

Limberg Flap Customised for Sacral Pressure Sore: A Case Study at a Rural Periphery

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Abstract

Background: Pressure sores are defined as soft tissue injuries resulting from unrelieved pressure over a bony prominence such as sacrum, trochanter, heel and occiput etc. There are a variety of reconstruction techniques for sacral pressure sore defects, including Rhomboid flap by Limberg which is a geometric local transposition flap. This paper outlines the rationale for using this flap as well as demonstrates its versatility.

Method: We present our case report using Limberg flap technique for treating a sacral pressure sore. After obtaining history, thorough clinical examination and necessary investigations, a single patient underwent surgical excision and single flap coverage of the defect. After flap coverage, the defect was closed over a suction drain.

Result: Full primary healing occurred in the patient without any complications after a hospital stay of one week.

Conclusion: Limberg flap is a rapid, accurate and reliable alternative surgical technique utilising local tissue in treating sacral pressure pressure ulcer and can be easily done by a general surgeon.

Keywords: Limberg flap; rhomboid flap; sacral pressure sores.

Introduction

Pressure sores occur due to ischemic tissue loss as a result of prolonged pressure against a bony

prominence. Terms such as bedsores / decubitus ulcers should be avoided as they suggest that all the pressure sores are a result of supine positioning. Although tissue destruction can occur over areas like sacrum, scalp, shoulder, calves and heels when a patient is lying down, the ischial sores occur in wheel chair bound patients who are sitting, making "pressure sores" the better term.¹

The sacral region is given special importance by virtue of its role in supine position when patient is bedridden and in sitting position after the patient is mobilised to a wheelchair. The treatment plan should be long term as recurrence is the norm with pressure sores. Over the years, innumerable methods have been applied to tackle them, but no consensus has been reached regarding their definitive management.² The choice between conservative treatment and surgery for a pressure ulcer depends on a thorough evaluation of ulcer as well as patient's physical and mental status. In general, superficial ulcers (stages 1 and 2) are likely to benefit from conservative treatment³ and deep ones (stages 3 and 4) often require surgical intervention because they take many months to heal conservatively and the resulting scar tissue is stiff, scant and lacks mechanical performance. Also, long-standing pressure ulcers can result in development of amyloidosis and Marjolin ulcer.⁴ Moreover, underlying osteomyelitic bone also signals the need for surgery.⁵

After adequate debridement, which is a quintessential and the first step in creating a suitable recipient for tissue transfer,⁶ an appropriate operative approach must be selected. The analysis begins by exploring the various types of surgical reconstruction methods available for sacral pressure

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ulcers, which include- primary closure, random skin flaps, Pedicle island flaps, free flaps, gluteus myoplasty, selected advancement flaps, gluteal artery perforator flaps, multi island propeller flaps, Limberg (rhomboid) flaps. The most frequently described techniques are the musculocutaneous and advancement flaps, which are often based on the gluteus maximus. These flaps are often advanced using V-Y technique. The advantages of muscle flaps are: 1) Volume - fills up the residual dead space seen post debridement of devitalised tissue from sore. 2) vascularity - helps combat infection and promotes healing. 3) skin coverage - acts as a cushion and prevents recurrence.⁷ A time tested alternative to muscle flaps is the use of one or more Limberg flaps. It provides the additional advantage of primary closure of the donor defect. Professor Alexander Alexandrovich Limberg (1894-1974) devoted his entire career to flap design and outlined his rhomboid flap in his book " The planning of local Plastic operations on body surface: theory and practice "(1963). He referred to it as a method of closing large defects with adjacent triangular flaps. The rhomboid flap is basically a parallelogram with opposing angles of 120° and 60° which can be modified depending on the shape of the defect. Thus, four individual flap choices are theoretically possible for any defect. However, the most suitable one is determined by skin laxity in donor area and surgeon's preference. A single Limberg flap is used frequently on face to close small to medium defects, whereas multiple flap technique can be used for closure of moderate to large defects of extremities, trunk and back(8). This versatile skin flap combines the principles of rotation and advancement. In this case report, we have outlined the rationale for using this flap for a long standing sacral pressure ulcer along with its versatility.

Material and Method

A 78 year old male patient (non paraplegic, decreased ambulation due bilateral knee osteoarthritis- restricted to bed and wheelchair most of the times) had a 5cm*10cm deep long standing (2 years) sacral pressure ulcer (stage-3, National pressure ulcer advisory panel's updated pressure ulcer staging system⁹ that had failed to heal with conservative and excision and repair methods of treatment. Because the ulcer had greatly reduced patient's quality of life and it had failed to recover with other methods, he was planned to undergo Limberg flap repair after taking an informed consent

with full explanation of the procedure, after care, intended benefits and risks of complications as well as a discussion of the alternative management.

Investigations

After thorough history taking and clinical examination, the patient underwent thorough routine and necessary investigations such as Complete blood count, ABO Rh blood grouping, BT, CT, viral markers for HIV, HCV and HBV, Renal function tests, liver function tests, Random blood sugar, urine routine examination, ECG, Echocardiogram, pus culture from wound and wound biopsy. The wound was found to be clean at the time of surgery. Informed consent was taken from the patient for the case study.

Method

Surgery was performed under spinal anaesthesia on August 29th, 2020. Patient was placed in a prone position with buttocks strapped for wide exposure. After adequate shaving and skin preparation, the area to be excised and flap lines were marked on the skin. A single Limberg flap was performed by raising from the lower back. A suction drain was placed in the wound cavity through a separate stab incision. The subcutaneous tissues were approximated, using 2-0 polygalactin interrupted sutures and the skin using 2-0 monofilament polyamide black interrupted mattress sutures. Three doses of antibiotics were given. One unit of packed RBCs was given to correct anaemia, vitamin C and zinc sulphate were added for speedy recovery. Patient was nursed in prone and lateral position with an air mattress and other supportive care. The drain was removed on 5th postoperative day and sutures on 10th postoperative day. Follow up of patient was done on an out patient basis, weekly for first one month, then monthly for next two months.

Design of the flap

The Limberg flap requires a rhomboid defect with all sides equal and set in position at 60° (against the longer axis) and 120° (against the shorter axis).

The Limberg flap (CDEF) consists of the defect margin, the side (DE) presenting extension of short width of the defect, the side (DE) which is parallel to the defect side (DC). (Fig. 1).¹⁰

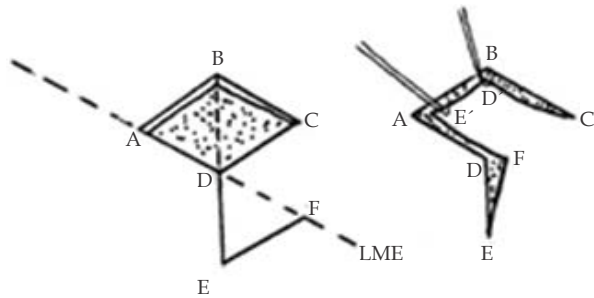


Fig. 1: Design of the Limberg flap. The Limberg flap (CDEF) consists of the defect margin, the side (DE) presenting extension of the short width of the defect, the side (EF) turned at an angle of 60 degrees related to the side (DE), which is parallel to the defect side (DC).¹⁰

There are single, double and triple Limberg flaps for rhomboid defects. Single flaps have four potential combinations, double flaps have five combinations, and triple flaps for circular or hexagonal defects have two different combinations.

The crucial point in designing a Limberg flap is the correct placement of the direction of the base of the triangle, in relation to the line (axis) of maximum extensibility. The latter is placed at a right angle to the relaxed skin tension line (Fig. 2).

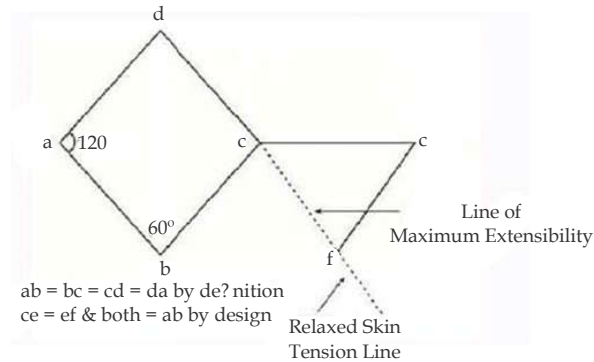


Fig. 2: The line (axis) of maximum extensibility is placed at a right angle to the relaxed skin tension line.¹¹

An additional consideration is the position of the donor defect - it should lie, if possible, in the long axis of the line of minimal tension. For convenience, 'X' is used for the maximum dimension of the defect, the height denoted by 'h' and the width by 'w' (Fig. 3).

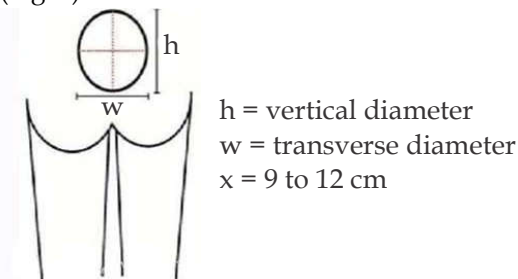


Fig. 3: For convenience, 'X' is used for the maximum dimension of the defect, the height denoted by 'h' and the width by 'w'.⁷

Anatomy and physiology

The rhombic flap is a random-pattern local flap that relies on blood supply through the subdermal plexus.¹² Anatomically this plexus is located at the junction between the reticular dermis and the subcutaneous layer. From this plexus, arterioles pass superiorly to supply the dermis and epidermis via the dermal and subepidermal plexuses. The rich anastomotic blood supply of the subdermal plexus provides the basis of circulation to random pattern flaps, without a requirement for the axially of blood supply to be considered. When raising the flap within the subcutaneous plane, the inclusion of a cuff of subcutaneous fat as an absolute minimum helps preserve the subdermal plexus. Whilst maintaining rhombic flap proportions on the horizontal plane, the use of minimal undermining of the pedicle also ensures adequate blood supply and reduces the risk of partial or complete flap necrosis.¹³

To successfully transpose and advance the flap from an area of relative skin laxity, careful orientation is advised. This involves awareness of the lines of maximal extensibility (LMEs) and the relaxed skin tension lines (RSTLs) or Langer lines. The rhombic flap should be orientated so that the short diagonal axis of the flap is perpendicular to the RSTLs.^{14,15}

Result

In the present case study, a single Limberg flap was used for repair of a 5cm *10cm long-standing sacral pressure sore. It had a fully successful outcome without any complications of wound dehiscence, infection, flap necrosis, Hematoma formation. There was no recurrence of the pressure sore in 2 month follow up and his quality of life has been greatly improved.



Fig. 4: long standing sacral pressure sore and pre operative marking for area to be excised and flap lines.



Fig. 5: Postoperative view of Limberg flap.

Discussion

In our study, the Limberg flap (single) was used to close a large (5cm *10cm) pressure ulcer. This flap is an interesting procedure for skin movement, in which a rhomboid defect is created and then closed primarily, with a similar shaped flap of the same size.¹⁶ In designing this flap, the surgeon draws a line from the outer point at a 120° angle; bisecting the angle, with its length being equal to that side of the rhomboid. From the outer point of this line, another line is drawn at 60°, parallel to the side of the defect. Its length again equals that of the side of the rhomboid. Before any incisions are made, a further check of skin availability and laxity is made with the thumb and forefinger.¹⁷ This checking procedure ensures that the donor defect closes primarily. If it doesn't, then the original rhomboid maybe changed in position or another donor flap maybe used.^{18,19} Despite a wide variety of flap options, sacral and ischial ulcers remain the most difficult pressure ulcers to treat. Another successful surgical procedure for coverage of sacro-ischial ulcers is using adipofascial turnover flaps combined with a local fasciocutaneous flap. After debridement, the adipofascial flaps are harvested both cephalad and caudal to the defect. The flaps are then turned over to cover the exposed bone in a manner so as to overlap the two flaps. A local fasciocutaneous flap (Limberg flap) is applied to the raw surface of the turnover flaps. Triple coverage with the combination of double adipofascial turnover flaps and a local fasciocutaneous flap allows for an easily performed and minimally invasive procedure, preservation of future flap options, and a soft-tissue supply sufficient for covering the prominence and bony prominence and filling dead space. This technique provides successful soft-tissue reconstruction for minor to moderate-size sacro-ischial pressure ulcers.²⁰

Conclusion

The Limberg flap is versatile in that a random flap can be raised from any one or all corners of the rhomboid. The defect is filled with tissue of same thickness and colour and with good vascularity. It is a robust flap that is easy to master and can be tailored to suit not only sacral defects but also skin cancer defects of head and neck region, spina bifida, burn contractures, chronic pilonidal sinuses. There is no tissue loss or dog ear formation while rotating the flap, since it is a geometrical flap. Any area from where creating a new flap is possible is not jeopardised, so there is always a backup plan in case of recurrence in the form of an opposite diagonal flap. Better nursing care is possible because all sutures meet with minimal lateral extension. It also provides a good padded skin cover, with sutures lining away from midline, which is the area for ulceration. The use of muscle flaps in partially paralysed patients or in patients recovering from neurological injury may lead to functional loss. The Limberg (rhomboid) flap is a very reliable surgical method in which the donor site and the associated tension in tissue lie outside the weight-carrying areas; the donor site lies in the perineal area, which is never used for other flaps.²¹ So at the end, we conclude that this flap is simple to execute by a general surgeon and results are satisfactory. However, further studies by different surgeons are desirable to further explore the efficacy of this approach in pressure ulcers.

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