Formosan Journal of Surgery (2015) 48, 21–25

Available online at www.sciencedirect.com

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journal homepage: www.e-fjs.com

CASE REPORT

Reverse-flow anterolateral thigh flap without antegrade venous reconstruction for knee soft-tissue reconstruction

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Received 24 January 2013; received in revised form 15 March 2013; accepted 25 July 2014
Available online 28 January 2015

KEYWORDS
anterolateral thigh flap;
knee reconstruction;
pedicled anterolateral thigh flap;
reverse flow

Summary For soft-tissue defects around the knee area, the pedicled gastrocnemius flap is classically the first choice for reconstruction. However, the gastrocnemius flap is not always sufficient, and it carries certain donor site morbidity. When local lower limb flaps are insufficient or unavailable, free-tissue transfer is considered. Because few recipient vessels are located around the knee, free-tissue reconstruction remains challenging. In addition, the optimal donor site for large soft-tissue defects has not been clearly established. The anterolateral thigh (ALT) flap is easily accessible and has minor donor site morbidity. We evaluated the reverse-flow ALT pedicled flap as a candidate for the reconstruction of large soft-tissue defects around the knee. We performed a retrospective review of charts between 2005 and 2008. A total of four patients underwent reverse-flow ALT flap for reconstructing large soft-tissue defects around the knee. None of the flaps were augmented in venous drainage with a venous supercharge. We reviewed the defect characteristics, flap size, patient factors, and reconstructive outcomes. The soft-tissue defects were successfully reconstructed for all patients intraoperatively. However, venous congestion of varying degrees developed postoperatively in all patients. Two of the patients had partial flap necrosis but were successfully treated with debridement and skin grafting or local flap repair. The reverse-flow ALT flap can be used to reconstruct large soft-tissue defects around the knee successfully. However, venous congestion remains the main cause of flap complication. In such clinical scenarios, we suggest either using a smaller flap or performing venous supercharge to enhance venous return and improve the survival ratio of the flap.

Conflicts of interest: None of the authors have any financial interest in any of the products, devices, or drugs mentioned in this manuscript.

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http://dx.doi.org/10.1016/j.fjs.2014.07.002

1. Introduction

Reconstruction of soft-tissue defects around the knee remains a challenge. The main goals of soft-tissue reconstruction around the knee area are to restore the contour of the knee and to preserve knee function. Large soft-tissue defects with underlying tendon, bone, or even bone fixation implant exposure are not uncommon during soft-tissue reconstruction in the knee area. Because of the limited choice of local cutaneous and muscle flap options in this area, free-tissue transfer is often required. However, the choice of recipient vessels around the knee area is limited.[1]

The reverse-flow anterolateral thigh (ALT) flap was first described by Zhang[2] in 1990. Pan et al[3] conducted an anatomic study of the reverse-flow ALT flap in 2004. They found that every 10 of 11 patients have type I or type III perforators according to Shieh et al's[4] classification of ALT perforators, meaning that most of the perforators are derived from the descending branch of the lateral circumflex femoral artery; thus, the reverse-flow ALT flap is an easily accessible flap to harvest. Limited data are available on reverse-flow ALT flap for knee area reconstruction. In this study, we present our experience regarding soft-tissue reconstruction around the knee area by using reverse-flow ALT flap without antegrade venous supercharge.

2. Materials and methods

Between June 2005 and November 2008, a total of four patients with soft-tissue defects around the knee area underwent reconstruction by using ipsilateral pedicled reverse-flow ALT flap. All patients were male. The average age at the time of reconstruction was 33.5 years (range, 19—46 years). The defects in the knees in two patients were caused by crush injuries in road accidents. The third patient sustained an electric burn in the knee and proximal lower leg with patellar tendon exposure. The fourth patient had a soft-tissue defect in the knee region as a result of fasciotomy for necrotizing fasciitis. The size of the defects in these patients ranged from 6 cm × 7 cm to 22 cm × 20 cm.

2.1. Surgical technique

Preoperative planning routinely begins with identification of the perforators by using a handheld Doppler machine. The flap is designed according to the size of the defect. All sizable perforators are identified, and the ideal perforator from the descending branch of lateral circumflex femoral artery is dissected in a retrograde manner. The pedicle of the flap is isolated distally until the pivot point is reached. The pivot point is located proximal to the division of the descending branch, which is approximately 6—7 cm above the upper margin of the patella. Before the proximal end of the descending branch of the lateral circumflex femoral artery is ligated, a vascular clamp is applied to the proximal end to ensure that the "reverse-flow" perfusion is adequate to supply the entire flap. After the adequacy of the flap perfusion is confirmed, the pedicle is then ligated proximally exactly at the bifurcation points of the descending branch. The flap is then transferred to the defect area subcutaneously through tension-free pedicle placement.

3. Results

All of the defects were initially reconstructed by using reverse-flow ALT flap (Table 1). The sizes of the flaps ranged from 12 cm × 6 cm to 20 cm × 10 cm (average, 140 cm^2), and the donor sites were primarily closed. The lengths of the pedicles ranged from 8 cm to 16 cm (average, 12.8 cm). The pivot points of the flaps were 5—13 cm (average, 7.75 cm) proximal to the upper margin of the patella. Although the procedures for the flap transfer were uneventful, various degrees of venous congestion occurred after the operation. The period of congestion was 3—7 days (average, 4.5 days). Two flaps had venous congestion for 3 days and survived completely. Flaps measuring 20 cm × 10 cm had venous congestion for 5 days and, therefore, necrotized (4 cm × 8 cm). A local rotational flap was used for wound closure. Another flap measuring 22 cm × 8 cm had venous congestion for 7 days, and, therefore, more than two-thirds of it necrotized; the wound was closed using a split-thickness skin graft.

Table 1 Clinical details.

Age (y)/ sex	Defect size (cm)	Pedicle length (cm)	Flap size (cm)	Number of perforators	Pivot point (cm proximal to patella proximal margin)	Days of venous congestion	Complications	Second procedure	Results
19/M	10 × 6	15	12 × 6	1	13	3 days		Defatting and scar revision	Healed
27/M	10 × 10	16	20 × 10	2	5	5 days	Partial flap necrosis	Debridement, evacuation of hematoma, rotation flap	Healed
40/M	6 × 7	12	16 × 7	1	8	3 days			Healed
46/M	22 × 20	8	22 × 8	1	5	7 days	>2/3 flap necrosis, wound infection	STSG to knee	Healed