

Original Article

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Reverse Sural Fascio-Cutaneous Flap for Management of Patients with Distal Third of Lower Limb Soft Tissue Defects Referring to the Emergency Department Following Traumatic Events; A Review of 13 Cases

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Abstract

Introduction: Soft tissue defects over the distal leg and/or heel are probable injuries that need a flap. Various coverage techniques have been described in this regard. It seems that applying Reverse Sural Fascio-Cutaneous Flap (RSFCF) for reconstructing soft tissue defects of lower limbs has superiorities over other techniques.

Objective: We intend to present a case series with soft tissue defect over the distal third of lower limb, covered using RSFCF technique.

Methods: This is a case series and longitudinal study in which patients with crush injuries who referred to the emergency department (Sina hospital, Tehran, Iran) from 2013 until 2020 and were treated with RSFCF technique were included. The data were collected using patients' charts, by interviewing the patients, and from hospital records. The patients' wounds were prepared, examined, and the surgery was done. Tendon and bone defects were repaired, and wounds were closed using reverse sural Fascio-Cutaneous Flap.

Results: A total of 13 patients were eligible during the 6-year study period. Men were more commonly affected with no conclusive gender trend. The posterolateral part of the foot of the right leg was the most frequently injured part (53.8%). Only 1 patient had mentioned complications after surgery including mild congestion and abnormal sensory and motor examination. Patients were followed by the surgeons until 3 months after the operation and all of them had been able to resume their daily life activities by then.

Conclusion: According to our findings, almost all of the patients (except one) had received their flaps without any complications. All the patients had been able to resume their daily life activities three months after the surgery. This may show that RSFCF, which can be quickly performed and does not need microsurgical skills, could be a suitable option for the coverage of distal third of lower limb soft tissue defects caused mainly by trauma.

Key words: Lower Extremity; Soft Tissue Injuries; Surgical Flaps; Wound Closure Techniques

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INTRODUCTION

Soft tissue defects over the distal leg and/or heel are probable injuries following trauma, which may also occur due to other reasons such as late complication of orthopedic surgeries (1). A flap should be used to cover the soft tissue defect in this area and various coverage techniques have been described in this regard. Free flaps are free muscle flaps that need microvascular anastomosis surgeries and special equipment that may not be available everywhere or the surgeon may not be skilled. Reverse Sural Fascio-Cutaneous Flap (RSFCF) is another technique that was primarily described in 1992 (2), which has recently received more attention (3). In this method, the flap is

supplied by at least 1 of the 3 superficial sural arteries, the sural nerve, and the lesser saphenous vein (3). It seems that applying RSFCF for reconstructing soft tissue defects of lower limb has superiorities over other techniques. In support of this method, we intend to present a case series including 13 cases with soft tissue defect over the distal third of lower limb, covered using RSFCF.

Methods

Study design and participants

This is a case series and longitudinal study in which patients who underwent crush injuries and were referred to the emergency department (Sina

Hospital, Tehran, Iran) from 2013 until 2020 and treated using RSFCF technique were included. The approval for the present study was received from ethics committee of Tehran University of Medical Sciences (IR.TUMS.SINAHOSPITAL.REC.1399.127).

Surgical anatomy

This fascio-cutaneous flap occupies the posterior leg between the popliteal fossa and the mid-portion of the leg and is centered over the midline raphe between the lateral and medial heads of the gastrocnemius muscle. The flap is around 10×3×12 cm in size. Flaps greater than 6 cm wide require skin grafting for donor site closure. Arterial anatomy consists of sural artery perforator for dominant pedicle and perforators from the peroneal artery, posterior tibial artery, and vasa nervorum of the sural nerve for minor pedicle. Venae comitantes accompany all perforating vessels to the flap in the reverse flow flap. Sensory part of nerve supply includes medial sural cutaneous nerve (S1-S2), which is a branch of the tibial nerve within the popliteal fossa.

Operative Technique

The patient is placed in prone position for preincisional markings. The first mark is a horizontal line about 5 to 6 cm above the lateral

malleolus. The defect (recipient site) is outlined with a template. Using a gauze sponge, the required length of the pedicle must be determined. The template is then transferred to the calf, and the skin island is marked slightly larger than the defect. A tail-type extension of the skin island can be added to the markings for tension-free inset. The incision starts at the superior border of the skin island, down to fascia. The lesser saphenous vein should better be preserved to a length of 1 to 2 cm for possible supercharging or insertion of a small intravenous catheter at the end of the procedure; the nerve is completely transected. then surgery proceeds with incisions from superior to inferior. The skin incision above the adipofascial pedicle remains in a superficial plane into the subdermal fat. The skin flaps should not be dissected too superficially to ensure adequate perfusion, and not too deeply to preserve the adipofascial pedicle. After complete elevation to the level of the horizontal line, about 5 to 6 cm above the lateral malleolus, the skin island is rotated into the defect. The skin flaps are approximated as much as possible, and the remaining adipofascial pedicle is covered with a split-thickness skin graft.

Figures 1 and 2 shows the pre-operative and post-



Figure 1: Pre-operative (left) and post-operative (right) picture of the left foot of a 31-year-old man, which was repaired with reverse sural artery flap.



Figure 2: Pre-operative (left) and post-operative (right) picture of the foot of a 45-year-old woman.

operative appearance of two patients who underwent RSFCF.

Clinical Considerations

This specific anatomic location is prone to traumatic injuries and frequently requires a free tissue transfer due to the lack of local tissues. This makes the reconstruction likely to be more challenging and time consuming. The reverse sural flap is the most commonly used soft tissue flap for the lower third of the leg and does not require microsurgical anastomosis. The pedicle of the reverse flap should not be skeletonized. A minimum of 5 cm should be maintained between the end of the pedicle elevation and the malleoli. For the reverse flap, extra length can be gained by moving the skin design more proximally toward

the popliteal fossa. In patients who are older and have peripheral vascular disease, the flap is less predictable, and surgical delay is recommended. Venous congestion, rather than arterial ischemia, tends to be the greatest problem with this flap. Paresthesia and distribution of the sural nerve is well tolerated in these patients.

RESULTS

We report 13 patients including 4 female and 9 male patients. The details are reported in table 1. Most of the patients referred for surgery were men (69.2%). Recent trauma was the indication of flap surgery in 11 cases, and only 2 patients underwent surgery due to flap rejection (complication of previous surgery). Seven cases had right foot injury

Table 1: The details of medical charts of the studied patients

Case	Age (years)	Sex	Etiology	Defect area	Exclusion of osteomyelitis	Flap size (cm ²)	Past orthopedic surgery	Length of hospital stay (days)	comorbidities	Complications	Post-operative care
1	15	male	Direct trauma	Posterior distal tibia of right leg	+	5×3	-	36	-	+	Antibiotic therapy enoxaparin
2	39	Female	Direct trauma	Ankle of left leg	-	4×3	-	14	-	-	Antibiotic therapy
3	19	Female	Direct trauma	Posterior distal tibia of left leg	-	5×3	-	10	-	-	Antibiotic therapy
4	33	male	Multiple trauma	Posterior distal tibia of left leg	-	5×4	-	14	-	-	Antibiotic therapy
5	31	male	Trauma (Flap Rejection)	Posterior distal tibia of right leg	-	6×4	+	10	-	-	Antibiotic therapy apply of brace
6	61	male	Direct trauma (extensive crush injury)	Posterior distal tibia of right leg and right ankle	+	3×4	-	2	-	-	Antibiotic therapy apply of brace
7	57	male	Direct trauma (extensive crush injury)	Left heel	+	15×25	-	6	-	-	Antibiotic therapy
8	72	male	Trauma (Flap Rejection)	Left ankle and heel	-	5×4	-	12	IHD HTN	-	Antibiotic therapy apply of brace Vaccination
9	20	male	Multiple trauma	Posterior distal tibia of right leg	+	10×10	-	12	-	-	Antibiotic therapy vaccination
10	24	female	Direct trauma	Posterior distal tibia of left leg	-	3×2	-	2	-	-	Antibiotic therapy
11	45	female	Direct trauma	Posterior distal tibia of right leg	-	7×8	-	8	HTN	-	Antibiotic therapy enoxaparin
12	33	male	Direct trauma	Posterior distal tibia of right leg	-	15×8	-	20	-	-	Antibiotic therapy
13	45	male	Direct trauma	Posterior distal tibia of right leg	+	20×20	-	15	-	-	Antibiotic therapy

*Congestion, and also abnormal sensory and motor examination

and 6 cases had left foot injury. Osteomyelitis was observed in 5 (38.5%) cases and only one patient reported history of past orthopedic surgery. Comorbidities were seen in only 2 patients. The median interval from surgery to discharge was 12 (range from 2 to 36) days. Only 1 patient had mentioned complications after surgery including a mild congestion and abnormal sensory and motor examination. Patients were followed by the surgeons until 3 months after the operation and all of them had been able to resume their daily life activities by then.

DISCUSSION

Soft tissue defects of the distal leg and/or heel have a reputation as challenging reconstructive cases for surgeons. The overarching goal of reconstruction in these patients is to recreate a functional lower limb. Since local donor tissue is often insufficient or is located within the zone of injury, microsurgical reconstruction remains the preferred technique for management of these complicated injuries. In spite of having many advantages, free flap transfer requires a skilled surgeon and special facilities, and is also associated with higher risk of donor site morbidity, bulky contours, and recipient vessel trauma (4).

The duration of surgery via this technique is lengthy, and such a prolonged surgery under general anesthesia may not be suitable for some patients. These concerns emphasize the need for an alternative, locally based tissue reconstruction technique that can be performed in a shorter time even by less experienced surgeons, while guaranteeing the desired outcome. RSFCF technique, first described by Masquelet et al. (2), could be an alternative technique in the distal third of lower limb soft tissues reconstruction whenever the use of a microsurgical free flap transfer is not possible (3, 5-7).

The RSFCF can cover a considerable part of the limbs from the middle and distal third of the leg, the medial and posterior sides of the ankle and heel and also the dorsum of foot. It has been claimed that RSFCF has several advantages over other methods; it requires a relatively easy dissection, no sacrifice of any of the 3 major arteries destined to the distal lower extremity is required, there is no need for microsurgical skills, and is not associated

with lower donor site morbidity (3). The major downside of RSFCF is the addition of a significant donor site defect to an already traumatized area (8).

There are maneuvers to decrease donor site defect, including placement of a purse-string-type suture and grafting the donor site with a thick and non-meshed split-thickness skin graft (sheet graft). Secondary tissue expansion and wound closure devices can also be used, but the possibility of a significant and unattractive donor site defect due to the reversed sural flap needs to be discussed before surgery (9).

Another disadvantage of RSFCF is the venous congestion that may lead to partial or complete flap loss; thus, this method is not recommended in patients with obvious acute or chronic venous stasis. The flap volume is sometimes not suited for the reconstructed area, and its appearance may not be as good as the free flap technique (5).

CONCLUSIONS

According to our findings, almost all of the patients (except one) had received their flaps without any complications. All the patients had been able to resume their daily life activities three months after the surgery. This may show that RSFCF, which can be quickly performed and does not need microsurgical skills, could be a suitable option for the coverage of distal third of lower limb soft tissue defects caused mainly by trauma.

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AUTHORS' CONTRIBUTION

All the authors met the standards of authorship based on the recommendations of the International Committee of Medical Journal Editors.

CONFLICT OF INTEREST

None declared.

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