

## RECONSTRUCTION OF LEG DEFECTS USING PEDICLED PERFORATOR FLAPS

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### SUMMARY

**Objectives:** To evaluate the results of reconstruction of leg defects using pedicled perforator flaps. **Subjects and methods:** This is a retrospective and prospective study on 55 patients who were treated for leg defects with the perforator flaps at 108 Military Central Hospital from March 2011 to December 2018. **Results:** The defect sizes were in the range of 2 x 3 cm to 6 x 14 cm. Total flap necrosis occurred in 1 patient (1.8%), 1 patient (1.8%) developed partial flap necrosis > 50%, 11 patients (20%) developed partial flap necrosis < 50%, and 42 patients had flaps completely survived (76.4%); donor site was closed primarily in 19 patients (34.5%) and small skin graft was performed in 36 patients (65.5%). The flap was based on a single perforator of the anterior tibial, posterior tibial, and peroneal arteries rotated up to 180 degrees. Operating time was from 90 to 150 minutes. Rest of the flaps survived well with good aesthetic results. **Conclusion:** Surgical reconstruction of leg defects using pedicled perforator flap is safe and reliable. The technique is convenient, less time consuming, and minimal donor site morbidity. It provides anesthesiologically good results.

\* **Keywords:** Perforator flap; Propeller flap; Leg defects; Surgical reconstruction.

### INTRODUCTION

The reconstruction of leg defects remains challenging due to the limited mobility and a paucity of overlying skin, even small lesions may require microsurgical reconstruction. While random pattern flaps are limited in size and mobility [7]; local fasciocutaneous flaps have limited availability, requiring wide skin graft; free microvascular transfer leads to considerable donor site morbidity, time consuming and requires microsurgical facility.

The perforator flaps are composed of skin and subcutaneous fat nourished by perforators rising from deep vascular systems, which reach the surface by

passing mostly through muscle and intramuscular septa [3]. The advantage of pedicled perforator flaps is safety, reliability, and reduced donor site morbidity. When perforator flap is designed as propeller, allowing for wide mobilization and rotation to 180° and increase the reach of flap, thus increasing versatility.

For decades, this type of flap has been applied worldwide. However, the number of domestic researches is limited, especially for pedicled perforator flap of lower limbs. Therefore, we conducted this study: *To describe the features and application of pedicled perforator flap in surgical reconstruction of leg defects.*

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## SUBJECTS AND METHODS

### 1. Subjects

55 patients were treated for leg defects with the perforator flaps at 108 Military Central Hospital from March 2011 to December 2018.

### 2. Methods

This is a retrospective and prospective study.

#### \* Operative procedures:

- Flap design: The concept of propeller flap corresponds to 1 long blade or 2 blades of the propeller of unequal length and perforator forming the pivot point. When the flap rotated, the long blade fills the defect.

- Surgical technique: Preoperatively, perforators near the defect was marked with the help of a hand-held Doppler or CT angiography. Then the flap was drawn adjacent to the defect around the perforator.

The design of the flap is described above. An exploratory incision was given along the anterior or posterior margin of the flap. The dissection started in a subfascial plane, keeping in mind the expected site of the perforator. Once a suitable perforator was found, the dimension of the flap was confirmed or changed to the extent, as required. Flap margins were then incised, to island them on the selected perforator. Later, adequate release of all fascial strands around the perforator and dissection around the perforator in intermuscular of the intramuscular plane to gain additional length were then carried out. This will facilitate the rotation of the flap without kinking the perforator. Next, the propeller flap was rotated into the defect, repositioning the perforator once again while checking to avoid kinking. Lastly, the flap was inset and sutured into the defect. The donor area is primarily sutured or requires small skin graft (*figure 1, 2*).

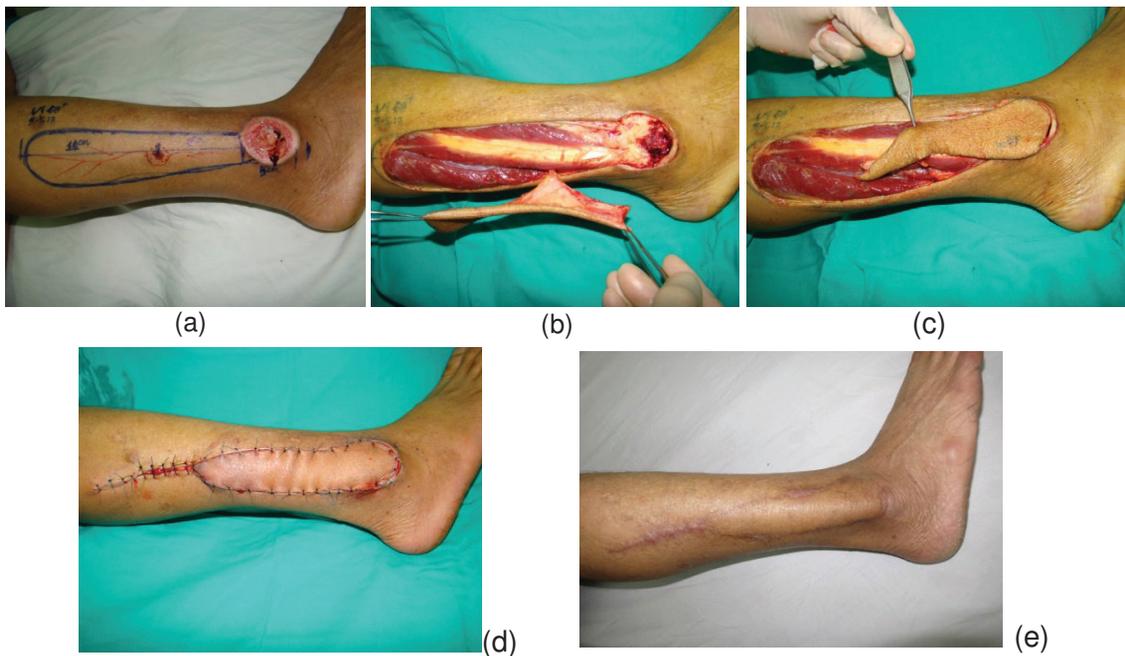


Figure 1: (a) Defect and design of the flap. (b) Flap islanded on a single perforator. (c) Flap rotated 180 degree. (d) Flap inset. (e) 12 months after surgery.

RESULTS

Table 1: Age and gender.

Gender \ Age	< 18 n (%)	18 - 50 n (%)	> 50 n (%)	Total n (%)
Male	2 (3.6)	19 (34.5)	23 (41.8)	44 (80.0)
Female	0 (0.0)	6 (11.0)	5 (9.1)	11 (20.0)
Total	2 (3.6)	25 (45.5)	28 (50.9)	55 (100.0)

Leg defects were mainly seen in male patients > 50 years old. Woman were affected less frequently with a low rate of 20.0%. The age group of 18 - 50 was present in 45.5% of all cases.

Table 2: Defect location.

		n	%
Leg	Right	28	50.9
	Left	27	49.1
Detailed location	Anterior 1/3 proximal	2	3.6
	Anterior 1/3 middle	2	3.6
	Anterior 1/3 distal	8	14.6
	Medial 1/3 middle	1	1.8
	Medial 1/3 distal	9	16.4
	Posterior 1/3 distal	23	41.9
	Lateral 1/3 distal	7	12.7
	Anteromedial 1/3 distal	2	3.6
	Lateromedial 1/3 proximal	1	1.8
Section	1/3 proximal	3	5.4
	1/3 middle	3	5.4
	1/3 distal	49	89.2

There was no great disparity of right leg defects and the left one (50.9% vs. 49.1%). However, lesions were mainly concentrated in the lower third of the lower leg (89.2%), especially posterior 1/3 distal (41.9%).

Table 3: Main artery.

Origin	n	%
Aterior tibial artery	1	1.82
Posterior tibial artery	33	60.0
Popliteal	21	38.18

The most commonly used pedicled flap is the one whose pedicle originates from posterior tibial artery with 33 cases (60.0%), followed by dedicled flap from popliteal artery with 21 cases (38.18%).

*Table 4: Flap and defect size.*

Size	Defect			Flap		
	$\bar{x} \pm SD$	Min	Max	$\bar{x} \pm SD$	Min	Max
Length (cm)	6.5 ± 2.1	3	14	13.5 ± 3.6	5	21
Width (cm)	4.5 ± 1.2	2	8	5.4 ± 1.1	3	8
Area (cm <sup>2</sup> )	30.7 ± 16.2	6	84	73.2 ± 25.9	20	130

Flap was designed with a maximal length and width of 21 cm and 80 cm, respectively.

*Table 5: Flap rotation and donor site closure.*

		n	%
Flap rotation	< 180 <sup>0</sup>	18	32.7
	180 <sup>0</sup>	37	67.3
Donor site closure	Skin grafting	36	65.5
	Direct closure	19	34.5

*Table 6: Flap survival.*

Flap survival	n	%
Favorable	42	76.4%
< 50% necrosis	11	20.0%
> 50% necrosis	1	1.8%
Total necrosis	1	1.8%

The majority of patients who underwent surgery for soft tissue defects had complete survival of the flap (76.4%). We witnessed flap necrosis < 50% in 11 patients (20%), partial necrosis > 50% in 1 patient (1.8%), total necrosis in 1 patient (1.8%).

## DISCUSSION

Reconstruction of soft tissue defects of the leg region remains frequent and challenging problems for reconstructive surgeons.

There is plenty of options to reconstruct this region such as local flap, distant flap, and free flap. Local flap includes random pattern flap, fasciocutaneous flap, reverse sural fasciocutaneous flap and muscle

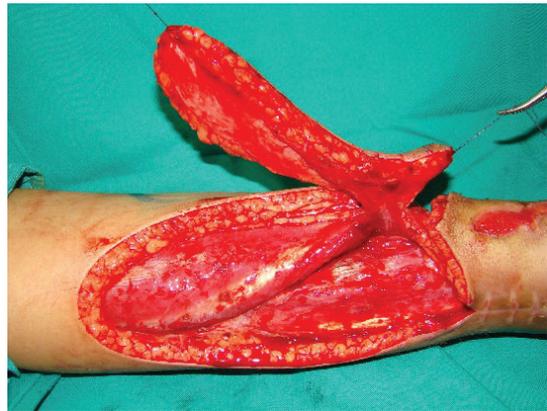
flap [7]. Distant flaps include cross-leg flap and free flap. Random pattern flaps have a high risk of failure. A free flap is not only expensive but also presents with significant donor site morbidity as well as long operating time, demanding microsurgery and expertise [1]. Fasciocutaneous flap on the same leg to reconstruct defect is less preferred due to its morbidity as a donor area always requires skin graft. Distally based superficial sural artery flap

is a good alternative to reconstruct distal leg defects. The sural nerve is not important for vascularization of the distally based superficial sural artery flap and can be spared during flap elevation [6]. Muscle flap has a limited role in addressing the ankle defects with the disadvantage of some sacrifice of function [4, 7].

The perforator flap has the advantage of gaining a tension-free reach to the defect due to its wider mobilization and rotation options. In our study, we used a flap design rotated to 180° to cover the defects. With a 180° rotation, the distant reach of the flap is possible and reliable. Flaps were based on anterior tibial, posterior tibial, and peroneal arteries which can be found by handheld Doppler or CT angiography [2, 8]. This perforator flap has various advantages over the conventional perforator flap. This flap design increases the reach of local perforator flaps, thus increasing their versatility. The donor site was minimized due to primary closure or small skin grafting of the donor site [9].



(a)



(b)



(c)



(d)

*Figure 2:* (a) Flap design. (b) Flap islanded around the perforator of posterior tibial artery. (c) Flap inset. (d) 5 years after surgery.

In this article, lesions in the size of 2 x 3 cm to 6 x 14 cm were satisfactorily treated by pedicled perforator flaps. The rate of flap survival was 98.2% including fully survived flaps in 42 patients (76.4%),

11 patients developed partial flap necrosis < 50% (20%), partial flap necrosis > 50% occurred in 1 patient (1.8%), total flap failure in 1 patient (1.8%). Donor sites were closed primarily in 19 patients (34.5%) and grafted with small skin grafting in 36 patients (65.5%). This technique brings more promising results than free flap one [1].

### **CONCLUSION**

Pedicled perforator flap based on anterior tibial, posterior tibial and peroneal perforator arteries requires a simple flap removal technique with minimal execution time, 180° rotation range of the flaps and adequately surfacing the defect. The maximal length and width of used flaps were 21 cm and 8 cm, respectively. The survival rate was 98.2% including 42 patients had fully survived flaps (76.4%), 11 patients developed partial flap necrosis < 50% (20%), partial flap necrosis > 50% occurred in 1 patient (1.8%), total flap failure in 1 patient (1.8%); Donor sites were closed primarily in 19 patients (34.5%) and grafted with small skin grafting in 36 patients (65.5%). Overall, this procedure has brought satisfactory covering outcomes as well as good aesthetics in both donor and receiving site. Using pedicled perforator flap is an effective and reliable technique to reconstruct soft tissue defects of the lower leg.

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