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Limberg Flap Customised for Sacral Pressure Sore

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Abstract

Background: Sacral pressure sores have been treated with a variety of flaps, including the rhomboid flap by Limberg. This paper outlines the rationale for using this flap, while laying down the guidelines for the number required and the methods, depending upon the size, orientation and excursion of the defect.

Methods: We present our experience using the Limberg flap technique for treating sacral pressure sores. Thirty two patients were treated surgically with excision, sacral bone ostectomy and flap coverage, either single or multiple, depending upon the size, orientation and excursion of the defect. After flap coverage, all defects were closed over a suction drain.

Results: Full primary healing occurred in twenty eight of the thirty two patients. Minor complications were noted in three patients and one patient required split thickness skin grafting, due to improper flap planning. The average hospital stay was 2 weeks.

Conclusion: The Limberg flap is a rapid, accurate and reliable alternative surgical technique utilizing local tissue in treating sacral pressure sore.

Keywords: Sacral pressure sore; Limberg flap; Rhomboid flap; Customized flaps

Introduction

Pressure sores occur due to ischemic tissue loss as a result of prolonged pressure against a bony prominence. The sacral region is given special importance by virtue of its role in the supine position, when the patient is bedridden, and in sitting position after the patient is mobilized to a wheelchair. Thus the treatment plan should be long term as recurrence is the norm with pressure sores. Over the years several methods have been used to tackle this problem. However, no consensus has been reached, regarding their definitive management [1]. Smaller pressure ulcers may be closed primarily [2]. Larger pressure ulcers may be closed, by Inferiorly based skin flaps, Gluteal perforator-based flaps [3], Gluteus Maximus Musculocutaneous V-Y Advancement flaps [4,5], Transverse lumbar flaps [6], Superior gluteus myoplasty and Turnover gluteus myoplasty. The advantages of these muscle flaps are: (1) Volume, which fills up the residual dead space seen post debridement of devitalized tissue from the sore [2]. Vascularity, which helps combat infection and promotes healing and [3] Skin coverage which acts as a cushion and prevents recurrence. A time tested alternative is the use one or more Limberg flaps. It provides the advantage of primary closure of the donor defect [7]. Professor Alexander Alexandrovich Limberg (1894-1974), from Leningrad, devoted his entire career to flap design. In his book "The Planning of Local Plastic Operations on the Body Surface: Theory and Practice", published in 1963, he described this flap. 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°. Thus four individual flap choices are theoretically possible for any defect. However, the most suitable one is determined by skin laxity in the donor area and the surgeon's preference. A single Limberg flap is used frequently on the face while for closure of small to medium defects; multiple Limberg flap techniques can help the surgeon cover moderate to large defects of the extremities, trunk and back [8]. This versatile skin flap combines the principles of rotation and advancement. Here we have outlined the rationale for the use of various designs and numbers of Limberg flaps, based on the experience, we have acquired, at our centre.

Patients and Methods

We performed the Limberg flap surgery on 32 patients admitted to our institution (Table 1). Inclusion criteria for this study was a stage III or stage IV pressure ulcer (National Pressure Ulcer Advisory Panel) [9] and the size of the sacral pressure defects was ranging from 5 x 6 cms to 12 x 14

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Table 1: Tabular presentation of Case Summaries.

Case No.	Age (years)	Gender	Pressure ulcer stage	Neurological status	Method of closure.
1	32	Male	III	Paraplegic	Single Limberg flap
2	62	Male	IV	Non-paraplegic	Double Limberg flap for excursion of the defect
3	25	Male	IV	Paraplegic	Double Limberg flap in kissing fashion with STG* for donor area
4	28	Male	III	Paraplegic	Double Limberg flaps in overlapping fashion
5	70	Male	III	Non-paraplegic	Double Limberg flaps in overlapping fashion
6	55	Female	III	Paraplegic	Double Limberg flaps in overlapping fashion
7	45	Female	IV	Paraplegic	Double Limberg flaps in kissing fashion
8	55	Male	III	Non-paraplegic	Single Limberg flap.
9	35	Male	IV	Non-paraplegic	Double Limberg flaps for excursion of the defect.
10	65	Male	III	Non-paraplegic	Double Limberg flaps for excursion of the defect.
11	83	Female	IV	Non-paraplegic	Triple Limberg flaps
12	45	Female	III	Paraplegic	Double Limberg flaps for excursion of the defect.
13	32	Female	III	Non-paraplegic	Single Limberg flap.
14	40	Male	IV	Paraplegic	Double Limberg flaps in kissing fashion
15	65	Male	III	Non-paraplegic	Double Limberg flaps in kissing fashion
16	35	Male	IV	Paraplegic	Single Limberg flap
17	36	Female	III	Non-paraplegic	Double Limberg flaps in overlapping fashion
18	35	Female	III	Paraplegic	Double Limberg flaps in overlapping fashion
19	35	Male	IV	Non-paraplegic	Single Limberg flap
20	33	Male	III	Non-paraplegic	Single Limberg flap
21	22	Male	IV	Paraplegic	Double Limberg flaps in kissing fashion
22	46	Female	III	Non-paraplegic	Single Limberg flap
23	22	Male	III	Paraplegic	Single Limberg flap
24	65	Female	IV	Paraplegic	Double Limberg flaps in kissing fashion
25	40	Male	IV	Non-paraplegic	Single Limberg flap
26	18	Male	III	Paraplegic	Double Limberg flaps in kissing fashion
27	23	Male	IV	Paraplegic	Single Limberg flap
28	63	Male	IV	Paraplegic	Double Limberg flaps in kissing fashion
29	48	Female	III	Non-paraplegic	Double Limberg flaps in overlapping fashion
30	65	Female	III	Paraplegic	Single Limberg flap
31	26	Male	IV	Paraplegic	Double Limberg flaps in overlapping fashion
32	55	Female	IV	Non-paraplegic	Double Limberg flaps in kissing fashion

*STG- Split Thickness Grafting.

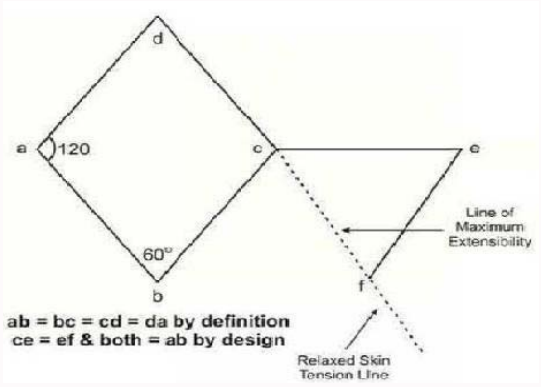

Figure1: The latter is placed at a right angle to the relaxed skin tension line.

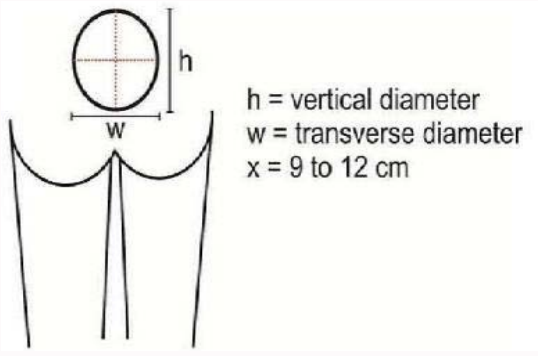

Figure 2: For convenience, 'X' is used for the maximum dimension of the defect ,the height denoted by 'h' and the width by 'w'.

cms, the average size being 10 x 12 cms. Surgery was performed under General Anesthesia. The patients were placed in a prone position with the buttocks strapped for wide exposure. After adequate shaving and skin preparation, the area to be excised and flap lines were marked

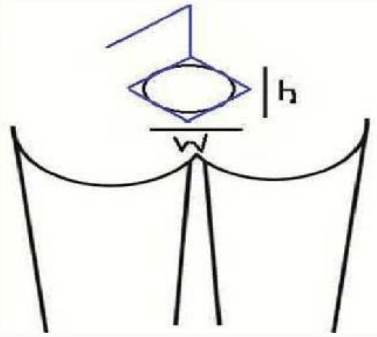

Figure 3: If 'X' is between 9 to 12 cms, then a single Limberg flap raised from the lower back achieves closure of the sacral defect.

Figure 4: If 'X' is between 9 to 12 cms, then a single Limberg flap raised from the lower back achieves closure of the sacral defect.

Figure 5: If 'X' is between 9 to 12 cms, then a single Limberg flap raised from the lower back achieves closure of the sacral defect.

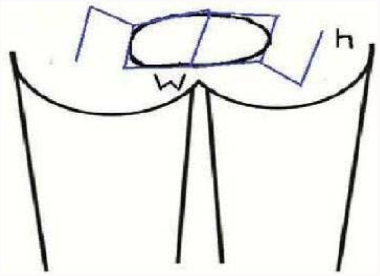

Figure 6: If 'X' is more than 9 to 12 cms in the horizontal dimension, then two Limberg flaps are required - one raised from the lower back and the other raised from the opposite gluteal region and the suture line meets in a kissing fashion.

Figure 7: If 'X' is more than 9 to 12 cms in the horizontal dimension, then two Limberg flaps are required - one raised from the lower back and the other raised from the opposite gluteal region and the suture line meets in a kissing fashion.

Figure 8: If 'X' is more than 9 to 12 cms in the horizontal dimension, then two Limberg flaps are required - one raised from the lower back and the other raised from the opposite gluteal region and the suture line meets in a kissing fashion.

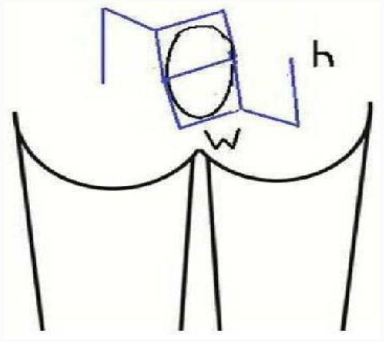

Figure 9: If 'X' is more than 9 to 12 cms in a vertical dimension, then also two flaps are required. The suture line will lie in a horizontal direction in an overlapping fashion.

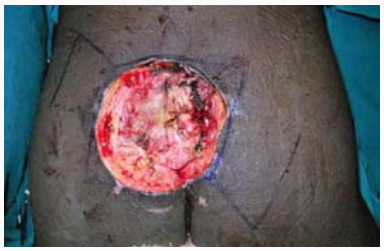

Figure 10: If 'X' is more than 9 to 12 cms in a vertical dimension, then also two flaps are required. The suture line will lie in a horizontal direction in an overlapping fashion.

on the skin. A single Limberg flap was performed, by raising the flap from the lower back. Double Limberg flaps were performed by raising two diagonally opposite flaps - one from the lower back and the other from the contra lateral Gluteal region; similarly, three flaps were raised in one case, wherein two flaps were raised from the bilateral Gluteal region and the third from the back, to cover the larger sacral defect. A suction drain was placed in the wound cavity through a separate stab incision. The subcutaneous tissues were approximated, using 2-0 polyglactin interrupted sutures and the skin using 2-0 monofilament polyamide black interrupted mattress sutures. Antibiotics were given for 7 days, initially in the intravenous form and then orally.

Figure 11: If 'X' is more than 9 to 12 cms in a vertical dimension, then also two flaps are required. The suture line will lie in a horizontal direction in an overlapping fashion.

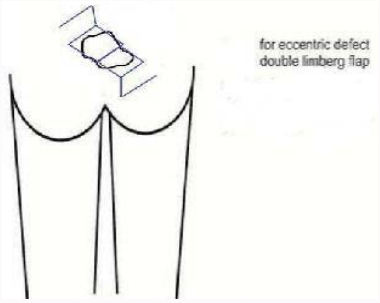

Figure 12: If 'X' is more than 9 to 12cms, in both the directions, then three flaps are designed - one each from the lower back and bilateral gluteal region, to cover the defect.

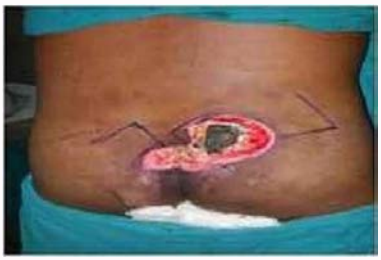

Figure 13: If 'X' is more than 9 to 12cms, in both the directions, then three flaps are designed - one each from the lower back and bilateral gluteal region, to cover the defect.

Patients were nursed in a prone or lateral position with an air-bed and other supportive care. The drain was removed between the 7th and 10th post-operative day and sutures by the 2nd week. Follow-ups of patients were done on out-patient basis, monthly, for the first six months.

Design of the flap

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 [10] (Figure 1). 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' (Figure 2). Scenario 1: If 'X' is between 9 to 12 cms, then a single Limberg flap raised from the lower back achieves closure of the sacral defect (Figure 3-5). Scenario 2: If 'X' is more than 9 to 12 cms in the horizontal dimension, then two Limberg flaps are required - one raised from the lower back and the other raised from the opposite Gluteal region and the suture line

Figure 14: If 'X' is more than 9 to 12cms, in both the directions, then three flaps are designed - one each from the lower back and bilateral gluteal region, to cover the defect.

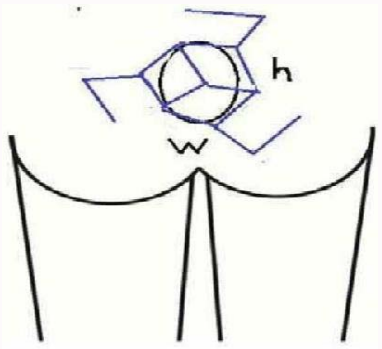

Figure 15: If 'X' is less than 9 to 12cms, but there is an excursion of the defect, making it impossible to close the defect with a single flap, that excursion is treated as a separate defect and two flaps are designed to close the defect.

meets in a kissing fashion (Figure 6-8). Scenario3: If 'X' is more than 9 to 12 cms in a vertical dimension, then also two flaps are required. The suture line will lie in a horizontal direction in an overlapping fashion (Figures 9-11). Using two flaps enables the surgeon to use redundant skin at two different locations around the defect while the principles of rhombic flap geometry and design remain the same [11]. The defect is split, by visualizing it as two adjacent equally sized rhombuses. By designing the flaps in a superior manner and symmetrically positioning them on either side, the resulting wound closure tension vectors are identical [12]. Scenario 4: If 'X' is more than 9 to 12cms, in both the directions, then three flaps are designed - one each from the lower back and bilateral Gluteal region, to cover the defect (Figures 12-14). Scenario 5: If 'X' is less than 9 to 12cms, but there is an excursion of the defect, making it impossible to close the defect with a single flap, that excursion is treated as a separate defect and two flaps are designed to close the defect (Figures 15-17). Based on this, it is proposed that the rhomboid Limberg flap - single or multiple - can be applied widely, with extreme safety and good cosmetic results [13]. The planning process can be summarized by the flow chart in (Figure 18).

Results

In the present study, Limberg flaps (single or multiple) were used in 32 patients. In 11 patients (34%), a single Limberg flap was used. In 20 patients (62.5%), double Limberg flaps (either in the kissing or overlapping fashion) were used and in one patient triple Limberg flaps were used. Wound dehiscence and infection were noticed in three cases (Table 2), which were managed by secondary suturing; and, in one case, due to improper flap planning, the donor area required split thickness skin grafting. Flap necrosis was not seen in any of the cases. The largest defect covered by this flap in our series was 12x14

Figure 16: If 'X' is less than 9 to 12cms, but there is an excursion of the defect, making it impossible to close the defect with a single flap, that excursion is treated as a separate defect and two flaps are designed to close the defect.

Figure 17: If 'X' is less than 9 to 12cms, but there is an excursion of the defect, making it impossible to close the defect with a single flap, that excursion is treated as a separate defect and two flaps are designed to close the defect.

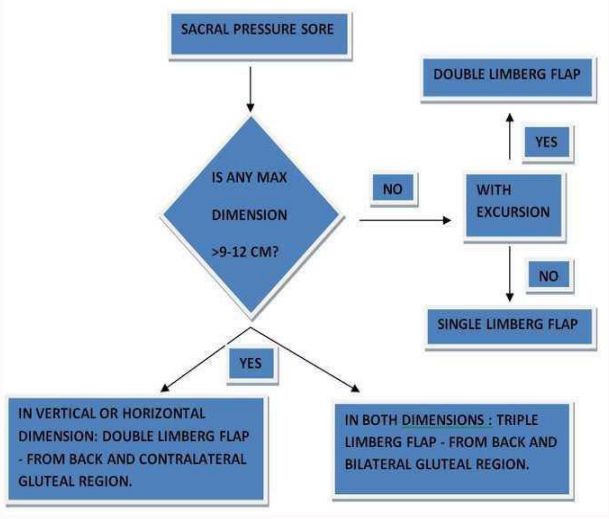

Figure 18: The planning process can be summarized by the flowchart.

cms. There was no recurrence of pressure sores in any patient in the 6 month follow-up period.

Discussion

In our study, the Limberg flap (single or multiple) was used, to close large pressure ulcers (up to 12 x 14 cms). 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 [14]. 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 [15]. This checking procedure ensures that the donor defect closes primarily. If it doesn't then the original rhomboid may be changed in position or another donor flap may be used [16,17].

Table 2: Complications.

Case No.	Complications	Management
3	Superficial dehiscence of the size - 3x2cms.	Secondary suturing
4	Improper flap planning	Split thickness skin grafting of the donor area.
12	Hematoma followed by wound dehiscence	Secondary suturing.
24	Partial suture line dehiscence	Secondary suturing.

Conclusion

The Rhomboid flap is a very versatile and robust flap, easy to master and practice and can be tailored to suit the sacral defect. There is no tissue loss or dog ear formation while rotating the flap, since it is a geometrical flap. Better nursing care is possible, as all sutures meet with minimal lateral extension. We do not jeopardize any area, from where creating a future flap is possible and there is always a backup plan in case of recurrence, in the form of an opposite diagonal flap. This flap is simple to execute and the results are satisfactory. Also, it spares underlying muscles for future use. The Limberg flap provides a good padded skin cover, with the suture line away from the midline, which is the area of ulceration. However, further study by different surgeons, at different centers is desirable to further explore the efficacy of this flap in pressure ulcers.

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