

Case Report  
Reconstructive Surgery

# Medial sural artery perforator flap aided by preoperative computed tomography angiography mapping for tongue reconstruction

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**Abstract.** The purpose of this paper is to present an innovative method for tongue reconstruction after cancer ablation using the medial sural artery perforator flap with the aid of preoperative computed tomography angiography (CTA) mapping. We describe the case of one patient treated with this technique and illustrate the anatomy of perforator vessels and the surgical techniques used in flap harvest. CTA was applied preoperatively to assess the number and location of medial sural artery perforators. The result obtained was both aesthetically and functionally satisfactory. The flap presented has the advantage of less donor site morbidity, and being thin, it is a suitable option for tongue reconstruction including that of a hemiglossectomy defect. CTA is an effective means of improving the safety of flap harvest.

**Key words:** medial sural artery perforator flap (MSAPF); computed tomography angiography (CTA); tongue reconstruction; supermicrosurgery.

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The reconstruction of a tongue defect is particularly challenging due to its comprehensive functions including speech, chewing, and deglutition. For decades, the radial forearm flap has most commonly been used for reconstruction after hemiglossectomy. However, the radial forearm flap sacrifices a major artery at the donor site and leaves a cosmetically unfavourable scar. Improved and sophisticated understanding of the vasculature of the skin has opened the door

to the evolution of perforator flaps that allow the use of skin and subcutaneous fat without sacrificing a major artery. Cavadas et al.<sup>1</sup> first described the use of the medial sural artery perforator flap (MSAPF) for lower limb reconstruction in 2001. Subsequently, Chen et al.<sup>2</sup> reported the application of the MSAPF for tongue and floor of the mouth reconstruction after cancer ablation. The MSAPF is comparable to the radial forearm flap in its thinness and pliability.

However, the safety of flap harvest remains uncertain due to the variations in vascular anatomy.

In this report, we introduce an innovative method for medium-sized tongue defect reconstruction using the MSAPF combined with computed tomography angiography (CTA) mapping. We also present a patient who underwent surgery with this technique and provide a preliminary evaluation of the outcome and the value of CTA in perforator location.

## Case report

A 20-year-old female presented to our hospital with a squamous cell carcinoma. She had been treated with TPF (docetaxel, cisplatin, and 5-fluorouracil) induction chemotherapy 2 weeks previously. Intraoral physical examination revealed a firm and invasive mass in her right tongue (T1N0M0). In accordance with the treatment protocol, the patient was scheduled to undergo a hemiglossectomy and receive a supraomohyoid neck dissection, which would result in a tongue defect. A MSAPF would then be used for tongue reconstruction. As the MSAPF is not frequently utilized in tongue reconstruction due to variations in the perforating vessel and the fine vascular dissection required, a preoperative CTA was performed to assess the number and location of the perforators.

## Vascular anatomy

The medial sural artery derives from the popliteal artery and enters the substance of the medial gastrocnemius muscle. After running longitudinally between the muscle fibre bundles for a distance of 3–6 cm, the main trunk of the medial sural artery

typically divides into a medial and a lateral branch. Correspondingly, musculocutaneous perforators run to the subfascial plexus through the deep fascia and supply the perforator-based skin along the course of the lateral or medial branch of the medial sural artery.<sup>3</sup>

Generally, the number of perforators ranges from one to four, with a mean of two. Kao et al.<sup>4</sup> revealed that the average distance from the popliteal crease in the medial calf area to the first and second perforators is about 10 cm and 16 cm, respectively. Almost all of the perforators are found between 6 and 18 cm below the popliteal crease. The arterial diameter of the vascular pedicle is 1–2 mm and it is usually accompanied by two venae comitantes, which may converge to a single one that drains into the popliteal vein. A sizeable perforator has been defined as 1 mm in diameter and is considered safe for anastomosis and flap perfusion. Most reported sizeable perforators have been located within the upper one-fifth to one-third of the lower limb measured from the midpoint of the popliteal crease. In addition, the diameter of the accompanying veins is slightly larger than the arterial diameter.

## Preoperative CTA image

The preoperative evaluation of the perforators was an essential part of the reconstruction process, and CTA was used to determine the number, size, course, and exact emerging point of each medial sural artery perforator.

The CTA image showed the first perforator clearly on the sagittal plane and coronal plane (Fig. 1A and B). The perforator emerged at 9.97 cm from the midpoint of the popliteal crease and 2 cm from the posterior midline of the leg. The proximal thickness of the flap was 8.9 mm and the distal measurement was 7.8 mm (Fig. 1A).

## Flap raising

After cancer ablation, the patient was placed in a prone position. A virtual line was drawn on the posterior midline of the leg. The point of emergence of the first perforator and its branches were carefully localized on the body surface with the aid of CTA images. The overall procedure was facilitated by the inflation of a pneumatic tourniquet without limb exsanguination.<sup>5</sup>

In accordance with the preoperative design, the initial incision used to confirm the perforator location and size was made through the skin and subcutaneous tissue in the lateral border of the flap. The perforator vessel was then exposed using a suprafascial dissection (Fig. 2A).

After confirming the targeted perforator, the residual boundary of the flap was then elevated from the medial gastrocnemius muscle. Retrograde supermicrosurgical dissection of the targeted perforators longitudinally between the muscle fibre bundles, with ligation of all the branches to the muscle, was then performed along the axial vessel until the main trunk of the medial sural vessel was reached and an appropriately long pedicle length was obtained (Fig. 2B). The procedure was performed carefully during the musculocutaneous and intramuscular dissection. Finally, excellent blood flow to the flap was confirmed after tourniquet release. The duration of the flap harvest procedure was 63 min in this case.

The harvested flap was 5 cm × 6 cm in dimension and the length of the pedicle from the flap to the popliteal artery was 7.5 cm, the result being in agreement with the CTA data. The diameter of the medial sural artery was 0.8 mm and the diameter of the associated vein was 1.2 mm.

## Surgical reconstruction procedure

Anastomoses were performed to the lingual artery and a branch of the general

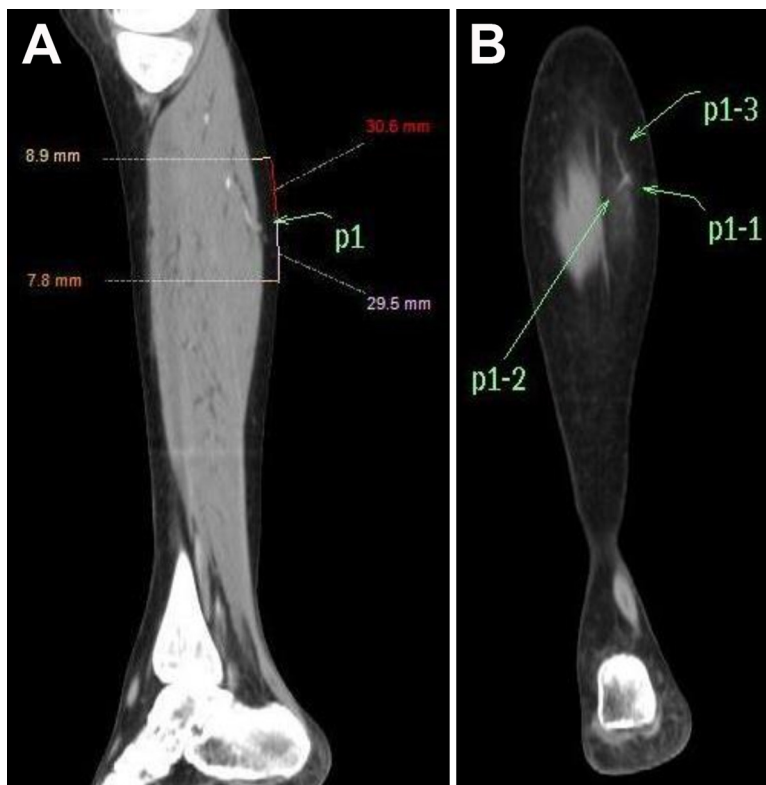


Fig. 1. Computed tomography angiogram showing the medial sural artery perforator. (A) The perforator (green arrow) emerging from the medial gastrocnemius muscle is marked on the sagittal plane. (B) Three branches of the first perforator in the subcutaneous tissue are marked on the coronal plane.

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