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Research Article

USE OF BIPEDICLE FLAPS IN LOWER LIMB RECONSTRUCTION: OUR CLINICAL EXPERIENCE

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ABSTRACT
Background: Soft-tissue defects of the lower limb with exposed implants present a reconstructive challenge, particularly following trauma. While free flaps are effective, simpler local flap options remain valuable in selected cases. The bipedicle flap offers reliable vascularity with minimal donor-site morbidity.
Objective: To evaluate the effectiveness of bipedicle fascio cutaneous flaps in the reconstruction of post-traumatic lower-limb soft-tissue defects with exposed implants.
Materials and Methods: This prospective clinical interventional study included 12 patients (8 males, 4 females) aged 24–64 years with post-traumatic lower-limb defects and implant exposure. Defect location was upper one-third in 1 case, middle one-third in 7 cases, and lower one-third in 4 cases. All defects were reconstructed using bipedicle fascio cutaneous flaps. Postoperative assessment include flap viability, wound healing, graft uptake, and complications.
Results: All bipedicle flaps survived completely, achieving stable wound coverage in all patients. Partial split-thickness skin graft loss was observed in three cases, predominantly involving defects in the lower one-third of the leg. They were managed conservatively, and no flap required revision.
Conclusion: Bipedicle fascio cutaneous flaps provide a simple, reliable and effective option for reconstruction of post-traumatic lower-limb linear soft-tissue defects with high flap survival and minimal complications.

Keywords: Bipedicle Flap, Lower Limb Reconstruction, Posttraumatic Defects, Exposed Implants, Local Flaps.

INTRODUCTION

Background

Soft tissue defects of the lower limb remain a reconstructive challenge due to limited local tissue availability, compromised vascularity, frequent exposure of vital structures such as bone, tendons and implants.[1,2]These defects commonly result from trauma, infection, tumor excision or postoperative wound complications and require timely, reliable coverage to prevent morbidity, infection and limb loss.

Various reconstructive options have been described ranging from skin grafts and local flaps to regional and free tissue transfer. While free flaps provide excellent coverage for large and complex defects, they demand microsurgical expertise, prolonged operative time, specialized infrastructure and may not be suitable for all patients, especially in resource limited settings or in those with significant comorbidities[6].

Local flaps continue to play a vital role in lower-limb reconstruction due to their simplicity, shorter operative time, and preservation of major vascular axes[2,3]. Among these, the bipedicle flap, based on dual vascular inflow, offers a reliable and versatile option for coverage of small to moderate sized defects. By maintaining vascular connections at both ends, the bipedicle flap provides enhanced perfusion, improved flap survival and allows safe advancement of tissue with minimal donor-site morbidity[1,2,3].

Objectives

The objective of the study to evaluate the role of the bipedicle flap in the reconstruction of lower-limb soft-tissue defects, focusing on indications, surgical technique, outcomes, and complications, thereby highlighting its effectiveness as a dependable reconstructive option in selected cases.

METHODS

Study Design and Patients

This is a prospective clinical interventional study conducted at a BIRRD hospital, a tertiary care centre. A total of 12 patients with soft-tissue defects of the lower limb requiring

flap coverage were included in the study. The study population consisted of 8 males and 4 females, with ages ranging from 24 to 64 yea**rs**. All patients sustained defects following trauma. Based on anatomical location, seven defects were located in the middle one-third of the leg**,** one in the upper one-third**,** and four in the lower one-third**.**

Inclusion criteria comprised defects with exposure of bone or implants where primary closure or skin grafting was not feasible and where reconstruction with a local bipedicle flap was deemed appropriate. Patients with extensive defects requiring free tissue transfer, severely compromised limb vascularity, or uncontrolled systemic illness were excluded.

All patients underwent detailed clinical evaluation, including assessment of defect size, location, surrounding tissue condition, and vascular status of the limb. Written informed consent was obtained from all patients prior to surgery.

Surgical Technique

All procedures were performed under regional anaesthesia with the patient positioned to provide optimal exposure of the defect. After thorough wound assessment, meticulous debridement was carried out to remove all nonviable tissue and to obtain a healthy wound bed.

Following debridement, the defect was accurately measured. A bipedicle fascio cutaneous flap was designed adjacent to the defect, oriented longitudinally along the limb axis to preserve subdermal plexus and perforator vascularity. The width and length of the flap was determined based on the size of the defect. If width of the defect is Y, the width of flap designed as 2 Y. If length of defect is X , length of flap is 2X. The donor area is covered with SSG in all cases.

Skin incisions were made along the marked margins of the flap, and dissection was performed in the subfascial plane, carefully preserving both proximal and distal pedicles. Excessive undermining was avoided to prevent compromise of the vascular supply. Adequate flap mobility was achieved while maintaining the integrity of both pedicles[4].

The flap was then advanced or transposed into the defect without tension and secured using absorbable sutures for deep layers and non-absorbable sutures for skin closure. The donor areas was covered with split-thickness skin grafts in all cases.

Fig 1: Soft Tissue Defect of Leg after Debridement

Fig 2: Bipedicle Flap Raised

Fig 3: Flap Advancement Done

Fig 4: Donor Area Covered With SSG

RESULTS

A total of 12 patients were included in the study, comprising 8 males and 4 females, with ages ranging from 24 to 64 years. All patients presented with post-traumatic soft-tissue defects with exposed implants. Seven defects were located in the middle one-third of the leg, one in the upper one-third, and four in the lower one-third.

All bipedicle flaps survived completely, demonstrating 100% flap viability. Stable wound coverage was achieved in all cases. Partial split-thickness skin graft loss was observed in three patients, predominantly in defects located in the lower one-third of the leg. These graft losses were managed conservatively, and none required flap revision. No major flap related complications were encountered during the follow-up period.

DISCUSSION

Reconstruction of lower-limb soft-tissue defects remains challenging because of limited tissue availability, compromised vascularity and the need for durable coverage over exposed vital structures. The present study highlights the usefulness of the bipedicle flap as a reliable local reconstructive option for selected small- to moderate-sized defects of the lower limb.

The primary advantage of the bipedicle flap lies in its dual vascular supply, which enhances flap perfusion and reduces the risk of distal necrosis when compared with random pattern advancement flaps. This feature is particularly advantageous in post-traumatic and post-infective wounds where surrounding vascularity may be compromised. In our series, flap survival was satisfactory with minimal complications, supporting the reliability of this technique[2,3].

When compared with commonly used local flaps such as the reverse sural artery flap[5], the bipedicle flap offers the advantages of technical simplicity, reduced donor-site morbidity. Although the reverse sural flap provides greater reach and is useful for distal leg and ankle defects, it is associated with complications such as venous congestion, partial flap necrosis, and sensory loss due to sural nerve sacrifice. In contrast, bipedicle flaps avoid nerve sacrifice and demonstrate more predictable vascularity.

Muscle and musculocutaneous flaps, such as the gastrocnemius and soleus flaps, are well-established options for coverage of knee and

proximal leg defects. However, these flaps may result in functional donor-site morbidity, contour deformity, and limited applicability depending on defect location[4,5]. Bipedicle flaps, being fascio cutaneous, preserve muscle function and provide thin, pliable coverage suitable for secondary procedures if required.

Perforator-based local flaps offer the advantage of islanded mobility and improved aesthetic outcomes but require precise perforator identification and advanced technical expertise. In comparison, bipedicle flaps are easier to plan and execute, have a shorter learning curve, and are particularly valuable in settings where handheld Doppler or perforator mapping may not be readily available[7].

Despite their advantages, bipedicle flaps have limitations, including restricted advancement and suitability only for small to moderate-sized defects. Therefore careful patient selection and defect assessment are essential. Free tissue transfer remains the preferred option for extensive, complex, or distal defects where local flap options are inadequate.

CONCLUSION

The bipedicle flap remains a simple, reliable reconstructive option for linear small to moderate lower-limb soft tissue defects. When compared with other local flap options, it offers a favourable balance between reliability, functional preservation, and surgical simplicity making it a valuable component of the lower limb reconstruction.

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