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## Free vascularized fascia flap combined with skin grafting for deep toe ulcer in diabetic patients



Xuekang Yang, MD,<sup>1</sup> Zhuoqun Fang, MM,<sup>1</sup> Mengdong Liu, MD, Yue Zhang, MM, Qiaohua Chen, MM, Ke Tao, MD, Juntao Han, MD, and Dahai Hu, PhD, MD\*

Department of Burns and Cutaneous Surgery, Xijing Hospital, Fourth Military Medical University, Xi'an, China

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### ABSTRACT

**Background:** This study introduces a technique for the reconstruction of deep toe defects in diabetic patients using a method that combines free vascularized fascia flap with skin grafting. **Methods:** In this retrospective study, conducted between March 2010 and February 2016, 15 diabetic patients with deep toe ulcer received surgeries that combined free vascularized fascia flap with skin grafting, including nine anterolateral thigh fascia lata flaps and six superficial temporal fascia flaps. Their medical records were systematically reviewed from electronic databases. The donor artery was anastomosed to the dorsalis pedis artery in an end-to-side manner, and the vein was anastomosed to the accompanying vein in an end-to-end manner.

**Results:** Thirteen fascia flaps completely survived without any rejection. Partially necrosed grafted skins, which were found in two cases, were healed after routine dressing changes. Patients achieved an esthetic outcome and acceptable functions without further revisions. Two patients suffered from ischemic necrosis of the fascia flap and eventually underwent amputation.

**Conclusions:** The present study demonstrated that vascularized fascia flap combined with skin grafting has great advantages for correcting deep toe ulcer in diabetic patients characterized by the esthetic outcome, abundant vascularity, surgical simplicity, and good deformability.

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### Introduction

Diabetic foot ulcer is one of the most common and serious complications that occurs in diabetic patients. It is particularly complicated by problems such as prolonged angiopathy and sensorial neuropathy. Further complications, such as numbness, pain, and skin ulcers probably cause gangrenes, which would lead to amputations or even death if not treated well.<sup>1</sup> Toes are the most common and vulnerable parts of the body for infections and ulcers that are usually conservatively

treated with debridement and local wound therapy. However, these treatments are inadequate for patients with deep ulcers as they expose the underlying bones and tendons and eventually lead to amputation of the toes.<sup>2</sup> Another method that is used to treat foot ulcers is reconstruction using reversed dorsalis pedis artery island flap. Although this method has the advantage that it can be occasionally performed when vascular conditions of the lower extremity are well conserved, the main problem is that it would destroy the anatomical structure of acrotarsium vessel. This would lead to a decrease

\* Corresponding author. Department of Burns and Cutaneous Surgery, Xijing Hospital, Fourth Military Medical University, 15 Changle Xi Road, Xi'an 710038, P.R. China. Tel.: +86-29-84775298; fax: +86-29-83251734.

E-mail address: [hudahaidoc@163.com](mailto:hudahaidoc@163.com) (D. Hu).

<sup>1</sup> Xuekang Yang and Zhuoqun Fang contributed equally to this work. 0022-4804/\$ – see front matter © 2018 Elsevier Inc. All rights reserved.

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in the foot blood supply and, therefore, increase the incidence of severe foot ulcer infection. In addition, the blood supply of reversed dorsalis pedis artery island flap relies on the deep plantar branch of artery.<sup>3</sup> The angiopathy in diabetic patients may predispose them for small vessel embolization and increase the risk of flaps failure.

In some medical centers, small free flaps (peroneal artery perforator flap, posterior interosseous artery perforator flap, and so forth) are given priority over repairing and reconstructing toe defects. The artery and vein of the small free flaps are anastomosed to the plantar arch of the foot. However, in diabetic patients who are prone to peripheral small vascular diseases, this would result in skin flap ischemia and anastomotic embolization eventually leading to the failure of small free flaps. Thus, the long vascular pedicle free flap (the anterolateral thigh flap and so forth) may offer a better choice for diabetic patients. The donor arteries of these flaps are anastomosed to the dorsalis pedis artery, which could highly increase the success rate of the surgery.<sup>4</sup> However, for patients with thick subcutaneous fat, it is difficult to clip the excess soft tissue and fat off the small flaps, which causes the recipient toe to appear bulky.

Thus, the purpose of this retrospective study was to evaluate the efficacy and feasibility of free vascularized fascia flaps together with skin grafts in treating diabetic patients with deep ulcers in their toes.

## Method

### Clinical data

Fifteen of the 973 diabetic foot patients admitted in our department of Xijing Hospital were enrolled in this study. All of them had consented to this study in accordance with the requirements of the Research Ethics Committee of Xijing Hospital. Although the injured toes of all the 15 patients were accompanied by severe soft tissue defects and bone and tendon exposure, their blood supply was still abundant. The inclusion criteria for this procedure were the presence of severe soft tissue defects with bone and/or tendon exposure after debridement without any severe uncontrollable systemic disease such as uremia. Each patient's detailed profile is documented in Table. The research work reported here was also performed in line with the process criteria.

### Preoperative preparation

Strict blood glucose control (80-110 mg/dL), water-electrolyte balance, and the absence of any systemic disease were assessed and improved in the perioperative period. Transcutaneous oxygen was measured in patients, and improvements were made so that oxygen levels reached more than 30 mmHg before surgery. Osteomyelitis was

**Table – Clinical data and treatment outcomes of patients.**

Case	Age/gender	Injured location	Defect size, (cm <sup>2</sup> )	Lower extremity vessels	PTA therapy	Fascia flap choice	Survival of flap	Complication
1	52/M	5th toe	1.9 × 1.6	Normal	No	ATFL flap	Yes	No
2	44/M	3rd toe	2.1 × 1.7	Normal	No	STF flap	Yes	No
3	59/W	4th, 5th toes	3.3 × 2.2	Normal	No	ATFL flap	Yes	Partial skin grafting necrosis
4	49/M	4th, 5th toes, and partial dorsum pedis	5.9 × 9.2	Normal	No	STF flap	Yes	No
5	55/W	5th toe	2.0 × 1.5	PT stenosis	Yes	ATFL flap	Yes	No
6	37/M	2nd toe	2.6 × 1.7	Normal	No	STF flap	Yes	No
7	45/M	2nd, 3rd toes	4.5 × 2.9	P and PT stenosis	Yes	ATFL flap	Yes	No
8	61/M	5th toes	3.1 × 2.2	AT, PT, and P stenosis	Yes	ATFL flap	No	5th toes amputation
9	57/W	4th toe	2.2 × 1.5	AT stenosis	Yes	ATFL flap	Yes	No
10	49/M	5th toe and partial dorsum pedis	5.6 × 4.2	Normal	No	ATFL flap	Yes	No
11	65/M	4th toe	3.1 × 1.9	AT and P stenosis	Yes	STF flap	No	No
12	76/W	5th toe	2.5 × 2.1	AT and P stenosis	No	ATFL flap	No	4th, 5th toes amputation
13	41/M	3rd toe	2.2 × 2.1	Normal	No	ATFL flap	Yes	No
14	51/M	1st toe	4.2 × 2.6	AT and P stenosis	Yes	STF flap	Yes	Partial skin grafting necrosis
15	48/M	1st, 2nd toes	4.1 × 4.6	Normal	No	STF flap	Yes	No

AT = anterior tibial artery; ATFL flap = anterolateral thigh fascia lata flap; DP = dorsalis pedis artery; P = peroneal artery; PT = posterior tibial artery; STF flap = superficial temporal fascia flap.

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