Original article:

Comparative Evaluation of Limberg Flap and Z-Plasty for Surgical Management of Sacrococcygeal Pilonidal Sinus

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Abstract

Background: Sacrococcygeal pilonidal sinus is a chronic inflammatory disorder that predominantly affects young adults, particularly males. Despite the availability of multiple operative techniques, consensus regarding the most effective surgical approach remains unsettled. This study compares the clinical outcomes of Limberg flap reconstruction and Z-plasty in the management of pilonidal sinus disease.

Materials and Methods: Sixty patients diagnosed with primary or recurrent pilonidal sinus disease were enrolled in this comparative clinical study conducted between August 2009 and January 2011. Participants were allocated into two equal groups: 30 underwent rhomboid excision with Limberg flap reconstruction, and 30 were treated using the Z-plasty technique. Operative parameters, postoperative recovery, complications, and recurrence were systematically evaluated.

Results: Patients treated with the Limberg flap demonstrated significantly shorter operative duration, reduced hospital stay, faster wound healing, and earlier return to routine activities. Postoperative complications were observed less frequently in this group. Although recurrence occurred in both groups, it was more commonly noted following Z-plasty; however, this difference was not statistically significant.

Conclusion: Within the limitations of this study, Limberg flap reconstruction was associated with more favorable perioperative and postoperative outcomes compared with Z-plasty. The findings support its consideration as a preferred surgical option in appropriately selected patients with pilonidal sinus disease.

Key words: Pilonidal Sinus; Surgical Flaps; Limberg flap; Z-plasty; Postoperative Complications; Treatment Outcome.

INTRODUCTION

Pilonidal sinus disease represents a chronic inflammatory condition involving the subcutaneous tissue of the sacrococcygeal region[1]. The disorder is characterized by the formation of sinus tracts that frequently contain hair and debris, resulting in persistent or recurrent infection. Although benign in nature, the condition often leads to discomfort, repeated medical visits, and absence from work, thereby imposing a notable functional burden. Epidemiologically, the disease is observed most commonly in young adult males. Several predisposing factors have been implicated, including increased body mass index, sedentary lifestyle, dense body hair, and a pronounced natal cleft[2]. These factors are thought to promote hair penetration and local friction, initiating a chronic inflammatory response that culminates in sinus formation[3].

The diversity of available treatment strategies reflects the ongoing debate regarding optimal management[4]. Techniques range from simple

incision and drainage to wide excision followed by various reconstructive flap procedures. Contemporary surgical approaches increasingly focus on minimizing midline tension, reducing recurrence, and facilitating rapid wound healing[5]. Among these, the Limberg flap and Z-plasty techniques are frequently employed, each aiming to modify local anatomy to improve outcomes[6].

This study was undertaken to evaluate these two procedures comparatively, with emphasis on operative efficiency, postoperative recovery profile, complication rates, and anatomical correction of the natal cleft.

MATERIALS & METHODS

This comparative study was conducted in the Department of General Surgery, National Institute of Medical Sciences & Research, NIMS University, Jaipur, Rajasthan (India) from August 2009 to January 2011. A total of 60 admitted patients diagnosed with symptomatic or recurrent sacrococcygeal pilonidal sinus disease were included in the study. The patients were equally divided into two groups, with 30 patients undergoing rhomboid excision followed by Limberg flap reconstruction and 30 patients treated with the Z-plasty technique. All procedures were performed under standard surgical protocols, and patients were followed up postoperatively to assess operative outcomes and complications.

Inclusion Criteria

- Individuals aged 18 to 70 years
- Male and female patients
- Patients diagnosed with clinically evident pilonidal sinus disease, including both primary and recurrent cases
- Presence of symptoms such as localized pain, abscess formation, sinus tract or cavity, and purulent or serous discharge

Exclusion Criteria

- Patients with acute systemic infection or severe local sepsis
- Patients with significant medical comorbidities that could impair wound healing
- Patients with immunocompromised status, including those receiving long-term steroid therapy or chemotherapy
- Patients with newly diagnosed diabetes mellitus, as determined by elevated HbA1c levels
- Patients diagnosed with bone tumors or osteomyelitis involving the sacrococcygeal region, confirmed by radiological investigations such as X-ray or computed tomography

Study Design: This was a comparative clinical study conducted on 60 patients diagnosed with symptomatic or recurrent sacrococcygeal pilonidal sinus disease. Patients were assigned into two equal groups according to the surgical procedure performed. Group A comprised 30 patients who underwent rhomboid excision with Limberg flap reconstruction, while Group B included 30 patients managed using the Z-plasty technique.

All patients underwent thorough preoperative assessment. Basic demographic details including age, sex, height, and weight were documented. A detailed clinical history was obtained with emphasis on potential risk factors such as occupational habits, lifestyle, family history, and associated medical conditions. General physical examination was followed by careful local examination of the pilonidal sinus to assess its position, extent, signs of infection, and presence or nature of discharge. In selected patients with complex or recurrent disease, additional investigations such as sinography or magnetic resonance imaging were performed when required.

After completion of evaluation and clearance through pre-anaesthetic assessment, patients were scheduled for elective surgical intervention. Standard institutional protocols were followed, including preoperative fasting, bowel preparation, and administration of a single prophylactic dose of intravenous antibiotics prior to surgery.

Operative Technique: Patients in the Limberg flap group underwent wide excision of the pilonidal sinus along with all associated tracts, followed by reconstruction using a Limberg flap[7]. Either general or spinal anaesthesia was administered depending on patient suitability and anaesthesiologist discretion. Patients were positioned prone in the jack-knife position, with support placed beneath the abdomen to elevate the pelvis. The buttocks were gently retracted using adhesive tapes to allow adequate exposure of the operative field. A rhomboid incision was marked around the lesion, with one angle extended laterally to design the flap[8]. Following complete excision, the fasciocutaneous flap was elevated, rotated into the defect, and secured. Skin closure was performed after achieving adequate haemostasis using Ethilon 3-0 sutures. In the Z-plasty group, a vertical elliptical incision was outlined with the sinus tract at its center[9]. Two oblique limbs were then marked on either side of the vertical limb, based on the required length for flap transposition. After excision of the sinus and surrounding tissue, the flaps were raised, transposed, and used to cover the defect. Skin closure was completed using Ethilon 3-0 sutures. In both groups, a suction drain was placed intraoperatively and was removed once the drain output was less than 10 ml over a 24-hour period[10].

Statistical Analysis: All collected data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) software. Comparison between the two study groups was carried out using the Chi-square test. Statistical significance was predefined at a two-sided alpha level of 0.05.

RESULTS

Postoperative Changes in Natal Cleft Depth: Limberg Flap Versus Z-Plasty

Patients who underwent the Limberg flap procedure demonstrated a greater degree of effective postoperative reduction in natal cleft depth when compared with those treated using Z-plasty. Inadequate or absent correction was noted exclusively in the Z-plasty group, suggesting that the Limberg flap provides better anatomical flattening of the natal cleft.

Assessment of Surgical Outcomes Between Limberg Flap and Z-Plasty Groups

Patients managed with the Limberg flap procedure required less operative time on average than those treated with Z-plasty, and this difference was statistically significant. The length of hospital stay was also shorter in the Limberg flap group, indicating earlier postoperative recovery when compared with the Z-plasty group. Wound healing was achieved more rapidly in patients who underwent the Limberg flap, with a significantly shorter mean duration to complete healing.

Postoperative complications occurred less frequently in the Limberg flap group than in the Z-plasty group, and this difference was statistically significant. Although recurrence was observed more often following Z-plasty, the difference in recurrence rates between the two groups did not reach statistical significance. In addition, patients treated with the Limberg flap resumed their normal daily activities earlier than those who underwent Z-plasty, and this finding was statistically significant.

Table 1: Comparison of Postoperative Correction in Depth of Natal Cleft Between Limberg Flap and Z-Plasty Groups

Degree of Natal Cleft Correction	Limberg Flap Group (n = 30)	Z-Plasty Group (n = 30)	Statistical Test	p-value
Adequate correction	26 (86.7%)	18 (60.0%)	Chi-square test	0.02
Partial correction	4 (13.3%)	9 (30.0%)	Chi-square test	0.11
Poor / no correction	0 (0%)	3 (10.0%)	Fisher's exact	0.04

Table 2: Comparison of Different Parameters Between Limberg Flap and Z-Plasty Groups

Parameter	Limberg Flap Group (n = 30)	Z-Plasty Group (n = 30)	Statistical Test	p-value
Mean operative time (minutes)	48.6 ± 6.4	62.3 ± 7.8	Unpaired t-test	< 0.001
Mean hospital stay (days)	3.1 ± 0.8	4.6 ± 1.1	Unpaired t-test	0.002
Time to complete wound healing (days)	18.4 ± 3.2	25.7 ± 4.5	Unpaired t-test	< 0.001
Postoperative complications	5 (16.7%)	11 (36.7%)	Chi-square test	0.04
Recurrence rate	1 (3.3%)	5 (16.7%)	Fisher's exact	0.08
Return to normal activity (days)	14.2 ± 2.6	21.5 ± 3.9	Unpaired t-test	< 0.001

DISCUSSION

The management of pilonidal sinus disease continues to evolve, with surgical techniques primarily directed toward reducing recurrence and enhancing postoperative recovery.[11] In the present study, measurable differences were observed between the two operative approaches.

Operative duration was significantly shorter in patients undergoing Limberg flap reconstruction. The geometric simplicity of the rhomboid design may facilitate predictable flap mobilization and closure, thereby streamlining the procedure. Reduced operating time is clinically relevant, as it may decrease anesthetic exposure and improve operating room efficiency.

Hospital stay and wound healing time were also shorter in the Limberg flap group.[12] One possible explanation lies in the off-midline placement of the final scar and the flattening of the natal cleft. By altering local contour and minimizing midline tension, this approach may create a more favorable environment for wound healing. In contrast, Z-plasty, while effective in redistributing tension, may not consistently achieve sufficient cleft flattening in all patients.

Postoperative complications were encountered more frequently following Z-plasty.[13] Tension at flap junctions and variable vascularity may contribute to delayed healing or wound-related issues. The Limberg flap, being a well-vascularized fasciocutaneous transposition flap, may offer more reliable perfusion and structural stability.

Although recurrence rates were higher in the Z-plasty group, statistical significance was not reached.[14] The limited sample size and follow-up duration may have influenced this outcome. Larger studies with extended follow-up would be beneficial to more definitively compare long-term recurrence patterns.

Earlier return to routine activities in the Limberg flap cohort further supports its functional advantage[15], particularly in young and working individuals, who constitute the majority of affected patients.

Overall, the comparative findings suggest that anatomical modification of the natal cleft and lateralization of the suture line may play an important role in optimizing surgical outcomes in pilonidal sinus disease.[16]

CONCLUSION

This comparative clinical study demonstrated measurable differences between Limberg flap reconstruction and Z-plasty in the surgical treatment of sacrococcygeal pilonidal sinus disease. The Limberg flap was associated with shorter operative time, reduced hospitalization, faster wound healing, and fewer postoperative complications. Although recurrence was observed in both groups, a lower incidence was noted following Limberg flap reconstruction.

These findings indicate that the Limberg flap provides favorable short-term clinical outcomes and may represent a reliable surgical option in appropriately selected patients. Further studies with larger cohorts and longer follow-up are recommended to validate long-term effectiveness.[17]

References

1. Hodges RM. Pilonidal sinus. Boston Med Surg J. 1880;103:485–486.
2. Karydakis GE. Easy and successful treatment of pilonidal sinus after explanation of its causative process. Aust N Z J Surg. 1992;62(5):385–389.
3. Bascom J. Pilonidal disease: long-term results of follicle removal. Dis Colon Rectum. 1983;26(12):800–807.
4. Bascom J, Bascom T. Failed pilonidal surgery: new paradigm and new operation leading to cures. Arch Surg. 2002;137(10):1146–1150.
5. Mentes O, Bagci M, Bilgin T, Ozgul O, Ozdemir M. Limberg flap procedure for pilonidal sinus disease: results of 353 patients. Langenbecks Arch Surg. 2008;393(2):185–189.
6. Ertan T, Koc M, Gocmen E, Aslar AK, Keskek M, Kilic M. Does technique alter quality of life after pilonidal sinus surgery? Am J Surg. 2005;190(3):388–392.
7. Topgul K, Ozdemir E, Kilic K, Gokbayir H, Ferahkose Z. Long-term results of Limberg flap procedure for treatment of pilonidal sinus: a report of 200 cases. Dis Colon Rectum. 2003;46(11):1545–1548.
8. Akin M, Gokbayir H, Kilic K, Topgul K, Ozdemir E, Ferahkose Z. Rhomboid excision and Limberg flap for managing pilonidal sinus: long-term results in 411 patients. Colorectal Dis. 2008;10(9):945–948.
9. Kitchen PR. Z-plasty in pilonidal sinus. Br J Surg. 1970;57(7):514–516.
10. Urhan MK, Kucukel F, Topgul K, Ozer I, Sari S. Rhomboid excision and Limberg flap for pilonidal sinus disease: results of 102 cases. Dis Colon Rectum. 2002;45(5):656–659.
11. Doll D, Luedi MM, Evers T, Kauf P, Matevossian E, Petersen S. Recurrence-free survival, but not surgical therapy per se, determines long-term patient satisfaction in pilonidal sinus disease. Int J Colorectal Dis. 2008;23(6):599–605.
12. Petersen S, Koch R, Stelzner S, Willems A, Ludwig K. Primary closure techniques in chronic pilonidal sinus: a survey of the results of different surgical approaches. Dis Colon Rectum. 2002;45(11):1458–1467.

13. Kronborg O. Excision and primary suture versus incision and curettage in pilonidal sinus disease. Acta Chir Scand. 1985;151(5):463–466.
14. Al-Khamis A, McCallum I, King PM, Bruce J. Healing by primary closure versus open healing after surgery for pilonidal sinus: systematic review and meta-analysis. BMJ. 2010;340:c283.
15. McCallum I, King PM, Bruce J. Healing by primary closure versus open healing after surgery for pilonidal sinus disease. Cochrane Database Syst Rev. 2007;(4):CD006213.
16. Can MF, Sevinc MM, Yilmaz M, Yagci G, Cetiner S. Comparison of Karydakis flap reconstruction versus primary midline closure in sacrococcygeal pilonidal disease: results of 200 cases. Int J Colorectal Dis. 2009;24(7):803–809.
17. Rao MM, Zawislak W, Kennedy R, Gilliland R. A prospective randomised study comparing Limberg flap with primary closure for pilonidal sinus disease. Tech Coloproctol. 2010;14(4):319–324.