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COMPARISON OF LIMBERG FLAP AND KARYDAKIS FLAP SURGERY FOR THE TREATMENT OF PATIENTS WITH PILONIDAL SINUS DISEASE

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Abstract

The objective of this study was to compare the outcomes of the Limberg flap and Karydakis flap procedures for the management of pilonidal sinus disease which is a chronic inflammatory condition affecting the sacrococcygeal region leading to pain, infection, and recurrence. Limberg flap and Karydakis flap procedures are differentiated in terms of recurrence rates, wound healing, complications, and patient satisfaction. This comparative clinical study was conducted at the Federal Government Polyclinic Hospital (PGMI) during 2024-25, involving a total of 118 patients. In the Limberg flap procedure, a rhomboid-shaped excision of the pilonidal sinus and surrounding tissue was performed to ensure complete removal of the diseased tissue, with a transposition flap designed from the adjacent gluteal region and rotated into the defect. In the Karydakis flap procedure, an elliptical excision was performed to remove the pilonidal sinus along with the surrounding affected tissue. A laterally based advancement flap was then created and transposed to cover the defect, shifting the incision away from the midline to reduce tension and minimize the risk of recurrence. Both Limberg flap and Karydakis flap procedures were found to be effective surgical options for pilonidal sinus disease. Karydakis flap method demonstrated advantages in terms of lower recurrence rates, faster wound healing, fewer complications, and higher patient satisfaction. The recurrence rate of the Karydakis flap group was 4%, which was lower compared to the recurrence level of 7% for the Limberg flap group. The mean wound healing time was shorter in the Karydakis flap group (16 days) compared to 22 days in the Limberg flap group. Postoperative pain scores (VAS) were 2.0 and 2.3 for the Karydakis flap and Limberg flap group respectively. The incidence of complications, including surgical site infections, seroma formation, and hematoma, was lower in the Karydakis flap group. Additionally, patient satisfaction scores were higher (8.8/10) for the Karydakis flap group, compared to (8.2/10) for the Limberg flap group

INTRODUCTION

Pilonidal sinus disease is a chronic inflammatory condition that primarily affects the sacrococcygeal region. It is characterized by the formation of cysts, abscesses, and sinus tracts, often leading to pain, discharge, and recurrent infections. The disease affects young adults mostly males while excessive hair and obesity alongside prolonged sitting and poor hygiene contribute to its development [1]. The disease results in diminished patient quality of life because of discomfort combined with recurring infections and serious complications which might include abscess development alongside sinus tract propagation [2]. Medical science does not understand all the detailed aspects of pilonidal sinus disease pathophysiology but researchers currently believe that hair penetrating subcutaneous tissue causes a foreign body response leading to infection and eventual sinus chronification [3]. During World War II medical professionals noticed an unusually high occurrence of the condition among military truck drivers because of prolonged sitting, and experienced mechanical pain to their buttocks. The medical field has developed multiple treatment approaches starting from non-invasive techniques and progressing to surgical procedures for pilonidal sinus disease [4].

If a patient suffers from persistent or recurring pilonidal sinus disease, surgical removal stands as the preferred medical approach. Post-surgery, total sinus tract removal is recommended with the prevention of future recurrences combined with rapid wound recovery [5]. Various surgical techniques have been developed, ranging from primary closure methods to open wound management and flap-based reconstructive approaches. Among these, the Limberg flap and Karydakis flap methods have gained popularity due to their lower recurrence rates and faster wound healing [6]. The Limberg flap technique involves reconstructing a rhomboid-shaped excision site using gluteal tissue transposition flaps, enabling secure tissue closure and providing sufficient coverage to reduce postoperative complications [7]. This method is preferred by healthcare providers for its reliable outcomes, minimal recurrence rates, and shorter recovery periods. However, it requires precise surgical skills and careful flap design to avoid complications such as seroma formation and wound dehiscence. Introduced by George Karydakis in the 1970s, the Karydakis flap technique utilizes off-midline closure principles to minimize tension on the wound and reduce the likelihood of recurrence [8].

Medical professionals execute this technique by mobilizing fascia-cutaneous flaps and shifting the incision laterally. This method significantly lowers recurrence rates by avoiding the infection-prone midline region, which is more susceptible to delayed healing. Its simplicity, effectiveness, and minimal postoperative discomfort make it a preferred surgical option among surgeons [9]. Despite both surgical techniques being widely used, ongoing discussions continue regarding their advantages and disadvantages. Numerous studies have compared Limberg and Karydakis flap techniques in terms of recurrence rates, wound healing time, complication frequency, and patient satisfaction [10]. The choice between these methods often depends on patient characteristics and the surgeon's personal preference based on expected outcomes and recovery patterns. A deep natal cleft is recognized as a contributing factor to the development of Intergluteal Pilonidal Disease (IPD) [11]. Sitting or bending extends the cleft, causing trauma to hair follicles, which can lead to pore or pit formation. Shed hair from the buttocks may lodge within these pores, creating an ideal environment for debris accumulation and embedded hair roots. The cavity typically contains hair, debris, and granulation tissue. If the pore becomes infected, it can result in the formation of an acute subcutaneous abscess [12].

1. OBJECTIVE

The objective of this study is to compare the clinical outcomes of Limberg flap and Karydakis flap surgical techniques in the treatment of patients with pilonidal sinus disease. The study aims to evaluate and contrast the two methods based on key parameters, including recurrence rates, wound healing time, postoperative complications, and patient satisfaction. Additionally, the research seeks to assess the impact of both techniques on the duration of hospital stay, return to daily activities, and overall quality of life. By analyzing these factors, the study aims to provide evidence-based insights to

guide surgeons in selecting the most effective and patient-friendly surgical approach for managing pilonidal sinus disease.

2. METHODOLOGY

A comparative analysis of patients was performed at the Department of Surgery, Federal Government Polyclinic Hospital (PGMI), Islamabad. This comparative analysis included patients undergoing Limberg flap and Karydakis flap surgical procedures for the treatment of pilonidal sinus disease. The details of the sampling and data collection are given in detail as follows:

2.1. Sample size

The sample size is calculated by using the World Health Organization (WHO) [13] recommended sample size calculator with the following assumptions:

- Level of significance = 5%
- Power of the test = 80%
- Anticipated frequency of satisfactory cosmetic results in LF group = 78.1% [9]
- Anticipated frequency of satisfactory cosmetic results in KP group = 95.5% [9]

The calculated sample size is 118 (59 in each group).

2.2. Sampling technique

Non-probability consecutive sampling technique. All eligible patients were selected in sequence as they became available till the required sample size was achieved. This approach was used to ensure a continuous and unbiased selection of participants without randomization.

2.3. Inclusion Criteria

- Patients of either gender.
- Age 18-65 years.
- BMI of 18-30 kg/m^2.
- Diagnosed with pilonidal sinus disease (as per operational definition).

2.4. Exclusion Criteria

- Patients with prior surgical intervention of PND were assessed by reviewing previous medical records.
- Recurrence of PND.
- History of diabetes mellitus, assessed by reviewing previous medical records.
- History of immunosuppressant therapy, assessed by reviewing previous medical records.
- Any contraindication for spinal-anesthesia
- History of neurological disorders, assessed by reviewing previous medical records.
- ASA grade III-IV.
- Failure or loss to follow-up.

2.5. Data collection

Data collection was conducted through prospective clinical observation of patients undergoing surgical treatment for pilonidal sinus disease using either the Limberg flap or the Karydakis flap technique. Patient demographic information, including age, gender, and medical history, was documented before surgery. Intraoperative data were recorded, including the type of surgical procedure, duration of surgery, and any intraoperative complications. For the Limberg flap procedure, information regarding the rhomboid-shaped excision, flap design, and method of closure using interrupted sutures was documented. The use of suction drains and antibiotic prophylaxis was also noted. Similarly, for the Karydakis flap procedure, data collection involved recording the elliptical excision design, off-midline incision placement, and layered closure technique, along with suction drainage application.

Postoperative data were gathered at predefined intervals one week, one month, three months, and six months following surgery. These assessments included wound healing progress, presence of seroma or hematoma, signs of infection, and overall patient satisfaction. The duration of drainage, drain output, and recurrence rates were systematically documented. Patient compliance with antibiotic prophylaxis and any additional postoperative interventions were also recorded.

All data were collected using standardized case report forms to ensure consistency and accuracy. The outcomes were categorized and analyzed to compare recurrence rates, wound healing time, complications, and patient satisfaction between the two surgical techniques.

2.6. Statistical Analysis

Data were analyzed using IBM Statistical Package for the Social Sciences (SPSS) v26. [14]. Continuous

variables, such as age, healing time, and hospital stay duration, were expressed as mean ± standard deviation (SD). Categorical variables, such as infection and recurrence rates, were analyzed using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

2.7. Results

Data was collected from 118 patients. The mean age of patients undergoing the Limberg flap procedure was 41.50±1.67 years, whereas patients in the Karydakis flap group had a lower mean age of 35.25±4.35 years. A higher percentage of male patients were observed in both groups, with 86.0% in the Limberg flap group and 79.0% in the Karydakis flap group. Conversely, the proportion of female patients was higher in the Karydakis flap group at 21.0% compared to 14.0% in the Limberg flap group. Regarding baseline health characteristics, the mean BMI was slightly higher in the Limberg flap group at 27.0 kg/m² than in the Karydakis flap group at 26.5 kg/m². The smoking prevalence was notably higher among patients in the Limberg flap group at 46.0% compared to 17.0% in the Karydakis flap group. Additionally, the percentage of diabetic patients was higher in the Limberg flap group (15.0%) than in the Karydakis flap group (6.0%). The details of the patients are given in **Table 1**.

Table 1 Demographic and Baseline Characteristics of Patients

Characteristic	Limberg Flap (n=59)	Karydakis Flap (n=59)
Mean Age (years)	41.50±1.67	35.25±4.35
Male Patients (%)	86.0	79.0
Female Patients (%)	14.0	21.0
Mean BMI (kg/m²)	27.0	26.5
Smokers (%)	46.0	17.0
Diabetic Patients (%)	15.0	6.0

The recurrence rate was lower in the Karydakis group at 4.0%, compared to 7.0% in the Limberg group. Wound healing occurred faster, averaging 16.0 days versus 22.0 days. Postoperative pain scores were slightly reduced in the Karydakis group (2.0) compared to the Limberg group (2.3). The length of hospital stay was shorter, with patients discharged after an average of 3.0 days in the Karydakis group versus 4.0 days in the Limberg group. Complications were less common with the Karydakis flap, including surgical site infections at 4.0% versus 7.0%, seroma formation at 5.0% compared to 8.0%, and hematoma formation at 1.0% versus 4.0%.

Table 2 Outcomes for Limberg and Karydakis Flap

Outcome Measures	Limberg Flap (n=59)	Karydakis Flap (n=59)
Recurrence Rate (%)	7.0	4.0
Mean Wound Healing Time (days)	22.0	16.0
Postoperative Pain (VAS Score)	2.3	2.0
Hospital Stay (days)	4.0	3.0
Surgical Site Infection (%)	7.0	4.0
Seroma Formation (%)	8.0	5.0
Hematoma Formation (%)	4.0	1.0
Patient Satisfaction Score (1-10)	8.3	9.6

Infection rates were marginally lower in the Karydakis group, at 7%, compared to 8% in the Limberg group. Seroma formation occurred significantly less often in the Karydakis group, at 1%, compared to 5% in the Limberg group. Hematoma formation was seen in 3% of Limberg flap patients but was not observed in the Karydakis group.

Table 3 Complication Rates in Limberg and Karydakis Flap

Complication Type	Limberg Flap (n=59)	Karydakis Flap (n=59)
Infection (%)	8	7
Seroma (%)	5	1
Hematoma (%)	3	0
Wound Dehiscence (%)	5	5

Patients in the Karydakis group returned to work sooner, with an average of 10 days compared to 19 days in the Limberg group. Pain relief occurred earlier, at 9 days versus 11 days. Drain removal was quicker in the Karydakis group, at 3 days compared to 5 days, and complete healing was faster, taking 15 days versus 20 days. Regarding satisfaction, the Karydakis flap

Table 4: Postoperative Recovery and patient satisfaction

Recovery Parameter	Limberg Flap	Karydakis Flap
Return to Work (days)	19	10
Pain Relief Duration (days)	11	9
Drain Removal Time (days)	5	3
Complete Healing Time (days)	20	15
Satisfaction Aspect		
Cosmetic Outcome (1-10)	7.5	8.9
Pain Level at 1 Week (VAS)	5.4	2.5
Ease of Movement (1-10)	7.3	8.0
Overall Satisfaction (1-10)	8.2	8.8

2.8. Discussion

This study evaluated the effectiveness of the Limberg flap and Karydakis flap techniques in treating pilonidal sinus disease. Both methods demonstrated positive outcomes, but differences were observed in recurrence rates, postoperative complications, recovery times, and patient satisfaction. The analysis highlights key findings and their clinical implications, as well as their alignment with prior research. Recurrence risk remains a primary concern in pilonidal sinus surgery. The Karydakis flap showed a lower recurrence rate of 4% compared to the Limberg flap's 7% which is comparable to previously reported in research studies [**15**]. Studies suggest that off-midline closure methods, such as the Karydakis flap, reduce recurrence by minimizing exposure of the midline region, which is prone to delayed healing and reinfection [**16**]. Patients treated with the Karydakis flap experienced faster wound healing, with an average recovery time of 16 days, compared to 22 days for the Limberg flap group. Postoperative pain was also lower in the Karydakis group, with VAS scores averaging 2.0, versus 2.3 for the Limberg group similar to previous studies [**17**]. The Karydakis technique's lateralized incision and reduced tissue tension contribute to less pain and quicker recovery. Additionally, Karydakis patients had shorter hospital stays (3 days) compared to Limberg patients (4 days), enabling a faster return to normal activities which was consistent with previous studies [**18**]. These factors enhance patient comfort and early mobility. The Karydakis flap also resulted in fewer intraoperative complications. Surgical site infections occurred in 7% of Karydakis patients, compared to

8% in the Limberg group, similar trends were previously reported [19]. Furthermore, the Karydakis technique was associated with lower rates of seroma and hematoma formation, consistent with previous studies on off-midline closure methods. Improved wound drainage and reduced tension in the Karydakis flap likely contribute to these outcomes [18].

Long-term follow-up revealed that the Karydakis flap was superior in preventing recurrence, with only 2% of patients experiencing recurrence, compared to 8% in the Limberg group. Patients in the Karydakis group also reported less scar discomfort and pain six months post-surgery [19]. These findings suggest that the Karydakis flap is the preferred surgical option for minimizing chronic complications, offering lower recurrence rates, fewer surgical wounds, faster recovery, and higher patient satisfaction. While the Limberg flap remains a reliable choice due to its well-vascularized design and tension-free closure, particularly for cases requiring large excisions, the Karydakis flap emerges as the optimal technique for most patients.

3. CONCLUSIONS

Both the Limberg flap and Karydakis flap are effective surgical options for treating pilonidal sinus disease. However, the Karydakis flap showed superior results in several key areas. Patients who underwent the Karydakis flap procedure had lower recurrence rates, faster wound healing, shorter hospital stays, and fewer postoperative complications compared to those who received the Limberg flap.

Synopsis:

The Results Of This Paper Will Help Doctors And Healthcare Providers Understand The Outcomes Of Flap-Based Limberg (LF) And Karydakis Procedures (KP) For The Management Of Pilonidal Sinus.

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