OPEN ACCESS

Saudi Journal of Medical and Pharmaceutical Sciences
Abbreviated Key Title: Saudi J Med Pharm Sci
ISSN 2413-4929 (Print) | ISSN 2413-4910 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article **Colorectal Surgery**

Outcome of the Treatment of Pilonidal Sinus with Limberg Flap

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DOI: https://doi.org/10.36348/sjmps.2026.v12i03.003 | **Received:** 14.01.2026 | **Accepted:** 07.03.2026 | **Published:** 12.03.2026

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Abstract

***Background*:** Pilonidal sinus is a chronic disease of the sacrococcygeal region, commonly seen in young adults, and is characterized by midline pits in the natal cleft associated with hair. This study was conducted to evaluate the outcomes of the Limberg flap procedure in the treatment of primary pilonidal sinus, including postoperative complications, duration of hospital stay, and time to return to work. ***Methods*:** This prospective observational study at the Department of Colorectal Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh (July 2019–August 2020), included 18 adults with primary pilonidal sinus. Excluding acute abscess and recurrent cases, patients underwent Limberg flap surgery under spinal anesthesia. Demographic, clinical, and outcome data were recorded, with follow-up at 2 weeks, and 1st, 3rd, 6th, and 9th months. Data were analyzed using SPSS® 24. ***Results*:** Among 18 patients undergoing Limberg flap repair, mean age was 26.9 ± 5.2 years, 88.9% were male, and most had BMI 18.5–24.9 kg/m². Single external opening was present in 83.3%. Mean operative time was 88.8 ± 12.7 minutes, hospital stay 4.17 ± 0.7 days, drain removal 3.4 ± 0.7 days, suture removal 12.9 ± 1.7 days, and return to work 12.7 ± 1.8 days. Postoperative complications occurred in 5 patients (27.7%), with no recurrences. Four of 5 overweight patients developed complications ($r = 0.93$, $p < 0.001$). ***Conclusion*:** The Limberg flap is a safe and effective treatment for sacrococcygeal pilonidal sinus, offering low recurrence, minimal complications, and rapid recovery.

Keywords: Pilonidal Sinus, Limberg Flap, Surgical Outcomes.

INTRODUCTION

Pilonidal sinus is a common chronic disease of the sacrococcygeal region, usually seen in young adults, and is manifested by midline pits in the natal cleft that are associated with hair [1]. Most people affected by pilonidal sinus disease are in the 15–30-year age group, with an incidence of 26 per 100,000 population (Male: Female = 4:1) [2]. The term "pilonidal" is derived from the root words "pilus" (hair) and "nidus" (nest), and the disorder was historically known as "Jeep Disease," thought to be related to modern mechanized warfare requiring prolonged sitting in vehicles [3].

Patients may present with acute symptoms, including moderate to severe pain and swelling, or more commonly with a draining site that causes intermittent discomfort and recurrent infection [1]. The most important predisposing factors for pilonidal sinus include a deep natal cleft and the presence of hair within the cleft. A deep natal cleft favors sweating, maceration, bacterial contamination, and hair penetration, leading to a foreign body reaction and infection that may result in an acute or chronic pilonidal abscess or sinus [4]. Other risk factors include sedentary occupation, positive family history, obesity, local irritation, and trauma [5].

The ideal treatment should provide reliable healing with a high chance of cure, minimal recurrence, and allow early return to work while avoiding general anesthesia and prolonged hospital stay [1]. Various surgical methods have been described, including excision and primary closure, excision and open packing, marsupialization, incision and curettage, and excision with plastic procedures [1]. However, conventional surgical methods and conservative treatment are associated with high recurrence rates, delayed healing, prolonged wound care, patient discomfort, and delayed return to work [4].

Techniques to obliterate the natal cleft, such as excision with Z-plasty, W-plasty, or fascio-cutaneous advancement flaps, have demonstrated low recurrence rates but may cause necrosis of flap tips or undesirable scarring, and are not suitable for extensive disease [4]. The Karydakis procedure uses asymmetric excision and lateralized primary closure to prevent hair penetration, while Bascom's technique focuses on excising hair follicles with lateral drainage. Both techniques, however, may be inadequate for patients with complex or extensive pilonidal disease [4]. Gluteal myocutaneous flaps are effective for large defects but involve prolonged hospital stay, longer operative time, and technical complexity [4].

The Limberg flap is a rhomboid fasciocutaneous flap used to cover the defect after radical excision of the pilonidal sinus. The rhomboid flap is excised down to the post-sacral fascia, transposed, and sutured, effectively flattening the natal cleft and displacing the incision scar from the midline [6]. This well-vascularized flap reduces sweating, maceration, and debris accumulation, eliminating major predisposing factors and achieving very low recurrence rates [4]. Off-midline procedures, including the Limberg flap, have shown statistically superior outcomes compared with midline closure in terms of healing time, surgical site infection, and recurrence rates [7]. Regarding drainage, hospital stay was noted to be shorter in patients without a drain, although other outcomes showed no significant difference [8].

Therefore, this study was conducted to evaluate the outcomes of the Limberg flap procedure in the treatment of primary pilonidal sinus, including postoperative complications, duration of hospital stay, and time to return to work.

Objective

To evaluate the clinical outcomes and postoperative complications of pilonidal sinus treatment using the Limberg flap technique.

METHODOLOGY & MATERIALS

This prospective observational study was conducted at the Department of Colorectal Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, between July 2019 and August 2020. A total of 18 adult patients with primary pilonidal sinus were enrolled based on specific inclusion and exclusion criteria to evaluate the outcomes of the Limberg flap procedure.

Inclusion Criteria

- Adult patients with primary pilonidal sinus

Exclusion Criteria

- Acute pilonidal abscess
- Recurrent pilonidal sinus

Study Variables

Demographic variables included age, sex, occupation, and socioeconomic status. Clinical variables included BMI and immunosuppression. Outcome variables were duration of hospital stay, postoperative complications, time to return to work, and recurrence.

Operational Definitions

- **Pilonidal sinus:** Chronic sacrococcygeal disease with midline pits containing hair (Daphan et al., 2004)
- **Limberg flap:** Rhomboid fasciocutaneous flap used to cover the defect after excision (Katsoulis et al., 2006)
- **Recurrence:** Reappearance of pilonidal sinus within 1 year after primary repair
- **Failure of surgery:** Wounds failing to close after 8 weeks
- **Seroma:** Collection of fluid under the skin
- **Wound dehiscence:** Partial or total separation of wound edges

Data Collection and Follow-up

Baseline demographic, clinical, and operative data were recorded in a predesigned data collection sheet. Patients were followed at 2 weeks, and 1st, 3rd, 6th, and 9th months postoperatively to evaluate complications, recurrence, and functional outcomes.

Surgical Procedure

All procedures were performed under spinal anesthesia with patients in the prone jackknife position. Prophylactic intravenous cefuroxime (1.5 g) was administered. The sacrococcygeal region was shaved and disinfected, and a rhomboid excision including the sinus was performed. Sinus tracts were visualized using methylene blue. A rhomboid fasciocutaneous flap was mobilized, hemostasis achieved, and a suction drain placed. Subcutaneous tissue was approximated with 2/0 polyglycolic acid sutures, and skin was closed with interrupted 2/0 polypropylene sutures.

Data Analysis

Data were analyzed using SPSS® version 24. Continuous variables were expressed as mean ± standard deviation (SD) and range, and categorical variables as frequencies and percentages. Pearson's correlation

coefficient was used to assess associations between variables. Data were presented in tables and figures.

Ethical Considerations

The study protocol was approved by the Institutional Review Board of BSMMU. Written informed consent was obtained from all participants. Confidentiality was maintained using unique identification numbers, and participants were free to withdraw at any time without affecting their treatment.

Figure 5: Final Postoperative Wound Closure with Interrupted Mattress Sutures and Suction Drain Demonstrating Early Surgical Outcome

RESULTS

Table 1: Demographic Characteristics of Study Participants (N = 18)

Variable		Number of Patients	Percentage (%)
Age (years)	≤29	12	66.7
	30–49	6	33.3
	>50	0	0.0
	Mean ± SD	26.9 ± 5.2	
	Range (Min–Max)	16–35	
Gender	Male	16	88.9
	Female	2	11.1
BMI (kg/m²)	≤18.5	0	0.0
	18.5–24.9	13	72.2
	25.0–29.9	5	27.8
	≥30	0	0.0
	Mean ± SD	23.9 ± 1.9	
Occupation	Tailor	1	5.6
	Businessman	1	5.6
	Service holder	4	22.2
	Student	4	22.2
	Garment worker	3	16.7
	Salesman	1	5.6
	Driver	4	22.2

The majority of patients were aged ≤29 years (12 patients, 66.7%), followed by those aged 30–49 years (6 patients, 33.3%). No patients were older than 50 years. The mean age was 26.9 ± 5.2 years (range: 16–35). Most participants were male (16 patients, 88.9%) compared with female (2 patients, 11.1%). Regarding BMI, 13 patients (72.2%) had a BMI of 18.5–24.9 kg/m², and 5 patients (27.8%) had a BMI of 25.0–29.9 kg/m², with a mean BMI of 23.9 ± 1.9 kg/m². Occupational distribution was as follows: service holder and student (each 4 patients, 22.2%), driver (4 patients, 22.2%), garment worker (3 patients, 16.7%), and tailor, businessman, and salesman (each 1 patient, 5.6%).

Table 2: Distribution of Patients by Number of External Openings in Pilonidal Sinus (N = 18)

Number of External Openings	Number of Patients (N)	Percentage (%)
1	15	83.3
2	2	11.1
3	1	5.6

Most patients had a single external opening (15 patients, 83.3%), 2 patients (11.1%) had 2 openings, and 1 patient (5.6%) had 3 openings.

Table 3: Distribution of Patients by Duration of Operation (Minutes) (N=18)

Duration of Operation (minutes)	n	%
70	2	11.1
80	6	33.3
90	5	27.8
100	2	11.1
110	3	16.7
Mean ± SD (Min–Max)	**88.8 ± 12.7 (70–110)**	

The mean duration of surgery was 88.8 ± 12.7 minutes (range: 70–110). Most operations lasted 80 minutes (6 patients, 33.3%) or 90 minutes (5 patients, 27.8%). Shorter and longer durations were less frequent: 70 minutes (2 patients, 11.1%), 100 minutes (2 patients, 11.1%), and 110 minutes (3 patients, 16.7%).

Table 4: Distribution of Patients by Duration of Hospital Stay (Days) (N=18)

Duration of Hospital Stay (days)	n	%
3	3	16.7
4	10	55.6
5	4	22.2
6	1	5.6
Mean ± SD (Min–Max)	**4.17 ± 0.7 (3–6)**	

The majority of patients stayed in the hospital for 4 days (10 patients, 55.6%), followed by 5 days (4 patients, 22.2%) and 3 days (3 patients, 16.7%). Only 1 patient (5.6%) stayed for 6 days. The mean hospital stay was 4.17 ± 0.7 days (range: 3–6).

Table 5: Distribution of Patients by Day of Drain Removal (N=18)

Day of Drain Removal	n	%
3rd	12	66.7
4th	4	22.2
5th	2	11.1
Mean ± SD	**3.4 ± 0.7**	

Drain tubes were removed most commonly on the 3rd day postoperatively (12 patients, 66.7%), followed by the 4th day (4 patients, 22.2%) and the 5th day (2 patients, 11.1%). The mean day of drain removal was 3.4 ± 0.7 days.

Table 6: Distribution of Patients by Day of Suture Removal (N=18)

Day of Suture Removal	n	%
10	1	5.6
12	10	55.6
13	2	11.1
14	1	5.6
15	1	5.6
16	3	16.7
Mean ± SD (Min–Max)	**12.9 ± 1.7 (10–16)**	

Sutures were most frequently removed on the 12th day (10 patients, 55.6%), followed by the 16th day (3 patients, 16.7%) and the 13th day (2 patients, 11.1%). Sutures were removed on the 10th, 14th, and 15th day in 1 patient each (5.6%). The mean day of suture removal was 12.9 ± 1.7 days (range: 10–16).

Table 7: Distribution of Patients by Time to Return to Work (Days) (N=18)

Time to Return to Work (days)	n	%
10	3	16.7
11	1	5.6
12	5	27.8
13	2	11.1
14	4	22.2
15	2	11.1
16	1	5.6
Mean ± SD (Min–Max)	**12.7 ± 1.8 (10–16)**	

Most patients returned to work on the 12th day (5 patients, 27.8%) or the 14th day (4 patients, 22.2%). Other return times were: 10th day (3 patients, 16.7%), 13th and 15th days (2 patients each, 11.1%), and 11th and 16th days (1 patient each, 5.6%). The mean time to return to work was 12.7 ± 1.8 days (range: 10–16).

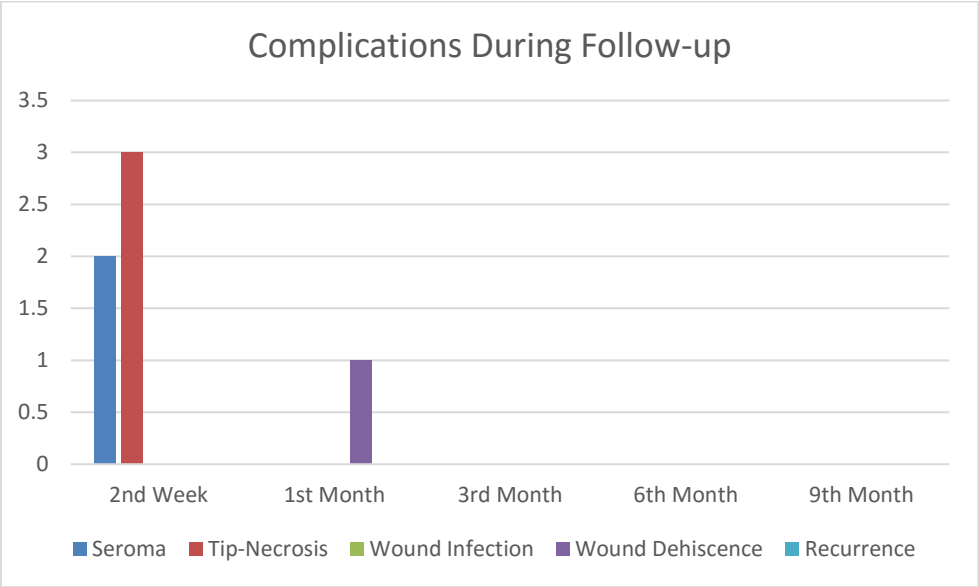

Figure 2: Postoperative Complications During Follow-up (N = 18)

Seroma was observed in 2 patients (11.1%) and tip necrosis in 3 patients (16.7%) at the 2nd week of follow-up. Wound dehiscence was noted in 1 patient (5.5%) at the 1st month. No wound infections or recurrences were reported during the 9-month follow-up. Overall, 5 patients (27.7%) experienced complications at any time during follow-up, while 13 patients (72.3%) had no complications.

Table 8: Correlation Between Overweight Status and Postoperative Complications (N = 18)

Variable	Total (N)	Complication (n)	No Complication (n)	Pearson's Correlation Coefficient (r)	p-value*
Overweight	5	4	1	0.93	<0.001

Among 5 overweight patients, 4 experienced complications and 1 had no complications. Pearson's correlation coefficient showed a significant positive correlation between overweight status and postoperative complications ($r = 0.93$, $p < 0.001$).

DISCUSSION

This prospective observational study was designed to evaluate the outcome of pilonidal sinus treatment using the Limberg flap technique. A total of 18 patients were included from the Department of Colorectal Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU) between July 2019 and August 2020. Ethical approval was obtained from the Institutional Review Board of BSMMU prior to the commencement of the study.

In the present study, the mean age at presentation was 26.9 ± 5.2 years, with a range of 16–35 years. Two-thirds of the patients were young adults (≤29 years), and one-third were aged 30–49 years, with no patient older than 50 years. This age distribution is consistent with previous reports, such as Eryilmaz *et al*. [4], who observed a mean age of 26 years (17–46), and Katsoulis *et al*. [6], who reported a mean age of 30 years (19–47). Zubair *et al*. [9] also found that most patients

with pilonidal sinus treated with the Limberg flap were adults aged 31–50 years, supporting a similar adult age predominance. The majority of patients in our study were male (16 patients, 88.9%) compared to female (2 patients, 11.1%), reflecting a strong male predominance consistent with Eryilmaz *et al*. [4] and further supported by Zubair *et al*. [9], who reported 65.2% males, and Sinnott *et al*. [11], who observed 87% males in their cohorts. Regarding BMI, 72.2% of patients were within the normal range (18.5–24.9 kg/m²) and 27.8% were overweight (25.0–29.9 kg/m²), which is comparable to the slightly higher mean BMI reported by Sinnott *et al*. [11]. Occupationally, service holders, students, and drivers were most common (22.2% each), followed by garment workers (16.7%) and tailor, businessman, and salesman (5.6% each), reflecting the typical sedentary or semi-sedentary occupations associated with pilonidal sinus. Overall, these findings align well with previously published literature regarding the demographic characteristics of pilonidal sinus patients.

On clinical examination, most patients in the present study had a single external opening in the pilonidal sinus (15 patients, 83.3%), while 2 patients (11.1%) had two openings and 1 patient (5.6%) had three openings. These findings are consistent with previous reports; Eryilmaz *et al*. [4] observed 48% of patients with a single midline pit, 33% with multiple midline pits, and 19% with lateral extensions, while Daphan *et al*. [1] reported 39.5% with a single midline opening, 53.7% with multiple openings, and 6.8% with lateral fistulas. More recent studies also support this pattern: Singh *et al*.[12] reported in a cohort of 43 patients undergoing EPSiT for pilonidal disease that ~69.8% had a single opening, 23.2% had two openings, and 7.0% had three openings, reflecting the predominance of single pits similar to our findings; Kılıç *et al*.[13] found an average of 1.75 ± 0.8 sinus openings, with 46.4% having a single opening and 82.1% presenting midline pits; and Oraby *et al*.[14] in a retrospective cohort of 205 patients reported that all patients had a midline primary pit, with only a small number having lateral sinus openings. Collectively, these studies confirm that pilonidal sinus most commonly presents with a single midline opening, with multiple openings being less frequent.

The mean operative time in the present study was 88.8 ± 12.7 minutes (range: 70–110), with most procedures lasting between 80 and 90 minutes. In comparison, Singh *et al*. [12] reported a shorter mean operative time of 50 minutes (30–80) in patients undergoing EPSiT for pilonidal disease. In their cohort of 43 patients, 69.8% had a single external opening, 23.2% had two openings, and 7.0% had three openings—findings comparable to our study, where the majority (83.3%) presented with a single opening. Similarly, Kılıç *et al*. [13] reported an average of 1.75 ± 0.8 sinus openings, with 46.4% of patients having a single opening and 82.1% presenting with midline pits. Oraby *et al*. [14] observed that all patients had a midline primary pit, with only a few demonstrating additional lateral openings.

Hospital stay duration in the present study averaged 4.17 ± 0.7 days (range: 3–6). Most patients stayed for 4 days (10 patients, 55.6%), followed by 5 days (4 patients, 22.2%) and 3 days (3 patients, 16.7%), while only one patient (5.6%) required a 6-day stay. These findings are comparable with previous studies. Daphan *et al*. [1] reported a mean hospital stay of 5.9 days (range 1–10), Singh *et al*. [12] observed a mean duration of 5 days (range 2–14), and Katsoulis *et al*. [6] documented an average of 4 days (range 3–7). Similarly, Mentes *et al*. [15] reported a mean hospital stay of 4.51 ± 2.85 days in a large series of 353 patients treated with Limberg flap, while Bessa [16] found that most patients undergoing Limberg flap had a postoperative stay of 4–5 days.

Drain tubes were removed most commonly on the 3rd postoperative day (12 patients, 66.7%), followed by the 4th day (4 patients, 22.2%) and the 5th day (2 patients, 11.1%). The mean removal day was 3.4 ± 0.7 days. This aligns with Daphan *et al*. [1] and Katsoulis *et al*. [6].

Sutures were most frequently removed on the 12th day (10 patients, 55.6%), followed by the 16th day (3 patients, 16.7%) and the 13th day (2 patients, 11.1%). The mean day of suture removal was 12.9 ± 1.7 days (range: 10–16). Katsoulis *et al*. [6] and Daphan *et al*. [1] reported similar timelines.

The mean time to return to work was 12.7 ± 1.8 days (range: 10–16). Eryilmaz *et al*. [4] reported a mean return to work of 15 days (12–26), and Daphan *et al*. [1] reported 18.8 days (10–25).

During follow-up, seroma occurred in 2 patients (11.1%) and tip necrosis in 3 patients (16.7) at the 2nd week. Wound dehiscence occurred in 1 patient (5.5%) at 1 month. Overall, 5 patients (27.7%) experienced complications, while 13 patients (72.3%) remained complication-free.

A high positive correlation was observed between overweight status and postoperative complications ($r = 0.93$, $p < 0.001$).

In comparison, Singh *et al*. [10] reported complications in 12.5% of patients, including seroma (6.2%), flap necrosis (3.1%), and superficial infection (3.1%). Katsoulis *et al*. [6] documented complications including superficial infection, wound dehiscence, prolonged drainage, and hematoma. Daphan *et al*. [1] observed seroma in 2%, partial wound detachment in 4.1%, and recurrence in 4.8%, while Eryilmaz *et al*. [4] reported wound infection in 5%, hematoma in 2%, and recurrence in 3% of patients. Arda *et al*. [17] found that overweight or obese patients developed more

postoperative complications, supporting the observed correlation between overweight status and postoperative complications in the present study.

Limitations of the study

The study had a few limitations:

- Small sample size in the present study.
- Single-center study design.
- Short study duration and limited follow-up period.

CONCLUSION

The Limberg flap procedure is an effective, safe, and reliable technique for the treatment of sacrococcygeal pilonidal sinus. It is associated with low recurrence rates, short hospital stays, early return to work, a very low incidence of postoperative complications, and provides complete cure.

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