Comparative analysis of treatment modalities and contributing factors in recurrent pilonidal sinus disease

JENNA LAGUS[1], HEIDI-MARI MYLLYKANGAS[2] and HENRIK NUUTINEN[1,2]

[1]Department of Surgery, University of Eastern Finland, 70210 Kuopio, Finland; [2]Department of Plastic Surgery, Kuopio University Hospital, 70211 Kuopio, Finland

Received April 9, 2025; Accepted August 26, 2025

DOI: 10.3892/etm.2025.12969

Abstract. Pilonidal sinus disease (PSD) is a common and frequently recurring condition affecting young men. Despite the frequent recurrence of PSD, there is a lack of published literature addressing the management of recurrent disease. In the present retrospective study, data from 63 patients with recurrent pilonidal sinuses treated at the Plastic Surgery Department of Kuopio University Hospital (Kuopio, Finland) between 2010 and 2021 were analyzed. Patients were categorized into three groups based on the primary operation: Laser treatment (n=13), excision combined with direct closure (n=32) and flap reconstruction (n=18). The patient characteristics, complications, re-operative methods and follow-up times of these groups were compared. The minimum follow-up time was 18.3 months. Furthermore, ~1 in 5 patients required re-operation after the primary operation: 18.8% after laser treatment, 20.5% after direct closure and 19.2% after flap reconstruction. Residual disease or recurrence was more common as a reason for re-operation in the laser group compared with the other groups (direct closure group, P=0.003; flap group, P=0.010). Direct closure was the most common method for re-operation after primary direct closure and flap reconstruction (56.3 and 55.6%, respectively). However, patients treated primarily with laser were most likely re-operated with laser (61.5%), with only 15.4% operated using secondary direct closure and 23.1% with secondary flap reconstruction. In conclusion, the risk of recurrent PSD remains significant, yet most patients typically required only one re-operation. Laser treatment was a promising approach for both primary and recurrent cases. However, long-term outcomes are necessary to confirm this.

Correspondence to: Dr Henrik Nuutinen, Department of Plastic Surgery, Kuopio University Hospital, Puijonlaaksontie 2, 70211 Kuopio, Finland
E-mail: henrik.nuutinen@kuh.fi

Key words: pilonidal sinus, recurrent, redo, laser, flap

Introduction

Pilonidal sinus disease (PSD) is a common condition, with an incidence rate of 26/100,000, typically affecting young men (1,2). PSD manifests in the sacrococcygeal region as either an acute abscess or chronic inflammation of the sinus tract (3-5). Multiple factors have been associated with PSD, including obesity, poor hygiene, prolonged sitting, hairiness, and deep natal cleft (5,6). Treatment options range from minimally invasive procedures, such as laser treatment and phenolization, to surgical excision combined with midline closure or flap reconstruction (5-7). While surgical methods have traditionally been the primary choice, recent studies have shown promising results for minimally invasive approaches, providing faster recovery and low post-operative complication rates (8-11).

Pilonidal disease is a frequently recurring condition, with a recurrence rate of up to 40% within a 5-year follow-up, and significant variation across different treatment modalities (12,13). In the literature, higher recurrence rates have been associated with surgical excision combined with midline closure, whereas off-midline techniques, such as Limberg flap and Bascom cleft, lift have been linked to lower recurrence rates (4,12-16). However, patient-related factors (13,16) and follow-up times (6,12) should also be considered when evaluating the recurrence rates. Recurrent PSD can be managed using primary case treatment modalities (16-18). The most effective approach remains debated despite the various treatment options available (15,16,18-20). Additionally, there is a shortage of published literature addressing the management of recurrent disease. This study aims to present the results of re-operations in our patient cohort and discuss the factors contributing to the recurrence of pilonidal disease to inform future decisions based on previous experiences and knowledge.

Materials and methods

Participants. This article presents a case series analysis of 63 patients with recurrent PSD, treated in the plastic surgery department of a teaching hospital between 2010 and 2021. A total of 319 patients with pilonidal sinus underwent surgery during this period. Both primary and recurrent cases of PSD were operated on using laser treatment, surgical excision with direct closure, or flap reconstruction. Over the years,

we have developed treatments for PSD patients. Initially, we used direct closure, then a flap, and now we utilize laser. We have discussed these techniques in our previously published articles (21,22). A majority (84.1%) of the patients in this study were men; 27 (84.4%) in the direct closure group, 15 (83.3%) in the flap reconstruction group, and 11 (84.6%) patients in the laser group. The median age in the laser group was 25.5 years (range 14-51), 28.5 years (range 7-70) in the direct closure group, and 30.5 years (range 14-65) in the flap group.

Study protocol. All patients underwent preoperative clinical evaluation and were selected for re-operation if they presented recurrence or residual disease, or complications such as infection, hematoma, or dehiscence, with some patients displaying multiple complications. The research material was gathered retrospectively from the medical records. Basic variables, including age, gender, BMI, and smoking habits, were collected preoperatively and postoperatively. The patients had routine follow-ups in the outpatient clinics one to three months after the surgery. This study has received approval from the regional institutional review board (ID164/2021).

Statistical analysis. Statistical analyses were performed using IBM SPSS Statistics, version 27. Categorical variables were presented as absolute numbers and percentages, and continuous variables as the mean ± standard deviation (SD). Fisher's exact test compared nominal data and the Mann-Whitney U test for nonparametric data. P-values <0.05 were considered statistically significant.

Results

Basic characteristics. Out of 319 pilonidal sinus patients, 69 (21.6%) underwent laser treatment, 156 (48.9%) excision with direct closure, and 94 (29.5%) excision with flap reconstruction. Within the study group of 63 re-operated patients, there were 13 in the laser treatment group, 32 in the direct closure group, and 18 in the flap reconstruction group. Approximately one in five patients required re-operation: 18.8% after laser treatment, 20.5% after direct closure, and 19.2% after flap reconstruction, with no statistical significance found between the treatment methods.

Patients who underwent flap reconstruction were statistically significantly older (30.9±8.9 years) than those treated with laser (P=0.038). The mean BMI in the laser group was 27.3±3.6, 29.3±4.5 in the direct closure group, and 33.1±4.7 in the flap group, with a statistical difference between laser and flap procedure (P=0.003). There were significantly fewer smokers in the laser group (*n*=2, 15.4%) in comparison to the flap group (*n*=11, 61.1%, P=0.039), and the direct closure group (*n*=15, 46.9%, P=0.025). The mean follow-up time was 18.1±7.3 months after laser treatment, with a statistically significant difference compared to direct closure (81.0±34.8 months, P=0.000), and the flap procedure (101.2±24.5 months, P=0.000) (Table I). There was no statistical difference when comparing patients' gender and re-operations, in the preoperative data, there were 70-76% of men and re-operated data included 83-84% men.

Reasons for the re-operations. Infection, hematoma, dehiscence, and recurrence or residual disease were indications for re-operation. Infection rates were equal across all groups: 38.5% (*n*=5) of laser-treated patients, 40.6% (*n*=13) of direct closure patients, and 38.9% (*n*=7) of flap-reconstructed patients presented signs of infection post-operatively. Hematoma occurred in 13 (40.6%) direct closure patients and four (22.2%) flap reconstructed patients, with no statistical significance. Dehiscence was more frequent after direct closure (*n*=15, 46.9%) than flap reconstruction (*n*=3, 16.7%), but no statistical significance was found (P=0.064). There were no reports of hematoma or dehiscence after laser treatment. Residual disease or recurrence was the most common reason for re-operation after laser treatment (n=11, 84.6%). Residual or recurrence was detected in 12 (37.5%) direct closure patients and seven (38.9%) flap-reconstructed patients. There was also a statistically significant difference when comparing recurrence and residual as reasons for re-operation between laser and direct closure or flap (P=0.003 & P=0.010) (Table II).

Re-operation techniques. The majority of re-operations after laser treatment were performed using the laser (n=9, 61.5%), two (15.4%) with direct closure, and three (23.1%) with flap reconstruction. Two (15.4%) laser-treated patients required two or more re-operations. Most re-operations after direct closure surgery were also performed using the same method (*n*=18, 56.3%). The flap procedure was used in 31.3% (*n*=10), and laser in 18.8% (*n*=6) of the re-operations after primary direct closure. Twelve (37.5%) patients in this group needed multiple re-operations. Most re-operations after flap reconstruction were direct closure surgeries (*n*=10, 55.6%), 38.9% (*n*=7) were flap procedures, and 11.1% (*n*=2) were laser operations. Only one flap-reconstructed patient (5.6%) required two or more re-operations (Table III).

Discussion

Our observations indicate that factors leading to recurrence and re-operation vary depending on the selected treatment method. Patients who underwent laser treatment as their primary operation exhibited more residual and recurrence when compared to those treated with other surgical techniques, and there was also a statistical difference between the groups. In our experience, laser treatment provides favorable results for relatively superficial pilonidal sinus. However, residual disease is more common when it affects deeper tissues of the sacrococcyx area. To address this, we perform a magnetic resonance imaging (MRI) scan to assess the extent of pilonidal sinuses if residuals are detected after the second laser treatment. While laser treatment has yielded promising results with fewer complications than open surgical methods (12,15,23), some studies have reported high recurrence rates over extended follow-up periods (11,12). Nevertheless, comprehensive long-term data on laser treatment are still limited. Differentiating recurrence from residual disease may also be challenging without close post-operative monitoring, thus potentially influencing the accuracy of recurrence rates.

The most common complication after direct closure was dehiscence, likely due to this technique resulting in tension and traction of the suture lines (2,5,16). Technical factors in

Table I. Basic characteristics of the re-operated patients.

Characteristics	Laser (n=13)	Direct closure (n=32)	P-value (laser vs. direct closure)	Flap (n=18)	P-value (laser vs. flap)
Age, years (mean ± SD)	24.54±7.23	26.84±11.55	0.688	30.94±8.86	0.038
Sex (male), n (%)	11 (84.6)	27 (84.4)	NC	15 (83.3)	NC
Smoking, n (%)	2 (15.4)	15 (46.9)	0.039 (0.078[a])	11 (61.1)	0.025 (0.050[a])
BMI, kg/m^2 (mean ± SD)	27.29±3.65	29.31±4.50	0.199	33.05±4.69	0.003
Follow-up, months (mean ± SD)	18.12±7.32	80.98±34.78	<0.001	101.24±24.48	<0.001

[a]After Bonferroni corrections. NC, not calculated.

Table II. Cause of the re-operation.

Causes	Laser, n (%) (n=13)	Direct closure, n (%) (n=32)	P-value (laser vs. direct closure)	Flap, n (%) (n=18)	P-value (laser vs. flap)
Infection[a]	5 (38.46)	13 (40.63)	>0.999 (>0.999[b])	7 (38.89)	>0.999 (>0.999[b])
Hematoma[a]	0 (0.0)	3 (9.38)	0.546 (>0.999[b])	4 (22.22)	0.120 (0.240[b])
Dehiscence[a]	0 (0.0)	15 (46.88)	0.002 (0.004[b])	3 (16.67)[c]	0.238 (0.476[b])
Residual disease/recurrence[a]	11 (84.62)	12 (37.50)	0.003 (0.006[b])	7 (38.89)	0.010 (0.020[b])

[a]Patients may have more than one cause for re-operation. [b]After Bonferroni corrections. [c]P=0.064 compared with direct closure.

Table III. Technique of re-operation.

	Primary operation		
Re-operation	Laser (n=13)[a]	Direct closure (n=32)[a]	Flap (n=18)[a]
Laser, n (%)	9 (61.54)	6 (18.75)	2 (11.11)
Direct closure, n (%)	2 (15.38)	18 (56.25)	10 (55.56)
Flap, n (%)	3 (23.08)	10 (31.25)	7 (38.89)
Two or more re-operations, n (%)	2 (15.38)	12 (37.50)	1 (5.56)

[a]Patients may have more than one re-operation.

suturing can also influence dehiscence. Factors leading to re-operation seemed more varied after primary flap reconstruction. Patients in the flap group experienced less dehiscence than those in the direct closure group, but hematoma was more prevalent. Flap techniques aim to reduce tension and traction by flattening the natal cleft and placing sutures away from the midline, decreasing the risk of dehiscence (2,5,16). However, flap reconstruction techniques require detaching the soft tissue from a wider area, resulting in a higher risk of postoperative hematoma, which may explain our findings.

Infection rates were similar between the groups, possibly affected by the location of the pilonidal sinus, which can increase the risk of bacterial contamination. Additionally, PSD often appears as an infected sinus before surgery (2,5,17). However, factors like poor hygiene and inadequate wound care may also influence infection rates (24). Other studies have shown significant differences in postoperative infection rates, with the highest risk usually linked to the direct closure method (6,10).

The re-operation method was individually selected for each patient, considering the primary operation. In most cases, patients were re-operated using the same treatment modality as in their initial procedure, apart from flap reconstruction, which was typically followed by direct closure. By mobilizing the flap during re-operative surgery, direct closure can be performed without causing tension on the suture lines, eliminating the need for new reconstruction. Re-operation with laser treatment was rare after direct closure or flap reconstruction, as most of these surgeries were conducted before the introduction of laser treatment to our clinic. Multiple re-operations were frequently required after primary direct closure, suggesting that this method may not be optimal for treating pilonidal

disease, a conclusion also reached by other studies (2,4,7,12). Re-operation with laser is recommended in cases with minor residual disease in the operation area. Laser is also a safe and effective option for recurrent pilonidal disease (25).

The typical characteristics of pilonidal disease patients (male gender, age, and overweight) were well represented in our patient cohort. However, significant variation was found between the groups. Patients who underwent flap reconstruction were older and had higher BMIs. Additionally, both the flap reconstruction and direct closure groups had significantly more smokers compared to the laser group, possibly reflecting the increased emphasis on smoking cessation in recent years. Smoking and obesity are associated with a higher risk of complications and inadequate healing, potentially influencing the complication rates of the groups. Smoking and high BMI could also contribute to the need for re-operation rate. Data on poor personal hygiene, sacrococcygeal hair density, sitting time, tight clothing usage, and microbiological data were not collected because the information was unavailable.

Laser treatment is a minimally invasive procedure performed in an outpatient clinic under local anesthesia, requiring little post-operative care and minimal sick leave. In contrast, flap reconstruction and direct closure are more extensive procedures, requiring postoperative wound care, sitting limitations, and longer sick leave for optimal healing (9-11). These differences present a challenge when comparing the complication rates of the groups. The follow-up time after laser treatment was significantly shorter after direct closure and flap reconstruction. Patients in these groups underwent treatment at different periods, so the follow-up times are not directly comparable. As laser treatment is a relatively new method in our clinic, extensive long-term data on its outcomes are yet to be acquired.

While this study provides valuable insights, its limitations include a retrospective design and a relatively small patient cohort. Additionally, comparing laser treatment and excision, combined with direct closure or flap reconstruction, presents challenges due to their distinct natures. Furthermore, variations in patient characteristics between the groups and the notably shorter follow-up time after laser treatment may impact the results. Multivariable analysis was not performed due to the small number of patients in the data. Different techniques used in various periods may lead to selection bias. The Flap group, for example, may include more complex cases. Larger studies with longer follow-up periods are required to determine the optimal treatment method for PSD. In the study, we did not evaluate the quality of life assessment, including pain and return to work, which is a limitation of the operative results. Only pairwise Mann-Whitney U tests were used, increasing the risk of type I error, therefore results should be interpreted with caution to avoid overinterpretation. Despite these limitations, the study benefits from a lengthy, continuous period during which the treatment of pilonidal disease has improved and shifted towards a minimally invasive approach. This improvement is reflected in the post-operative results, with fewer complications associated with laser treatment than other modalities. Additionally, the extended follow-up of patients in the flap and direct closure groups provides valuable insight into the recurrence rates associated with these methods.

In conclusion, the risk of recurrent pilonidal sinus disease remains significant, yet most patients typically require only one re-operation. Laser treatment emerges as a promising approach for both primary and recurrent cases. However, long-term outcomes are necessary to confirm the matter.

Acknowledgements

Not applicable.

Funding

No funding was received.

Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

JL, HMM and HN contributed to data collection, writing, data analysis and editing. JL, HMM and HN confirm the authenticity of all the raw data. All authors have read and approved the final version of the manuscript.

Ethics approval and consent to participate

The present study was conducted retrospectively from data obtained for clinical purposes and has been approved by the Regional Institutional Review Board of Kuopio University Hospital (approval no. ID164/2021). Informed consent was not required as this was a retrospective study.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

References

1. Søndenaa K, Andersen E, Nesvik I and Søreide JA: Patient characteristics and symptoms in chronic pilonidal sinus disease. Int J Colorectal Dis 10: 39-42, 1995.
2. Harries RL, Alqallaf A, Torkington J and Harding KG: Management of sacrococcygeal pilonidal sinus disease. Int Wound J 16: 370-378, 2019.
3. Chintapatla S, Safarani N, Kumar S and Haboubi N: Sacrococcygeal pilonidal sinus: Historical review, pathological insight and surgical options. Tech Coloproctol 7: 3-8, 2003.
4. McCallum IJ, King PM and Bruce J: Healing by primary closure versus open healing after surgery for pilonidal sinus: Systematic review and meta-analysis. BMJ 336: 868-871, 2008.
5. De Parades V, Bouchard D, Janier M and Berger A: Pilonidal sinus disease. J Visc Surg 150: 237-247, 2013.
6. Bi S, Sun K, Chen S and Gu J: Surgical procedures in the pilonidal sinus disease: A systematic review and network meta-analysis. Sci Rep 10: 13720, 2020.
7. Iesalnieks I and Ommer A: The management of pilonidal sinus. Dtsch Arztebl Int 116: 12-21, 2019.

8. Pappas AF and Christodoulou DK: A new minimally invasive treatment of pilonidal sinus disease with the use of a diode laser: A prospective large series of patients. Colorectal Dis 20: O207-O214, 2018.
9. Harju J, Söderlund F, Yrjönen A, Santos A and Hermunen K: Pilonidal disease treatment by radial laser surgery (FiLaC™): The first Finnish experience. Scand J Surg 110: 520-523, 2021.
10. Giarratano G, Toscana C, Shalaby M, Buonomo O, Petrella G and Sileri P: Endoscopic pilonidal sinus treatment: long-term results of a prospective series. JSLS 21: e2017.00043, 2017.
11. Chen S, Dai G, Liu P, Zhao X, Zhang J, Yang C, Xu X, Wang L, Chen W, Wang M and Zhang D: Comparative analysis on the effect of the endoscopic versus conventional treatment for pilonidal sinus: A meta-analysis of controlled clinical trials. Medicine (Baltimore) 101: e31767, 2022.
12. Stauffer VK, Luedi MM, Kauf P, Schmid M, Diekmann M, Wieferich K, Schnüriger B and Doll D: Common surgical procedures in pilonidal sinus disease: A meta-analysis, merged data analysis, and comprehensive study on recurrence. Sci Rep 8: 3058, 2018.
13. Uçar AD, Cartı EB, Oymacı E, Sarı E, Yakan S, Yıldırım M and Erkan N: Recurrent pilonidal disease surgery: Is it second primary or reoperative surgery? Ulus Cerrahi Derg 32: 162-167, 2015.
14. Mahdy T: Surgical treatment of the pilonidal disease: Primary closure or flap reconstruction after excision. Dis Colon Rectum 51: 1816-1822, 2008.
15. Milone M, Velotti N, Manigrasso M, Anoldo P, Milone F and De Palma GD: Long-term follow-up for pilonidal sinus surgery: A review of literature with metanalysis. Surgeon 16: 315-320, 2018.
16. Yoldas T, Karaca C, Unalp O, Uguz A, Caliskan C, Akgun E and Korkut M: Recurrent pilonidal sinus: Lay open or flap closure, does it differ? Int Surg 98: 319-323, 2013.
17. Notaro JR: Management of recurrent pilonidal disease. Semin. Colon Rectal Surg 14: 173-185, 2003.
18. Humphries AE and Duncan JE: Evaluation and management of pilonidal disease. Surg Clin North Am 90: 113-24, 210.
19. Prassas D, Rolfs TM, Schumacher FJ and Krieg A: Karydakis flap reconstruction versus Limberg flap transposition for pilonidal sinus disease: A meta-analysis of randomized controlled trials. Langenbecks Arch Surg 403: 547-554, 2018.
20. el-Khadrawy O, Hashish M, Ismail K and Shalaby H: Outcome of the rhomboid flap for recurrent pilonidal disease. World J Surg 33: 1064-1068, 2009.
21. Tyrväinen E, Nuutinen H, Savikkomaa E and Myllykangas HM: Comparison of laser ablation, simple excision, and flap reconstruction in the treatment of pilonidal sinus disease. Lasers Med Sci 39: 52, 2024.
22. Nuutinen H, Savikkomaa E, Tyrväinen E and Myllykangas H: Laser treatment of pilonidal disease-immediate and mid-term results. Indian J Surg 86: 94-97, 2024.
23. Horesh N, Meiri H, Anteby R, Zager Y, Maman R, Carter D, Meyer R, Nachmany I and Ram E: Outcomes of laser-assisted closure (SiLaC) surgery for chronic pilonidal sinus disease. J Laparoendosc Adv Surg Tech A 33: 556-560, 2023.
24. Herrod PJ, Doleman B, Hardy EJ, Hardy P, Maloney T, Williams JP and Lund JN: Dressings and topical agents for the management of open wounds after surgical treatment for sacrococcygeal pilonidal sinus. Cochrane Database Syst Rev 5: CD013439, 2022.
25. Emral AC and Yazici SE: Evaluation of laser ablation for recurrent pilonidal sinus disease: Treatment success, recurrence rates, and patient outcomes. Lasers Med Sci 40: 281, 2025.