

## Pilonidal Sinus Management – A Clinical Comparative Study between Limberg Flap and Karydakias Flap

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### Abstract

**Introduction:** Intergluteal pilonidal disease (IPD) is a skin and subcutaneous infection near the upper part of the natal cleft of the buttocks, affecting 26 cases per 100,000 populations, with men being 2 to 4 times more prone. Risk factors include obesity, local trauma, prolonged sitting, deep natal cleft, and a positive family history.

**Aims:** The study's goal is to compare the results of the Limberg flap and Karydakias flap and discover the best techniques for treating Pilonidal Sinus illness Patient satisfaction.

**Materials & methods:** This is a hospital based prospective randomized clinical trial, to compare Limberg flap and Karydakias flap. This study was conducted at the Bokaro General Hospital, Department of General Surgery. The study covered over a period of one and half year (October 2019 to Mar 2021). Numbers of the patients taken for the study were 70

**Result:** There are 70 patients, 35 in each Limberg and Karydakias. Discharge is present in all the patients of both Limberg and Karydakias. The Routine Blood Investigation is normal in all patients of both flap Limberg and Karydakias In puss culture, Staph Aureus is highest in both flap Limberg and Karydakias, 13 in each flap. Mixed Growth and Proteus Mirabilis is lowest in both flap, 2 in each flap. The Bacteroides Fragilis is 12 in Limberg and 12 in Karydakias. E.Coli is 6 in Limberg and 6 in Karydakias.

**Conclusion:** The Limberg flap is recommended for treating recurrent pilonidal sinus illness, as it reduces complication rates, short hospital stays, lower pain scores, and improves patient satisfaction.

**Keywords:** Pilonidal sinus, Limberg flap, Karydakias flap, surgical management.

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### Introduction

Intergluteal pilonidal disease (IPD) is an infection of the skin and subcutaneous tissues at or near the upper part of the natal cleft of the buttocks. Although pilonidal cavities are considered pseudocysts, the sinus tracts may be epithelialized [1]. The clinical presentations are consistently variable, ranging from an asymptomatic pilonidal cavity or sinus to acute infection or chronic inflammation and drainage. The intergluteal cleft is the groove between the buttocks, which extends from right below the sacrum to the perineum and occurs due to the anchoring of deep skin layers overlying the coccyx to the anococcygeal raphe. The incidence of IPD is estimated at 26 cases per

100,000 populations. The mean age at IPD onset is 19 years in women and 21 years in men. Generally, men are 2 to 4 times more prone to this disease. The risk factors for IPD include obesity, local trauma or irritation, prolonged sitting, a deep natal cleft, and positive family history. The exact mechanism of the progress of pilonidal disease is uncertain, although hair and inflammation are recognized as contributing factors [2]. IPD is a condition characterized by deep natal clefts, which can damage hair follicles and open pore or pits, allowing hair roots to lodge and become embedded. Cavities may contain hair, debris, and granulation tissue. Infected pore can lead to an acute

subcutaneous abscess. Physical examinations show primary pores in the midline of the cleft and a painless sinus opening. In acute or chronic cases, tender masses, sinus drained mucus, purulent fluid, and bloody fluid can be identified. Complete removal of these substances is expected to lead to definitive treatment.

However, in practice, pilonidal cysts can recur following an extensive surgical resection of the affected area. The mainstay of operative management for chronic or persistent IPD is en bloc excision of the entire pilonidal sinus and epithelialized tracts, using methylene blue to identify the involved sinus tracts down to the level of the sacrococcygeal fascia. Optimal closure of the wound following excision is debated.

Primary closure can be accomplished by using either midline or off-midline techniques, including the Z-plasty, V-Y advancement flap, or rhomboid (Limberg) flap techniques [3]. Complex reconstructive operations using flaps are used for patients with extensive diseases or those unresponsive to simpler surgeries.

These techniques allow for the excision of more involved tissues and reduce tension in the healing wound, facilitating closure lateral to the natal cleft, a moist, hypoxic, and bacteria-laden area. [4].

The study's goal is to compare the results of the Limberg flap and Karydakias flap. To discover the best techniques for treating Pilonidal Sinus illness Patient satisfaction.

## Material & Methods

**Study Design:** This is a hospital based prospective randomized clinical trial, to compare Limberg flap and Karydakias flap.

**Study Setting:** This study was conducted at the Bokaro General Hospital. A 910 bedded tertiary care hospital in Bokaro Steel City, Jharkhand, under Bokaro Steel Plant, A Steel Authority of India Limited subsidiary.

**Participants:** Patients attending outpatient department or inpatients, of the Department of General Surgery of Bokaro General Hospital,

presenting with PILONIDAL SINUS were included in this study

**Time Frame:** The study covered over a period of one and half year (October 2019 to March 2021)

### Inclusion Criteria:

- Patients willing to give written informed consent.
- Presence of recurrent pilonidal sinus.
- Adult (over 16 years of age) undergoing surgery for recurrent pilonidal sinus.
- International normalizing ratio (INR) of less than 1.5.
- Prothrombin time (PT) of less than 15 s.
- Partial thromboplastin (PTT) time near normal.
- Platelet count greater than 50,000 per mm<sup>3</sup> to limit the risk of bleeding.

### Exclusion Criteria:

- Patients not willing to give informed consent.
- Age less than 16 years.
- Patient presenting with different conditions mimicking pilonidal sinus.
- Chronic medical conditions, such as diabetes mellitus, renal failure, or immunosuppression
- Doesn't include pregnant women.
- Acute presentation-Pilonidal abscess
- Osteomyelitis of the underlying bone.

### Statistical Analysis:

Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0. Continuous variables were presented as Mean+SD or median if the data was unevenly distributed. Categorical variables were expressed as frequencies and percentages. The comparison of normally distributed continuous variables between the groups were performed using Student's t test. Nominal categorical data between the groups were compared using Chi-squared test or Fisher's exact test as appropriate. Non-normal distribution continuous variables were compared using Mann Whitney U test. For all statistical tests, a p value less than 0.05 were taken to indicate a significant difference

### Result

**Table1: Presentation**

	Limberg		Karydakias	
	N	Percent	N	Percent
<b>Pain</b>				
<b>Present</b>	35	100	35	100
<b>Absent</b>	0	0	0	0
<b>Total</b>	35	100	35	100
<b>Discharge</b>				
<b>Present</b>	35	100	35	100
<b>Absent</b>	0	0	0	0
<b>Total</b>	35	100	35	100

<b>Past Intervention</b>				
<b>Present</b>	20	57.1	20	57.1
<b>Absent</b>	15	42.9	15	42.9
<b>Total</b>	35	100	35	100
<b>Swelling</b>				
<b>Present</b>	0	0	0	0
<b>Absent</b>	35	100	35	100
<b>Total</b>	35	100	35	100
<b>General Phys. Exam</b>				
<b>Normal</b>	35	100	35	100
<b>Total</b>	35	100	35	100
<b>Sys. Exam</b>				
<b>Normal</b>	35	100	35	100

**Table 2: Investigation**

	<b>Limberg</b>		<b>Karydakis</b>	
	<b>N</b>	<b>Percent</b>	<b>N</b>	<b>Percent</b>
<b>Routine Blood Investigation</b>				
<b>Normal</b>	35	100	35	100
<b>Total</b>	35	100	35	100
<b>PUS Culture</b>				
<b>Bacteroides Fragilis</b>	12	34.3	12	34.3
<b>E.Coli</b>	6	17.1	6	17.1
<b>Mixed Growth</b>	2	5.7	2	5.7
<b>Proteus Mirabilis</b>	2	5.7	2	5.7
<b>Staph Aureus</b>	13	37.1	13	37.1
<b>Total</b>	35	100	35	100
<b>RAD</b>				
<b>NRA</b>	35	100	35	100
<b>Total</b>	35	100	35	100

**Table 3: Postoperative Assessment**

	<b>Limberg</b>		<b>Karydakis</b>	
	<b>N</b>	<b>Percent</b>	<b>N</b>	<b>Percent</b>
<b>DOHSPO</b>				
<b>4 Days</b>	20	57.1	0	0
<b>5 Days</b>	14	40	10	28.6
<b>6 Days</b>	0	0	12	34.3
<b>7 Days</b>	1	2.9	5	14.3
<b>8 Days</b>	0	0	4	11.4
<b>10 Days</b>	0	0	4	11.4
<b>Total</b>	35	100	35	100
<b>Post OP Pain</b>				
<b>Mild Pain</b>	32	91.4	2	5.7
<b>Moderate Pain</b>	3	8.6	33	94.3
<b>Total</b>	35	100	35	100
<b>Wound Infection</b>				
<b>Present</b>	1	2.9	4	11.4
<b>Absent</b>	34	97.1	31	88.6
<b>Total</b>	35	100	35	100
<b>Wound Healing Time</b>				
<b>9 Days</b>	7	20	0	0
<b>10 Days</b>	27	77.1	0	0
<b>12 Days</b>	1	2.9	12	34.3
<b>13 Days</b>	0	0	10	28.6
<b>14 Days</b>	0	0	7	20
<b>15 Days</b>	0	0	3	8.6
<b>16 Days</b>	0	0	3	8.6

<b>Total</b>	35	100	35	100
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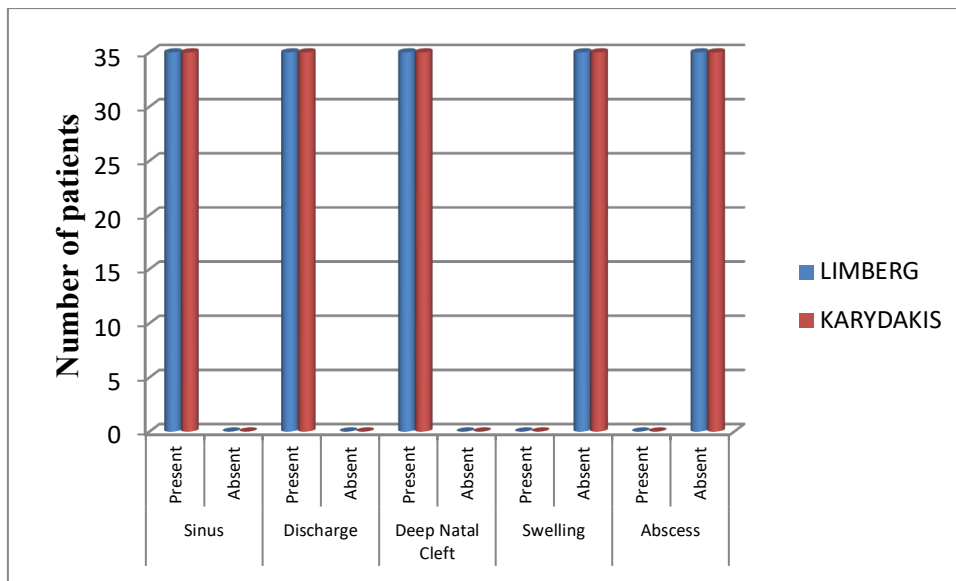


Figure 1: Local Examination

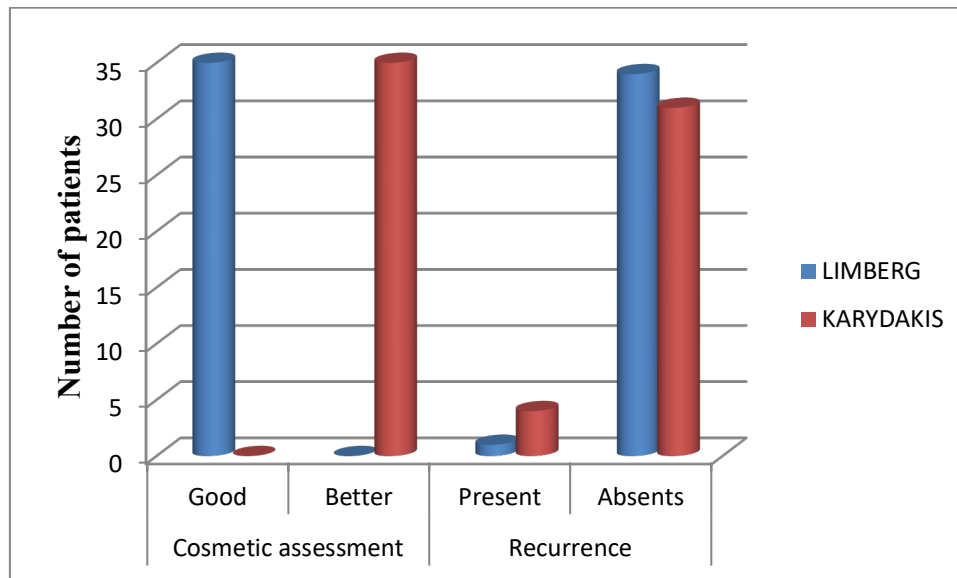


Figure 2: Follow Up

In limberg, 35 (100.0%) patients had Pain. In karydakis, 35 (100.0%) patients had Pain. In limberg, 35 (100.0%) patients were Discharge. In karydakis, 35 (100.0%) patients were Discharge. In limberg, 20 (57.1%) patients had Past Intervention. In karydakis, 20 (57.1%) patients had Past Intervention. In limberg, 35 (100.0%) patients had General Phys. Exam. In karydakis, 35 (100.0%) patients had General Phys. Exam. In limberg, 35 (100.0%) patients had Sys. Exam. In karydakis, 35 (100.0%) patients had Sys. Exam. The Routine Blood Investigation is normal in all patients of both flap Limberg and Karydakis. In puss culture, Staph Aureus is highest in both flap Limberg and Karydakis, 13 in each flap. Mixed Growth and Proteus Mirabilis is lowest in both

flap, 2 in each flap. The Bacteroides Fragilis is 12 in Limberg and 12 in Karydakis. E.Coli is 6 in Limberg and 6 in Karydakis. We can see in the graph Rad is normal in all patients of both Limberg and Karydakis. In Post OP Assessment, DOHSPO can be seen in 20 patients of Limberg in 4 days and in 0 Karydakis in 4 days. In 5 days, DOHSPO can be seen in 14 patients of Limberg and 10 patients of Karydakis. In 6 days, DOHSPO can be seen in zero patients of Limberg and 12 patients of Karydakis. In 7 days, DOHSPO can be seen in 1 patient of Limberg and 5 patients of Karydakis. In 8 days, DOHSPO can be seen in zero patients of Limberg and 4 patients of Karydakis. In 10 days, DOHSPO can be seen in zero patients of Limberg and 4 patients of Karydakis. We can see that Post OP

mild pain is present in 32 patients of Limberg and in 2 patients of Karydakis. The Post OP moderate pain is present in 3 patients of Limberg and 33 patients of Karydakis. The Wound Infection is present in 1 patient of Limberg and 4 patients of Karydakis and Wound infection is absent in 34 patients of Limberg and 31 Patients of Karydakis. The Wound Healing Time is 9 days in 7 patients of Limberg and Zero patients of Karydakis. In 10 days, the wound healed of 27 patients of Limberg and zero patients of Karydakis. In 12 days, the wound healed of 1 patient of Limberg and 12 patients of Karydakis. In 13 days, the wound healed of zero patients of Limberg and 10 patients of Karydakis. In 14 days, the wound healed of zero patients of Limberg and 7 patients of Karydakis. In 15 days, the wound healed of zero patients of Limberg and 3 patients of Karydakis. In 16 days, the wound healed of zero patients of Limberg and 3 patients of Karydakis.

We can know that in Limberg the Wound healing is started in 9 days and maximum in 12 days. But in Karydakis the Wound healing is started in 12 days and maximum in 16 days. In limberg, 35 (100.0%) patients had Sinus Present. In karydakis, 35 (100.0%) patients had Sinus Present. In limberg, 35 (100.0%) patients were Discharge. In karydakis, 35 (100.0%) patients were Discharge. In limberg, 35 (100.0%) patients had Deep Natal Cleft. In karydakis, 35 (100.0%) patients had Deep Natal Cleft. Abscess is absent in all the patients of Limberg and Karydakis.

In Limberg Flap, recurrence is present in 1 patient and absent in 34 patients. Whereas, in Karydakis Flap, recurrence is present in 4 patients and absent in 31 patients.

### Discussion

Pilonidal sinus is characterized by acute exacerbations. A pilonidal cyst or pilonidal sinus is a small skin cavity with hair in the lower back. This disease is more common in the sacrococcygeal region among white adult men. Pilonidal sinus disease has an incidence of approximately 26 per 100,000 populations with a male: female ratio of 2:1 and a rare occurrence in children. The highest age range is 16–26 years, and cyst infection usually starts in early adulthood (18–40 years). Gurer et al [5] reported a mean patient age of 25.5 and a gender balance of 95% males in a series detailing the Karydakis flap procedure. In our series, the mean age was 24, and more than 95% of the patients were male. Recurrence is the main problem in the treatment of pilonidal sinus. In 1970, Foss reported a collective series of 1,129 pilonidal sinus patients treated with excision and primary closure by different investigators. The failure rate of primary healing was 16%, the length of hospitalization averaged 21.7 days, and the

recurrence rate was 16%. Several flap techniques have been described with recurrence rates ranging between zero and 6-8%.

The Karydakis flap procedure was first described by George Karydakis [6] in 1973 and has frequently been used to treat sacrococcygeal PS. The KF achieves symmetric closure of the pilonidal wounds by avoiding placement of the wound in the midline at the depth of the natal cleft and also flattens the cleft, thereby reducing hair accumulation and mechanical irritation and decreasing recurrence.

Karydakis reported a recurrence rate of 1%, a complication rate of 8%, and a length of hospital stay of 3 days. In a similar study, Sözen et al [7] reported a recurrence rate of 1.5% and a complication rate of 6%. In our series, no recurrence was observed in either group. In the KF group, the complication rate was 10%, and the mean duration of hospital stay was 3 days.

Wound infection, fluid collection, edema, hematoma and wound separation can occur after use of the Karydakis flap procedure and other surgical techniques. The use of drains after surgery can be used to prevent fluid accumulation, edema and hematoma formation in such cases. Gurer et al [5] reported that fluid accumulation is reduced after the routine use of post-operative drains.

In our study, recurrence was not observed in either group; in addition, time to discharge from hospital and complication rates were similar to values reported in the literature. The Limberg flap group had lower mean time to hospital discharge and lower wound infection rates than the KF group. In addition, comparison of the two groups showed a difference in terms of flap edema and hematoma.

A Cochrane overview has been performed to provide evidence-based guidance for surgical treatment. The review concluded that off-midline closure (including rhomboid, Karydakis and Bascom flaps) is the best choice if the sinus is to be excised and sutured, and this closure is associated with shorter hospital stay and the lowest recurrence rates.[8]

Other important points in the treatment of pilonidal sinus surgery are return to daily activities and work, postoperative pain score (VAS), duration of operation, time sitting on the toilet, and patient aesthetic satisfaction. In patients with recurrence and large defects, undergoing flap procedures can reduce aesthetic satisfaction. Karaca et al [9] reported that the Limberg Flap group provided better postoperative pain score (visual analogue scale: VAS), complication rate, time to discontinuation of analgesics, and painless sitting than the KF group, Can et al showed that mean operation time for the Karydakis flap procedure

was  $49 \pm 7$  minutes, compared with  $52 \pm 5$  minutes for the Limberg flap procedure. In our study, the LF group exhibited a lower VAS score (2/4), higher patient satisfaction (2.8/1.43), earlier first mobilization (1/2 days) and more painless toilet sitting. (1/2 day). These patients also had shorter complete healing time (22/24 day) than the KF group ( $p \leq 0.001$ ). On the other hand, the KF group had a shorter operation time than the LF group (48 and 54 minutes, respectively) ( $p = 0.001$ ).

The Limberg flap procedure is a safe choice for the surgical treatment of sacrococcygeal recurrent pilonidal sinus disease due to its low complication rate, short length of hospital stay, early return work, low VAS score, high patient satisfaction and shorter complete healing duration. Therefore, we recommend the Limberg flap procedure for the treatment of recurrent pilonidal sinus disease.

Today, considering the importance of time and rapid return to work and life activities, the off-midline approach is recognized as the best surgical technique, which can lead to full recovery within 1–12 days. The ultimate goal of treatment is improved wound healing, low relapse rate, short length of hospitalization, fewer complications, and high patient satisfaction. The results of the present study showed that the mean total recovery time after surgery was 12 days for the Limberg flap technique and 16 days for the Karydakakis flap technique. In similar studies, such as the one performed by Bali et al [10], duration of recovery was 22.12 days, and the full recovery time was 24.08 days in the Karydakakis flap group.

The mean score of postoperative pain was approximately similar in patients undergoing Limberg and Karydakakis flap surgeries. In a similar study, pain was significantly lower after the Limberg flap surgery. The present study showed that 8.6% of patients undergoing Limberg flap surgery had at least one postoperative complication. On the other hand, complications following Karydakakis flap surgery were detected in 94.3% of the patients. The recurrence rate was 2.9% in the Limberg flap group and 11.4% in the Karydakakis flap group.

Bessa et al [11] in a trial involving 120 patients undergoing a modified Karydakakis flap surgery, reported significantly less wound dehiscence compared with patients undergoing a modified Limberg flap surgery (0 patients vs. 9 patients). Patients undergoing the modified Karydakakis flap surgery showed, compared to the other group, similar total rates of complications (23% vs. 40%), wound infections (3% vs. 5%), subcutaneous fluid collection (5% vs. 0%), and hypoesthesia (10% vs. 23%). However, no significant difference in the rates of recurrence was found between patients treated with the modified Karydakakis flap technique

and those treated with the modified Limberg flap technique (3% vs. 2%).

For our cases, we used incision and drainage of the abscessed bladders followed by excision (Open or with Primary Closure) and marsupialization. Clear criteria for selecting the treatment method do not exist. Nevertheless, it is emphasized that Primary Closure should be used in small, uncomplicated bladders and the open excision in larger bladders.

After incision and drainage of the bladder has been performed, and after inflammation has subsided, a permanent treatment can be applied. Based on our 70 observed surgical cases, marsupialization is the surgical method of choice as it had a low percentage of recurrence and an acceptably short healing period. It should be noted that selecting marsupialization as a treatment method presupposes the absence of inflammation and that the case is not a recurrence. In apparently large, inflamed and recurrent situations, we should prefer the Open Excision, where the healing time is longer but the percentage of success is greater.

The maceration and wound infection rates have been statistically higher in the classical procedure than in the modified Limberg procedure. As far as the complications are concerned, in the present study wound infection and dehiscence were observed in 1 and 4 cases respectively. Further, one of the patients had a recurrence in the Limberg flap group. Herbert Mayo [12] described PS in detail for the first time in 1833. This chronic, infectious, benign disease of the sacro-coccygeal region is more common in males than in females. We also observed that it was more common in males than females.

The results of this study show that PMC is preferred among female patients compared to the other operations. We think this is due to cosmetic concerns. PMC is still important as a treatment method for many surgeons. However, it should be noted that the recurrence rates due to inadequate excision are highest in PMC.

Various studies have been carried out and the results have been compared. It was concluded by Allen-Mersh in 1990 [13] that off midline closure with flap techniques are better when compared to excision and primary closure and wide excision with secondary healing in terms of healing time and rate of recurrence. The goal of these flap techniques is to prevent the midline recurrences by removing the cavity in the natal cleft.

Several flap techniques have been described with recurrence rates ranging between zero and 6–8%, with Karydakakis and Limberg flap techniques having the lowest recurrence rates (0%–4.6%). In this study, there was a male predominance in both groups with (80%) in Limberg and (91.4%) in

Karydakias, the age of patients ranges from 26 - 30 years with a mean±SD of (26.23 ± 4.99) in Limberg and (28.43 ± 5.43) in Karydakias with no significant difference between both groups regarding demographic data. This agrees with Bahar and his co-workers who studied the management of 74 patients with pilonidal disease with an age mean of (24.7±2.76) and (24.8±3.89) years in his two study groups and a male predominance of 66%.

In Ates et al [14] study on 135 patients operated via The Karydakias flap and 134 patients via Limberg flap, stating that Karydakias flap patients versus Limberg flap patients were complicated with wound dehiscence. It also reported Karydakias flap patients with postoperative wound infection versus in the Limberg group. This denotes that wound infection and wound dehiscence were observed more with the Limberg group which supports our findings.

According to our thesis, recurrence was 2.9% in Limberg and 11.4% in Karydakias. Recurrence percentage is less in Limberg. Finally, regarding patient satisfaction, Limberg achieved a higher patient's satisfaction in comparison to Karydakias that achieved a lower patient's satisfaction. There was significant difference between Limberg flaps versus Karydakias flap regarding patient satisfaction.

### Conclusion

The Karydakias and Limberg flaps are effective treatments for pilonidal sinus illness, with the Karydakias flap resulting in reduced operational time, reduced wound disruption, and improved patient satisfaction. However, the Limberg flap has been linked to reduced complication rates, shorter hospital stays; earlier work return, lower pain scores, higher patient satisfaction, and faster full healing. Therefore, the Limberg flap should be the standard approach for treating IPD patients, rather than the Karydakias flap procedure.

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