DOI: 10.7860/JCDR/2016/20094.8340

Case Report

Anatomy Section

Multiple Heads of Gastrocnemius with Bipennate Fiber Arrangement- A Clinically Significant Variation

VINCENT RODRIGUES[1], MOHANDAS KG RAO[2], SHIVANANDA NAYAK[3]

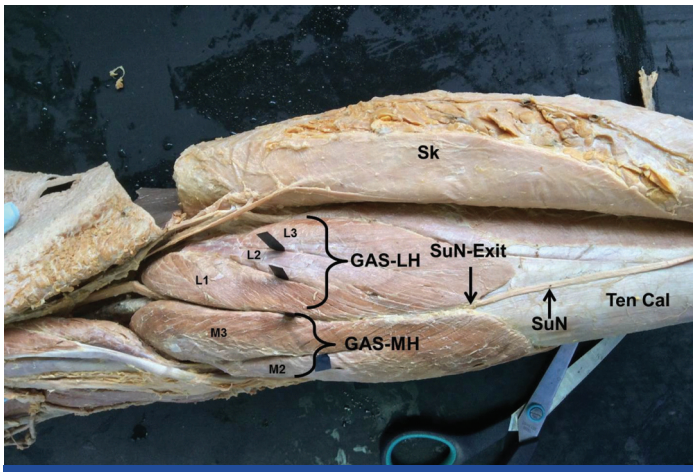
ABSTRACT

It is common to have additional muscles or muscle slips in the extremities. Some of them may compress the nerves and vessels or restrict the movements, while others may enhance the muscular activity. However, a small number of them may go unnoticed. Knowledge of such variant muscles becomes important for plastic surgeons while performing various reconstructive surgeries and for clinicians while managing the pain. A case of multiple heads of gastrocnemius muscle was observed during routine dissection of the right lower limb of about 70-year-old male cadaver. It was observed that the medial head of gastrocnemius was attached to the femur with 3 thick heads and lateral head was arising from the lateral condyle of femur by 3 thick heads. All the heads of the muscles remained separate till they formed tendocalcaneus. Some of these heads showed bipinnate fiber arrangement. All the heads were innervated by the branches of tibial nerve. As the muscle heads passed down from their origin, they entrapped the sural nerve and sural nerve was seen emerging at the beginning of tendocalcaneus. Further, detailed literature and the clinical and surgical importance of the case are discussed.

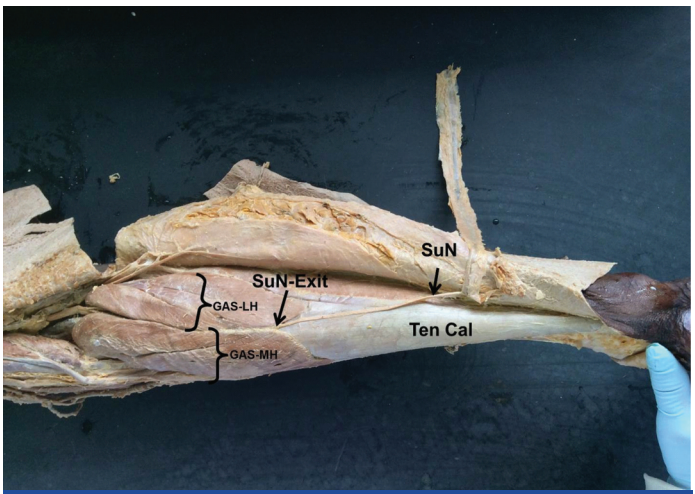
Keywords: Bipennate gastrocnemius, Calf muscles, Tendocalcaneus, Variations

CASE REPORT

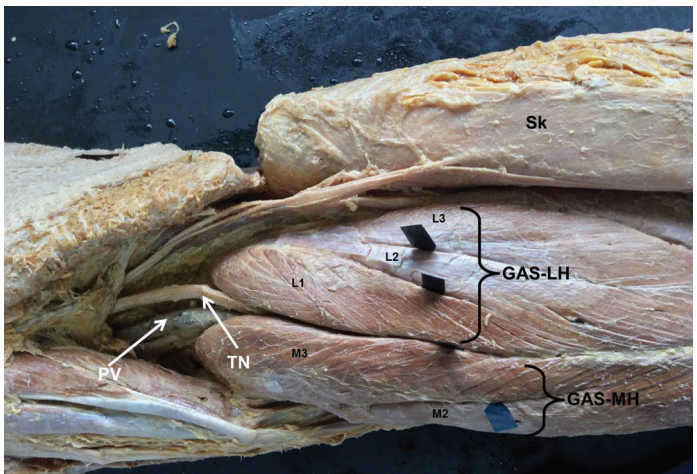
During routine dissection of approximately 70-year-old male cadaver of East Indian origin, multiple origins of both heads of gastrocnemius with bipennate arrangement of the muscle fibers in the right lower limb were observed at University of the West Indies, Trinidad and Tobago. It was observed that the gastrocnemius muscle was very bulky with both lateral and medial heads of origin. The medial group had three heads which were originating from the medial femoral condyle and adjoining part of the medial supracondylar line. All the heads were thick and were measuring about 2cm in width through most of their length. In lateral group also, there were three heads. Of the three heads, the lateral most head was arising from lateral femoral condyle, whereas, other two heads were arising from the lower 6cm of the lateral supracondylar line. All the heads of the muscle remained separate till they formed tendocalcaneus and were not separated by any fascial sheath. All the heads were innervated by the branches of tibial nerve. Another interesting observation made in this muscle was the bipennate arrangements of fleshy fibers in some of the heads. It was mainly



[Table/Fig-2]: Dissection of the popliteal fossa and back of the leg showing two heads (M2 and M3) of origin of medial (GAS-MH) head and three heads (L1, L2 and L3) of origin of lateral (GAS-LH) head of gastrocnemius. It can be noted that tibial nerve (TN) is passing between the two heads of gastrocnemius before giving origin to the sural nerve. Black stripes indicate the direction of muscle fibers showing their bipennate nature. (CPN- Common peroneal nerve; PV- Popliteal vessels).



[Table/Fig-1]: Dissection of the back of the leg showing two heads (M2 and M3) of origin of medial (GAS-MH: Gastrocnemius- Medial Head) head and three heads (L1, L2 and L3) of origin of lateral (GAS-LH: Gastrocnemius- Lateral Head) head of gastrocnemius. Entrapped sural nerve (SuN) emerging (SuN-Exit) at the beginning of the tendocalcaneus (Ten Cal) can also be noted (Sk- Skin and fasciae reflected).



[Table/Fig-3]: Dissection of the back of the leg showing three heads (M1, M2 and M3) of origin of medial (GAS-MH) head of gastrocnemius. Black stripes indicate the direction of muscle fibers showing their bipennate nature. (CPN- Common peroneal nerve; PV- Popliteal vessels).

observed in the lateral head of the medial group and medial most head of the lateral group [Table/Fig-1-3]. Sural nerve originating as a branch from the tibial nerve deep to the gastrocnemius was found passing downwards between the medial and lateral groups of gastrocnemius heads. It then pierced gastrocnemius at the level of beginning of tendocalcaneus to reach its superficial surface [Table/Fig-1]. Other deep relations of the gastrocnemius muscle like tibial nerve, popliteal vessels and plantaris muscle were normal in their course and relationships.

DISCUSSION

Gastrocnemius is a muscle of the calf which normally arises by two heads, from the condyles of the femur. The medial larger head is attached to the medial condyle and the lateral head is attached to lateral surface of the lateral condyle and corresponding supracondylar line. Some fibers of both the heads also arise from subjacent part of the genicular capsule. Normally, the tendinous attachments expand to cover the posterior surface of each head with an aponeurosis. From the anterior surface of this aponeurosis, the fleshy muscle fibers arise. The fleshy muscle fibers of the medial head extend lower than those of the lateral head. Below, the muscle fibers insert into a broad aponeurosis; till such point the muscular masses of two heads remain separate. The aponeurosis gradually narrows and is joined by the tendon of soleus on its deep surface to form the tendocalcaneus. Gastrocnemius is supplied by the branches of tibial nerve and popliteal artery. Presence of additional heads and other variations of the muscle is very rare [1].

The sural nerve is a branch of tibial nerve given in the popliteal fossa. From its origin, it descends between medial and lateral heads of gastrocnemius and supplies the skin of the calf and lateral aspect of dorsum of foot. It is mainly a sensory nerve with some sympathetic fibers supplying smooth muscle and sweat glands in the skin. [1]

Variations of the gastrocnemius muscle are very rare. It has been mentioned that occasionally lateral head or whole muscle can be absent [1]. One of the most common variations of gastrocnemius is presence of a third head (caput tertius) often arising from the popliteal surface of the femur [1-3]. Singh et al., have reported a case where both lateral and medial heads of gastrocnemius were found to be fleshy in their entire length and were getting inserted to the calcaneum directly without forming the tendocalcaneus [4]. An abnormal muscle originating from the semimembranosus and biceps femoris muscles and then getting inserted into the tendocalcaneus has also been reported by Somayaji et al., [5]. A study by Ashaolu et al., has revealed that four headed gastrocnemius muscle is the most frequent (51.7%) of its variations followed by three headed gastrocnemius (13.3%). However, no case of six headed gastrocnemius was reported [6]. Yildirim et al., have reported a case of bilateral gastrocnemius tertius muscle and a unilateral accessory soleus muscle [7]. They have discussed the potential problem for structures in the popliteal fossa due to the presence of additional head of this muscle. The characteristic signs and symptoms observed in such patients with the third head include pain in the leg, tenderness in the popliteal fossa and decreased pulsations of the arteries of leg and foot [7]. These symptoms may be amplified when there is multiple heads occupying almost entire lower part of popliteal fossa as in the present case. It is also suggested that surgical resection of the additional heads may help in relieving the symptoms [7].

There are many reports on entrapment of sural nerve by gastrocnemius muscle. Though the sural nerve is generally considered as a sensory nerve, there are reports of occurrence of motor fibers in it and also the reports of motor communication between sural nerve and the tibial nerve in the lower part of the leg [8,9]. Hence, any entrapment of the sural nerve as in the present case, may not only result in alterations of sensations in area of its distribution, but also, may have motor consequences. According to Pimentel et al., compression of sural nerve either by entrapment or by injury is often associated with neuropathies of the nerve [10]. Knowledge of abnormalities of the sural nerve is also clinically important as it is frequently used in nerve transplantation procedures, nerve conduction velocity studies and in nerve grafting.

CONCLUSION

There are plenty of reports of isolated cases of presence of caput tertium gastrocnemius or sural nerve entrapment or sural nerve entrapment by the 3rd head of gastrocnemius. However, presence of six heads of origin of gastrocnemius which could cause sural nerve entrapment is being reported for the first time. It would be handy for the clinicians to keep these possibilities of sural nerve entrapment in mind while dealing with any pain that occurs in the area of distribution of the sural nerve.

REFERENCES

[1] Standring S, Borley NR, Collins P, Crossman AR, Gatzoulis MA, Healy JC, et al. Gray's Anatomy: The anatomical basis of clinical practice. 40th Edition, Elsevier, Churchill Liwingstone, London. 2008;1420-21.

[2] Dave MR, Yagain VK, Anadkat S. Unilateral third/accessory head of the gastrocnemius muscle: a case report. *Int J Morphol*. 2012;30(3):1061-64.

[3] Rajan KS, Rimpi G. Caput tertium gastrocnemius: A Case Report. *Journal of Clinical and Diagnostic Research*. 2012;6(6):1059-60.

[4] Singh G, Agrawal VP, Basavarajappa M, Manohar M. Gastrocnemius - achilles tendon: a human anatomical variation. *Int J Biomed Adv Res*. 2012;3(08):653-55.

[5] Somayaji SN, Vincent R, Bairy KL. An anomalous muscle in the region of the popliteal fossa: case report. *J Anat*. 1998;192(2):307-08.

[6] Ashaolu JO, Oni-Orisan OP, Ukwenya VO, Alamu O, Adeyemi DO. Variability of the morphology of gastrocnemius muscle in an african population. *Anatomy Journal of Africa.* 2014;3(3):400-04.

[7] Yildirim FB, Sarikcioglu L, Nakajima K. The co-existence of the gastrocnemius tertius and accessory soleus muscles. *J Korean Med Sci*. 2011;26(10):1378-81.

[8] Amoiridis G, Schols L, Ameridis N, Przuntek H. Motor fibers in the sural nerve of humans. *Neurology*. 1997;49:1725–28.

[9] Sekiya S, Kumaki K. Sural-tibial nerve communications in humans. *Anat Sci Int*. 2002;77:140–44.

[10] Pimentel ML, Fernandes RMP, Babinski MA. Anomalous course of the medial sural cutaneous nerve and its clinical implications. *Braz J Morphol Sci*. 2005;22:179–82.

PARTICULARS OF CONTRIBUTORS:

1. Senior Lecturer, Department of Preclinical Sciences, Faculty of Medical Sciences, University of the West Indies, St. Augustine, Trinidad and Tobago, West Indies.
2. Professor, Department of Anatomy, Melaka Manipal Medical College, Manipal University, Manipal, Karnataka, India.
3. Professor, Department of Preclinical Sciences, Faculty of Medical Sciences, University of the West Indies, St. Augustine, Trinidad and Tobago, West Indies.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Mohandas KG Rao,
Professor, Department of Anatomy, Melaka Manipal Medical College (Manipal Campus),
Manipal University, Manipal-576104, Karnataka, India.
E-mail: mohandaskg@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Mar 15, 2016**
Date of Peer Review: **Apr 11, 2016**
Date of Acceptance: **May 16, 2016**
Date of Publishing: **Aug 01, 2016**