Third head of gastrocnemius. *Radiopaedia.* 2022.
15. Singla RK, Gupta R. Caput tertium gastrocnemius: A case report. *J Clin Diagn Res.* 2012;6:1059-61.
16. Ranjan DS, Panda S, Chinara PK. Caput tertium gastrocnemius-A case report. *J Anat Soc India.* 2015;64:S45.
17. Soobrah R, Nawaz A, Hussain T. Popliteal artery entrapment syndrome presenting with acute limb ischaemia: a case report. *Case Rep Medic.* 2010.
18. Hai Z, Guangrui S, Yuan Z, et al. CT Angiography and MRI in Patients with Popliteal Artery Entrapment Syndrome. *Amer J Roentgenol.* 2008;191:1760-6.
19. Iwai T, Sato S, Yamada T, et al. Popliteal vein entrapment caused by the third head of the gastrocnemius muscle. *Brit J Sur.* 1987;74:1006-8.
20. Khan I. Accessory head of the gastrocnemius muscle. *Radiopaedia.* 2022.
21. Nsitem V. Diagnosis and rehabilitation of gastrocnemius muscle tear: a case report. *J Can Chiropr Assoc.* 2013;57:327-33.