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Use of revascularized artery as a recipient in microvascular reconstruction of the lower leg: An analysis of 62 consecutive free flap transfers

Hyung Min Hahn, Yeon Seong Jeong, You Sun Hong, Je Hwan Won, Sang Hyun Lim, Jinoo Kim, Myong Chul Park, Dong Ha Park, Il Jae Lee*

Ajou University School of Medicine, Suwon, Republic of Korea

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Summary *Background:* This study aimed to demonstrate the safety and reliability of combined preoperative angioplasty and free flap transfer in patients with peripheral arterial occlusive disease (PAOD) by analyzing the surgical outcomes.

Methods: Between October 2011 and October 2015, patients who had undergone lower extremity angiography and subsequent free flap transfer were retrospectively reviewed. Data collected included demographics, perioperative data, and postoperative outcomes. The cases were divided into two groups: one group with microanastomosis performed on revascularized artery by balloon angioplasty and the other group performed on native artery. Multiple logistic regression model using propensity score and linear regression was computed to determine the association between preoperative angioplasty and the surgical outcomes.

Results: A total of 62 lower limb reconstruction cases (19 angioplastied cases and 43 nonangioplastied cases) were included in the study. Complications occurred in 6 cases in the angioplastied group and in 11 cases in the control group. The overall limb salvage rate was 100% during the average follow-up of 29.5 months in the angioplastied group and 97.7% in the nonangioplastied control group during the average follow-up of 31.1 months. Preoperative angioplasty was not a significant predictor of increased complications and longer postoperative downtime in logistic and linear regression model, both in the weighted and unweighted model.

* Corresponding author. Department of Plastic and Reconstructive Surgery, Ajou University School of Medicine, 164, World cup-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16499, Republic of Korea. Fax: +82 31 219 5244.

E-mail address: i00325@live.co.kr (I.J. Lee).

Conclusions: The combined approach of preoperative endovascular revascularization and free flap transfer for limb reconstruction in PAOD patients can be performed safely and effectively with acceptable morbidity.

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Introduction

For successful reconstruction, the vascular condition of the wound must be taken into account. Diabetic vasculopathy and other vascular lesions interfere with the blood inflow necessary for wound healing and thus may increase flap failure. Despite considerable advancements in microvascular surgery, many patients with peripheral arterial disease undergo lower limb amputation for complex wounds on their lower extremities. Insufficient data and knowledge of vasculopathy and microsurgery largely account for the tendency toward amputations.

Since the report by Briggs et al. in 1985,¹ many studies that combined bypass vascular reconstruction and free tissue transfer of lower limb have been performed, and the safety and reliability of the combination procedure have been documented.^{2–5} However, the use of endovascular revascularization before free flap transfer has been scarcely looked into. This case-controlled study describes our experience with combined preoperative revascularization and free flap transfer for the coverage of complex lower extremity wounds secondary to chronic ischemia or trauma.

Materials and methods

We conducted a retrospective study of patients who had undergone preoperative angiographic evaluation of lower extremity and subsequently free flap transfer between October 2011 and October 2015 at our institute. This study was approved by the institutional review board and was conducted in accordance with the ethical standards set forth in the Declaration of Helsinki and its later amendments. In all cases in the study, preoperative angiography for a lower extremity vessel was performed in close collaboration with an interventional radiologist. Immediate balloon angioplasty for endovascular revascularization of an artery with stenosis or occlusion was performed when the lesion was verified on preoperative angiographic evaluation, and we excluded patients who were treated by balloon angioplasty with stent placement or balloon angioplasty for an above-knee vessel.

We retrospectively reviewed cases of all patients who were followed up for more than 6 months after surgery including their medical records, clinical photographs, and radiographs. The gathered data included age, gender, defect location, cause of defect, comorbidities, flap type, flap size, TransAtlantic Inter-Society Consensus (TASC) level (Figure 1), flap outcome, endovascular procedures, duration of hospital stay, and initiation of weight-bearing ex-

ercise. We conducted and report on this study in accordance with the STROBE guidelines.⁶

We divided the study cases into two groups based on preoperative revascularization: one group with free tissue transfer on the revascularized recipient artery (angioplastied group) and the other group on the unobstructed native artery (nonangioplastied, control group). Patients in the angioplastied group had significant peripheral arterial occlusive disease (PAOD) confirmed by conventional angiography for whom arteriorrhaphy was performed on the recipient artery of postrevascularization at below-the-knee level. Defects with ischemia were considered extremely difficult to treat by conventional treatments, and spontaneous wound healing was not expected even after revascularization because of exposure of less vascularized tissue and the presence of osteomyelitis. These patients would have been candidates for major leg amputation if angioplasty and successful free flap transfer has not been performed. Patients in the latter group underwent conventional angiography for the evaluation of the recipient vessel for a free flap.

The primary outcomes of interest were early postoperative complications, which included perioperative mortality and arterial and venous insufficiency. Secondary outcomes included flap necrosis requiring additional operation, duration of hospital stay after flap transfer, length of stay for the initiation of weight-bearing exercise, further amputation, and consequent limb salvage rate.

With regard to the treatment protocol, all potential candidates for lower extremity free flap underwent preoperative computed tomographic angiography (CTA) for the accurate localization of thigh perforators and for the evaluation of the recipient vessel (Figure 2). Not all patients who were free flap candidates underwent preoperative conventional angiography. Indications for angiographic intervention included suspicion of occlusive arterial disease in CTA, inadequate evaluation of a vessel in CTA, presence of chronic kidney disease, diabetes, diagnosed coronary or peripheral arterial disease, and clinical suspicion such as a faint Doppler sound or absent palpable pulse. The endovascular procedures were performed by interventional radiologists with more than 10 years of experience in endovascular procedures, and a contralateral femoral approach was used in the majority of patients. In rare cases of below-the-knee interventions, an ipsilateral antegrade femoral approach was used.

When vascular occlusion or stenosis was verified on angiography, immediate revascularization was performed on the below-the-knee tibial artery prior to surgical wound coverage. Lesions were crossed under fluoroscopic guidance using a catheter and guidewire based on the

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