



The segmental gastrocnemius muscles' flap: A cadaveric study

Pawan Agarwal*, Rakesh Dawar, Prashant Yadav

Plastic Surgery Unit, Department of Surgery, N.S.C.B. Government Medical College, Jabalpur 482003, (M.P.), India

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Summary The aim of this study was to evaluate the feasibility of splitting each head of the gastrocnemius muscle into two segments. This prospective study was conducted on 35 fresh cadavers with injection of radio-opaque contrast material in the popliteal artery. Seventy medial gastrocnemius and 70 lateral gastrocnemius muscle specimens were obtained. Gastrocnemius intramuscular arterial anatomy was analysed by using the digital X-ray technique. The most common vascular pattern found in this study was both bellies supplied by individual sural arteries, which shows distal bifurcation. The medial sural artery always showed bifurcation in the medial gastrocnemius muscle in both lower limbs, whereas this bifurcation of the lateral sural artery was present in only 87% cases and 13% of cases showed a single lateral sural artery without bifurcation in the lateral gastrocnemius muscle. The mean pedicle length of the medial sural artery in the right lower limb was 2.1 cm, and in left lower limb 2.3 cm. The mean pedicle length of the lateral sural artery in the right lower limb was 2.44 cm and in the left lower limb 3.21 cm. The segmental vascular pattern of the medial belly of the gastrocnemius is constant, and, thus, it can be divided safely for coverage of multiple wound defects around the knee joint. The short length of the median sural artery allows for high division of the medial gastrocnemius muscle belly. The segmental vascular anatomy is not constant in the lateral belly of the gastrocnemius muscle and, hence, division of the lateral belly is not advocated without prior preoperative colour Doppler.

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The closure of soft tissue and bone defects by mobilisation of muscles' flaps has become a basic method in reconstructive and plastic surgery. Ger Efron first reported that lesions in the knee and adjacent area are best treated by

transposition of the gastrocnemius muscle, either alone or as a myocutaneous flap.¹ The gastrocnemius muscle is frequently employed as a local flap for coverage of soft-tissue defect or bone in the lower thigh and upper one-third of the leg. Use of the gastrocnemius muscle is equivalent or superior to other methods of wound coverage due to the muscle's accessibility, wide arc of rotation, easy dissection and a reliable vascular pedicle.^{2,3}

* Corresponding author. 292/293 Napier Town, Jabalpur 482001, Madhya Pradesh, India.

E-mail address: drpawanagarwal@yahoo.com (P. Agarwal).

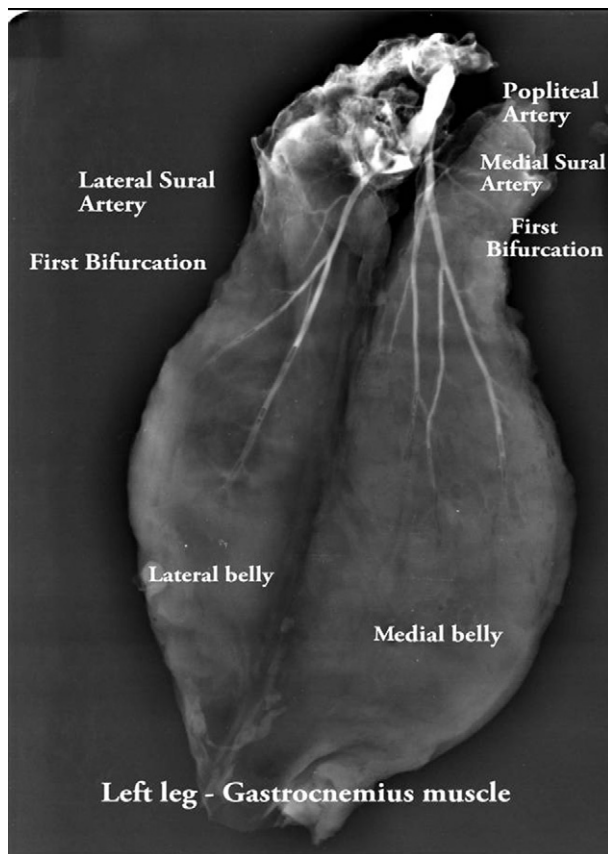


Figure 1 The most common vascular pattern.

The limitations of the gastrocnemius flap include difficulties in covering multiple separate wounds in the same area as well as contour deformity because of the bulkiness of the flap and possible disability due to sacrifice of the muscle. To avoid contour deformity and the ability to cover multiple wounds, one of the bellies of the gastrocnemius muscle can be split longitudinally, thus creating four different segments that can be independently transposed. The existing anatomical studies support this type of muscle division and clearly show the proximal bifurcation of the sural artery with its longitudinal course toward the distal part of the muscle.⁴ This cadaveric study is intended to evaluate the feasibility of splitting each head of the gastrocnemius muscle into two segments as well as to determine the highest point of segmentation in fresh cadavers in the Indian population.

Materials and methods

A prospective study was conducted over a period of 15 months from August 2009 to October 2010 at the Department of Surgery and Department of Forensic Medicine, N.S.C.B. Medical College and Hospital Jabalpur, M. P., India. After permission from the human ethics committee, 70 specimens of gastrocnemius muscle were obtained from 35 fresh cadavers. Cadavers with any congenital deformity, fractures or crush injury and previous surgery around the knee joint were excluded from the study. They were placed in prone position. The gastrocnemius muscle was harvested

by making a posterior vertical midline incision approximately 5 cm above the knee joint and up to the Achilles tendon below. The two skin flaps were reflected medially and laterally. The short saphenous vein encountered during the dissection was either retracted or excised. The sural nerve, which is located lateral to the vein after it pierces the deep fascia, was identified and preserved. The deep fascia was incised vertically and retracted, exposing the superficial surface of the gastrocnemius muscle. The gastrocnemius muscle was carefully separated from the soleus muscle and plantaris tendon posteriorly. Sharp dissection is required to separate the muscle from the aponeurosis, which develops on its anterior surface. The two heads of the gastrocnemius muscle were detached from the femoral bone by carefully dissecting the neurovascular pedicle. The distal end of the popliteal artery was ligated. The gastrocnemius muscle was completely isolated and left attached only by its vascular pedicle from the popliteal artery. Then, 10 ml of sodium diatrizoate (Iohexol) were injected through the popliteal artery straight into the sural artery and the popliteal artery was ligated at the proximal end. Photographs and digital radiographs of the gastrocnemius muscles were taken to demonstrate the standard vascular pattern and any variations. The true length of the vascular pedicle of each head was also noted with the help of radiological measuring system.

Observation

We dissected 35 fresh cadavers with injection of radio-opaque contrast material in the popliteal artery, and 70

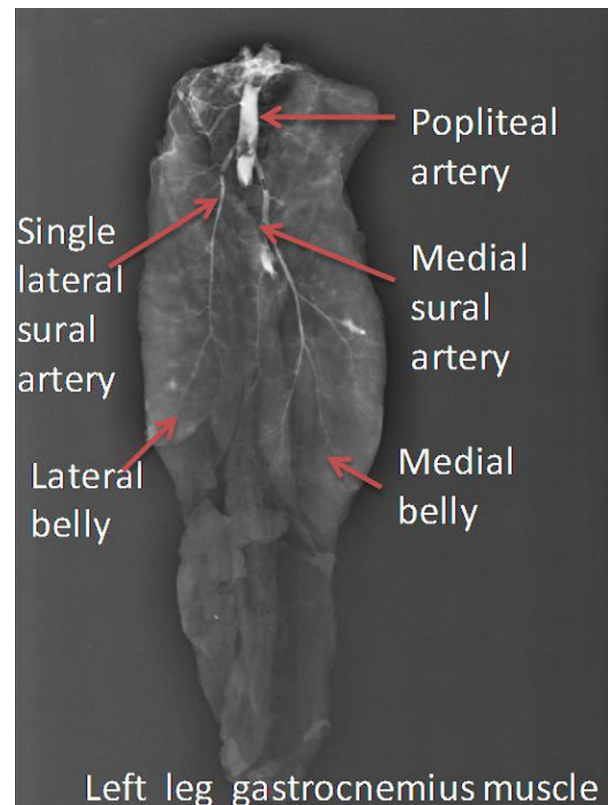


Figure 2 Single lateral sural artery without bifurcation.

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