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ORIGINAL ARTICLE

Effectiveness and Feasibility of Limberg and Karydakis Flap in Recurrent and Complicated Pilonidal Sinus Disease

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Abstract

The aim of this study is to evaluate the effectiveness and feasibility of Limberg and Karydakis flap in complicated and recurrent cases of pilonidal sinus**.** This study was performed on 54 patients with complicated or recurrent (PSD) who referred to Minya University Hospital from January 2018 to January 2019**.** Patients were randomly divided into two groups, group A who were subjected to the Limberg flap and group B who were subjected to the Karydakis flap technique. Regarding postoperative complications, the occurrence of wound breakdown in the Karydakis group was 40.7% versus 11.1% in the Limberg group. No recurrence occurred in the Limberg group but recurrence observed in six cases in the Karydakis group. In the Karydakis group, eight patients had infection in comparison to one case in the Limberg group. All these differences were statistically significant. The overall patient satisfaction in the Limberg group was significantly higher than that in the Karydakis group. It is concluded that Limberg flap rotation is clearly preferred in management of recurrent and complicated PNS for safety reasons given its low recurrence and postoperative complication rates.

Keywords Limberg flap · Kardakis flap · Recurrent · PNS

Introduction

Pilonidal sinus disease (PSD) is a chronic inflammation and infection of the sacrococcygeal or intergluteal region. It is commonly affects young adult males after puberty. Patients usually presents with swelling, abscess, and discharge in sacrococcygeal region or painful sinus tract in the natal cleft [1, 2].

The etiology and pathogenesis of PSD are not clear [3, 4]. The pathogenesis of the disease is hypothesized to be related to deep natal cleft associated with other favorable factors such as sweating, maceration, poor personal hygiene, bacterial contamination, and penetration of shed hair shafts through the skin in the intergluteal region, which resulting in foreign body reaction, leading to abscess and sinus formation [5, 6]. Male sex, family history, sedentary lifestyle, obesity, and jobs that require sitting for long hours are among the listed risk factors [7].

Although many treatment methods have been described for the treatment of PSD, an ideal treatment has not been determined until now due to high rate of recurrence, infections, and delayed wound healing [8]. A number of surgical options are available. The simplest are incision and drainage, laying open, open excision, excision, and primary closure [9]. Simple excision techniques are associated with high morbidity and recurrence (0–5%) due to presence of natal cleft which provides a portal for hair entry starting the vicious circle of abscess formation, and discharging sinuses begins [10]. Accumulation of dead tissue or debris in the intergluteal cleft, sweating, friction, and poor hygiene are predisposing factors for recurrence [11].

The more complex surgical options include Kardaykis and rhomboid excision with Limberg flap. The purpose with these methods is to prevent recurrence through removing the cavity in the natal cleft and lateralization of the midline. It is achieved with the Karydakis flap (KF) by moving the suture laterally,

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while in the Limberg flap (LF) operation by flattening the natal cleft with a full-thickness flap [12].

The objective of this study is to evaluate the effectiveness and feasibility of KF and LF in complicated and recurrent cases of pilonidal sinus.

Patient and Methods

This study was performed on 54 patients with complicated or recurrent (PSD) who referred to Minya University Hospital from January 2018 to January 2019. This study is a prospective, comparative study using randomized controlled trial (RCT).

Patients with complicated or recurrent pilonidal sinus were included in the study. Patients were considered they have complicated pilonidal sinus when the patient have multiple sinuous orifices in the sacrococcygeal region; large wound dehiscence after previous surgical interference (Fig. 1); large external opening of the pilonidal sinus; sinuses localized laterally of the midline (Fig. 2), while the diagnosis of recurrent PSD was made based on clinical features no matter what the first operation was. Thirty six patients were referred to us with recurrence following primary surgery while there was 18 patients had complicated disease.

The exclusion criteria were cases with incomplete patients' data, patients who were lost to follow-up, patient presenting with different conditions mimicking PNS, and patients with chronic conditions such as immunosuppression and diabetes mellitus.

Sample size was calculated according to the following formula [13]:

$$N = \frac{2 \times \left(Z_{\frac{\alpha}{2}} + Z_{\beta}\right)^2 \times (1 + (k-1)\rho)}{k \times \left[\frac{(\mu_1 - \mu_2)}{\sigma}\right]^2} = 20$$

where $\alpha = 0.5$, $\beta = 0.1$, $\mu_1 = 2$, $\mu_2 = 4$, $\sigma = 2$, $K = 4$, $\rho = 0.9$.

Then, we added additional number, about 20% of the calculated sample to guard against drop out. All patients who met the inclusion criteria were selected. All details of both the procedures were explained to all the patients and then they agreed for being randomized. Written consent from the patients was obtained after that.

An independent clinician was responsible for generating a random allocation sequence that kept hidden from all the trial participants. Based on type of operation, the participants were assigned equally into two groups using a computer-generated block randomization technique. The printed letters were folded several times and placed within an aluminum foil. The letter placed inside an opaque sealed and stapled envelope, including patient's identification code, name, time, and date. The type of treatment was masked for the patient (single-blinded technique).

Patients were randomly divided into two groups:

- Group A: this group included 27 patients who were subjected to the Limberg flap technique.
- Group B: this group included 27 patients who were subjected to the Karydakis flap technique.

Surgical Procedure

Patients were placed in the prone position under general or spinal anesthesia. Intravenous 1 g of ceftriaxone was administered as antibiotic prophylaxis. In group A, the area of the sinus was marked in the shape of a rhomboid and the rotation (Limberg) flap was drawn to the site of sinuses. The rhomboid excision was carried down to the pre-sacral fascia. The subcutaneous tissue was approximated with absorbable sutures.

Fig. 1 Limberg flap

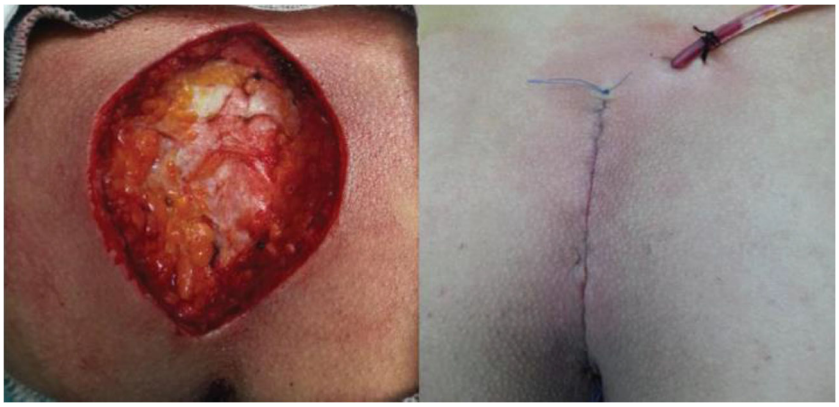

Fig. 2 Karydakis flap

Suction drains were placed in all patients (Fig. 1). While in group B, the Karydakis flap was performed as an asymmetrical elliptic excision was done, lower and upper ends being located at approximately 2 cm lateral to the natal cleft, and all defective tissues were removed until reaching to the healthy borders. After that, the medical wound edge was mobilized, and the flap was slid by suturing to the fascia and skin suitable wound layers on the lateral wound edge corresponding to one another. The subcutaneous tissue was closed with 2-fold 2/0 polyglactin suture, and the skin was closed with 3/0 polypropylene mattress suture. In all patients, a suction drain was applied to the region (Fig. 2).

The demographic data of the patients included in the study were recorded. Preoperative presence of an infection or abscess; number and outcome of previous surgery in recurrent cases; operative time; hospital stay; time of drain removal and early postoperative complications: wound site infection, seroma, discharge, and wound dehiscence; recovery time, time to return to work; and patient satisfaction were recorded. Follow-up was scheduled for all patients as visits at 3 and 10 days following discharge and once at the end of 1, 3, 6, and 12 months after the operation. Preoperative evaluation of this area with a sinogram was performed routinely to look for any branching of the tract.

Ethical Approval

The protocol of the study was discussed and approved regarding ethics of research in the general surgical department. The study had been approved by the ethical committee for human studies in our institution. Full written, informed consent was signed from all participants.

Statistical Analysis

The statistical program SPSS version 13 was used for data entry and analysis. Quantitative data were presented by mean and SD, whereas qualitative data were presented by frequency distribution. The Chi-square test was used to compare between two or more proportions. The Student's *t* test was used to compare two means. The lowest accepted level of significance was 0.05 or less.

Results

This study included 54 patients with either recurrent or complicated PSD, of whom 27 patients were treated with Karydakis flap and 27 with Limberg flap. Patients' age ranged from 19 to 48 and the mean was 32 ± 7.9. Males were 40.7% and 44.4% in group A and group B respectively, while females were 59.3% and 55.6% respectively. No statistically significant differences were observed between the groups regarding age and sex (Table 1).

This study showed that the operative time in the Limberg group was 50.1 ± 14.4, whereas in the Karydakis group, it was 37.2 ± 8.9, and this difference was significantly different as shown in Table 2. Whereas, the differences between the two groups in term of length of hospital stay, postoperative analgesic needed, and duration of drainage were not statistically significant.

Regarding time of first mobilization and painless toilet setting, they are significantly shorter in the Limberg group (1 ± 0 and 1.4 ± 0.5 respectively). On the other hand, access to

Table 1 Age and sex distribution of the studied patients

	Limberg flap $n = 27$	Karydakis flap $n = 27$	*P* value
Age (years)			
Range	19–48	21–45	0.1
Mean ± SD	29.8 ± 8.4	33 ± 6.9	
Sex			
M/F *n* (%)	11/16 (40.7/59.3)	12/15 (44.4/55.6)	0.7

Table 2 Comparison between 2 groups regarding short term results

Short term results	Limberg flap $n=27$	Karydakis flap $n=27$	*P* value
Operative time (min)			
Range	30–80	25–60	0.002
Mean ± SD	50.1 ± 14.4	37.2 ± 8.9	
Length of hospital stay (days)			
Range	1–2	1–2	0.3
Mean ± SD	1.3 ± 0.5	1.5 ± 0.5	
Analgesic use, *n*			
Range	1–3	1–3	0.4
Mean ± SD	1.9 ± 0.7	1.7 ± 0.8	
Duration of drainage (weeks)			
Range	1–3	1–3	0.4
Mean ± SD	2.2 ± 0.6	1.9 ± 0.8	
Time of first mobilization			
Range	1–1	1–3	< 0.001*
Mean ± SD	1 ± 0	2 ± 0.8	
Painless toilet sitting (days)			
Range	1–2	1–3	0.01
Mean ± SD	1.4 ± 0.5	2 ± 0.9	
Access to normal daily activity			
Range	12–30	13–22	< 0.001*
Mean ± SD	23.3 ± 5.6	17.2 ± 2.6	

*Significant *P* value 0.0009

normal daily activity was shorter in the Karydakis group (17.2 ± 2.6) and these differences were statistically significant (Table 2).

The time of wound healing in the Karydakis group was 24.3 ± 3.4, whereas in the Limberg group, it was 25.8 ± 4.8; this was not a significant difference. The time taken to remove stitches in the Karydakis group was 15.3 ± 1.5, which is shorter the time taken in the Limberg group (17 ± 2.3), and this difference was significant as shown in Table 3.

Regarding postoperative complications, the occurrence of wound breakdown in the Karydakis group was 40.7% versus 11.1% in the Limberg group. No recurrence occurred in the Limberg group but recurrence observed in six cases in the Karydakis group. In the Karydakis group, eight patients had infection in comparison to one case in the Limberg group. All these differences were statistically significant (Table 3).

All patients have to lie prone postoperatively in limberg group to avoid flap necrosis for at least 2 weeks, whereas in the Karydakis group no need for that position. The overall patient satisfaction in the Limberg group was significantly higher than that in the Karydakis group (Table 3).

Discussion

Although several surgical methods have been defined for PSD treatment, no golden standard method is available yet. The present study compares the effectiveness of two procedures: Limberg flap and Karydakis flap in the surgical management of recurrent or complicated sacrococcygeal PSD. It was found that there is a significant differences between the groups in operative time, which is shorter in Karydakis operation. This is in agreement with Kohla et al. who found that duration

Table 3 Comparison between 2 groups regarding wound healing and postoperative complications

	Limberg flap $n=27$	Karydakis flap $n=27$	*P* value
Time of wound healing (days)			
Range	20–35	20–30	0.2
Mean ± SD	25.8 ± 4.8	24.3 ± 3.4	
Time of stitches removal (days)			
Range	14–21	14–18	0.007
Mean ± SD	17 ± 2.3	15.3 ± 1.5	
Infection, Y/N (%)	1/26 (3.7/96.3)	8/19 (29.6/70.4)	0.02
Recurrence, Y/N (%)	0/27 (0/100)	6/21 (22.2/77.8)	0.03
Wound breakdown†			
Y/N (%)	3/24 (11.1/88.9)	11/16 (40.7/59.3)	0.03
Prone position, Y/N (%)	27/0 (100/0)	7/20 (25.9/74.1)	< 0.001*
Patient satisfaction			
Y/N (%)	22/5 (81.5/18.5)	13/14 (48.1/51.9)	0.02
Cosmetic agreement			
Y/N (%)	17/10 (63/37)	16/11 (59.3/40.7)	0.8

†Wound breakdown: seroma, hematoma, wound dehiscence and flap ischemia

*Significant *P* value 0.0009

of surgery in the Karydakis group was 37.73 ± 12.98, whereas in the Limberg group, it was 61.60 ± 11.11 [14]. However, there is no significant difference between the two groups regarding length of hospital stay which is not in accordance with Bostanoglu et al. who observed that hospital stay was shorter (3.0 ± 1.5 days) in Karydakis technique as compared to Limberg flap procedure (4.3 ± 1.5 days) [15].

In terms of remaining short term results, the current study shows that Karydakis operation is superior to Limberg operation regarding access to normal daily activity. This is in line with Karaca et al. [16]. After 12 months from follow-up, we had no recurrence in the Limberg group. However, six of 27 patients had recurrence in the Karydakis group and these cases suffered from postoperative seroma and wound infection as Arslan et al. reported that the appearance of seroma, hematoma, or wound infection in the early period increases the risk of recurrence of the disease [17], and this difference was statistically significant.

A Cochrane overview has been performed to provide evidence-based guidance for surgical treatment [18]. 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 [19]. In the current study, cosmetic results did not differ between the studied groups. These findings were in coherence with Ashok and Nikhilesh who found no significant differences between the groups in cosmetic results [20]. However, patient satisfaction in the Limberg group was significantly higher than that in the Karydakis group, and this result is consistent with Alvandipour et al. [13].

Conclusion

It is concluded that Limberg flap rotation is clearly preferred in management of recurrent and complicated PNS for safety reasons given its low recurrence and postoperative complication rates. Karydakis technique is superior to Limberg flap regarding shorter operative time and shorter time needed for access to normal daily activity so it is preferred in uncomplicated PNS.

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Compliance with Ethical Standards The protocol of the study was discussed and approved regarding ethics of research in the general surgical department. The study had been approved by the ethical committee for human studies in our institution. Full written, informed consent was signed from all participants.

Conflict of Interest The authors declare that they have no conflicts of interest.

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