

# Effectiveness of the Limberg and Karydakis Procedures in Complicated Pilonidal Sinus Disease

## Komplike Pilonidal Sinüs Hastalığında Limberg ve Karydakis Prosedürlerinin Etkinliği

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### ABSTRACT

**Objective:** There is no accepted gold standard method for treating complicated pilonidal sinus disease (CPSD). The objective of this study was to examine the effect of the Limberg procedure (LP) and the Karydakis procedure (KP) for treating CPSD.

**Methods:** A total of 44 patients who underwent surgery for CPSD between July 2020 and July 2023 were included. These patients were divided into two groups: the LP and KP groups. The patients were followed up for an average of 18.9 months.

**Results:** There were no differences in preoperative characteristics between the two groups ( $p>0.05$ ). The complications were higher in the KP group and approached statistical significance ( $p=0.052$ ). This situation was attributed to a 45.5% incidence of wound dehiscence in the KP group compared with 13.6% in the LP group ( $p=0.021$ ). In the LP group, the median time to return to work was 20.5 days, whereas the healing time was 30 days. In the KP group, the median time to return to work was extended to 30 days, with a healing time of 56 days. There was no difference in recurrence between the two groups ( $p=0.607$ ).

**Conclusion:** LP is recommended for treating CPSD because of its faster return to work and healing time.

**Keywords:** Complicated pilonidal sinus disease, Limberg procedure, Karydakis procedure

### ÖZ

**Amaç:** Komplike pilonidal sinüs hastalığının (KPSH) tedavisinde kabul edilmiş bir altın standart yöntem yoktur. Bu çalışmanın amacı Limberg prosedürünün (LP) ve Karydakis prosedürünün (KP) KPSH tedavisindeki etkisini incelemektir.

**Yöntem:** Temmuz 2020 ile Temmuz 2023 tarihleri arasında KPSH nedeniyle ameliyat edilen toplam 44 hasta çalışmaya dahil edildi. Bu hastalar iki gruba ayrıldı: LP grubu ve KP grubu. Hastalar ortalama 18,9 ay takip edildi.

**Bulgular:** İki grup arasında preoperatif özellikler açısından fark yoktu ( $p>0,05$ ). Komplikasyonlar KP grubunda daha yüksekti ve istatistiksel anlamlılığa yaklaştı ( $p=0,052$ ). Bu durum LP grubunda %13,6 iken KP grubunda %45,5 oranında yara açılması görülmesine bağlandı ( $p=0,021$ ). LP grubunda medyan işe dönüş süresi 20,5 gün, iyileşme süresi ise 30 gündü. KP grubunda medyan işe dönüş süresi 30 güne, iyileşme süresi ise 56 güne çıktı. İki grup arasında nüks açısından fark yoktu ( $p=0,607$ ).

**Sonuç:** LP, daha hızlı işe dönüş ve iyileşme süresi nedeniyle KPSH tedavisinde önerilir.

**Anahtar Kelimeler:** Komplike pilonidal sinüs hastalığı, Limberg prosedürü, Karydakis prosedürü

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## INTRODUCTION

Pilonidal sinus disease (PSD) can manifest in different anatomical regions, including the natal cleft, umbilicus, genital area, and interdigital spaces. The natal cleft is the most often impacted area.<sup>1</sup> The disease has an incidence rate of 26 per 100,000 individuals, with a higher prevalence observed among young adult males.<sup>2</sup> The pathogenesis of the disease is hypothesized to be related to a foreign body reaction caused by shed hair shafts penetrating the skin in the deep natal cleft.<sup>3</sup> PSD risk factors include male gender, obesity, a sedentary lifestyle, family history, excessive body hair, and skin irritation and trauma in the natal cleft.<sup>3,4</sup>

Although clinically asymptomatic in some cases, PSD can also develop as a chronic, complicated disease characterized by multiple lateral sinus tracts, leading to a serious deterioration in the patient's quality of life.<sup>5</sup> Advanced PSD is characterized by the presence of deep abscesses and fistulas.<sup>6</sup> Over time or following surgery, simple PSD can progress to a chronic or complicated state. The terms complicated, chronic, recurrent, complex, refractory, complex, and recalcitrant are used to describe these challenging disorders of the pilonidal sinus.<sup>7</sup>

Because of the high recurrence and complication rates, an effective treatment strategy for PSD has not yet been determined, despite the availability of various therapy alternatives.<sup>8</sup> The available treatment methods include both surgical and non-surgical procedures. After the excision, the surgical choices available are marsupialization, primary repair, or closure using flaps. Non-surgical treatments use methods such as crystallized phenol, fibrin glue, or laser probes to ablate the sinus.<sup>9</sup> The presence of multiple sinuses in a complicated pilonidal sinus disease (CPSD) requires a more extensive excision of tissue and leaves a large defect that is difficult to close without a flap procedure.<sup>10</sup>

The two most commonly applied off-midline flap procedures are the Limberg procedure (LP) and Karydak's procedure (KP).<sup>11</sup> This study aimed to evaluate the efficacy of LP and KP for treating CPSD.

## METHODS

This study was approved by the Ethics Committee of the University of Health Sciences Türkiye, Fatih Sultan Mehmet Training and Research Hospital (no: KAEK 2023/88, date: 27.07.2023) and was conducted in accordance with the principles of the Declaration of Helsinki.

### Patients and Study Design

We retrospectively reviewed 44 patients who underwent surgery for CPSD between July 2020 and July 2023.

According to Tezel<sup>12</sup> PSD classification, all patients included in this study had pilonidal sinuses at stage IV. This classification describes the navicular region. The lateral margins of the navicular area are represented by the outer lines of contact when the buttocks are pulled together. The back of the anal triangle, with the coccyx as its apex and the ischial tuberosities as its bases, forms its inferior extent. Stage IV is considered if the sinus opening is located outside the navicular area. Based on the type of surgery, the patients were divided into two groups. The patients who were administered KP were referred to as the KP group, whereas those who were administered LP were referred to as the LP group. In deciding on the procedure, the surgical team took the patient's preferences into account after explaining the advantages and disadvantages of both procedures to them. Each procedure was performed by a single surgeon.

### Surgical Procedure

The patients were positioned in the jack-knife position under spinal anesthesia and received 1g of intravenous cefazolin for antibiotic prophylaxis. Stick tape was used to retract both buttocks laterally. A 10% povidone-iodine solution was used to disinfect the surgical site. In the LP group, the sinus area was equilateral. An incision was made through the skin and subcutaneous tissues, extending down to the presacral fascia. The sinus area was removed, ensuring complete clearance of the defecting tissues. A Limberg flap was constructed in accordance with the rhomboid area, and absorbable subcutaneous sutures were used to approach the flap to the excision site. Drains were applied to every patient (Figure 1). In the KP group, the sinus area was marked with an asymmetric elliptical incision. The lower and upper ends of the incision were situated 2 cm lateral to the natal cleft. The incision extended through the skin and subcutaneous tissues, reaching down to the presacral fascia. The sinus area was removed, ensuring complete clearance of the defecting tissues. Subsequently, the medical wound edge was mobilized, and the flap was sutured to the fascia and shifted. Drains were applied to every patient (Figure 2).

### Preoperative Characteristics and Postoperative Outcomes

From patient files and in-person or telephone interviews, the following information was gathered: age, gender, smoking status, diabetes mellitus, operation time, healing time, complications (including seroma, hematoma, surgical site infection, and wound dehiscence), time to return to work, and recurrences. The healing time was defined as the number of days required for the wound



**Figure 1.** Limberg procedure

1: Prepared view of the Limberg flap. 2: Postoperative view of the Limberg procedure



**Figure 2.** Karydakis procedure

1: Prepared view of the Karydakis flap. 2: Postoperative view of the Karydakis procedure

to attain complete epithelization and no longer require dressings.<sup>13</sup> Recurrence was defined as the reappearance of disease symptoms after the complete healing of the wound.<sup>14</sup>

### Statistical Analysis

IBM Statistical Package for the Social Sciences version 25 was used to analyze the data. Descriptive statistical procedures (median, percentage) were used to analyze the study data. Fisher's exact test and Pearson's chi-square test were used to compare categorical variables. The Shapiro-Wilk test was used to determine whether numerical values were suitable for a normal distribution. The Mann-Whitney U test was used for group comparisons because of the non-normal distribution of the numerical values. The minimum level of accepted significance was set at 0.05.

### RESULTS

The study comprised 44 patients. There were 22 patients in the LP group and 22 patients in the KP group. In the LP group, only one patient (4.5%) was female, whereas all patients in the KP group were male ( $p=1.000$ ). The median age was 27.5 (17-59) years in the LP group and 25 (16-43) years in the KP group ( $p=0.226$ ). Fifteen patients (71.4%) in the LP group and 13 patients (65%) in the KP group were smokers ( $p=0.658$ ). Diabetes mellitus was not observed in any of the study patients (Table 1).

The median operation time was 52.5 (30-80) minutes in the LP group and 37.5 (25-100) minutes in the KP group ( $p=0.110$ ). Complications occurred in four patients (18.2%) in the LP group. One patient had a surgical site infection, and three patients had wound dehiscence. Because of a dehisced wound area, one patient underwent negative

pressure wound treatment. Complications occurred in 10 patients (45.5%) in the KP group. Ten of the complications had wound dehiscence and one had a hematoma. One patient with wound dehiscence was given negative pressure wound treatment. The two groups' complication rates were statistically significant ( $p=0.052$ ). The rate of wound dehiscence from the subgroups was significantly higher in the KP group ( $p=0.021$ ). Compared with the KP group, the LP group had a faster healing time and time to return to work. Time to return to work was 20.5 (7-45) days in the LP group and 30 (10-90) days in the KP group ( $p=0.046$ ). Healing time was 30 (11-91) days in the LP group and 56 (14-144) days in the KP group ( $p=0.015$ ) (Table 2).

The average duration of follow-up for all patients was 18.9 months. Within this period, a single recurrence (4.5%) occurred in the LP group, whereas three recurrences (13.6%) were observed in the KP group ( $p=0.607$ ) (Table 2).

## DISCUSSION

We compared KP and LP for CPSD in our study. The LP demonstrated a significant decrease in wound dehiscence as well as shorter times for both return to work and healing. Additionally, total complications were marginally significantly lower. There was no statistically significant difference between the groups, although the LP group had a lower recurrence rate.

The presence of lateral or caudal tracts and sinuses in PSD complicates treatment.<sup>7</sup> Treatment options range from minimally invasive techniques to excision procedures with or without flaps.<sup>15</sup> Flap procedures aim to close the resulting gap without tension while flattening the natal cleft and lateralization.<sup>7,16</sup> The success of surgical treatment is often gauged by factors such as short surgery time and hospital stay, rapid recovery and return to work, minimal complications, and a low recurrence rate.<sup>17</sup> However, similar to many surgical procedures, flap procedures may not achieve all these objectives simultaneously.<sup>18</sup>

Healing time and recurrence after complete healing are the most important consequences of PSD surgery. There was a nearly threefold disparity in recurrence rates between the two groups, although there was no statistical difference in recurrence. The recurrence rate was 4.5% in the LP group and 13.6% in the KP group. The limited sample size in our study may have had an impact on this result. There are many studies in the literature that compare both procedures. Emile et al.<sup>19</sup> found a recurrence rate of 4.4% for KP and 3.7% for LP in their meta-analysis. The results of the two techniques were similar in another meta-analysis.<sup>20</sup> However, in all except one of the studies included in these meta-analyses, there was no clear evidence whether the pilonidal sinuses were characterized as complicated or uncomplicated. Because these studies probably included PSD at various stages, it is difficult to make definitive

**Table 1. Comparison of preoperative characteristics among the groups**

	LP group (n=22)	KP group (n=22)	p value*
Gender			
Male, n (%)	21 (95.5)	22 (100)	1.000 <sup>1</sup>
Female, n (%)	1 (4.5)	0	
Age, years	27.5 (17-59)	25 (16-43)	0.226 <sup>2</sup>
Smoking, n (%)	15 (71.4)	13 (65)	0.658 <sup>3</sup>
DM	0	0	

<sup>1</sup>Fisher's exact test, <sup>2</sup>Mann-Whitney U test, <sup>3</sup>Pearson chi-square test, \* $p<0.05$  significant.  
LP: Limberg procedure, KP: Karydakias procedure, DM: Diabetes mellitus

**Table 2. Intraoperative and postoperative outcomes among the groups**

	LP group (n=22)	KP group (n=22)	p value
Operation time, min	52.5 (30-80)	37.5 (25-100)	0.110 <sup>1</sup>
Complication	4 (18.2)	10 (45.5)	0.052 <sup>2</sup>
Hematoma, n (%)	0	1 (4.5)	1.000 <sup>3</sup>
Surgical site infection, n (%)	1 (4.5)	0	1.000 <sup>3</sup>
Wound dehiscence, n (%)	3 (13.6)	10 (45.5)	0.021 <sup>2*</sup>
Time to return to work, days	20.5 (7-45)	30 (10-90)	0.046 <sup>1*</sup>
Healing time, days	30 (11-91)	56 (14-144)	0.015 <sup>1*</sup>
Recurrence, n (%)	1 (4.5)	3 (13.6)	0.607 <sup>3</sup>

<sup>1</sup>Mann-Whitney U test, <sup>2</sup>Pearson chi-square test, <sup>3</sup>Fisher's exact test, \* $p<0.05$  significant.  
LP: Limberg procedure, KP: Karydakias procedure

findings. Literature on pilonidal sinuses is mostly limited to uncomplicated cases or covers both uncomplicated and complicated cases. The number of studies exclusively completed using CPSD is limited. Elheeny et al.<sup>3</sup> conducted a study only with CPSD and compared both procedures. They found that 22.2% of the KP group had recurrences, whereas the LP group did not. This study is the only CPSD study among the studies included in the two mentioned meta-analyses.

Healing time is another crucial aspect to consider when assessing the results of PSD surgery. This is because a shorter healing time is associated with an earlier return to work and frequently leads to increased levels of patient satisfaction. In our study, the healing time of patients in the LP group was 30 (11-91) days and the time to return to work was 20.5 (7-45) days. In the KP group, the healing time increased to 56 (14-144) days and the time to return to work increased to 30 (10-90) days. The statistical significance in favor of LP was evident. In our study, we defined healing time as the absence of any discharge or need for dressing in the patient. The extended healing time observed in the KP group resulted from a higher incidence of wound dehiscence. While wound dehiscence was observed in 45.5% of the patients in this group, it was observed in 13.6% of the patients in the LP group. This discrepancy arises from the fact that KP results in the closure of the defect under higher tension compared with LP.<sup>21</sup> Published meta-analyses have shown that there is no statistically significant difference between the two procedures in terms of complications and wound dehiscence.<sup>19,20</sup> However, in the study by Elheeny et al.<sup>3</sup>, focusing on CPSD, wound site issues were more common with KP.

Based on the literature, the KP generally has a shorter operation time, which may be due to the higher complexity of the LP.<sup>19</sup> In our study, we found a nearly 15-min longer operation time in the LP group. However, the difference was not statistically significant when comparing the two groups.

### Study Limitations

Our study has certain limitations. First, the retrospective nature of the study may introduce patient selection bias. Second, the sample size is relatively small. Nevertheless, our study's strength is that it evaluates Stage IV CPSD, an area that is not often studied. Its addition to the current literature is significant in this respect.

### CONCLUSION

Wound dehiscence was statistically lower in the LP group, resulting in faster healing and an earlier return to work. Although it was not statistically significant, recurrence was

less in the 18.9-month follow-up. Based on our findings, we recommend LP among the flap reconstruction techniques for treating CPSD because it is more effective than KP in treating CPSD.

### Ethics

**Ethics Committee Approval:** This study was approved by the Ethics Committee of the University of Health Sciences Türkiye, Fatih Sultan Mehmet Training and Research Hospital (no: KAEK 2023/88, date: 27.07.2023).

**Informed Consent:** Retrospective study.

### Authorship Contributions

Surgical and Medical Practices - Concept - Design - Data Collection or Processing - Analysis or Interpretation - Literature Search - Writing: Y.G., E.T.

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### REFERENCES

1. Akinci OF, Bozer M, Uzunköy A, Düzgün SA, Coşkun A. Incidence and aetiological factors in pilonidal sinus among Turkish soldiers. *Eur J Surg.* 1999;165:339-42.
2. Søndena K, Andersen E, Nesvik I, Søreide JA. Patient characteristics and symptoms in chronic pilonidal sinus disease. *Int J Colorectal Dis.* 1995;10:39-42.
3. Elheeny A, Saad DA, Farahat MS. Effectiveness and feasibility of Limberg and Karydakias flap in recurrent and complicated pilonidal sinus disease. *Indian J Surg.* 2021;83:55-60.
4. Humphries AE, Duncan JE. Evaluation and management of pilonidal disease. *Surg Clin North Am.* 2010;90:113-24.
5. Guner A, Cekic AB, Boz A, Turkyilmaz S, Kucuktulu U. A proposed staging system for chronic symptomatic pilonidal sinus disease and results in patients treated with stage-based approach. *BMC Surg.* 2016;16:18.
6. Bascom J, Bascom T. Failed pilonidal surgery: new paradigm and new operation leading to cures. *Arch Surg.* 2002;137:1146-50.
7. Akinci OF, Coskun A, Ozgonul A, Terzi A. Surgical treatment of complicated pilonidal disease: limited separate elliptical excision with primary closure. *Colorectal Dis.* 2006;8:704-9.
8. Kohla SM, Alsesy AA, Abd El-Aziz TF, Mohammed MA, Zaid MA. Comparative study between the Karydakias technique and the Limberg flap in pilonidal sinus. *Menoufia Med J.* 2016;29:539-44.
9. Ozdemir H, Unal Ozdemir Z, Sunamak O. Complete natal cleft removal with kite incision in the treatment of extensive sacrococcygeal pilonidal sinus. *ANZ J Surg.* 2020;90:533-7.
10. Eryilmaz R, Okan I, Coskun A, Bas G, Sahin M. Surgical treatment of complicated pilonidal sinus with a fasciocutaneous V-Y advancement flap. *Dis Colon Rectum.* 2009;52:2036-40.
11. Alvandipour M, Zamani MS, Ghorbani M, Charati JY, Karami MY. Comparison of Limberg Flap and Karydakias Flap Surgery for the Treatment of Patients With Pilonidal Sinus Disease: A Single-Blinded Parallel Randomized Study. *Ann Coloproctol.* 2019;35:313-8.

12. Tezel E. A new classification according to navicular area concept for sacrococcygeal pilonidal disease. *Colorectal Dis.* 2007;9:575-6.
13. Maione F, D'Amore A, Milone M, et al. Endoscopic approach to complex or recurrent pilonidal sinus: A retrospective analysis. *Int Wound J.* 2023;20:1212-8.
14. Guner A, Boz A, Ozkan OF, Ileri O, Kece C, Reis E. Limberg flap versus Bascom cleft lift techniques for sacrococcygeal pilonidal sinus: prospective, randomized trial. *World J Surg.* 2013;37:2074-80.
15. Erkent M, Şahiner İT, Bala M, et al. Comparison of Primary Midline Closure, Limberg Flap, and Karydakı Flap Techniques in Pilonidal Sinus Surgery. *Med Sci Monit.* 2018;24:8959-63.
16. Berkem H, Topaloglu S, Ozel H, et al. V-Y advancement flap closures for complicated pilonidal sinus disease. *Int J Colorectal Dis.* 2005;20:343-8.
17. Omer Y, Hayrettin D, Murat C, Mustafa Y, Evren D. Comparison of modified limberg flap and modified elliptical rotation flap for pilonidal sinus surgery: a retrospective cohort study. *Int J Surg.* 2015;16:74-7.
18. Calisir A, Ece I. Comparison of the Keystone flap and the Limberg flap technique in the surgical treatment of pilonidal sinus disease. *Updates Surg.* 2021;73:2341-6.
19. Emile SH, Khan SM, Barsom SH, Wexner SD. Karydakı procedure versus Limberg flap for treatment of pilonidal sinus: an updated meta-analysis of randomized controlled trials. *Int J Colorectal Dis.* 2021;36:1421-31.
20. Prassas D, Rolfs TM, Schumacher FJ, Krieg A. Karydakı flap reconstruction versus Limberg flap transposition for pilonidal sinus disease: a meta-analysis of randomized controlled trials. *Langenbecks Arch Surg.* 2018;403:547-54.
21. Karaca T, Yoldaş O, Bilgin BÇ, Ozer S, Yoldaş S, Karaca NG. Comparison of short-term results of modified Karydakı flap and modified Limberg flap for pilonidal sinus surgery. *Int J Surg.* 2012;10:601-6.