Original Research

A COMPARATIVE STUDY OF KARYDAKIS FLAP REPAIR AND LIMBERG FLAP REPAIR IN PATIENTS OF PILONIDAL SINUS

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ABSTRACT

Background: Pilonidal sinus disease (PSD) is a chronic, inflammatory condition that typically affects the natal cleft of the sacrococcygeal region, occurs more commonly in young males. There is formation of sinus tracts that may contain hair and debris, often leading to infection, abscess formation, or chronic discharge. There are many nonsurgical and surgical techniques in the treatment of pilonidal sinus disease. This was a comparative study between two surgical techniques- Karydakis flap repair and Limberg flap repair in patients of pilonidal sinus.

Material and methods: This prospective comparative study was conducted in the Department of General Surgery at Government medical college Patiala and Rajindra Hospital, from August 1, 2023 to July 31, 2024. The current study evaluated 60 patients diagnosed with sacrococcygeal pilonidal sinus disease, evenly divided between two surgical technique groups: Karydakis flap repair (Group A) and Limberg flap repair (Group B). The study aimed to evaluate and compare the operative durations, length of hospital stay, postoperative wound complications and wound healing time between the Karydakis flap repair and the Limberg flap repair in patients diagnosed with pilonidal sinus disease. All patients participating in the study were thoroughly informed about the procedure prior to surgery, and written informed consent was obtained from each individual.

Results: The mean age was 29.1 ± 6.1 years with majority of patients were male, accounting for 90% of the total sample, while females represented 10%. The mean operative time was 41.9 ± 6.3 min in Karydakis flap (KF) repair and 46.5 ± 7.1 min in Limberg flap (LF) repair (p=0.03). Wound healing was faster in KF (11.6 ± 1.8 days) compared to LF (13.1 ± 2.1 days, p=0.02). However, postoperative complications were higher in KF (infection 20%, dehiscence 13.3%) compared to LF (infection 6.7%, dehiscence 3.3%, p=0.04). At 6-month follow-up, recurrence was seen in 3 cases (10%) in KF group, while none were reported in LF group.

Conclusion: In conclusion, both the Limberg and Karydakis procedures are safe and effective surgical options for managing pilonidal sinus disease, showing comparable hospital stays and similar impacts on patients' productivity. However, the Karydakis flap appears to be associated with a higher rate of postoperative infections, making the Limberg procedure more favorable in terms of short-term outcomes. To determine the definitive superiority of either technique requires evaluation of long-term outcomes as our findings are based solely on early postoperative outcomes. Further research with larger sample sizes and long-term follow-up is recommended to validate these results and assess long-term outcomes.

Keywords: Pilonidal Sinus Disease, Limberg and Karydakis.

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INTRODUCTION

Pilonidal sinus disease (PSD) is a chronic, inflammatory condition that typically affects the natal cleft of the sacrococcygeal region. It is characterized by the formation of sinus tracts that may contain hair and debris, often leading to infection, abscess formation, or chronic discharge. The term "pilonidal" is derived from Latin—pilus (hair) and nidus (nest)— reflecting the typical nest like accumulation of hairs within the sinus cavity.[1] PSD is often considered a minor condition, but it can lead to significant morbidity, including pain, recurrent infections, and prolonged periods away from work or school.[2]

A specific form of PSD, known as intergluteal pilonidal disease (IPD), involves infection of the skin and subcutaneous tissues at or near the upper part of the natal cleft. The intergluteal cleft, extending from below the sacrum to the perineum, is anatomically predisposed to hair accumulation and friction, contributing to disease development.[3]

Although pilonidal sinus typically appears in the sacrococcygeal region, it can occasionally develop in other body areas, where it is known as an extrasacrococcygeal pilonidal sinus. The lesions were located in various areas - breast, scalp, sternum, along the abdominal wall, neck, groin and axilla.[4] PSD predominantly affects young adults, especially those aged 15–30 years, and exhibits a strong male predominance, with a male-to-female ratio of approximately 2:1[5]. The incidence of IPD is estimated at 26 cases per 100,000 population, with a mean age of onset of 19 years in women and 21 years in men.[3,6,7] It is more prevalent in individuals from Mediterranean regions and is rarely seen before puberty or in older adults.

This study aims to conduct a comparative analysis of the Karydakis flap repair and the Limberg flap repair in patients with pilonidal sinus disease. The objective is to evaluate and compare the clinical outcomes, including wound healing, postoperative complications, operative time, duration of hospital stay and recurrence rates between the two surgical techniques. By providing evidence-based insights, the study seeks to determine the more effective and patient-friendly surgical option for pilonidal sinus disease management.

MATERIAL AND METHODS

This prospective comparative study was conducted in the Department of General Surgery at Government medical college Patiala and Rajindra Hospital, from August 1, 2023 to July 31, 2024. The current study evaluated 60 patients diagnosed with sacrococcygeal pilonidal sinus disease, evenly divided between two surgical technique groups: Karydakis flap repair (Group A) and Limberg flap repair (Group B). The study aimed to evaluate and compare the operative durations, length of hospital stays, postoperative wound complications and wound healing time between the Karydakis flap repair and the Limberg flap repair in patients diagnosed with pilonidal sinus disease. All patients participating in the study were thoroughly informed about the procedure prior to surgery, and written informed consent was obtained from each individual. Hair removal was carried out by shaving the patients in the evening prior to surgery. As a prophylactic measure, appropriate antibiotic was administered 30 minutes before the operation. All procedures were done under spinal anesthesia. The surgical site was disinfected by cleaning it at least twice with gauze soaked in povidone-iodine. Prior to the incision, the surgical margins, including the sinus tract, were marked using a sterile surgical pen.

Ethics Approval

Ethics clearance was obtained from the institutional ethics committee and written informed consent was taken from all patients.

Inclusion Criteria

- Patients aged 18 years and older.
- Diagnosed with pilonidal sinus disease requiring surgical intervention.
- No active infection at the time of surgery.
- Provided written informed consent to participate in the study.

Exclusion Criteria

- Patients under 18 years of age.
- Conditions mimicking pilonidal sinus disease (e.g., dorsal dermal sinus, sacral osteomyelitis).
- Chronic medical conditions such as uncontrolled diabetes mellitus, renal failure, or immunosuppression.
- Presence of a communicating fistula-in-ano.
- Patients unwilling to provide informed consent.

RESULTS

Table 1: Gender-Wise Distribution of Patients across Age Groups

Age Group	Female		Male	
	Frequency	Percentage	Frequency	Percentage
≤20	0	0.0	6	100.0
21-25	1	8.3	11	91.7
26-30	2	11.1	16	88.8

31-35	2	13.3	13	86.7
36-40	1	16.7	5	83.3
>40	0	0.0	3	100.0
Total	6	10.0	54	90.0

Table 1 presents the gender-wise distribution of patients across different age groups. The majority of patients were male, accounting for 90% of the total sample, while females represented 10%. In the age groups ≤20 and >40, there were no female patients, with males constituting 100% of these categories. The highest proportion of females was observed in the 36– 40 age groups, with 16.7%. The 26–30 and 31–35 age groups had 11.1% and 13.3% females, respectively.

Table 2: Descriptive Statistics for Age, Operation Duration, Hospital Stay, and Wound Healing By Group

Variable	Group A (Karydakis flap) Mean (SD)	Group B (Limberg flap) Mean (SD)
Age	28.97 (6.09)	29.27 (6.31)
Duration of Operation (min)	39.06 (4.50)	49.40 (4.66)
Hospital Stay (days)	3.67 (1.35)	4.47 (1.63)
Wound Healing (days)	11.80 (1.83)	12.87 (2.15)

Normality of continuous variables was assessed separately for the Karydakis and Limberg groups using both the Kolmogorov–Smirnov (K–S) and Shapiro–Wilk tests. Test type chosen based on normality test results (Shapiro–Wilk). $p < 0.05$ considered statistically significant.

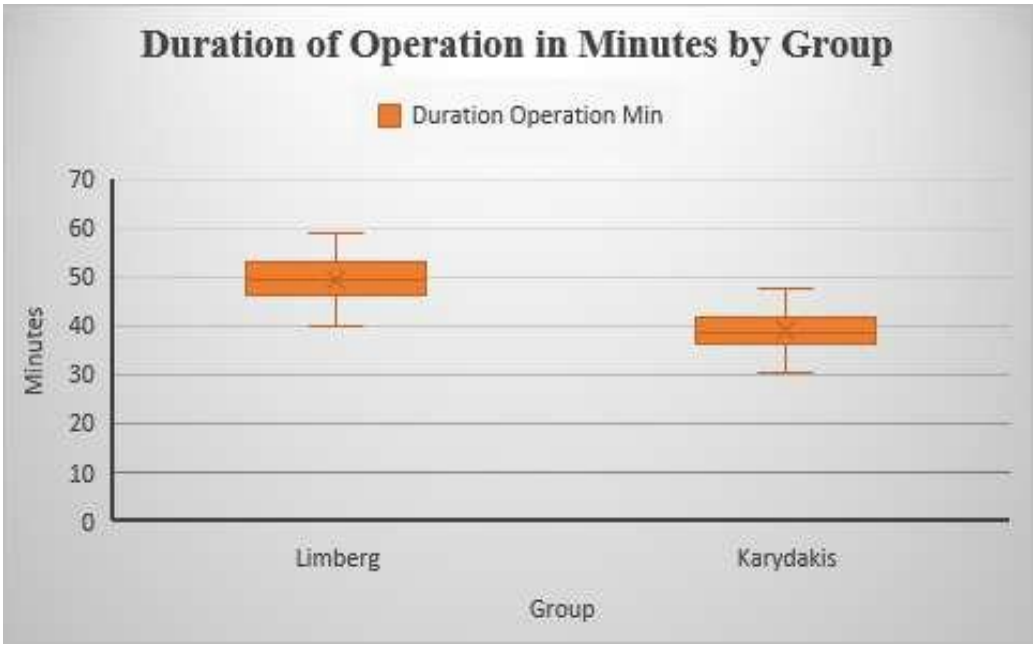

Figure- 1

Figure 1 illustrates the comparison of operation durations between the Limberg and Karydakis groups using box plots. The median duration of operations in the Limberg group was approximately 50 minutes, with an interquartile range (IQR) of 45 to 55 minutes. In contrast, the Karydakis group had a median operation duration of approximately 40 minutes, with an IQR of 35 to 45 minutes.

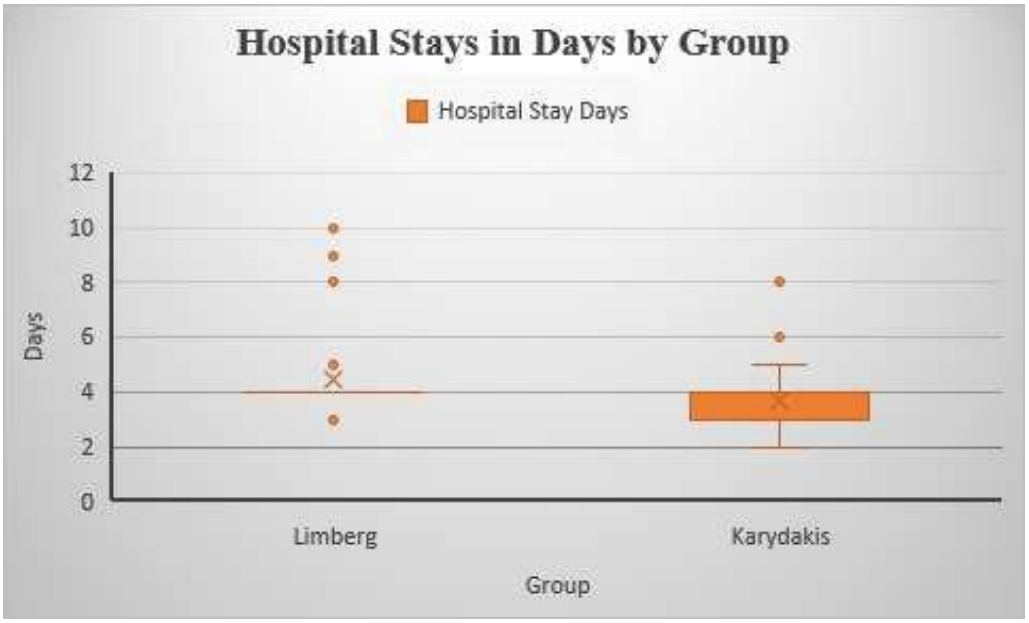

Figure-2

Figure 2 displays a box plot comparing hospital stay durations between the Limberg and Karydakis groups. The plot indicates that the Karydakis group had a longer hospital stay on average compared to the Limberg group. The interquartile range and median values suggest greater variability and a higher central tendency in hospital stay days for the Karydakis group. Outliers are present in both groups, indicating individual cases with unusually long stays.

Figure-3

Figure 3 presents a box plot comparing wound healing durations between the Limberg and Karydakis groups. The Limberg group had a longer median wound healing time of approximately 13 days, with a range from 10 to 16 days. In contrast, the Karydakis group had a shorter median healing time of approximately 11 days, ranging from 9 to 14 days. The distribution suggests that the Karydakis procedure may be associated with faster wound healing compared to the Limberg procedure.

Table 3: Chi-Square Test of Association between Surgical Group and Postoperative Complications (N = 60)

Postoperative Outcome	**Group A (Karydakis)**	**Group B (Limberg)**	**χ^2 (df)**	***p*-value**
Recurrence	3 (10.0%)	1 (3.3%)	1.071 (1)	0.612**
Wound Infection	8 (26.7%)	4 (13.3%)	1.667 (1)	0.197*

Wound Dehiscence	3(10%)	2 (6.7%)	0.218 (1)	1.000**

Note: Group A = Karydakis procedure; Group B = Limberg flap. * Pearson Chi-Square, **Fisher's Exact Test values are reported where expected cell counts <5. p-value <0.05 is consider as statistically significant.

The association between the type of surgical procedure (Limberg vs. Karydakis) and the occurrence of three postoperative complications: recurrence, wound infection, and wound dehiscence were assessed by chi- square tests.

For recurrence, the association was not statistically significant, χ^2 (1, N = 60) = 1.071, p = 0.612 (Fisher's Exact Test, 2-sided. Figure 4 shows, the recurrence rate was slightly higher in the Karydakis group (10%, n = 3) compared to the Limberg group (3.3%, n = 1)

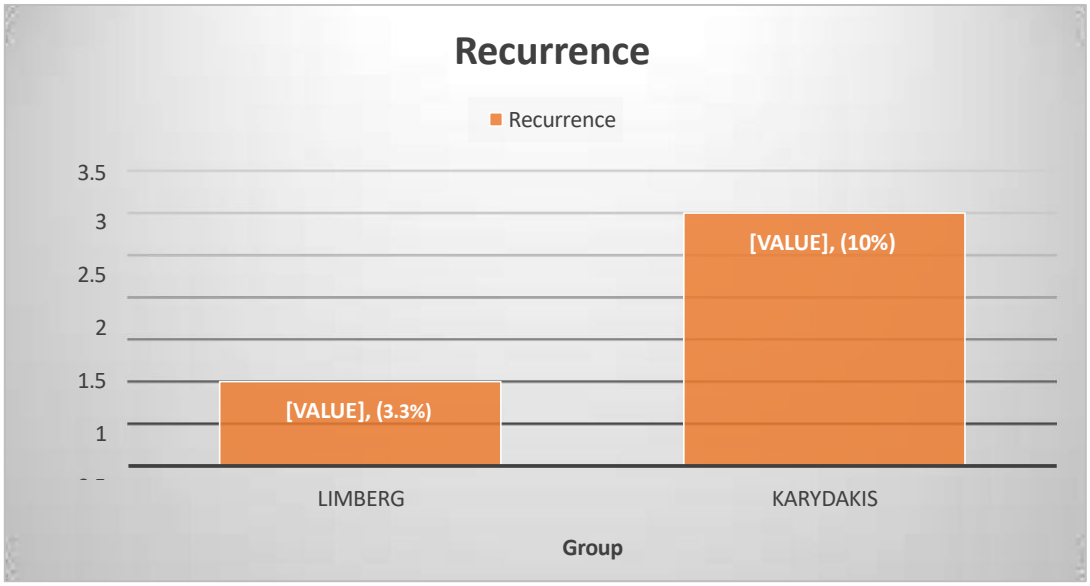

Figure - 4

In terms of wound infection, the difference between the groups was also not significant, χ^2 (1, N = 60) = 1.667, p = 0.197 (Pearson Chi-Square, 2-sided), with wound infections reported in 26.7% (n = 8) of Karydakis patients and 13.3% (n = 4) of Limberg patients, As shown in Figure 5.

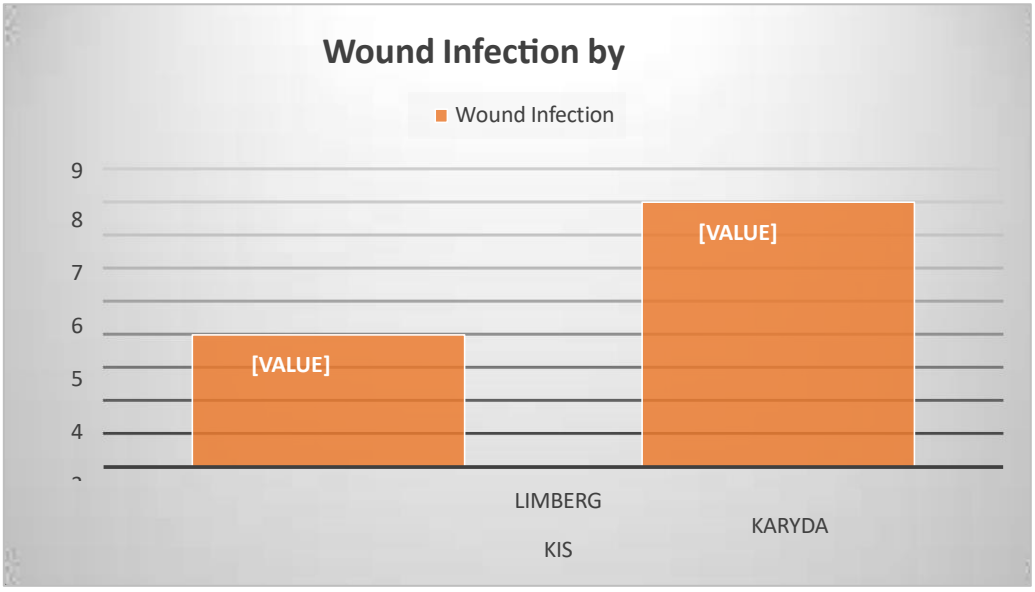

Figure - 5

Similarly, no significant association was observed for wound dehiscence, χ^2 (1, N = 60) = 0.218, p = 1.000 (Fisher's Exact Test, 2-sided). Wound dehiscence occurred in 10.0% (n = 3) of patients in the Karydakis group and 6.7% (n = 2) in the Limberg group, as shown in table 4.

Table 4. Cross Tabulation of Wound Dehiscence by Surgical Group (N = 60)

Surgical Group	Wound Dehiscence Absent	Wound Dehiscence Present	Total
Karydakis (Group A)	27 (90.0%)	3 (10.0%)	30
Limberg (Group B)	28 (93.3%)	2 (6.7%)	30
Total	55 (91.7%)	5 (8.3%)	60

Overall, none of the postoperative complications analysed showed a statistically significant difference between the two surgical techniques.

DISCUSSION

A pilonidal cyst (or pilonidal sinus) is a small cavity or tract in the skin, containing hair and sometimes debris. If it becomes inflamed or infected, it can turn into a tender, pus-filled lump. Historically, during World War II, this condition became known as "Jeep driver's disease" after being frequently observed in soldiers who spent long hours driving Jeeps, leading to repetitive pressure and friction in the sacrococcygeal area. Clinically, it often appears as a small opening or pit in the lower back, which may or may not contain visible hair strands and doesn't always present with a tangled mass of hair.

The current study evaluated 60 patients diagnosed with sacrococcygeal pilonidal sinus disease, evenly divided between two surgical technique groups : Karydakis flap repair (Group A) and Limberg flap repair (Group B). This age distribution line up with the typical demographic affected by pilonidal sinus disease, which predominantly affects young adults, particularly males in their second and third decades of life. The mean age in the current study was 29.12 years (SD = 6.15), slightly higher than that reported in earlier studies such as Elshazly et al. (2011), where the mean age was approximately 25.5 years.[12] The demographic distribution revealed that the majority of patients were between 21 and 35 years of age, with the highest concentration in the 26–30 years group (18 patients), followed by the 31–35 years group (15 patients). This age pattern is consistent with previous literature, which identifies pilonidal sinus disease as predominantly affecting young adults, particularly males. For instance, Gurer et al. (2005)[3] and Bali et al. (2025)[8] reported mean ages of 25.5 and 24 years, respectively, with over 90% of patients being male. This age distribution line up with the epidemiological trend of pilonidal sinus disease, which predominantly affects individuals in their second and third decades of life due to factors such as increased hair growth, friction, and hormonal activity (Ertugrul et al., 2021; El Hadidi et al., 2019).[10,11]

In terms of sex distribution, the current study observed a higher proportion of male patients, consistent with previous literature indicating a male predominance in pilonidal sinus cases. For instance, Yildiz et al. (2013)[13] reported that 86.8% of their study population were male, while Muhammad Azeem et al. (2021)[14] found that 95.6% of their participants were male. This gender disparity is often attributed to anatomical and behavioural differences, including denser body hair and prolonged sitting (taxi driver, desk job), which are more common in males.

Similarly, Antony et al. (2022) observed a male-to-female ratio of 4:1, which match with the current study's demographic profile.[9]

The average duration of surgery was 39.06 minutes (SD = 4.50) in Karydakis flap repair and 49.40 minutes (SD = 4.66) in Limberg flap repair. Antony et al. (2022)[9] found that the Karydakis flap had a shorter operative time (mean 45.1 minutes) compared to the Limberg flap (mean 57.7 minutes), while Alsesy et al.[15] (2016) reported even more pronounced differences (37.73 ± 12.98 minutes for Karydakis vs. 61.60± 11.11 minutes for Limberg).

Hospital stay duration also favoured the Karydakis flap group, with a mean of 3.07 days (SD = 0.58) compared to 3.97 days (SD = 0.49) in the Limberg flap group. The Mann–Whitney U test confirmed this difference as statistically significant ($U = 133.00$, $Z = -5.17$, $p < .001$), consistent with earlier findings by Ersoy et al. (2009)[16], who reported that Karydakis flap patients experienced significantly shorter hospital stays.

However, these benefits must be weighed against the higher incidence of postoperative complications associated with the Karydakis flap. Ersoy et al. (2019)[16] reported a higher wound infection rate in the Karydakis flap group (13/50) compared to the Limberg flap group (4/50), along with increased requirements for analgesia and wound care.

In the current study, recurrence occurred in 10.0% of Karydakis flap patients and 3.3% of Limberg flap patients ($p = 0.612$), indicating no statistically significant difference. This aligns with the meta-analysis by Prassas et al.(2018)[17], which found no significant difference in recurrence between the two techniques (OR = 1.07; 95% CI [0.59–1.92]; $p = 0.83$). Similarly, Emile et al.(2012)[18] reported comparable recurrence rates across 15 randomized controlled trials. However, Shahid et al. (2024)[19] observed a recurrence rate of 11.1% in the Karydakis flap group and 0% in the Limberg flap group, with the difference reaching statistical significance ($p = 0.046$), suggesting a potential advantage of the Limberg flap in recurrence prevention.

CONCLUSION

In conclusion, both the Limberg and Karydakis procedures are safe and effective surgical options for managing pilonidal disease, showing comparable

hospital stay and similar impacts on patients' productivity. However, the Karydakis flap appears to be associated with a higher rate of postoperative infections, making the Limberg procedure more favorable in terms of short-term outcomes. To determine the definitive superiority of either technique requires evaluation of long-term outcomes as our findings are based solely on early postoperative outcomes. Further research with larger sample sizes and long-term follow-up is recommended to validate these results and assess long-term outcomes.

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