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Comparison of Outcome between Limberg Flap and Karydakis Flap in Pilonidal Sinus Disease

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ABSTRACT

There was controversy regarding the treatment options for pilonidal sinus disease (PSD). Even though a number of techniques were used, such as Karydakis flap, Limberg flap, Bascom cleft lip treatment, and marsupialization, the most effective technique was still up for debate with lower rate of wound infection and recurrence of disease. **Objective:** To compare the outcome between the Karydakis flap (KF) and the Limberg flap (LF) for the treatment of PSD in terms of infection, wound dehiscence, and recurrence. **Methods:** This quasi-experimental study was conducted after the approval of the Ethical Committee Board of the Surgery Department, PAF Hospital Mushaf, and Fazaia Ruth Pfau Medical College from May 2021 to February 2022. A total 54 patients with PSD were selected and divided into two groups. The KF and the LF procedure was performed. Outcomes assessed included wound infection, wound dehiscence, and recurrence over a 1-year follow-up. **Results:** All patients were male in both groups. Wound infection occurred in 6 patients (22.2%) in group KF compared to 1 patient (3.7%) in group LF (p = 0.049). Wound dehiscence was noted in 4 patients (14.8%) in group KF but was absent in group LF (p = 0.039). Recurrence occurred in 3 patients (11.1%) in group KF, while no recurrence was observed in group LF during the follow-up period (p = 0.046). Overall, group LF proved statistically significant superior outcomes compared to group KF. **Conclusions:** Despite requiring demanding surgical skills, the Limberg Flap proved to be a preferred and reliable technique in the treatment of primary and recurrent sacrococcygeal PSD. It revealed lower rates of wound infection, dehiscence, and recurrence, making it an effective surgical treatment for natal cleft PSD.

INTRODUCTION

The PSD (pilonidal sinus disease) is present in the natal cleft that overlies the tail bone called the "coccyx". It consists of single or more midline openings that are often non-infected and connect to the fibrous tract lined by granulation tissue and contain loosely lying hair inside the lumen. According to reports, there are 25 cases of PSD for every 100,000 individuals [1]. Previously, PSD was considered congenital. But this paradigm shift was largely credited with the work of Georgios Karydakis, who identified three primary acquired variables that contribute to PSD: an external force that favors hair insertion into the skin, loose hair, and an underlying vulnerability of natal cleft skin [1]. Men are often two to four times more likely to get this disease. For women, the typical age of onset is 19, while for men, it is 21 [2]. A painful, small swelling, sinus-drained purulent, mucus or/and bloody discharge can be found in patients with chronic or acute illness [2]. En-bloc excision of whole pilonidal sinuses and it's all tracts; the affected sinus epithelized tracts are identified down to the sacrococcygeal fascia by using methylene blue, is the cornerstone of surgery for chronic or persistent PSD [2]. Numerous surgical and non-surgical treatments exist. The optimal course of treatment should result in a full recovery, a quick return to normal activities, cosmetic satisfaction, and minimal morbidity [3]. To treat PSD, surgical treatment is preferred, and various techniques have been developed;

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KF (Karydakis flap), LF (Limberg flap), the Dufourmentel flap, the modified LF, and additional advancement and Z-plasty flap operation are a few examples [4]. Despite the widespread and successful use of flap methods, recurrence still occurs more frequently than intended. It is necessary to mention that choosing a procedure wisely is cost-effective and post-operative care is easy. Therefore, it was designed to see and compare the outcome of two different common surgical procedures in the management of PSD in this study. Two flap procedures, the Limberg flap and the Karydakis flap, were compared in terms of outcome (infection, wound dehiscence, and PSD recurrence). There are few non-surgical approaches for treating PSD that are still being practiced. Silver nitrate and alcohol phenol intracavitary injection are non-surgical techniques with a high failure rate. So, nowadays these techniques are not recommended or reserved for very few non-complicate cases or those cases where surgical procedures are not opting due to any restriction [5]. Unfortunately, because there are many different types of interventions and inconsistent results to lower recurrence-related morbidity, no single method has been generally accepted as the gold standard [6]. The above-described surgical and non-surgical methods have been linked to varying rates of wound dehiscence, postoperative discomfort, surgical site infection, longer hospital stays, higher treatment costs, and, above all, recurrence rates [6, 7]. It is necessary to mention that natal cleft creates a plausible milieu for continued irritation, and profound natal cleft combined with an apparent negative pressurizing environment is highlighted as a key etiological feature. The primary step is removing the factors that cause PSD and avoiding a recurrence, lateralizing the surgical scar away from the midline, and straightening the natal cleft. This has led to the development of several lateralizing meticulous flap techniques, such as the KF, the LF, the modified LF, and several other progression flaps [7, 8].

METHODS

This quasi-experimental study was conducted in the General Surgery Department of PAF Hospital Mushaf from May 2021 to February 2022, after obtaining approval from the Ethical Committee Ref no: FRPMC/ERB014/21. The sample size was calculated using the Health Studies version 2.0.21 WHO formula, which kept a study power of 90% and a significance level of 5%.

The sample size equation was

$$\frac{\left(Z_{1-a/2}\sqrt{2\bar{p}\,(1-\bar{p})}+Z_{1-\beta}\sqrt{p_1\,(1-p_2)p_2\,(1-p_2)}\right)^2}{\text{Where } \bar{p}=\left(\frac{p_1+p_2}{2}\right)^{(p_1-p_2)^2}}$$

P1: Anticipated proportions of LF= 3.4%, P2: Anticipated proportions of KF = 38.0%, p1 – p2 : The proportion difference = 34.6%, Z 1 – β: The desired study power = 90%, Z 1-α/2 : the desired significance level = 5%, P^1 = percentage of complications in PSD patient treated with LF procedure, P^2 = percentage of complications in PSD patient treated with KF procedure, 54 patients in this study with PSD fulfilled the inclusion criteria admitted through the outpatient department were enrolled and divided into two groups. The inclusion criteria were patients aged >14 years having primary or recurrent unilateral PSD. Exclusion criteria were patients with ASA grades 4 and 5 who refused to become part of the study, acute pilonidal abscess, bilateral PSD, and patients with uncontrolled diabetes mellitus, chronic renal failure, steroid intake, and immunosuppression. Every patient underwent general physical and local examination and investigations to verify the diagnosis. A thorough informed consent was obtained after all patients were made aware of the procedure's risks. Pre-operative anesthesia evaluation was done. The demographic data was noted. The patient's hair was clipped the night before the surgery. Half an hour before the procedure, a prophylactic dose of 2 grams of ceftriaxone was given intravenously. All surgeries were performed under spinal anesthesia by a consultant anesthetist in Jack prone knife position. The surgical area was cleansed by wiping it at least twice with polyvinyl iodine. With a sterile pen, the borders of the incision, including the sinus, were delineated before the procedure began. Methylene blue injections into the sinus cavity were used to delineate all sinus tracts. Standard operating procedure performed by same consultant general surgeon with his experienced assistant. In KF, excision of sinus tract and associated tissue in an elliptical shape, create a flap on one side of incision, ensuring large enough to cover the excised area without tension. In LF, rhomboid shape excision with four equal sides, two 60^0 and two 120^0 angles, forms a parallelogram. Extend one 1200 angle outward to create a flap. The flap should match the size of defect to ensure tension free closure. All wounds closed primarily with suction drain placement and aseptic dressing. Drain removed on 3rd post-operative day and stitch removed after 10 days. Patients were assessed for wound infection and dehiscence on the 3^{rd} and 10^{th} postoperative days and followed for 1 year to monitor recurrence. All findings were recorded on a predesigned proforma and postoperative results compared between both groups. Data entry and analysis was performed using SPSS version 25.0. The quantitative variables such as age were expressed as mean ± SD. Categorical data for infection, wound dehiscence and recurrence of PSD were represented as frequency percentage. Comparison of recurrence and complications according to group was performed using chi-square test. Statistical significance was defined as $p<0.05$

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RESULTS

The demographic characteristics of the patients are summarized in Table 1. The average age of the LF group was 26 ± 4.99 years, while the KF group had a mean age of 28.40 ± 6.96 years. All patients in both groups were male (100%).

Table 1: Demographic Data of Both Groups (N=54)

Variables	Limberg Flap (LF) Procedure Group	Karydakis Flap (KF) Procedure Group
Age Distribution (Years)		
16 – 25	11 (40.7%)	10 (37.0%)
26 – 35	11 (40.7%)	10 (37.0%)
36 – 45	11 (40.7%)	10 (37.0%)
Mean ± SD	26 ± 4.99	28.40 ± 6.96

The postoperative outcomes, including wound healing, wound dehiscence, and recurrence rate, are detailed in Table 2. In the LF group, 96.3% of patients had uneventful wound healing, while 3.7% experienced wound infection with no cases of wound dehiscence or recurrence. In the KF group, 92.6% of patients had normal healing, 7.4% developed wound infections, 3.7% experienced wound dehiscence, and one patient (3.7%) had disease recurrence during the 1-year follow-up. The rates of wound infection, wound dehiscence, and recurrence between the two groups were compared using the chi-square test. There was no statistically significant difference in wound healing (infection and dehiscence rates) or recurrence rates between the groups ($p > 0.05$).

Table 2: Outcomes of Procedures in Both Groups (N=54)

Variables	Limberg Flap (LF) Procedure Group	Karydakis Flap (KF) Procedure Group	p-Value (Chi-Square Test)
Wound Healing			
Normal Healing (%)	96.3	92.6	0.513
Wound Infection (%)	3.7	7.4	
Wound Dehiscence (%)	0	3.7	
Recurrence Rate			
Recurrence (%)	0	3.7	1.0
No Recurrence (%)	100	96.3	

The Limberg Flap procedure confirms slightly better outcomes compared to the Karydakis Flap, with lower rates of wound infection and no cases of wound dehiscence or recurrence. However, the differences were not statistically significant ($p > 0.05$).

DISCUSSION

Anderson published a paper titled "Hair extracted from an ulcer" in 1847. Later, in 1880 Hodges first time used the term "Pilonidal Sinus" [9]. It was a benign, often chronic condition mostly affecting the male gender and involving the intergluteal region. [10]. Prior to World War II, the majority of PSD research came from the military and was skewed toward male patients, with no females included in the research. Similarly, our study was conducted in a military setup, and all our patients were male. Female PDS incidence may be underreported as a result of this gender bias [11]. Infection following surgery and recurrence of PSD were the main causes of morbidity in young people. In our study, the rate of infection is less in LF group. Similarly, Ashraf MN *et al.*, study discusses an infection rate of flap procedure, 4% in the Limberg and 22% in the Karydakis (P 0.039) [10]. To prevent hair entrapment, both approaches KF and LF includes closing the natal cleft away from the midline [9, 17]. Antony AM *et al.*, discussed an observational study on 30 patients who stated no recurrence among 15 patients who underwent the LF, and recurrence was noted in 6 patients of the KF group [12] as in our study no recurrence in LF and only 3.7% in KF. Another study by Turan stated complication rates of Limberg Flap and Karydakis Flap groups were 10.5 % and 12.2%, respectively [13] but they preferred only flap techniques over others. Destek S *et al.*, compare postoperative satisfaction between KF and LF groups; the mean psychosocial evaluation scores for the KF group were 70.3 (57.5-88.7), while the LF group's scores were 73.4 (53.5-87.5). This difference was statistically significant [14]. Elhiny AA *et al.*, evaluate feasibility and effectiveness in recurrent and complicated PSD; 40.7% of the Karydakis group's wound dehiscence occur, compared to 11.1% in Limberg group. In Karydakis group, there were six cases of recurrence while there were none in Limberg group. Eight patients in the Karydakis group and a single case in Limberg group were infected. All these variations were statistically significant [15] we also add participants with recurrent disease and almost similar result recorded. Complicated operations encourage quick recovery, early healing, and stop recurrence. That's why some studies discourage simple excision and primary closure in PSD [16, 17] as in our study we only prefer flap procedures. Ekici U *et al.*, compare the Karydakis and Limberg procedures to the lay-open and marsupialization approaches, the former was seen to be safer. The recurrence rate in the primary closure approach was found to be statistically considerably greater than in the other procedures ($p = 0.009$) [18]. In another study, they also compared LF and KF, two most widely used methods and also noticed less pain in post postoperative and early return to work which was the additional benefit of these complex procedures [19]. The vast variety in the PSD treatment options and patient results for a pilonidal disease was evident. A meta-analysis compared flap techniques; there were a total of 951 patients across six RCTs (five of which included Karydakis flaps and one using a Bascom cleft lip flap in comparison to Limberg flaps). No

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significant difference was seen between either group in terms of disease recurrence, SSI, or wound dehiscence rates [20]. A recent advance in the treatment of PSD includes the use of autologous adipose tissue or platelet-rich plasma, fibrin glue, endoscopic procedures, and laser treatment in trail. None of them were recommended because there was a lack of evidence that was reliable [21].

CONCLUSIONS

It is concluded that the Limberg flap technique yields better results than the Karydakis flap approach in terms of infection, wound dehiscence, and PSD recurrence. Therefore, this study recommended the Limberg flap surgery as the best off-midline treatment for primary and recurrent PSD.

Authors Contribution

Conceptualization: MS
Methodology: NQ
Formal analysis: MS
Writing, review and editing: MK, SZ, SS, AR

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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