



Clinical profile and comparison of different surgical treatment modalities amongst patient of pilonidal sinus

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Abstract

Introduction: Pilonidal sinus disease is a chronic inflammatory condition of the sacrococcygeal region that predominantly affects young adults and tends to recur regardless of the technique used for its surgical correction. Comparative data on commonly performed surgical modalities from Indian tertiary care settings remain limited. This study was undertaken to evaluate the clinical profile of patients with pilonidal sinus and to compare the outcomes of the Limberg flap, Z-plasty, and excision with lay-open technique in its surgical management.

Methods: Seventy patients with pilonidal sinus disease who fulfilled the inclusion criteria were enrolled on accrual at a tertiary care teaching hospital. Demographic, clinical, intraoperative, and postoperative data were recorded, and patients were followed up for six weeks. Outcomes among the three surgical procedures were compared using the chi-square test for categorical variables and one-way ANOVA for continuous variables, with $p < 0.05$ taken as significant.

Results: The mean age was 28.87 years (SD 4.21), with a marked male predominance (57 patients, 81.4%). Pain was the commonest presenting complaint (28, 40.0%) and Limberg flap was the most frequently performed procedure (28, 40.0%). It required a longer operative time and hospital stay than excision with lay-open technique ($p < 0.001$ and $p = 0.011$) and was associated with significantly faster wound healing and earlier return to normal activity ($p < 0.001$ and $p = 0.003$). Postoperative complications (20.0% overall) and recurrence (10.0% overall) did not differ significantly among the three procedures.

Conclusion: Pilonidal sinus predominantly affected young men, with obesity, dense hair growth, and prolonged sitting as commonly observed risk factors. Although flap-based reconstruction required longer operative time, the Limberg flap offered faster wound healing and earlier functional recovery with comparable complication and recurrence rates, supporting its use as a favourable surgical option in this population.

Keywords: Pilonidal sinus, Limberg flap, Z-plasty, Lay-open excision, wound healing, recurrence

Introduction

Pilonidal sinus disease is a chronic suppurative condition of the sacrococcygeal region that occurs about twice as often in men as in women, usually presenting between 15 and 30 years of age [1]. It is now understood to be an acquired condition resulting from penetration of loose hair into the skin of the natal cleft under repeated friction and pressure, giving rise to one or more sinus tracts containing hair and granulation tissue [2, 3]. Clinically, the disease may present as an asymptomatic pit, an acute abscess, a chronic discharging sinus, or recurrent disease, and carries an appreciable burden of recurrence that has been reported to range from about 5% to more than 30% depending on the surgical technique used [4].

A wide range of surgical options has been described for pilonidal sinus, extending from simple excision with healing by secondary intention to reconstructive flap procedures such as the Limberg flap and Z-plasty, each aiming to obliterate the natal cleft and reduce recurrence [5, 6]. Systematic reviews and comparative case series continue to report conflicting conclusions regarding operative time, wound healing, and recurrence among these techniques, and no single procedure has emerged as a universally accepted standard of care [7, 8, 9]. This variability in reported outcomes,

together with limited comparative data from Indian tertiary care hospitals evaluating all three techniques concurrently, provided the rationale for the present study.

This study was therefore undertaken to evaluate the clinical profile of patients with pilonidal sinus disease and to compare the operative, postoperative, and recurrence outcomes of the Limberg flap, Z-plasty, and excision with lay-open technique used in its management at a tertiary care teaching hospital.

Patients and Methods

Study design and setting

This was an observational case series analysis of patients with pilonidal sinus disease who were included from the Department of Surgery at a tertiary care teaching hospital. Ethical approval was obtained from the Institutional Ethics Committee prior to initiation of the study, and the study was conducted in accordance with the ethical principles for medical research involving human participants. Written informed consent was obtained from all participants before enrolment. The study received approval from the Institutional Ethics Committee under Approval No. MVPS/Dr. VPMCH&RC/IEC/26/2024–25

Participants

Patients aged 18 years and above who were diagnosed with pilonidal sinus disease on clinical examination, imaging, or both, and who underwent surgical treatment during the study period, were included after they provided written informed consent. Patients with a previous history of pilonidal sinus who were currently asymptomatic and those unwilling to provide consent were excluded. Patients meeting the eligibility criteria were enrolled consecutively until the planned sample size was reached, giving a final cohort of 70 patients.

Sample size

The minimum required sample size was estimated using the single population proportion formula, which yielded a minimum requirement of about 30 patients. To improve the precision of the comparative estimates and considering patient availability during the study period, patients fulfilling the inclusion criteria were enrolled until a final sample of 70 patients was obtained.

Data collection

A structured proforma was used to record demographic details, clinical history and predisposing factors such as body mass index, hair density over the sacrococcygeal region, personal hygiene, daily sitting duration, smoking, and family history. Pain severity was graded using the Visual Analog Scale. Clinical examination documented the site and number of sinus openings, presence of secondary tracts, and associated abscess formation.

Surgical management

The surgical technique performed, either Limberg flap, Z-plasty, or excision with lay-open technique, was selected by the operating surgeon on the basis of the clinical extent of disease, presence of infection, and surgeon preference, and was not randomly allocated. In the Limberg flap procedure, the sinus and surrounding tissue were excised in a rhomboid pattern and the defect was covered with a transposition flap raised from the adjacent gluteal region to flatten the natal cleft. Z-plasty involved excision of the sinus tract followed by transposition of triangular flaps to redirect the resulting scar away from the midline. In the lay-open technique, the sinus tract and surrounding infected tissue were excised completely and the wound was left open to heal by secondary intention. Intraoperative findings, including the number and extent of sinus tracts, the type of anaesthesia administered, operative duration, and any intraoperative complications, were recorded for each patient.

Outcome measures and follow-up

The primary outcome measures were recurrence of pilonidal sinus, occurrence of postoperative complications, and time to complete wound healing. Secondary outcome measures included duration of hospital stay, postoperative pain assessed on the Visual Analog Scale, and time to return to normal daily activity. Patients were followed up at one, three, and six weeks after surgery, at which the surgical site was examined for healing, infection, discharge, or dehiscence. Recurrence was defined as reappearance of a sinus opening, discharge, or related symptoms at or near the operated site after initial healing.

Statistical analysis

Data were entered in Microsoft Excel and analysed using SPSS version 23. Categorical variables were expressed as

number and percentage and compared among the three surgical procedures using the chi-square test. Continuous variables were expressed as mean and standard deviation (SD) and compared using one-way ANOVA. A p value of less than 0.05 was considered statistically significant.

Results

A total of 70 patients with pilonidal sinus disease who fulfilled the eligibility criteria were enrolled. The baseline demographic and clinical characteristics of the study population are summarised in Table 1.

The mean age of the patients was 28.87 years (SD 4.21), and the largest proportion belonged to the 21 to 30-year age group (35, 50.0%). Men markedly outnumbered women, accounting for 57 patients (81.4%) as against 13 (18.6%). The mean body mass index was 26.83 kg/m² (SD 2.71), with more than half the patients classified as overweight (38, 54.3%). Moderate hair density over the sacrococcygeal region was noted in 41 patients (58.6%) and dense hair growth in 23 (32.9%). Personal hygiene was rated average in 29 patients (41.4%) and poor in 15 (21.4%). Half the cohort reported sitting for two to six hours daily (35, 50.0%), 23 patients (32.9%) gave a history of smoking, and a family history of pilonidal sinus was present in 12 patients (17.1%).

Pain was the commonest presenting complaint (28, 40.0%), followed by swelling (17, 24.3%), discharge (15, 21.4%), and redness (10, 14.3%). The mean duration of symptoms before presentation was 2.84 months (SD 1.96), and moderate pain on the Visual Analog Scale was reported by 37 patients (52.9%), with a mean score of 5.93 (SD 1.64). A single sinus opening was found in 41 patients (58.6%) and an associated abscess in 21 (30.0%). A previous history of pilonidal sinus was present in 17 patients (24.3%) and comorbid illness in 19 (27.1%), while 48 patients (68.6%) had received no prior treatment for the condition.

Table 1: Baseline demographic and clinical characteristics of patients with pilonidal sinus (n = 70)

Characteristic	n (%) / Mean (SD)
Age group (years)	
≤20	12 (17.1)
21–30	35 (50.0)
31–40	23 (32.9)
Mean (SD), years	28.87 (4.21)
Sex	
Men	57 (81.4)
Women	13 (18.6)
Body mass index category	
Normal	21 (30.0)
Overweight	38 (54.3)
Obese	11 (15.7)
Mean (SD), kg/m ²	26.83 (2.71)
Hair density over the sacrococcygeal region	
Sparse	6 (8.6)
Moderate	41 (58.6)
Dense	23 (32.9)
Daily sitting duration	
<2 hours	16 (22.9)
2–6 hours	35 (50.0)
>6 hours	19 (27.1)
Primary presenting symptom	
Pain	28 (40.0)
Swelling	17 (24.3)
Discharge	15 (21.4)
Redness	10 (14.3)

Duration of symptoms	
<1 month	18 (25.7)
1–3 months	34 (48.6)
3–6 months	12 (17.1)
>6 months	6 (8.6)
Mean (SD), months	2.84 (1.96)
Pain severity (Visual Analog Scale)	
Mild (1–3)	9 (12.9)
Moderate (4–6)	37 (52.9)
Severe (7–10)	24 (34.3)

SD, standard deviation. Percentages are rounded to one decimal place and may not total exactly 100%.

The intraoperative characteristics of the study population, the distribution of surgical procedures performed, and the postoperative outcomes compared among the three procedures are shown in Table 2. Limberg flap was the most frequently performed procedure (28, 40.0%), followed by excision with lay-open technique (22, 31.4%) and Z-plasty (20, 28.6%). Spinal anaesthesia was used in the majority of patients (49, 70.0%). A single sinus tract was identified

intraoperatively in 41 patients (58.6%), and intraoperative complications occurred in 6 patients (8.6%).

The comparative operative and postoperative recovery parameters among the three surgical procedures are presented in Figure 1. The Limberg flap required the longest mean operative time, at 62.4 minutes (SD 8.7), followed by Z-plasty at 58.3 minutes (SD 7.5), while excision with lay-open technique required the shortest time, at 44.1 minutes (SD 6.9), a difference that was statistically significant ($p < 0.001$). Similarly, the mean duration of hospital stay was longest after Limberg flap, at 4.72 days (SD 1.31), and shortest after excision with lay-open technique, at 3.59 days (SD 1.12) ($p = 0.011$). In contrast, wound healing was fastest after Limberg flap, at 4.21 weeks (SD 1.18), and slowest after excision with lay-open technique, at 5.84 weeks (SD 1.41) ($p < 0.001$), and patients returned to normal activity earliest after Limberg flap, at 12.4 days (SD 3.1), as compared with 15.9 days (SD 4.2) after excision with lay-open technique ($p = 0.003$).

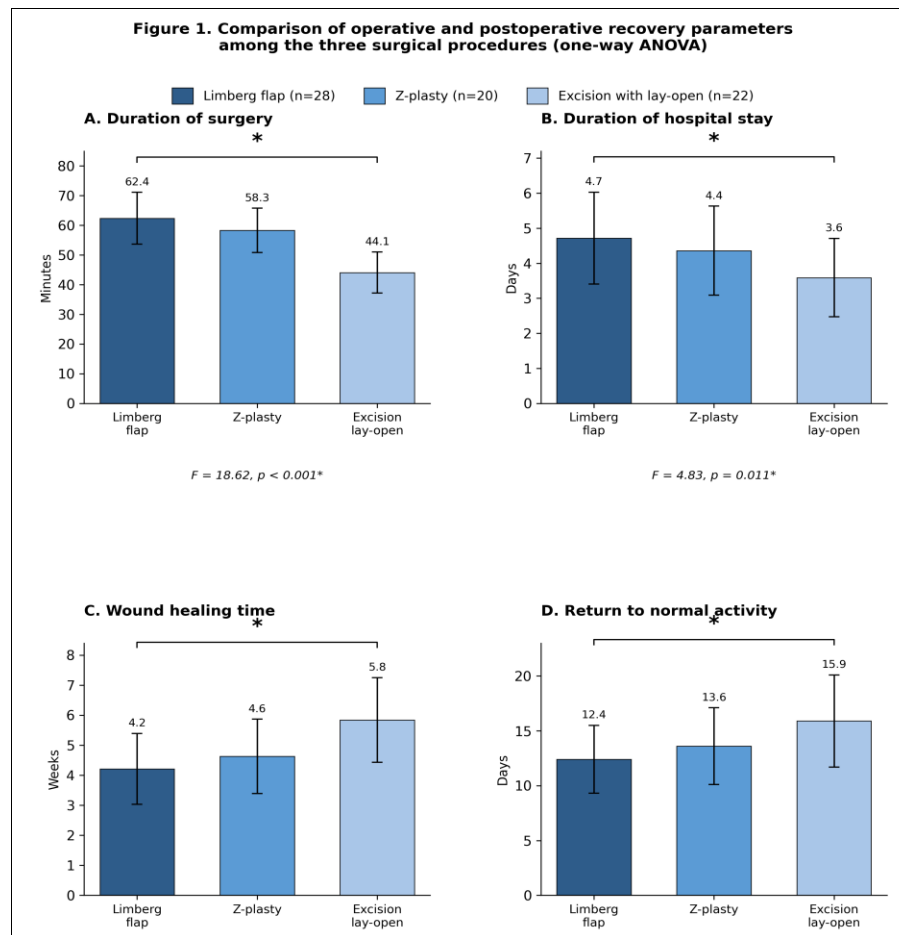


Fig 1: Comparison of operative and postoperative recovery parameters among the three surgical procedures. Bars represent mean values with error bars denoting standard deviation. *Statistically significant difference among the three procedures (one-way ANOVA, $p < 0.05$).

Overall, postoperative complications occurred in 14 patients (20.0%), most often surgical site infection (6, 8.6%), followed by seroma (4, 5.7%), wound dehiscence (3, 4.3%), and haematoma (1, 1.4%). As shown in Table 2, complication rates were 14.3% after Limberg flap, 25.0% after Z-plasty, and 22.7% after excision with lay-open technique. Recurrence occurred in 7 patients overall (10.0%), following a similar pattern across procedures (3.6% after Limberg flap,

10.0% after Z-plasty, and 18.2% after excision with lay-open technique). The final treatment outcome was successful in 63 patients (90.0%) overall. Postoperative pain declined steadily over the first postoperative week, with the mean Visual Analog Scale score falling from 5.12 (SD 1.48) on postoperative day 1 to 3.76 (SD 1.32) on postoperative day 3 and 2.14 (SD 0.96) on postoperative day 7 (Table 2). Complete wound healing was achieved in 58 patients (82.9%) by six weeks, while 10 patients (14.3%) had

delayed healing and 2 patients (2.9%) had a persistent wound.

Table 2: Intraoperative characteristics and postoperative outcomes among patients with pilonidal sinus (n = 70)

Surgical procedure performed, n (%)					
Limberg flap	28 (40.0)				
Z-plasty	20 (28.6)				
Excision with lay-open technique	22 (31.4)				
Postoperative outcomes by surgical procedure					
Characteristic / Parameter	Limberg flap (n=28)	Z-plasty (n=20)	Excision with lay-open (n=22)	χ^2 /F	p value
Postoperative complications, n (%)	4 (14.3)	5 (25.0)	5 (22.7)	1.42	0.49
Recurrence, n (%)	1 (3.6)	2 (10.0)	4 (18.2)	2.61	0.27
Postoperative pain, Visual Analog Scale score, mean (SD) (n=70)					
Day 1	5.12 (1.48)				
Day 3	3.76 (1.32)				
Day 7	2.14 (0.96)				

χ^2/F , chi-square or one-way ANOVA F statistic as applicable. $p < 0.05$ was considered statistically significant. SD, standard deviation.

The association between selected risk factors and recurrence is presented in Table 3. Although recurrence appeared more frequent among patients who were obese (2, 18.2%), had dense hair density (4, 17.4%), sat for more than six hours daily (4, 21.1%), or had poor personal hygiene (4, 26.7%), none of these associations reached statistical significance, with personal hygiene showing the closest approach to significance ($\chi^2 = 5.12$, $p = 0.077$).

Table 3: Association of selected risk factors with recurrence of pilonidal sinus (n = 70)

Risk factor	Category	Recurrence present, n (%)	Total, n	χ^2	p value
Body mass index	Normal	1 (4.8)	21	1.94	0.37
	Overweight	4 (10.5)	38		
	Obese	2 (18.2)	11		
Hair density	Sparse	0 (0.0)	6	2.11	0.34
	Moderate	3 (7.3)	41		
	Dense	4 (17.4)	23		
Sitting duration	<2 hours	1 (6.2)	16	4.26	0.12
	2–6 hours	2 (5.7)	35		
	>6 hours	4 (21.1)	19		
Smoking	Yes	3 (13.0)	23	0.56	0.45
	No	4 (8.5)	47		
Personal hygiene	Good	1 (3.8)	26	5.12	0.077
	Average	2 (6.9)	29		
	Poor	4 (26.7)	15		

χ^2 , chi-square test. $p < 0.05$ was considered statistically significant. No association reached statistical significance.

Discussion

This study evaluated the clinical profile of 70 patients with pilonidal sinus disease and compared the outcomes of the Limberg flap, Z-plasty, and excision with lay-open technique used in its management. Similar to previous reports, the disease predominantly affected young men in their third decade of life, with a mean age of 28.87 years (SD 4.21) and a male to female ratio of over four to one, findings comparable to those of Saaq et al and Jawade and Bande *et al*, who likewise reported disease onset in the third decade with a strong male preponderance [10, 11]. Consistent with the risk factor profile described by Harlak *et al* and Arda *et al*, most patients in the present study were overweight, had moderate to dense hair growth over the sacrococcygeal region, and reported prolonged sitting, reinforcing the contribution of these factors to disease pathogenesis [12, 13].

The principal finding of this study was that the Limberg flap, although requiring a longer operative time and hospital stay than excision with lay-open technique, was associated with significantly faster wound healing and earlier return to normal activity. This pattern is consistent with the findings of Gupta *et al*, who compared the Limberg flap with Z-plasty and had similarly reported a shorter operative time, shorter hospital stays, and faster wound healing with the Limberg flap [9]. Kartal *et al* similarly reported a longer operative time for Limberg flap reconstruction as compared with primary closure, alongside lower complication and recurrence rates with the flap technique, and Palsania *et al* likewise reported longer operative duration but faster recovery with Limberg flap reconstruction as compared with excision with lay-open technique [14, 15]. This trade-off is best explained by the nature of wound closure achieved by each technique. The longer operating time for the Limberg flap reflects the additional steps of rhomboid marking, flap elevation, and layered suturing, which are not required for simple excision. Once created, however, the well vascularised transposition flap achieves a tension free primary closure that obliterates the natal cleft and leaves little raw surface to heal, whereas the wound after lay-open excision must granulate and epithelialise entirely by secondary intention, a process that inherently takes longer and delays the return to normal activity.

These findings carry practical implications for the choice of surgical technique in this patient population. Where flap expertise and adequate resources are available, the Limberg flap appears to offer a meaningful advantage in postoperative recovery and may be preferable for patients who need an early return to work or physical activity, despite the longer time and resource commitment in the operating room. Excision with lay-open technique remains a simpler, quicker option that may still be appropriate in resource-limited settings, in patients unfit for prolonged anaesthesia, or when flap expertise is not readily available, provided patients are counselled about the longer expected healing time. As complication and recurrence rates were comparable across all three techniques in this study, the choice between them can reasonably be individualised on the basis of disease extent, patient preference, and locally available resources rather than being driven by safety concerns alone.

Postoperative complications and recurrence rates were comparable among the three procedures in the present study,

without statistical significance. This mirrors the findings of Karaca *et al*, who compared Limberg flap with excision and primary closure and similarly reported no significant difference in complication rates or recurrence between the two techniques, despite a significantly faster return to normal activity with the flap procedure^[16]. The absence of statistical significance for these secondary outcomes in the present study may reflect the modest sample size and the six week follow-up period rather than a true equivalence between techniques.

None of the risk factors examined, including body mass index, hair density, sitting duration, smoking, and personal hygiene, showed a statistically significant association with recurrence, although recurrence was numerically higher among patients with poor hygiene and dense hair growth, consistent with the associations reported by Albabtain *et al* and Salih *et al*^[17, 18]. This is most plausibly explained by the modest subgroup sizes in the present study rather than a true absence of effect.

Limitations

The present study adds comparative data on three commonly practiced surgical techniques for pilonidal sinus from an Indian tertiary care setting, an area in which such data remain limited. The study was conducted at a single centre with a modest sample size, the surgical technique was selected by the operating surgeon rather than randomly allocated, which may have introduced selection bias, and the six week follow-up period may not have captured late recurrences. Notably, larger comparative studies such as that of Cihan *et al* have found a statistically significant reduction in recurrence with Limberg flap reconstruction as compared with primary closure, suggesting that the present study may have been underpowered to detect a true difference in recurrence among the three techniques rather than the techniques being genuinely equivalent^[19]. Variables such as personal hygiene, sitting duration, and smoking were based on patient self report and may be subject to recall bias.

Conclusion

Pilonidal sinus disease predominantly affected young men in the present study, with obesity, dense hair growth, prolonged sitting, and suboptimal hygiene commonly observed among affected patients, and pain as the leading presenting complaint. Among the three surgical techniques compared, the Limberg flap required a longer operative time and hospital stay but was associated with significantly faster wound healing and earlier return to normal activity, along with a nonsignificant trend toward lower recurrence, as compared with Z-plasty and excision with lay-open technique. Postoperative complication and recurrence rates were comparable across all three procedures. These findings support flap-based reconstruction, particularly the Limberg flap, as a favourable option for the surgical management of pilonidal sinus, although larger multicentric studies with longer follow-up are required to confirm its advantage over other techniques and to define the independent predictors of recurrence.

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