

Comparison of Early- and Mid-Term Outcomes of Surgical Treatment and Laser Ablation for Pilonidal Sinus Disease

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Abstract

Aim: This study aimed to compare the early- and mid-term outcomes of different surgical and minimally invasive treatment methods for pilonidal sinus disease in terms of wound healing, postoperative complications, chronic postoperative pain, and recurrence.

Materials and Methods: Data from 173 patients operated on for sacrococcygeal pilonidal sinus disease between July 2021 and May 2025 were retrospectively evaluated. Patients were divided into Karydakís flap, primary closure, and laser ablation groups according to the surgical method performed. Demographic characteristics, wound healing, complications, chronic pain, and recurrence rates were compared. Subgroup analyses were also performed in primary cases without previous abscess attacks or prior surgery.

Results: Karydakís flap was performed in 96 (55.5%) patients, primary closure in 42 (24.3%), and laser ablation in 35 (20.2%). Mean hospital stay was shorter in the laser group ($p=0.0002$). Complete wound healing time was significantly longer in the laser group ($p<0.001$). The overall recurrence rate was 9.8%, with recurrence rates of 4.2% in the Karydakís group, 14.3% in the primary closure group, and 20.0% in the laser group ($p=0.014$). However, subgroup analysis in primary cases showed no significant difference between groups ($p=0.118$). Chronic pain and recurrence rates were higher in patients with early wound complications.

Conclusion: Minimally invasive methods may provide advantages such as shorter hospital stay and lower wound dehiscence rates. However, patient selection, disease severity, and wound healing process play an important role in long-term outcomes.

Keywords: Pilonidal sinus, Karydakís flap, Laser ablation, Recurrence, Wound healing

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Pilonidal Sinüs Hastalığında Cerrahi Tedavi ve Lazer Ablasyonun Erken ve Orta Dönem Sonuçlarının Karşılaştırılması

Özet

Amaç: Bu çalışmada pilonidal sinüs hastalığında farklı cerrahi ve minimal invaziv tedavi yöntemlerinin yara iyileşmesi, postoperatif komplikasyonlar, kronik postoperatif ağrı ve nüks açısından erken ve orta dönem sonuçlarının karşılaştırılması amaçlandı.

Gereç ve Yöntem: Temmuz 2021-Mayıs 2025 tarihleri arasında sakrokoksigeal pilonidal sinüs hastalığı nedeniyle opere edilen 173 hastanın verileri retrospektif olarak değerlendirildi. Hastalar uygulanan yönteme göre Karydakıs flep, primer kapama ve lazer ablasyon gruplarına ayrıldı. Demografik veriler, yara iyileşmesi, komplikasyonlar, kronik ağrı ve nüks oranları karşılaştırıldı. Ayrıca geçirilmiş abse veya önceki cerrahi öyküsü olmayan primer olgularda alt grup analizi yapıldı.

Bulgular: Hastaların 96'sına (%55,5) Karydakıs flep, 42'sine (%24,3) primer kapama ve 35'ine (%20,2) lazer ablasyon uygulandı. Ortalama yatış süresi lazer grubunda daha kısa bulundu ($p=0,0002$). Tam yara iyileşme süresi lazer grubunda anlamlı olarak daha uzundu ($p<0,001$). Toplam nüks oranı %9,8 idi ve nüks oranı Karydakıs grubunda %4,2, primer kapama grubunda %14,3 ve lazer grubunda %20,0 olarak saptandı ($p=0,014$). Ancak primer olgular üzerindeki alt grup analizinde gruplar arasındaki fark anlamlılığını kaybetti ($p=0,118$). Erken yara komplikasyonu gelişen hastalarda kronik ağrı ve nüks oranları daha yüksekti.

Sonuç: Minimal invaziv yöntemler kısa yatış süresi ve düşük yara ayrışması oranı gibi avantajlar sağlayabilir. Bununla birlikte hasta seçimi, hastalık şiddeti ve yara iyileşme süreci uzun dönem sonuçlar üzerinde önemli rol oynamaktadır.

Anahtar Kelimeler: Pilonidal sinüs, Karydakıs flep, Lazer ablasyon, Nüks, Yara iyileşmesi

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INTRODUCTION

Pilonidal sinus disease (PSD) is a chronic inflammatory disease located in the sacrococcygeal region, particularly common in young adult men. Hair penetration, local trauma, the deep gluteal groove structure, and hygiene factors play a role in the etiopathogenesis of the disease. PSD remains a significant clinical problem due to recurrent infections, pain, discharge, and loss of work capacity (1, 2).

Different surgical and minimally invasive methods have been described for the treatment of pilonidal sinus disease, and there is still no complete consensus on the ideal treatment method. Classical surgical approaches include total excision and primary closure, as well as off-midline flap techniques (such as Karydakıs flap and Limberg flap). It has also been reported that flap techniques that shift the midline are associated with lower recurrence rates (3, 4).

However, these methods may be associated with longer operating times, more tissue dis-

section, and postoperative morbidity. In recent years, minimally invasive approaches to pilonidal sinus disease have gained increasing importance. Methods such as laser ablation offer advantages such as being less invasive, shorter hospital stays, faster recovery, and earlier return to work. However, data on the long-term effectiveness and recurrence rates of these techniques are limited (5).

While some studies report that minimally invasive methods provide the advantage of low morbidity and rapid recovery, other studies have reported higher recurrence rates and the need for re-intervention, especially in long-term follow-ups (6, 7).

In addition, it is thought that different surgical techniques may have different clinical outcomes not only in terms of recurrence rates but also in terms of wound healing process, post-operative complications, and long-term patient comfort (8).

The impact of early wound complications on long-term recurrence and chronic symptom development is not sufficiently clarified in the literature. Therefore, it is important to comparatively evaluate the effects of different surgical and minimally invasive treatment methods in pilonidal sinus disease not only in terms of recurrence but also on wound healing, postoperative complications, and long-term patient comfort.

This study aimed to compare the early and mid-term outcomes of different treatment methods in patients who underwent surgical treatment for pilonidal sinus disease, in terms of wound healing, postoperative complications, development of chronic symptoms, and recurrence.

MATERIALS AND METHODS

Patient Selection and Study Design

This study was planned as a single-center comparative cohort study retrospectively examining the data of patients who underwent surgical treatment for pilonidal sinus disease. Data from patients operated on for sacrococcygeal pilonidal sinus disease at the General Surgery Clinic of Istanbul Aydın University Faculty of Medicine between July 2021 and May 2025 were retrospectively evaluated. A total of 173 adolescent and adult patients who were diagnosed with pilonidal sinus disease and underwent Karydakis flap procedure, total cyst excision and primary closure or laser ablation during the specified period, and for whom regular postoperative follow-up data were available, were included in the study. Patients were divided into Karydakis flap procedure, total cyst excision and primary closure, and laser ablation groups according to the surgical method applied. Demographic data, disease characteristics, operation records, and postoperative follow-up data were evaluated from patient files and the electronic record system. Patients with incomplete clinical data, unavailable follow-up information, incomplete postoperative follow-up process, or pathology results inconsistent with pilonidal sinus disease were excluded from the study.

Patient Assessment

The variables examined included age, gender,

duration of symptoms, history of abscess attacks, previous surgical history, type of anesthesia, drain use, and length of hospital stay. Additionally, the time to return to work or school, complete wound healing time, suture removal time, early complications, development of chronic pain or discharge, presence of recurrence, time of recurrence, and need for re-intervention were evaluated in the postoperative period. Early complications were defined as wound infection, wound dehiscence, and seroma. Clinically, recurrence was defined as the development of a new sinus or the need for re-surgery/intervention. Chronic postoperative symptoms included pain or persistent discharge exceeding the normal wound healing time and lasting at least 2 months. A subgroup analysis was also performed on primary cases without a history of previous abscess attacks or previous surgery.

Surgical Techniques and Follow-up

In the presence of an infected wound, patients were treated with antibiotic therapy appropriate to their age and clinical condition. Surgical treatment was applied after the local and systemic infection signs subsided. Patients presenting with pilonidal sinus abscesses underwent local abscess drainage and were re-evaluated by being followed up in the outpatient clinic every two days after the procedure. Definitive surgery was planned after complete healing was achieved.

All surgical procedures were performed by the same surgical team. The surgical methods applied were:

1. Total cyst excision and primary closure
2. Karydakis flap procedure
3. Laser ablation

Laser ablation was preferentially offered to patients without evidence of chronic infection, with limited disease extent, and who preferred a minimally invasive treatment after being informed about the available treatment options. Conversely, Karydakis flap or primary closure was preferred in patients presenting with persistent chronic discharge, recurrent disease, relatively extensive pilonidal sinus disease, lateral secondary sinus openings, or in patients

who declined laser ablation. The final treatment decision was made based on both clinical suitability and patient preference.

Total cyst excision was defined as a surgical method based on the principle of completely removing the cystic area with minimal loss of healthy tissue through an incision made to include all sinus openings and tracts in the sacrococcygeal region, and then primary closure without midline shifting. The Karydakias flap procedure is defined as a surgical method based on the complete excision of pilonidal sinus tracts through an asymmetric elliptical incision in the sacrococcygeal region, followed by sliding the gluteal flap to lateralize the midline, thereby moving the wound away from the midline and performing primary closure. Laser ablation is defined as a surgical method performed without extensive tissue excision, where the pilonidal sinus tracts are cleaned using a minimally invasive approach, and epithelialized tracts are destroyed by thermal ablation using a radial laser probe placed inside the sinus cavity. During this procedure, continuous energy is applied to the laser probe placed inside the sinus cavity from distal to proximal, and the probe is withdrawn at approximately 1 mm per second to achieve thermal ablation throughout the entire sinus tract. Cold compression was applied to the surgical area for 5 minutes after the procedure. Surgical procedures were performed under local, spinal, or general anesthesia. All patients were prescribed oral antibiotics and nonsteroidal anti-inflammatory drugs in the postoperative period. Patients who underwent surgical excision and had drains placed were called for outpatient follow-up visits every two days to monitor the drains. Drains were removed when the 24-hour drainage volume fell below 25 cc. All patients, with or without drains, were called for outpatient follow-up visits on the 10th postoperative day for suture evaluation, and the decision regarding suture removal was made based on the wound condition.

Patients who underwent laser ablation were called for outpatient follow-up visits every two days for wound monitoring during the first two weeks. After the second week, weekly follow-up visits continued, and follow-ups were main-

tained until the wound was completely closed. In patients who underwent surgical excision, complete wound healing was defined as the removal of sutures and the absence of infection or dehiscence at the wound site; in patients who developed wound infection or dehiscence, complete wound healing was defined as the complete closure of the wound site without discharge.

All materials obtained from patients who underwent excision were sent for histopathological examination, and all samples were reported as consistent with benign pilonidal sinus disease. All patients were followed up for at least 12 months. Follow-up of patients was carried out through outpatient follow-up visits and telephone calls. Recurrence was primarily confirmed by clinical examination during outpatient follow-up visits. For patients who could not attend outpatient visits, recurrence status was assessed by structured telephone interviews, and those with suspected recurrence were invited for clinical evaluation.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA).

The distribution of continuous variables was evaluated using the Kolmogorov–Smirnov test. Normally distributed data were expressed as mean $\pm$ standard deviation, while non-normally distributed data were expressed as median (minimum–maximum). Categorical variables were presented as numbers and percentages. Student t-test or Mann–Whitney U test was used to compare continuous variables between two groups, while One-Way ANOVA or Kruskal–Wallis test was preferred for comparisons between three groups when appropriate. Chi-square test or Fisher exact test was used to compare categorical variables. In addition, subgroup analyses were performed on primary cases without a history of previous abscess attack or previous surgery. A p value <0.05 was considered statistically significant.

This study was approved by the Istanbul Aydın University Faculty of Medicine Clini-

cal Research Ethics Committee (Decision no: 155/2026, Date: 15.04.2026). The requirement for informed consent for patient inclusion in the study was waived by the ethics committee due to the retrospective design.

RESULTS

A total of 173 patients were included in the study. The mean age of the patients was 30.3 ± 9.6 years, with 140 (80.9%) being male and 33 (19.1%) being female. The median duration of symptoms was 2 months (0.5–36 months). Karydakís flap procedure was performed on 96 (55.5%) patients, total cyst excision and primary closure on 42 (24.3%) patients, and laser ablation on 35 (20.2%) patients. 131 (75.7%) patients were operated on

under general anesthesia, 37 (21.4%) under spinal anesthesia, and 5 (2.9%) under local anesthesia. 41 (23.7%) patients had a history of previous pilonidal abscess, and 11 (6.4%) had a history of recurrence after previous surgery. Histopathological examination of all excision materials was reported as consistent with benign pilonidal sinus disease. The overall median follow-up duration was 14 months (range, 12–48 months). The median follow-up duration was 14 months (range, 12–48 months) in the Karydakís group, 15 months (range, 12–23 months) in the primary closure group, and 15 months (range, 12–24 months) in the laser ablation group. The demographic characteristics, operative data, and postoperative outcomes of the patients are summarized in Table 1.

Table 1. Comparison of demographic, operative, and postoperative outcomes according to surgical technique

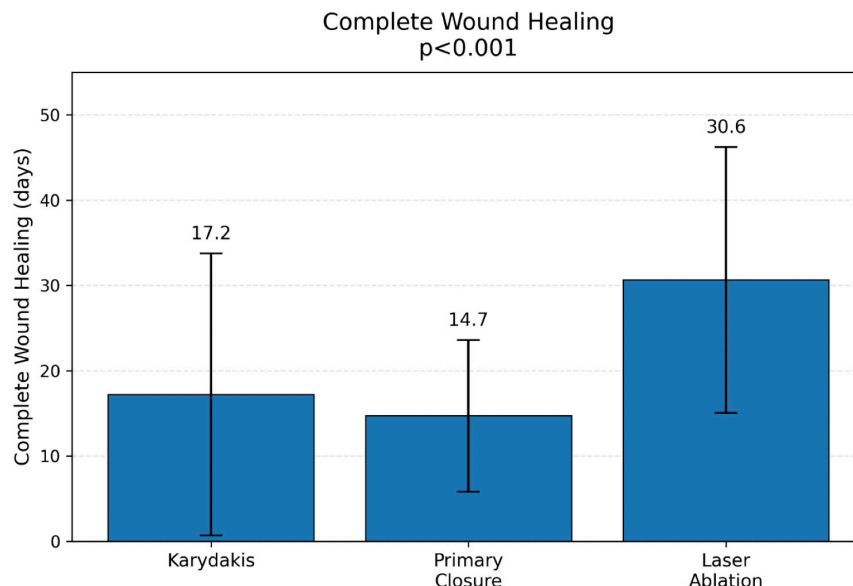
Variable	Karydakís (n=96)	Primary Closure (n=42)	Laser Ablation (n=35)	p
Age (years)	31.31±9.13	31.02±9.67	26.69±10.41	0.044
Male sex, n (%)	80 (83.3)	32 (76.2)	28 (80.0)	0.610
Symptom duration (months)	2.0 (0.2–24.0)	3.0 (0.5–42.0)	2.0 (0.5–12.0)	0.002
Previous abscess history, n (%)	16 (16.7)	12 (28.6)	13 (37.1)	0.028
Previous surgery/recurrence history, n (%)	2 (2.1)	3 (7.1)	6 (17.1)	0.006
General anesthesia, n (%)	69 (71.9)	39 (92.9)	23 (65.7)	<0.001
Spinal anesthesia, n (%)	27 (28.1)	3 (7.1)	7 (20.0)	<0.001
Local anesthesia/sedoanalgesia, n (%)	0 (0.0)	0 (0.0)	5 (14.3)	<0.001
Drain use, n (%)	91 (94.8)	11 (26.2)	0	<0.001
Length of hospital stay (days)	1.07±0.29	1.00±0.00	0.86±0.35	0.0002
Return-to-work time (days)	12.56±3.65	11.76±3.06	10.83±4.41	0.058
Complete wound healing time (days)	17.20±16.53	14.71±8.89	30.63±15.57	<0.001
Suture removal time (days)	11.74±2.09	11.24±1.59	—	0.251
Early complications, n (%)	26 (27.1)	10 (23.8)	4 (11.4)	0.169
Wound dehiscence, n (%)	12 (12.5)	6 (14.3)	0	0.074
Seroma, n (%)	3 (3.1)	0	0	
Chronic pain, n (%)	5 (5.2)	1 (2.4)	3 (8.6)	0.476
Recurrence, n (%)	4 (4.2)	6 (14.3)	7 (20.0)	0.014
Follow-up duration (months), median (range)	14 (12–48)	15 (12–23)	15 (12–24)	0.155

The mean length of hospital stay was found to be shorter in the laser group. The mean length of hospital stay was 1.07 ± 0.29 days in the Karydakakis group, 1.00 ± 0.00 days in the primary closure group, and 0.86 ± 0.35 days in the laser group ($p=0.0002$). Patients operated on under local anesthesia or sedoanalgesia were discharged on the same day. Drains were used in 91 (94.8%) of the patients who underwent the Karydakakis flap procedure and in 11 (26.2%) of the patients who underwent primary closure. The duration of drain placement in patients with drains was found to be 4.05 ± 1.46 days on average in the Karydakakis group and 3.55 ± 1.21 days in the primary closure group; No statistically significant difference was found between the groups in terms of drain dwell time ($p=0.281$).

No statistically significant difference was found between the groups in terms of return-

to-work or school time ($p=0.058$). Return-to-work/school time was found to be an average of 12.56 ± 3.65 days in the Karydakakis group, 11.76 ± 3.06 days in the primary closure group, and 10.83 ± 4.41 days in the laser group. Complete wound healing time was significantly longer in the laser group ($p<0.001$). The average complete wound healing time was found to be 17.20 ± 16.53 days in the Karydakakis group, 14.71 ± 8.89 days in the primary closure group, and 30.63 ± 15.57 days in the laser group. Suture removal time was evaluated only in patients who underwent excision. The mean suture removal time was 11.74 ± 2.09 days in the Karydakakis group and 11.24 ± 1.59 days in the primary closure group, with no significant difference between the groups ($p=0.251$). Complete wound healing times according to surgical techniques are shown in Figure 1.

Figure 1. Complete wound healing times according to surgical technique and comparison of complete wound healing durations among different treatment methods.



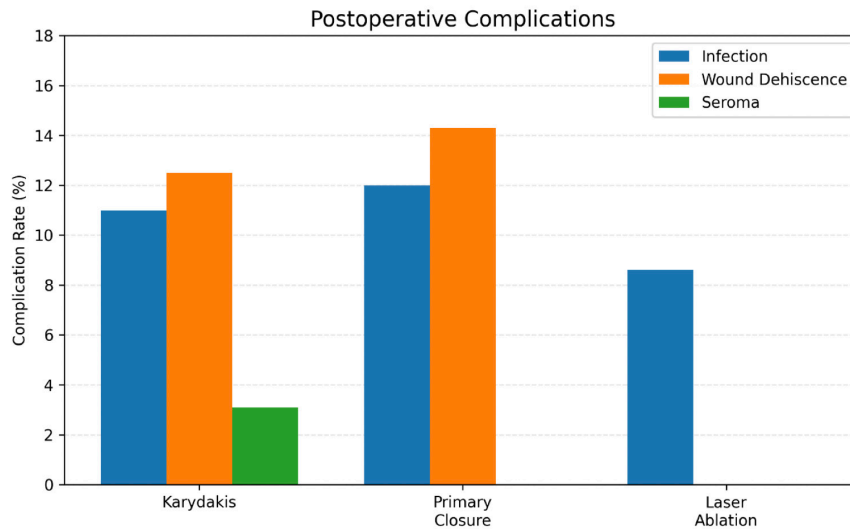
A total of 40 patients (23.1%) developed early complications. Early complication rates were 27.1% in the Karydakakis group, 23.8% in the primary closure group, and 11.4% in the laser group; however, no statistically significant difference was observed between the groups ($p=0.169$). Wound infection occurred in 19

patients (11.0%), wound dehiscence in 18 patients (10.4%), and seroma in 3 patients (1.7%). Wound infection rates were similar among surgical methods ($p=0.941$). Wound dehiscence was observed in 12.5% of the Karydakakis group and 14.3% of the primary closure group, while no wound dehiscence was observed in the la-

ser group. Although the difference between the three groups was not statistically significant ($p=0.074$), wound dehiscence was significantly lower when the laser method was compared with other surgical methods ($p=0.026$). Seroma

was observed only in the Karydakakis group. The distribution of postoperative complications according to surgical techniques is shown in Figure 2.

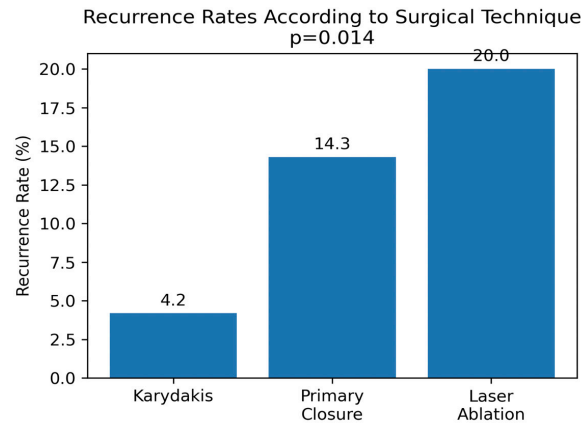
Figure 2. Distribution of postoperative complications according to surgical technique and comparison of wound infection ($p = 0.941$), wound dehiscence ($p = 0.074$), and overall postoperative complication rates ($p = 0.169$) among treatment groups. Comparisons were performed using the Chi-square test.



A total of 9 patients (5.2%) developed chronic postoperative pain. The rates of chronic postoperative pain were found to be 5.2% in the Karydakakis group, 2.4% in the primary closure group, and 8.6% in the laser group, and no significant difference was observed between the groups ($p=0.476$). The median duration of symptoms in patients who developed chronic postoperative pain was 3 months (2–6 months). The rate of chronic postoperative pain was significantly higher in patients who developed early complications (12.5% vs. 3.0%; $p=0.032$). Similarly, chronic postoperative pain was significantly more frequent in patients who developed wound infection (21.1% vs. 3.2%; $p=0.009$).

Recurrence was detected in a total of 17 patients (9.8%). Recurrence was observed in 4 patients (4.2%) in the Karydakakis group, 6 patients (14.3%) in the primary closure group, and 7 patients (20.0%) in the laser group, with a significant difference between the groups ($p=0.014$). The median time to recurrence was 10 months (2–52 months). The recurrence rate was significantly higher in patients who developed wound infection (26.3% vs. 7.8%; $p=0.025$). The recurrence rate was also significantly higher in patients who developed chronic postoperative symptoms (44.4% vs. 7.9%; $p=0.006$). The distribution of recurrence rates according to surgical techniques is shown in Figure 3.

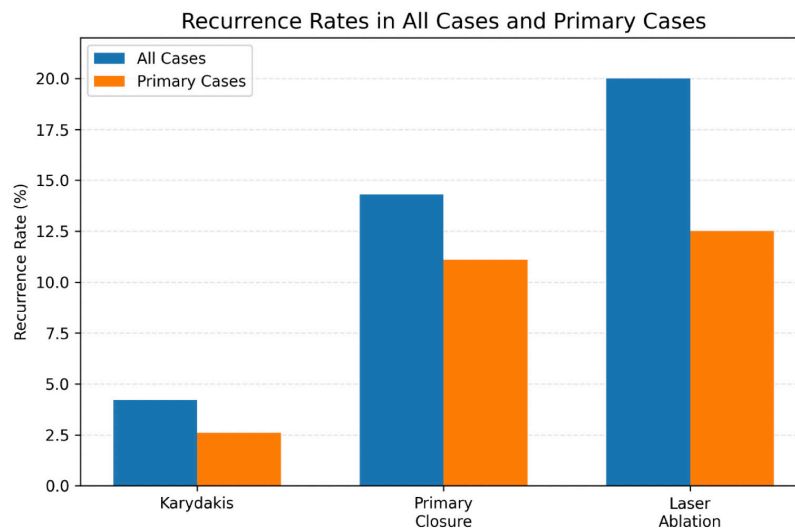
Figure 3. Recurrence rates according to surgical technique and comparison of recurrence rates among Karydakis flap, primary closure, and laser ablation groups.



A history of previous pilonidal abscess was more frequent in the laser group (37.1%) compared to the Karydakis (16.7%) and primary closure (28.6%) groups, with a significant difference between the groups ($p=0.028$). Similarly, the rate of recurrent cases after previous surgery was significantly higher in the laser group (17.1% vs. 7.1% and 2.1%; $p=0.006$). In subgroup analysis performed on primary cases

without a history of previous abscess attack or previous surgery, recurrence rates were found to be 2.6% in the Karydakis group, 11.1% in the primary closure group, and 12.5% in the laser group; however, no statistically significant difference was found between the groups ($p=0.118$). Comparison of recurrence rates in all cases and primary cases is shown in Figure 4.

Figure 4. Comparison of recurrence rates between all cases and primary cases according to surgical technique. The recurrence rates differed significantly among all cases ($p = 0.014$), whereas no significant difference was observed after excluding patients with previous abscess history or recurrent disease (primary cases, $p = 0.118$). Comparisons were performed using the Chi-square test.



DISCUSSION

Recurrence rates after surgical and minimally invasive treatment of pilonidal sinus disease worldwide have been reported as variable (7,9). While Bi et al. reported that flap techniques were associated with lower recurrence rates in their network meta-analysis, it was emphasized that minimally invasive methods offer advantages in terms of short-term patient comfort, but long-term recurrence results are still controversial(10).

In our study, consistent with the literature, the recurrence rate was lower after the Karydakís flap procedure than after primary closure. Although the laser ablation group demonstrated a shorter hospital stay and lower wound dehiscence rates, the crude recurrence rate was higher. Although the difference in hospital stay was statistically significant, the absolute difference was relatively small and its clinical relevance should be interpreted with caution. Subgroup analysis showed that a considerable proportion of patients who developed recurrence after laser ablation had a history of previous abscess episodes or prior surgery at the time of initial presentation. This finding suggests that patient selection and baseline disease severity may have substantially influenced the observed outcomes. Indeed, the loss of statistical significance after excluding complicated cases indicates that the higher crude recurrence rate may not be attributable solely to the surgical technique itself. This imbalance in baseline characteristics represents a potential source of selection bias. Therefore, the higher crude recurrence rate observed in the laser ablation group should be interpreted with caution and may partly reflect the greater proportion of patients with previous abscess episodes or recurrent disease rather than the treatment modality itself. Furthermore, follow-up duration did not differ significantly among the three treatment groups ($p = 0.155$), suggesting that the observed differences in recurrence rates were unlikely to be explained by unequal follow-up periods. Consequently, the outcomes of minimally invasive techniques should be interpreted with careful consideration of patient selection, particularly in patients with more advanced or recurrent disease.

Laser ablation has gained attention due to its simple and minimally invasive technique. In fact, it has been shown to be easily repeatable in well-selected cases of relatively less severe recurrence. There are studies showing that better healing results are obtained in studies where multiple sessions are applied (11, 12). In our study, we performed a single session of laser ablation on patients in the laser ablation group. Also, compared to other groups, the rate of patients with a history of abscess and recurrence was higher in this group. Therefore, the use of a single-session laser protocol should be considered when interpreting our findings, as it may have contributed to the observed recurrence rates and represents a limitation of the present study.

Although the suture removal time was similar between the Karydakís and primary closure groups in patients who underwent excision in our study, the complete wound healing time showed a more variable distribution. This situation can be explained by the fact that suture removal time is mostly a procedure dependent on the standard postoperative follow-up protocol, while complete wound healing is affected by clinical factors such as wound infection, wound dehiscence, seroma, and delayed epithelialization. Indeed, while suture removal time is generally reported to be between 10–15 days in the literature, it has been shown that wound healing time can vary over a wider range depending on surgical technique, development of complications, and open/closed wound management (13-15).

In minimally invasive methods such as laser ablation, suture removal is not necessary, but complete wound healing or time to complete closure without discharge should be evaluated as a separate clinical healing parameter. Therefore, the different results of suture removal time and complete wound healing time in our study are not a methodological discrepancy, but a natural consequence of the two evaluated parameters reflecting different clinical processes. In our study, it was observed that chronic postoperative pain and recurrence rates were significantly higher in patients who developed early wound complications. The significantly

increased rates of both chronic pain and recurrence, particularly in patients who develop wound infection, suggest that early wound healing problems may have an impact on long-term clinical outcomes. Some recent studies have reported that wound healing problems and postoperative infections may be associated with recurrence after pilonidal sinus surgery (6, 16, 17).

However, while most studies in pilonidal sinus surgery focus on comparing surgical techniques, the number of studies evaluating the relationship between wound complications and long-term outcomes is limited. Therefore, we believe that our study can contribute to the literature in this respect. Overall, our findings highlight that careful patient selection remains a key determinant of successful outcomes following minimally invasive treatment for pilonidal sinus disease and should be carefully considered when interpreting the results of laser ablation.

Study Limitations

Due to the retrospective and single-center design of our study, selection bias cannot be completely ruled out. The choice of surgical method was not randomized and may have been influenced by clinical factors such as disease extent, previous abscess attack, and previous surgical history. Nevertheless, the fact that all patients were operated on by the same surgical team, had a follow-up period of at least 1 year, and underwent regular outpatient follow-ups can be considered among the strengths of the study. In addition, the relatively small number of recurrence and chronic pain events may have limited the statistical power of some subgroup analyses.

CONCLUSION

In conclusion, minimally invasive techniques may provide advantages such as shorter hospital stay and lower wound dehiscence rates in appropriately selected patients with pilonidal sinus disease. However, patient selection, baseline disease severity, and postoperative wound healing appear to play a significant role in long-term outcomes. Careful patient selection should therefore remain a fundamental con-

sideration when choosing minimally invasive treatment, particularly in patients with recurrent or more extensive disease. Furthermore, early wound complications may be associated with an increased risk of long-term recurrence and chronic postoperative pain.

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Conflict of interest: No conflict of interest was declared by the authors. The authors declared that this study received no financial support.

Ethical approval: This study was approved by the Istanbul Aydın University Faculty of Medicine Clinical Research Ethics Committee (Decision no: 155/2026, Date: 15.04.2026). The requirement for informed consent for patient inclusion in the study was waived by the ethics committee due to the retrospective design, and the study was conducted in accordance with the principles of the 1967 Declaration of Helsinki.

Informed consent: Informed consent was obtained from all adult patients and from the legal guardians of patients under 18 years of age, after providing information about all procedures.

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