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Short and long-term results of the Karydakis flap versus the Limberg flap for treating pilonidal sinus disease: a prospective randomized study

Mustafa Ates, M.D.,[a,*] Abuzer Dirican, M.D.,[a] Mehmet Sarac, M.D.,[b] Ahmet Aslan, M.D.,[b] Cemil Colak, Ph.D.[c]

[a]Department of General Surgery; [b]Department of General Surgery, Malatya State Hospital, Malatya, Turkey and [c]Department of Biostatistics, Inonu University Medical Faculty, Malatya, Turkey.

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Recurrence

Abstract

BACKGROUND: Pilonidal sinus is a common disease that mostly affects young people. Although various surgical techniques have been described for treating sacrococcygeal pilonidal disease (SPD), controversy still exists as to the best surgical technique. The purpose of this study was to compare the efficiency and short-term and long-term results of the Karydakis flap with that of the Limberg flap for treating SPD.

METHODS: In this prospective randomized study, 269 patients with SPD were recruited to undergo either the Karydakis flap (n = 135) or the Limberg flap (n = 134) procedure between September 2004 and September 2008.

RESULTS: The mean operative time for the Karydakis group (42.32 ± 8.64 minutes) was shorter than that for the Limberg group (50.14 ± 6.96 minutes) (P = .01). The complication rate for the Karydakis group (n = 15 [11.1%]) was lower than that for the Limberg group (n = 28 [20.8%]) (P = .029). The visual analogue scale score for postoperative pain at the operation site on the 30th day was lower in the Karydakis group than in the Limberg group (2.22 ± 1.01 vs 3.23 ± 1.14, P = .01). The visual analogue scale score for satisfaction with the cosmetic appearance of the scars in the Karydakis group was 7.08 ± 1.75, whereas it was 3.16 ± 1.40 in the Limberg group at the 3rd month (P = .01). Length of hospital stay was significantly shorter in the Karydakis group than in the Limberg group (3.40 ± .94 vs 3.8 ± 1.19 days, P = .03). Only 4 patients in the Karydakis group developed recurrence (3%), whereas 9 patients (6.9%) did so in the Limberg group (P = .151).

CONCLUSIONS: The Karydakis flap procedure should be chosen instead of the Limberg flap for treating uncomplicated SPD because of its lower postoperative complication rate, lower pain scores, shorter operation time and length of hospital stay, and good cosmetic satisfaction. However, no differences existed between the 2 surgical procedures in terms of recurrence prevention.

Sacrococcygeal pilonidal disease (SPD) is a chronic inflammation and infection of the sacrococcygeal region. It is a common condition that occurs mostly among young adults after puberty and usually presents as an abscess or a painful sinus tract on the natal cleft with chronic seropurulent discharge.[1–3]

* Corresponding author. Tel.: 90-422-377-30-00; fax: 90-422-341-00-36.
E-mail address: drmustafaates@hotmail.com
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Although many surgical and nonsurgical treatment methods have been described for the treatment of pilonidal disease, from phenol application to complex advanced flap mobilization, an optimal treatment has not been determined because of the high complication and recurrence rates.[2–4] Most authors have accepted that pilonidal sinus disease is an acquired condition that does not been change by means of traditional surgical or nonsurgical intervention. In this regard, modifying the natal cleft and lateralizing the scar from the midline are the most important factors to eliminate the essential causative factors of pilonidal sinus disease.[5–7] Therefore, numerous lateralizing surgical flap techniques based on principles such as the Karydakis flap, the Limberg flap, the modified Limberg flap, the Dufourmentel flap, and all advancement and plasty flap procedures have been devised for treating SPD.[2,4,5,7–14]

Although flap techniques have been performed at many centers with a high curative rate, complication and recurrence rates are still observed more often than predicted. In recent years, the Karydakis and Limberg flap techniques have had low recurrence and complication rates compared with other flap procedures and have gained more popularity.[2,8,9,15] Studies comparing the Karydakis and Limberg flap techniques using adequate sample sizes may help resolve the ongoing controversies regarding the ideal surgical treatment for SPD. However, a prospective randomized clinical study has not been conducted to compare the long-term results of the Karydakis flap with the Limberg flap for SPD.

To clarify the data from these 2 methods, we performed a prospective randomized clinical trial to compare the short-term and long-term results of the Karydakis and Limberg flap techniques for treating SPD.

Methods

Three hundred six patients with SPD were considered for inclusion in the study between September 2004 and September 2008 at Malatya State Hospital in Malatya, Turkey. Patients with concurrent abscess formation (n = 8), recurrent pilonidal sinus (n = 7), a more complex pilonidal sinus (orifices of the sinus extending laterally or near the anus; n = 7), prisoners from a state prison (n = 11), and 4 patients who did not accept randomization were excluded. Finally, 269 patients with SPD were enrolled in the study. Seven patients with a complex pilonidal sinus extending to the anus or laterally underwent unroofing and marsupialization because they were not amenable to the procedures.

After the details of the surgical procedure were explained to all participants and written informed consent was obtained, patients were sent to the inpatient admission center for hospitalization and randomization. The patients were randomized to a Karydakis flap group (n = 135) or a Limberg flap group (n = 134) consecutively by an independent officer using patient admission numbers. Both surgical procedures were performed by the same surgeons.

The patients were placed in the prone position under spinal anesthesia. All patients received cefazolin 1 g intravenously during the operation. The trunk was slightly jackknifed at the hips, and the buttocks retracted with adhesive tape to allow wide exposure of the operative field. The surgical site was shaved just before the operation, and the skin was prepared with 10% povidone-iodine solution. All sinus openings were injected with methylene blue to visualize the sinus and all tracts.

For the Karydakis flap, an asymmetric elliptical incision was made as described in the Karydakis technique.[5] The cranial and caudal tips of the incision were placed at opposite sides of the perianal opening (Fig. 1A). The ellipse was based only on the pits in the vicinity of the midline. The incision covered lateral secondary openings. Under the guidance of methylene blue, both sides of the elliptical incision were deepened into the gluteal fascia. The flap was prepared as described by Karydakis.[5] The flap was then sutured with polyglycolic acid sutures in 2 layers, and a suction drain was placed. Finally, the skin and circular perianal incision were closed separately with 3–0 polypropylene sutures (Fig. 1B).

For the Limberg flap, a rhombus, including the pilonidal sinus and the flap line, was marked on the skin using a sterile skin-marking pen (Fig. 2A). Under the guidance of methylene blue, the rhombus was excised down to the presacral fascia, and the fasciocutaneous flap was transposed medially so the defect would be covered without any tension. The size of the prepared flap was equal to that of the rhomboid area. A suction drain was placed beneath the flap through a separate stab incision, and subcutaneous tissue was approximated with polyglycolic acid sutures. The skin was closed separately using 3–0 polypropylene sutures (Fig. 2B). For both procedures, the suction drain was removed on the 3rd or 4th postoperative day, depending on the amount and duration of drainage. The duration of surgical drainage was the same as the period of stay in the hospital. The sutures were removed between the 10th and 13th postoperative days.

Patient age, gender, symptoms, type of procedure, operation time, length of hospital stay, access to normal daily activity, time of wound healing, postoperative complications, cosmetic dissatisfaction (postoperative 3rd month), pain when sitting (postoperative 15th and 30th days), time of recurrence (months), and mean follow-up period (months) were recorded. Pain from the operation site and cosmetic dissatisfaction were assessed using a visual analogue scale (VAS) score from 1 to 10. For cosmetic satisfaction, we asked the patients, “Please describe your satisfaction with the operation scar as compared to pilonidal sinus disease.” To assess pain, we asked “Do you have pain while sitting on the operation site? Please rate it on the VAS.” All patients were given routine follow-up examinations for the 1st 3 months after surgery. Beyond 3 months, long-term follow-up of patients was monitored by phone

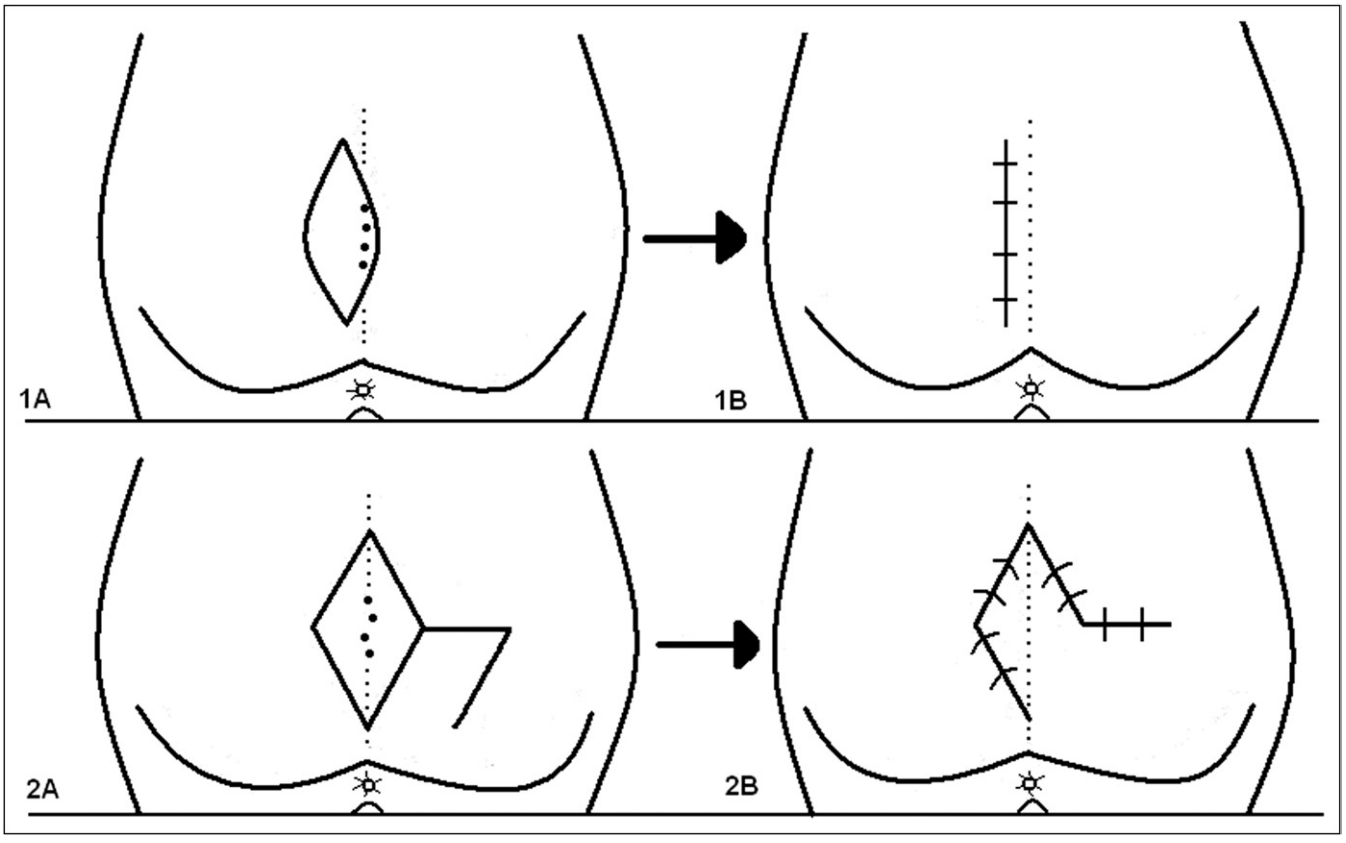

Figure 1 Preparation of the Karydakis (1A,1B) and Limberg (2A,2B) flap techniques.

calls every 3 months or directly at the outpatient clinic to check for recurrences.

Statistical analyses

Power calculations were performed for testing the hypotheses related to the comparisons between the treatment groups. The sample sizes of 135 and 134 for the Karydakis flap and the Limberg flap groups, respectively, provided power approximately >.85 to compare the 2 treatment groups (Hintze J, 2001; NCSS and PASS, Number Cruncher Statistical Systems, Kaysville, UT). Comparisons between the groups were performed using unpaired *t* tests, paired *t* tests, and Pearson's χ^2 tests. *P* values < .05 were accepted as significant. SPSS version 17.0 for Windows (SPSS, Inc, Chicago, IL) was used for the statistical analyses.

Results

In total, 269 patients (median age, 25 years; range 15–46 years) were enrolled. Of these, 240 patients (89.2%) were male and 29 (11.8%) were female. The Karydakis flap group consisted of 135 patients, and the Limberg flap group was composed of 134 patients. The mean length of follow-up was 26.40 ± 8.20 months. Six patients in the Karydakis group and 4 patients in the Limberg group could not be followed up and were excluded from the long-term statistical analysis (after 9, 15, and 21 months). The most frequent presenting symptoms were seropurulent discharge (78%) and pain (34%). No differences were detected between the groups for age, gender, and clinical disease presentation. Demographic data and clinical presentation of the 2 groups are compared in Table 1.

In the Karydakis group, seromas developed in 2 patients, a hematoma in 1, wound infections in 4, and wound dehiscence in 8. With the exception of 1 patient, the others subsequently healed completely with conservative treatment during the 1st month. One patient required a 2nd operation under local anesthesia on the 20th day because of wound dehiscence. In the Limberg group, seromas developed in 3

Table 1 Demographic characteristics of the 2 treatment groups

Characteristic	Karydakis (n = 135)	Limberg (n = 134)	*P**
Age (y)	24.45 ± 7.30	25.50 ± 7.11	.231
Male/female	123/12	117/17	.315
Symptoms			
Seropurulent discharge	109	97	.123
Pain	36	48	

Data are expressed as mean ± SD or as numbers.
**P* values < .05 were considered statistically significant.

patients, hematomas in 3, wound infections in 8, and wound dehiscence in 14. With the exception of 4 patients, the others subsequently healed completely with conservative treatment during the 1st month. The 4 patients required 2nd operations under local anesthesia during the 1st month because of wound dehiscence. All flaps remained viable in the 2 groups, and neither ischemia nor necrosis of the flaps was observed.

No statistically significant difference was observed in the timing of access to normal daily activity, VAS score for pain at the operation site on the 15th day, or the mean follow-up and recurrence rate between the Karydakis and Limberg flap groups ($P > .05$).

Statistically significant differences were detected between the 2 treatment methods for operation time, number of complications, VAS score for pain at the operation site on the 30th day, VAS score for the satisfaction rate related to the cosmetic appearance of the scars at the 3rd month, and length of hospital stay. The mean operative time for the Karydakis group (42.32 ± 8.64 minutes) was shorter than that for the Limberg group (50.14 ± 6.96 minutes) ($P = .01$). The number of complications in the Karydakis group (n = 15 [11.1%]) was lower than that in the Limberg group (n = 28 [20.8%]) ($P = .029$). The VAS score for postoperative pain at the operation site on the 30th day was lower in the Karydakis group than in the Limberg group (2.22 ± 1.01 vs 3.23 ± 1.14, $P = .01$). The VAS score for satisfaction with the cosmetic appearance of the scars in the Karydakis group was 7.08 ± 1.75, whereas it was 3.16 ± 1.40 in the Limberg group at the 3rd month ($P = .01$). Length of hospital stay was significantly shorter in the Karydakis group than in the Limberg group (3.40 ± .94 vs 3.8 ± 1.19 days, $P = .03$). Although only 4 patients (3.1%) in the Karydakis group developed recurrences within 4 to 12 months, 9 patients (6.9%) developed recurrences within 3 to 10 months in the Limberg group; however, the difference was not significant ($P = .151$). The clinical outcomes of the 2 groups are compared in Table 2.

Table 2 Clinical outcomes of Karydakis and Limberg flap procedures for SPD

Outcome	Karydakis (n = 135)	Limberg (n = 134)	P*
Time of the operation (min)	42.32 ± 8.64	50.14 ± 6.96	.001
Length of hospital stay (d)	3.43 ± .94	3.80 ± 1.19	.003
Access to normal daily activity (d)	8.45 ± 1.16	8.55 ± 1.18	.484
VAS score for pain of operation site			
Postoperative day 15	5.58 ± 1.52	5.56 ± 1.55	.924
Postoperative day 30	2.22 ± 1.01	3.23 ± 1.14	.001
VAS score for cosmetic satisfaction, 3rd month	7.08 ± 1.75	3.16 ± 1.40	.001
Number of complications	15 (11.1%)	28 (20.8%)	.029
Hematoma	1	3	
Seroma	2	3	
Wound dehiscence	8	14	
Wound infection	4	8	
Number of patients needing 2nd operation	1 (.7%)	4 (2.9%)	
Recurrence	4 (3.1%)	9 (6.9%)	
Mean follow-up period (mo)	26.22 ± 8.18	26.58 ± 8.25	.720

Data are expressed as mean ± SD or as number (percentage).
*P values < .05 were considered statistically significant.

Comments

The incidence of SPD has been reported to be between .026% and .7%, but the disease is considerably more common than generally supposed in some Mediterranean and Persian Gulf region countries.[16,17] Some factors, such as driving, obesity, deep natal cleft, poor hygiene, male gender, and young age, increase the rates of the disease.[3,11,15,16,18]

The etiopathogenesis of SPD is still under debate. Although hypotheses for the occurrence of a pilonidal sinus have been based on an embryologic origin, the disease has largely been accepted to be caused by an accumulation of hair penetrating the skin and to be an acquired condition.[5,19–21] The reason for the large acceptance of the acquired theory may be the high recurrence rates of up to 30% after the most radical local excisions of pilonidal disease, which suggests that a pilonidal sinus is an acquired new disease rather than the persistence of some existing sinuses.[2,5,8–10] Moreover, Karydakis[5] suggested 3 factors related to the development of this disease: the invader, consisting of loose hair; a force that causes hair insertion; and vulnerability of the skin to hair insertion at the depth of the natal cleft are strong evidences supporting acquired theory.

Many surgical procedures for SPD have been developed, but an optimal treatment approach with low complication and recurrence rates has still not been achieved.[2,4] Simple excision and primary closure or open wound healing does not flatten the natal cleft and cannot prevent the penetration tendency of hair to the skin at depths of the natal cleft and may lead to more patient discomfort, a high midline recurrence rate, and longer hospitalization.[2,5,21–24] Day surgery with simple opening, curettage, brushing, or phenol injection may remove hair and cure the sinus, but the midline wound may take several weeks to heal, and a significant recurrence rate is observed because of the open portal for hair insertion.[2,21]

After clarifying the acquired nature of the disease, an ideal operation should be simple and have low complication and recurrence rates by flattening the natal cleft with an off-midline closure; it should be associated with minimal pain and wound care to decrease time off from work and

make the procedure more cost effective while preventing a prolonged hospital stay.[21,22] In light of this widely accepted concept, surgical procedures for SPD have changed in favor of flap techniques by general surgeons who treat SPD. The theoretical aim of a flap technique is to flatten and lateralize the natal cleft, which should eliminate predisposing etiopathogenetic factors for the pilonidal sinus and avoid median recurrences.[2,5] Flap techniques such as the V-Y advancement or the Z-plasty technique cover the wound defect by moving full-thickness skin and subcutaneous tissue into the midline defect, but they have been thought to be overtreatment for pilonidal sinus because of large tissue displacements using sophisticated methods.[6,7,14] In recent decades, the Karydakis and Limberg flap techniques have had low complication and recurrence rates (0%–4.6%) compared with other flap procedures and have gained more popularity.[2,5,8–13] We believe that studies comparing the Karydakis and Limberg flap techniques may help resolve the ongoing controversies regarding the ideal surgical treatment for SPD.

Ersoy et al[13] reported a randomized clinical study comparing short-term results of the Karydakis and the Limberg flap techniques in 100 patients. The study reported no complications other than wound infection but a significantly higher wound infection rate after the Karydakis technique (26%) compared with the Limberg flap (8%); wound infection rates were 2.9% for the Karydakis flap and 5.9% for the Limberg flap.[13] In our study, complication rates (hematoma, seroma, wound infection, and dehiscence) were significantly lower for the Karydakis flap (11.1%) than the Limberg flap (20.8%) technique ($P < .029$).

The most important parameters for comparing pilonidal sinus surgery results are the complications during the early period and recurrences during the late period. Unfortunately, no study has compared the long-term results of the Karydakis and Limberg flap techniques. In our study, the mean follow-up period was 26.40 ± 8.20 months; 9 recurrences (6.9%) developed in the Limberg flap group, which tended to be higher than those in the Karydakis flap group (n = 4 [3%]), although the difference was not significant ($P = .151$).

On the basis of our experience, the natal cleft could be flattened, and tissue could be approximated without tension, but suture holes and scars within the intergluteal sulcus could not be transferred laterally from the midline, and the lower and upper pole of the flap stayed within the intergluteal sulcus during the Limberg flap procedure. All recurrences occurred at the lower flap pole scar, and the sutures left in these areas were in a favorable environment for sweating, maceration, and penetration of hairs during the early postoperative period in the Limberg group. In addition to a flattened natal cleft, successful results using the Karydakis procedure may stem from the observation that the incisional line, scar, and all suture line holes could be easily transferred laterally from the midline and that a favorable environment for recurrence could be avoided.[2,5,25,26]

Mentes et al[27] and some other authors[10,28] have stated a need for modifying the Limberg flap procedure after their initial experience. They reported that the site of recurrence, which was located at the lower flap pole, stayed within the intergluteal sulcus and indicated that this site was the weakest point of the Limberg flap. Thus, they modified the flap reconstruction by tailoring the rhomboid excision asymmetrically to place the lower flap pole lateral to the intergluteal sulcus and achieved lower complication and recurrence rates. In this regard, an important study was conducted by Can et al.[29] They used a modified Limberg flap and compared it with a Karydakis flap, and the overall early complication and recurrence rates in the 2 groups were not statistically different. In our study, the number of postoperative early complications in the Limberg group was higher than that in the Karydakis group, but the recurrence rates between the 2 groups were not significantly different. On the basis of these data, it can be thought that a modification of the Limberg procedure may only reduce the early complication rate compared with that of the Karydakis procedure. The clinical outcomes of these 3 studies are briefly compared in Table 3.

Operation time and postoperative pain are very important for the effectiveness of a surgical technique. Operative time for the Limberg flap (50.14 ± 6.96 minutes) was longer than that for the Karydakis flap (42.32 ± 8.64 minutes) in our study ($P = .001$). Although no significant differences were observed in the VAS score for postoperative pain at the operation site on the 15th day between the 2 groups, it was significantly lower in the Karydakis group than in the Limberg group on the 30th day ($P = .01$).

The Limberg flap technique is a sophisticated method because of large tissue displacements, which result in numbness and dissatisfaction with the cosmetic appearance of the scars at the operation site.[2,21,30] In a previous study, Eryilmaz et al,[30] who evaluated the appearance of flap scars, reported that as many as 40% of patients were not pleased with the appearance of Limberg flap scars. In our study, the VAS score for satisfaction with the cosmetic appearance of the scars in the Karydakis group was 7.08 ± 1.75, whereas

Table 3 Results of different studies of treatment techniques for SPD

Study	Methods	Number of Patients	Median Follow-Up	Early Complication Rate (%)	Recurrence Rate (%)
Ersoy et al[13]	Karydakis vs Limberg flap	50/50	30 d	26/8	Not available
Can et al[29]	Karydakis vs modified Limberg flap	73/72	16 mo	12.9/10.3	5.5/4.8
Present study	Karydakis vs Limberg flap	135/134	26.40 mo	11.1/20.8	3.1/6.9

it was 3.16 ± 1.40 in the Limberg group ($P < .01$), and the cosmetic appearance of the scars may be more important for women than men. In the Limberg flap group, female patients expressed dissatisfaction with the cosmetic appearance of the scars at the 3rd month.

We believe that proper patient selection is of paramount importance for the success of both flap procedures. It may be feasible to exclude complex SPD patients, so we had difficulty in mobilization and closure with the Karydakis flap in 8 patients and Limberg flap in 5 patients, often resulting in wound dehiscence and seroma. This may be a weakness of the flap procedures.

Conclusions

The Karydakis flap procedure should be chosen instead of the Limberg flap for treatment of uncomplicated SPD because of its low postoperative complication rate and pain score, short operation time and length of hospital stay, and good cosmetic satisfaction. However, no differences in recurrence rates were observed between the 2 surgical procedures in this study.

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