



Locating recipient perforators for perforator-to-perforator anastomosis using color Doppler ultrasonography



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KEYWORDS

Perforator flap; Color doppler; Ultrasound doppler; Perforator-toperforator anastomosis; Free flap reconstruction; Preoperative examination **Summary** Background: The authors investigated the efficacy of color Doppler ultrasonography (US) to locate perforators prior to performing perforator-to-perforator anastomosis in free flap reconstruction.

Methods: The authors examined 20 patients who had undergone free flap transfers between April 2013 and July 2014 at the Department of Plastic and Reconstructive Surgery, University of Tokyo Hospital. On the day before surgery, color Doppler US examination was performed to locate lower-extremity perforators. During surgery, the perforators were dissected, observed directly, and used for perforator-to-perforator anastomosis.

Results: Perforator-to-perforator anastomosis was performed in 20 patients. The mean diameters of the perforators used in anastomosis were 0.69 mm in the anterolateral thigh lesion, 0.65 mm in the medial thigh lesion, 0.66 mm in the medial lower-extremity lesion, and 0.63 mm in the lateral lower leg lesion. Comparing preoperative data with the direct observation of perforators, no false-positive results were registered in the localization of the perforators.

Conclusions: By using color Doppler US as a preoperative examination technique, we can locate perforators in the lower extremity efficiently to perform perforator-to-perforator anastomosis, with shorter time, less invasiveness, lower cost, and no risk of radiation exposure. © 2014 British Association of Plastic, Reconstructive and Aesthetic Surgeons. Published by Elsevier Ltd. All rights reserved.

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Introduction

Perforator-to-perforator anastomosis with the use of a supermicrosurgical technique has had an increasingly important role in reconstructive surgery recently.¹ Although perforator-to-perforator anastomosis is still technically demanding and special training is needed to master it, the advantages of this technique are as follows: shorter surgery time, less donor-/recipient-site morbidity, minimizing the risk of major vessel injury, less postoperative complications, smaller skin incision, and multiple/multistage tissue transfers.²

In the recipient site, approximately 0.3-1.0-mm-diameter perforators and veins are required to complete this kind of tissue transfer, but it is still difficult to find perforators that would require small skin incisions because of anatomical variations of the recipient-site perforators especially in the lower extremity.

Previously, acoustic Doppler was used for localization of perforators. It is useful for locating perforators but not for determining their diameter and course. Multi-detector row computed tomographic angiography (MDCTA) is also used for locating perforators but exposes patients to radiation.³

In this study, we report the application of color Doppler ultrasonography (US) for determining the location and diameter of perforators for perforator-to-perforator anastomosis in the lower extremities. To the best of our knowledge, no article has described the usefulness of color Doppler US for the localization of recipient perforators, especially in performing perforator-to-perforator anastomosis.

Patients and methods

We examined a total of 20 patients who had undergone vascularized tissue transfers between April 2013 and July 2014 at the Department of Plastic and Reconstructive Surgery, University of Tokyo Hospital (Table 1), under the University of Tokyo Hospital Institutional Review Boardapproved protocol. In all the patients, we searched for perforators in the lower extremities using color Doppler US on the day before surgery.

The color Doppler US (Noblus; Hitachi Aloca, Tokyo, Japan) was performed by the first author (KT) on a patient in the supine position, as in the operative position. The examination had been completed within 10 min and no special technique was needed. For each of the evaluated vessels, the vessel diameter at maximal pulsation and the peak systolic flow velocity (cm/s) were measured (See Figure 1). In addition, the number of perforators in each lesion and their three-dimensional course through the

Table 1 Brief summary of the patients	5.
No. of cases	20
Sex	
Female	17
Male	3
No. of limbs	40
Average age (range), yr	58.7 (39-73)

Preoperative perforator marking, indicating the

Figure 1 diameter and peak systolic flow.

muscle and fat tissue were determined to provide information for surgery.

We searched in the anterolateral thigh lesion, supplied mainly by the descending branch of the lateral circumflex femoral artery; in the medial thigh lesion, supplied mainly by the descending branch of the lateral circumflex femoral artery or descending genicular artery; in the medial side of the lower leg, supplied mainly by the posterior tibial artery; and in the lateral side of the lower leg, supplied mainly by the anterior tibial or peroneal artery (See Figure 2).

In the 20 patients, the preoperative results were compared with the intraoperative findings (Table 3). During surgery, we made a skin incision as small as possible to search recipient-site vessels, and the diameter of the perforators was measured under direct observation (See Figure 3). The vessels were used as recipient vessels for perforator-to-perforator anastomosis (See Figure 4). Our selection criterion for performing dissection on the recipient site is a perforator velocity >20 cm/s in preoperative color Doppler examination.

Results

Perforator-to-perforator anastomosis was performed in 20 patients. The mean perforator diameter measured on direct observation intraoperatively was 0.69 mm in the anterolateral thigh lesion, 0.65 mm in the medial thigh lesion, 0.66 mm in the medial lower leg lesion, and 0.63 mm in the lateral lower leg lesion (Table 2). Comparing the preoperative examination data with the direct observation



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