

A Case of Well Developed Median Superficial Sural Artery (Small Saphenous Artery) Piercing Through the Medial Sural Cutaneous Nerve

*Lazar Jelev**, *Nikolai Krastev*, *Lina Malinova*,

Department of Anatomy, Histology and Embryology, Medical University, Sofia, Bulgaria

* Corresponding author e-mail: ljelev@abv.bg

A case of well-developed median superficial sural artery (small saphenous artery) is reported here, found during routine student dissections of the left lower limb of an adult formalin-fixed male cadaver. This small sized artery was starting from the posterior surface of the popliteal artery and passed between the main tibial nerve and its muscular branch to the gastrocnemius medial head. Further distally, the artery pierced through the initial part of the medial sural cutaneous nerve. Along the upper calf region, the small arterial vessel was located on the lateral side of the small saphenous vein and cutaneous nerves and terminated in the lower part of the leg. The literature descriptions concerning the cutaneous popliteal artery branches are reviewed, including their application in the field of plastic and reconstructive surgery.

Key words: popliteal artery; cutaneous branches; median superficial sural artery, sural nerve, human

Introduction

In the detailed anatomy textbooks [5, 13, 16, 19], the branches of the popliteal artery are divided into muscular, genicular (articular) and superficial. The superficial branches are described as occasionally present arteries of small size, starting directly from the popliteal artery or some of its branches and piercing through the crural fascia they supply the skin over the calf. Despite not included in Terminologia Anatomica [6], these superficial branches have clinical importance as vascular pedicles of fasciocutaneous flaps [2, 8, 12, 15, 18, 20, 21] or vascularized nerve grafts [7, 14] for plastic and reconstructive surgery and microsurgery.

In this report, we present a demonstrative case of such a well-developed superficial artery branching from the popliteal artery.

Materials and Methods

The reported findings were observed during routine student dissections of the left lower limb of an adult formalin-fixed male cadaver of a Caucasian descent. All dissections took place at the Department of Anatomy, Histology and Embryology, Medical University of Sofia.

Case report

After removal of the skin of posterior crural region, a dissection was started in the subcutaneous fat tissue in order to demonstrate the superficial veins and cutaneous nerves branches. A common way of formation of the sural nerve was observed by fusion of the medial sural cutaneous nerve, piercing through the crural fascia, and sural communicating branch from the lateral sural cutaneous nerve, which fusion happened in the middle of the leg. The sural nerve and medial sural cutaneous nerve were accompanied by the small (lesser) saphenous vein, as usual. A small-sized artery (external diameter 1.8 mm) was also observed in companion to the cutaneous nerves and vein (**Fig. 1a**). Dissecting completely the crural fascia and popliteal fossa revealed the origin of this arterial vessel (**Fig. 1b**). It was starting from the posterior surface of the lower part of the popliteal artery. Then, the small artery passed between the main tibial nerve and its muscular branch to the gastrocnemius medial head. Further distally, the artery pierced through the initial part of the medial sural cutaneous nerve and continued downwards on the lateral side of the small saphenous vein and the cutaneous nerves. By fine dissection, this artery was traced to the lower third of the posterior leg and did not reach the ankle. Because of its midline position and superficial location, the small artery can be identified as “median superficial sural artery” [11] or according to its close relation to the small saphenous vein as “small saphenous artery” [1].

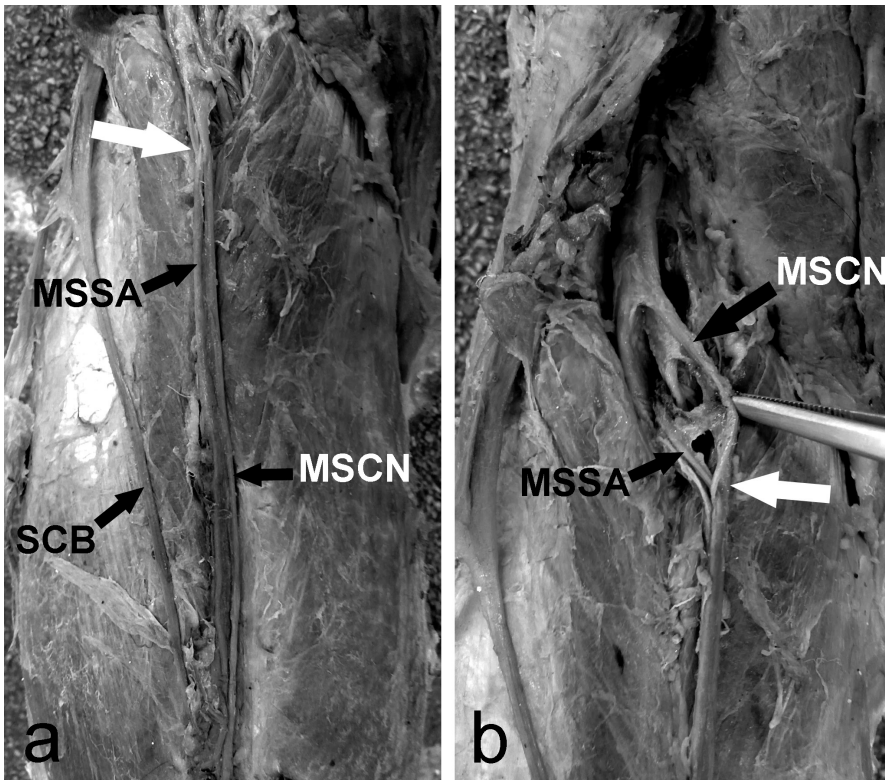


Fig. 1. Photographs of the reported case, presenting dissection of the upper calf region (a) and popliteal fossa (b). The nerve piercing point is indicated with white arrow. Artery: MSSA - median superficial sural artery. Nerves: MSCN – medial sural cutaneous nerve; SCB - sural communicating branch from the lateral sural cutaneous nerve.

Discussion

In the classical textbooks of anatomy, the superficial branches of the popliteal artery usually do not have their proper names [5, 13, 19]. According to these sources, the largest and most constant of all is the small artery passing between the gastrocnemius heads, which accompanies the small saphenous vein and medial sural cutaneous and sural nerves.

In the texts of anatomical variations, the small superficial artery between the heads of gastrocnemius is either not mentioned [9, 17] or described as the occasionally present “small saphenous artery” [3] or “arteria saphena parva” (“a. suralis superficialis media”) [1]. Such an artery was described in 2 out of 180 lower limbs dissected but only when of larger size and anastomosing with the tarsal arteries [1]. Obviously, the superficial sural arteries did not attract much attention of variational anatomists.

The most detailed descriptions of the superficial sural arteries can be found in the clinically oriented texts such as the profound book on the cutaneous arteries in the human body by Manchot [11], and in a number of papers [7, 10, 15, 18]. Three cutaneous arteries are identified in these texts - the median (central), medial and lateral superficial sural arteries [7, 10, 15, 18]. It was reported that the median superficial sural artery is usually the largest one (0.9-2.6 mm) [10] and is present in more than 90% of the lower limbs. This artery may start from the popliteal artery (most commonly), from the other superficial sural arteries or from the genicular arteries [7, 10, 15, 18]. In plastic and reconstructive surgery a number of fasciocutaneous flaps have been described, which are based on the vascular pedicles of superficial sural arteries [2, 8, 12, 15, 18, 20, 21]. The median superficial sural artery is also providing extensive blood supply to the sural nerve, which make possible a useful vascularized nerve graft to be developed [7, 14].

In summary, the median superficial sural artery, a small-sized cutaneous vessel, is scarcely described in the classical anatomical texts, despite well-known in the area of plastic and reconstructive surgery. The reported here course of the median superficial sural artery through the fibers of the medial sural cutaneous nerve might be a reason for sural nerve entrapment [4], as well as its passage together with the small saphenous vein and medial sural cutaneous (or sural) nerve through the unyielding fibrous arcade of the crural fascia.

References

1. **Adachi, B.** *Anatomy of Japanese I. The arterial system of Japanese*, Vol. II: Aorta thoracalis – Arcus plantaris profundus. Kyoto, Verlag der Keiserlich-Japanischen Universitat zu Kioto, 1928, 213. [in German]
2. **Al-Qattan, M. M.** A modified technique for harvesting the reverse sural artery flap from the upper part of the leg: inclusion of a gastrocnemius muscle “cuff” around the sural pedicle. – *Ann. Plast. Surg.*, **47**, 2001, 269-278.
3. **Bergman, R. A., A. K. Affi, R. Miyauchi.** *Illustrated encyclopaedia of human anatomic variation*. Opus II: Cardiovascular system, 2020. Available at: <https://www.anatomyatlases.org/AnatomicVariants/Cardiovascular/Text/Arteries/Popliteal.shtml>.
4. **Brown, M. N., B. S. Pearce, T. K. Vanetti.** Sural nerve entrapment. – In: *Peripheral nerve entrapments* (Ed. M. Trescot), Switzerland, Spinger, 2016, 795-810.
5. **Clemente, C.D.** (Ed.). *Anatomy of the human body*, 30th Ed, Philadelphia, Lea and Febiger, 1985, 770.
6. **Federative Committee of Anatomical Terminology (FCAT).** *Terminologia anatomica: International anatomical terminology*, Stuttgart, Georg ThiemeVerlag, 1998, 1-292.
7. **Frachinelli, A., A. Masquelet, J. Restrepo.** The vascularized sural nerve. – *Int. J. Microsurg.*, **3**, 1984, 57.

8. **Karacalar, A.** Axial bilobed flap based on the median and medial superficial sural arteries: a case report. – *Scand. J. Plast. Reconstr. Surg. Hand. Surg.*, **35**, 2001, 207-210.
9. **Lippert, H., R. Pabst.** *Arterial variations in man*, München, J.F. Bergmann Verlag, 1985, 1-121.
10. **Magden, A. O., A. Menderes, M. Yilmaz, A. Barutcu.** Anatomical study of the origin and course of the median superficial sural artery. – *Eur. J. Plast. Surg.*, **19**, 1996, 29–32.
11. **Manchot, C.** *The cutaneous arteries of the human body*, New York, Springer, 1983, 105-131. English translation of: Manchot C. *Die Hautarterien des menschlichen Körpers*, 1889.
12. **Mazur, N., R. Osinga, S. Lo.** Split median superficial sural artery perforator (MSSAP) flap and medial sural artery perforator (MSAP) flap for posterior thigh sarcoma reconstruction. – *BMJ Case Rep.*, **13**, 2020, 1-2.
13. **Moore, K. L.** *Clinically oriented anatomy*, 3rd Ed., Baltimore, Williams & Wilkins, 1992, 423-426.
14. **Riordan, C. L., L. B. Nanney, J. Upton, III, S. F. Wolfort.** Vascularized medial sural cutaneous nerve based on the superficial sural artery: A reliable nerve graft. – *J. Reconstr. Microsurg.*, **18**, 2002, 147-152
15. **Satoh, K., F. Fukuya, A. Matsui, T. Onizuka.** Lower leg reconstruction using a sural fasciocutaneous flap. – *Ann. Plast. Surg.*, **23**, 1989, 97-103.
16. **Standring, S.** (Ed.). *Gray's Anatomy - The Anatomical Basis of Clinical Practice*, 41th Ed, London, Elsevier, 2016, 983-986.
17. **Tubbs, R. S., M. M. Shoja, M. Loukas.** (Eds.). *Bergman's comprehensive encyclopedia of human anatomic variation*, Hoboken, New Jersey, John Wiley & Sons, Inc., 2016, 741-751.
18. **Walton, R. L., J. Bunkis.** The posterior calf fasciocutaneous free flap. – *Plast. Reconstr. Surg.*, **74**, 1984, 76-85.
19. **Williams, P. L., L. H. Bannister, M. M. Berry, P. Collins, M. Dyson, J. E. Dussek, M. W. J. Ferguson** (Eds.). *Gray's anatomy*, 38th Ed, Edinburgh, Churchill Livingstone, 1995, 1568-1570.
20. **Wolff, K.-D., F. Hölzle.** *Rising of microvascular flaps*, Berlin, Springer, 2018, 273-291.
21. **Xie, X. T., Y. M. Chai.** Medial sural artery perforator flap. – *Ann. Plast. Surg.*, **68**, 2012, 105-110.