

Limberg Rhomboid Flap for Reconstruction of a Chronic Prepatellar Wound: A Case Report

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ABSTRACT

Introduction: Chronic wounds of the prepatellar region pose a reconstructive challenge because of limited soft-tissue laxity, constant exposure to tensile forces, and scant coverage over bony prominences. Although multiple reconstructive options are available, local flaps remain an effective option for small- and medium-sized defects, providing stable coverage with tissue of similar characteristics. **Case presentation:** We present the case of a 54-year-old woman with type 2 diabetes mellitus who developed a chronic wound over the right prepatellar region following direct trauma five years earlier and a failed attempt at primary closure at another institution. Complete excision of the lesion was performed under local anesthesia, revealing a blood collection with an organized appearance in the surgical bed, which was evacuated during the procedure. Reconstruction was performed using a Limberg rhomboid flap. The postoperative course was satisfactory, with adequate flap integration, complete healing, and no complications or recurrence during the first eight weeks of follow-up. **Conclusions:** The Limberg rhomboid flap is a simple, reproducible, and reliable option for the reconstruction of small prepatellar defects, enabling tension-free closure and adequate coverage with local tissue. Appropriate patient selection and flap planning are key determinants of favorable outcomes.

KEYWORDS: Limberg flap; rhomboid flap; reconstruction; knee; chronic wounds; plastic surgery.

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INTRODUCTION

Reconstruction of soft-tissue defects of the anterior knee remains challenging for the reconstructive surgeon because of the anatomical and biomechanical characteristics of this region. Prepatellar skin has limited laxity, is continuously subjected to flexion-extension movements, and directly overlies bony prominences; these factors increase the risk of dehiscence, necrosis, and exposure of deep structures when closure is performed under tension or after repeated procedures. Prepatellar lesions may result from trauma, chronic bursitis, infection, excision of skin tumors, or complications following surgical procedures. Regardless of etiology, the reconstructive

goal is to restore stable coverage capable of withstanding mechanical loads while minimizing donor-site morbidity. The reconstructive strategy depends primarily on defect size, the quality of the surrounding tissues, the presence of infection, exposure of critical structures, and the patient's overall condition.

Within the reconstructive ladder¹¹, primary closure may be sufficient for small defects provided that it can be achieved without tension. However, when fibrosis, tissue loss, or limited mobility of the surrounding skin is present, local flaps offer better functional and aesthetic outcomes by providing tissue with similar characteristics, preserving sensation, and avoiding

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the morbidity associated with grafts or more complex regional flaps⁹.

The rhomboid flap described by Alexander Limberg in 1946 is one of the most commonly used transposition flaps for closure of small- and medium-sized cutaneous defects^{4,5}. Its geometric design facilitates uniform redistribution of tension, permits reproducible planning, and provides reliable results in multiple anatomical regions^{6,8}. Although its use is widely documented in dermatologic surgery and head and neck reconstruction, published evidence regarding its application to prepatellar defects is comparatively scarce^{3,7}.

We present the case of a patient with a chronic wound of the right prepatellar region secondary to trauma and failed primary closure, treated with complete excision and immediate reconstruction using a Limberg rhomboid flap. The utility of this technique as a local reconstructive option for small prepatellar defects is discussed.

CASE PRESENTATION

A 54-year-old woman had a history of type 2 diabetes mellitus diagnosed three months before evaluation and was receiving metformin 850 mg every 24 hours. Her surgical history included two cesarean sections, and she had a known allergy to dexamethasone. Five years before presentation, she sustained direct trauma to the anterior aspect of the right knee after a fall from standing height. She subsequently developed intermittent swelling in the prepatellar region without significant functional limitation. Six months before evaluation, the condition progressed with increasing swelling, pain, erythema, local warmth, and spontaneous drainage of purulent material. She was initially treated at another institution with local wound care and primary wound closure. During follow-up, the closure dehisced and the lesion persisted, progressing to a chronic wound, for which she presented to the plastic surgery service. Physical examination revealed an approximately 1 × 1 cm ulcerated lesion over the right prepatellar region, with a central necrotic eschar, slightly elevated fibrotic borders, and no active drainage at the time of evaluation (Figure 1). There were no clinical signs of acute infection, bone exposure, or impairment of knee joint mobility. Because of the chronicity of the lesion, the previous failed primary closure, and the local characteristics of the surrounding tissue, complete excision of the lesion followed by immediate reconstruction with a Limberg

rhomboid flap was planned



FIGURE 1.

SURGICAL TECHNIQUE

After written informed consent was obtained, the procedure was performed in a procedure room under local anesthesia. Preoperative markings of the lesion and the rhomboid flap design were made using a sterile ruler to define the dimensions of the defect and the orientation of the flap (Figure 2).



FIGURE 2.

The operative field was prepared with an antiseptic solution and draped in sterile fashion. Local anesthesia with lidocaine and epinephrine was infiltrated into both the recipient site and along the planned flap. The lesion was completely excised together with the scar tissue and fibrotic borders, creating a full-thickness rhomboid defect suitable for reconstruction

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(Figure 3). The specimen is shown in Figure 4.



FIGURE 3.



FIGURE 4

During dissection, a blood collection with an organized appearance was identified in the surgical bed and carefully evacuated. Copious irrigation with sterile saline was then performed, the operative field was dried, and adequate hemostasis was confirmed.

The rhomboid flap was elevated in the subcutaneous plane while preserving the subdermal vascular plexus and was then transposed into the defect according to the classic design described by Limberg. It was confirmed that coverage could be achieved without excessive tension and with adequate flap perfusion. Layered closure was performed using 3-0 polyglactin 910 (Vicryl®) for the subcutaneous tissue and 3-0 monofilament nylon simple interrupted sutures for the skin (Figure 5). At the end of the procedure, adequate color, capillary refill, and flap viability were confirmed, without evidence of vascular compromise.



FIGURE 5

POSTOPERATIVE COURSE

The postoperative course was satisfactory from the immediate postoperative period, with no complications related to flap perfusion, infection, or wound dehiscence.

At the 2-week follow-up, the wound edges were adequately approximated, with no evidence of necrosis or infection. Because of the anatomical location and the tension generated by knee flexion, the sutures were retained for an additional week.

At three weeks, approximately 80% epithelialization was observed, with adequate flap integration and sufficient wound strength to permit complete suture removal.

At the 8-week follow-up, the patient had satisfactory healing, adequate flap integration, and a favorable functional outcome, with no evidence of lesion recurrence, dehiscence, infection, or impairment of knee mobility.



FIGURE 6

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DISCUSSION

Reconstruction of soft-tissue defects in the prepatellar region is challenging because of the anatomical and biomechanical characteristics of the knee. Limited skin laxity, constant movement during flexion and extension, and pressure over the anterior aspect of the joint predispose to wound dehiscence and increase the risk of complications when closure is performed under tension. Therefore, the reconstructive technique should be individualized according to defect size, the quality of the surrounding tissues, and exposure of deep structures.

For small cutaneous defects, primary closure is the simplest option provided that it can be achieved without excessive tension. However, in the presence of fibrosis, chronic inflammation, or loss of skin elasticity, this strategy may fail by compromising perfusion of the wound edges and promoting dehiscence⁹. In the present patient, the previous failed primary closure resulted in a scarred environment that was unfavorable for a second attempt at direct approximation; therefore, a local flap was considered more appropriate.

Skin grafts represent another reconstructive option for superficial defects; however, they require a well-vascularized bed and provide less resistance to the shear forces characteristic of the prepatellar region. They are also more susceptible to repeated trauma and generally yield an inferior aesthetic result because of differences in color, thickness, and texture compared with the adjacent skin³. For these reasons, when local tissue is available, transposition flaps generally provide more stable and durable coverage¹⁰.

Among local flaps, the rhomboid flap described by Alexander Limberg remains one of the most versatile reconstructive techniques for small- and medium-sized cutaneous defects. Its geometric design redistributes tension toward the adjacent skin, minimizes distortion of the defect, and permits closure with tissue similar in characteristics to the reconstructed area^{4,12}. In addition, the technique is technically straightforward and reproducible and can be performed under local anesthesia in carefully selected patients, thereby avoiding more complex reconstructive procedures.

For larger defects or when the patellar tendon, patella, or osteosynthesis hardware is exposed, the reconstructive ladder¹¹ requires consideration of more complex alternatives, such as fasciocutaneous, perforator, or muscle flaps, particularly the medial gastrocnemius flap, which is recognized as one of the most commonly used options for coverage of extensive proximal knee defects³. However, these techniques entail longer operative time, greater donor-site morbidity, and, in some cases, regional or general anesthesia; therefore, they are not necessary for every patient.

In the present case, the defect resulting from excision was amenable to reconstruction with a local flap, allowing tension-free closure with adequate integration during follow-up. A

blood collection with an organized appearance was identified during the procedure. Because neither the excised tissue nor the evacuated blood material was submitted for histopathologic examination, the definitive nature of this finding could not be established, nor could the underlying pathophysiologic mechanism be confirmed.

The available evidence regarding the specific use of the Limberg flap for prepatellar defects is limited and consists primarily of case reports and small clinical series⁷. Nevertheless, published results show high flap survival rates, a low incidence of complications, and satisfactory functional outcomes when patients are appropriately selected^{5,6}. The present case is consistent with these findings and supports the use of this technique as a reliable option for localized defects of the anterior knee.

LIMITATIONS

The main limitation of this report is the absence of histopathologic examination of the surgical specimen and the blood material identified during the procedure, which precluded a definitive pathologic diagnosis. In addition, this report reflects the experience of a single patient with an 8-week follow-up period; therefore, the results cannot be extrapolated to larger defects or to patients with exposure of deep structures.

CONCLUSIONS

The Limberg rhomboid flap is a simple, reproducible, low-morbidity reconstructive option for the treatment of small prepatellar defects in appropriately selected patients. In the present case, it provided stable coverage, tension-free closure, and a favorable clinical course without complications or recurrence during the follow-up period. Its versatility, ease of performance, and feasibility under local anesthesia make it a valid reconstructive option in carefully selected patients with small prepatellar defects.

INFORMED CONSENT

The patient provided written informed consent for the surgical procedure and for publication of the case report and images for academic purposes, with her anonymity preserved at all times.

ETHICAL CONSIDERATIONS

This report was prepared in accordance with the ethical principles of the Declaration of Helsinki and institutional standards for case report preparation^{1,2}. Because this was a report of a single clinical case, approval by a research ethics committee was not required under current institutional regulations.

CONFLICT OF INTEREST

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The authors declare no conflict of interest related to the preparation of this manuscript.

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FIGURES

- Figure 1. Preoperative clinical appearance. Frontal view of the ulcerated lesion over the right prepatellar region, with a central necrotic eschar, fibrotic borders, and measurement using a sterile ruler.
- Figure 2. Surgical planning. Preoperative marking of the Limberg rhomboid flap before local anesthetic infiltration.
- Figure 3. Lesion excision. Rhomboid defect obtained after complete excision of the lesion and the excised scar tissue.
- Figure 4. Excised surgical specimen. Specimen corresponding to the excised scar tissue and fibrotic borders, measured using a sterile ruler.
- Figure 5. Reconstruction using a Limberg rhomboid flap. Immediate result after layered skin closure, with adequate approximation of the wound edges.
- Figure 6. Postoperative course at eight weeks, showing complete healing and adequate flap integration.

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