GSC Advanced Research and Reviews
eISSN: 2582-4597 CODEN (USA): GARRC2
Cross Ref DOI: 10.30574/gscarr
Journal homepage: https://gsconlinepress.com/journals/gscarr/

(RESEARCH ARTICLE)

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Sinus laser-assisted closure – SiLaC: Early outcomes and influencing factors

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GSC Advanced Research and Reviews, 2025, 24(02), 295-301

Publication history: Received on 15 July 2025; revised on 25 August 2025; accepted on 28 August 2025

Article DOI: https://doi.org/10.30574/gscarr.2025.24.2.0259

Abstract

Background: Pilonidal sinus disease (PSD) is a chronic condition of the sacrococcygeal region, commonly affecting young men, causing pain and reduced quality of life. Traditional operations such as open excision or flap procedures (Limberg, Karydakis) are effective but leave large scars, cause significant pain, and require long recovery times. Current practice favors minimally invasive techniques. Sinus Laser Closure (SiLaC) uses a 1470-nm laser fiber to ablate the epithelial lining and shrink the tract, thereby closing the sinus. Early studies report that SiLaC is safe, less painful, and promotes rapid healing (2–3 weeks) with low short-term recurrence; however, long-term data remain limited.

Objective: To determine the preliminary outcomes of SiLaC at Hanoi Medical University Hospital, Vietnam.

Methods: Consecutive patients who underwent SiLaC at Hanoi Medical University Hospital from February 2024 to June 2024 were included. This was a retrospective analysis of a prospectively maintained database.

Results: Nine patients underwent laser sinus closure. Mean age was 19 ± 3.08 years (15–25); 6/9 (66.7%) were male and 3/9 (33.3%) female. Mean BMI was 28.51 ± 5.04 kg/m^2 (23.23–36.73). Prior pilonidal surgery was recorded in 3/9 (33.3%). Mean tract length was 39.55 ± 14.91 mm (19–62); a secondary tract was found in 1/9 (11.1%). Disease severity: simple 6/9 (66.7%), complex 3/9 (33.3%). Mean operative time was 30 minutes with no intraoperative complications. Postoperatively, all patients had mild pain with VAS <4 (9/9, 100%); no case had VAS >4. Mean length of stay was 1.11 ± 0.33 days. No postoperative complications were observed. Over a mean follow-up of 103.11 ± 73.26 days (29–234), primary wound healing occurred in 100% (9/9); time to complete healing was 20.22 ± 10.06 days (7–30). No recurrences were recorded during follow-up.

Conclusion: SiLaC is a minimally invasive and safe technique with a high success rate, low complication rate, and minimal postoperative pain.

Keywords: Pilonidal Sinus Disease; Laser; Sinus Closure; Silac

1. Introduction

Pilonidal sinus is a common condition, with an estimated prevalence of about 26 cases per 100,000 population. It occurs more frequently in young men, with a male-to-female ratio of approximately 3:1 to 4:1. A pilonidal sinus is a cavity located within the subcutaneous tissue of the sacrococcygeal (coccygeal) region. Most authors regard it as an acquired

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disease, whereas a minority consider it congenital in origin.[1] Although a variety of surgical techniques have been employed—from open excision to flap procedures (Limberg, Karydakis)—they are often limited by large wounds, significant postoperative pain, unfavorable scarring, and prolonged recovery times.[2, 3] This has driven the development of minimally invasive techniques aimed at reducing complications and enabling patients to return to normal activities sooner. In 2014, Dessily et al. were the first to apply sinus laser-assisted closure (SiLaC) for the treatment of pilonidal sinus disease (PSD), based on principles similar to FiLaC—a novel technique that uses a radially emitting diode-laser probe for anal fistulas. An increasing body of evidence from small case series suggests that the use of diode lasers in PSD may be an effective solution. This approach is minimally invasive, causes limited collateral tissue damage, and has reported success rates of 80–90%.[4–6] In this study, we aimed to assess the preliminary outcomes and identify factors influencing the success rate of this technique.

2. Materials and Methods

2.1. Study Population

All patients who underwent the SiLaC technique at the Department of Coloproctology and Pelvic Floor Surgery, Hanoi Medical University Hospital, Vietnam, from December 2024 to July 2025 were included. All participants provided written informed consent, including consent for the use of anonymized clinical data and intraoperative images for publication.

Patients with prior treatment failure were eligible for inclusion. Medical records with incomplete data were excluded.

All patients underwent standardized sequential assessments comprising clinical examination, perineal ultrasonography, proctoscopy, and pelvic magnetic resonance imaging (MRI).

Postoperative follow-up was scheduled at 2 weeks, 1 month, 3 months, and 6 months, or earlier if any abnormalities occurred. For longer-term follow-up, patient status was assessed via direct telephone calls

Primary healing was defined as the absence of discharge and pain with complete wound closure after the initial SiLaC procedure. Healing lasting more than 60 days was considered delayed healing [1] and warranted additional follow-up. Recurrence was defined as the reappearance of disease symptoms after an initial period of healing. [7] It was considered a form of treatment failure. At the end of the study period, patients who were asymptomatic with complete wound closure were classified as having achieved overall complete healing.

2.2. Pain assessment

Postoperative pain was evaluated using the visual analogue scale (VAS) from 0 to 10 (0 = no pain; 10 = worst imaginable pain). Mild pain: 1–4; moderate pain: 5–7; severe pain: 8–10.

To better identify which patients might benefit most from the procedure, we classified cases into two groups:

- Group 1 – Simple cases: No history of abscess; only 1–2 sinus pits (external openings) located close to each other and confined to the midline (intergluteal sulcus).
- Group 2 – Complicated cases: History of abscess drainage; ≥3 sinus pits, or any pit located ≥4 cm lateral to the midline.

2.3. Study methods

This was a retrospective descriptive study. All patients underwent surgery according to a standardized protocol.

- Anesthesia: Spinal anesthesia was preferred in most cases; general anesthesia with a laryngeal mask airway or endotracheal intubation was used in selected cases.
- Patient position: Prone.

2.3.1. Surgical technique

The procedure began by enlarging the primary sinus openings or reopening those that had completely sealed, with simultaneous hair removal using forceps (Figure 1A).

Subcutaneous tissues surrounding the tract were infiltrated with normal saline to provide a cooling and tumescence effect, thereby preventing skin burns. In addition, this injection increased the safety margin during laser application. A safe distance between the skin and the probe was maintained while the laser energy acted on tissues within a 2–3 mm radius (Figure 1B).

A metal stylet was used to determine the length and course of the tracts (Figure 1C).

The laser probe was advanced to the end of the tract and then slowly withdrawn (approximately 0.5 cm/second) while the laser was activated. Laser energy ablated the epithelial lining and produced a shrinkage effect (Figure 1D).

If shrinkage was incomplete (e.g., when reintroducing the probe there was no resistance or blockage), a second pass was performed. In cases with a secondary opening at the site of a prior abscess, the procedure was performed through this opening after intervention via the primary opening (Figure 1E).

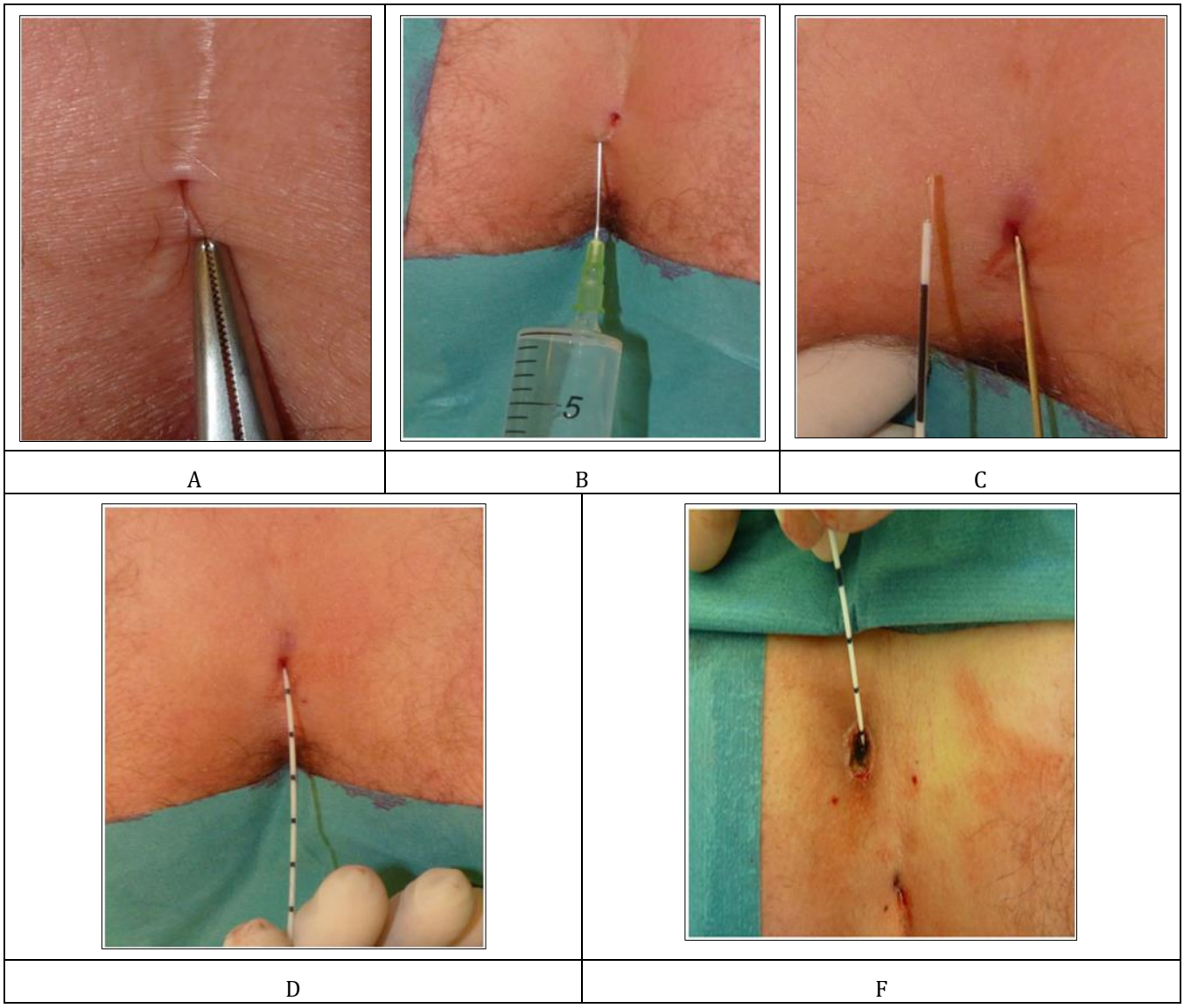

Figure 1 SiLaC procedural workflow at Hanoi Medical University Hospital

2.4. Data analysis

- Categorical variables were presented as frequencies and percentages.
- Continuous variables were expressed as mean ± standard deviation.
- Differences in categorical variables were compared using the χ^2 test or Fisher's exact test, as appropriate.
- Differences in continuous variables were compared using the student's t-test.

- Statistical significance was set at $p < 0.05$.
- Data were analyzed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA).

3. Results

3.1. General characteristics of the study population

Table 1 General characteristics of the study population (n = 9)

Characteristic	Result
Mean age, years	19 ± 3.08 (15–25)
Sex, n (%)	Male: 6 (66.7%); Female: 3 (33.3%)
Mean BMI, kg/m^2	28.51 ± 5.04 (23.23–36.73)
Prior pilonidal surgery, n (%)	3 (33.3%)
Tract length, mm	39.55 ± 14.91 (19–62)
Secondary tract present, n (%)	1 (11.1%)
Classification	
Simple PSD, n (%)	6 (66.7%)
Complicated PSD, n (%)	3 (33.3%)

***Summary**:* Among nine patients, the mean age was 19.0 ± 3.08 years (15–25); 6/9 (66.7%) were male and 3/9 (33.3%) female. The mean BMI was 28.51 ± 5.04 kg/m^2 (23.23–36.73). Prior pilonidal surgery was documented in 3/9 (33.3%). The mean sinus tract length was 39.55 ± 14.91 mm (19–62). A secondary tract was identified in 1/9 (11.1%). Simple and complicated PSD accounted for 6 (66.7%) and 3 (33.3%) cases, respectively.

3.2. Intraoperative and postoperative outcomes

Table 2 Intraoperative and postoperative outcomes

Outcome	Result
Operative time, min	30
Intraoperative complications	0
Postoperative pain (Day 1)	
VAS < 4, n (%)	9 (100%)
VAS > 4, n (%)	0
Length of postoperative stay, days (mean ± SD)	1.11 ± 0.33
Postoperative complications	0
Follow-up duration, days (mean ± SD; range)	103.11 ± 73.26 (29–234)
Primary healing, n (%)	9 (100%)
Time to complete healing, days (mean ± SD; range)	20.22 ± 10.06 (7–30)
Recurrence	0

Summary: Among the nine patients undergoing intervention, the mean operative time was 30 minutes, with no intraoperative complications recorded. Postoperative pain was mild, with VAS < 4 in all cases (9/9, 100%); no case had VAS > 4. The mean postoperative length of stay was 1.11 ± 0.33 days. No postoperative complications were observed. The mean follow-up duration was 103.11 ± 73.26 days (range, 29–234). Primary healing was achieved in 100% (9/9),

with a mean time to complete healing of 20.22 ± 10.06 days (range, 7–30). No recurrences were documented throughout follow-up.

4. Discussion

4.1. General characteristics of the study population

Our study included nine patients with a mean age of 19 ± 3.08 years (15–25); 6/9 (66.7%) were male and 3/9 (33.3%) were female. This pattern aligns with the typical epidemiology of PSD, which predominantly affects adolescents and young adults (15–30 years), with a clear male predominance.[7] These figures are lower than those reported by Dessily et al. (2019): in a cohort of 200 patients, the mean age was 24.5 ± 7.2 years (15–45), with 72% males and 28% females. [7], nghiên cứu của Horesh và cộng sự (2023) trên 92 bệnh nhân với tuổi trung bình 22 (16–62), nam 93,8% [8]. This discrepancy is likely attributable to the technique's recent introduction in our country. Historically, our practice relied on open excision and flap procedures, and the number of eligible cases remains limited.

The mean BMI in our cohort was 28.51 ± 5.04 kg/m^2 (range, 23.23–36.73), comparable to the findings of Ahmet et al. (2025), who reported a mean BMI of 27.5 ± 1.9 kg/m^2 [9] This is consistent with the global literature, wherein a high body mass index (BMI) is a recognized risk factor for PSD. [10]. Three of nine patients underwent abscess incision and drainage (IandD) (33.3%). A secondary tract was identified in 1/9 (11.1%). We classified PSD into two categories—simple and complicated—with 6 (66.7%) and 3 (33.3%) cases, respectively; this stratification was also applied in the study by Evirgen et al. (2025)[11] with 187 patients, including 109 in the simple group and 78 in the complicated group, in this study the simple group had significantly lower operative time, postoperative pain, and healing time, as well as a lower recurrence rate (3.7% vs 14.1%). [11] The mean tract length was 39.55 ± 14.91 mm (range, 19–62), comparable to the findings of Zhicheng Li et al. (2023), who reported a mean tract length of 34 mm in 48 patients. [12] In our study, no recurrences were observed among the nine patients during the follow-up period. Likewise, no statistically significant association was identified between delayed wound healing and disease complexity (simple vs. complicated). However, to obtain a more accurate and comprehensive assessment of recurrence rates, studies with larger sample sizes and longer follow-up are needed.

4.2. Intraoperative and postoperative outcomes

In our study, the mean operative time was 30 minutes, comparable to that reported by Romic et al. (2022) in 971 patients, where the mean operative time was 26 minutes [13] Another study by Dessily et al. (2019) involving 200 patients reported an operative time of approximately 9 minutes. By comparison, other techniques such as EPSiT (Endoscopic Pilonidal Sinus Treatment) showed a mean operative time of 42.8 ± 17.4 minutes in the series by Parente et al. (2023)[14], off-midline flap techniques (Karydakis/Limberg) generally entail longer operative times due to flap dissection and creation—typically 40–60 minutes, according to Ates (2011). [15] In our study, no intraoperative complications were observed. This result is consistent with previous reports on other minimally invasive approaches such as SiLaC and EPSiT, as well as flap procedures, which likewise demonstrate low intraoperative complication rates. [7, 14, 15]

In our series, 100% of patients experienced mild pain (VAS < 4) with no cases of VAS > 4; the mean length of stay was 1.11 ± 0.33 days, and patients required no analgesics or only paracetamol (acetaminophen). These pain levels and hospitalization durations are consistent—if not favorable—compared with recent SiLaC reports. In the prospective 200-case study by Dessily et al. (2019), the authors reported a mean duration of analgesic use of approximately 4.7 days in an outpatient setting [7], According to Sluckin et al. (2022) (n = 311), 84% of patients required no analgesics or paracetamol only, and the mean time to return to normal daily activities was 6 days, reinforcing the "low-pain, rapid-recovery" profile of SiLaC. [16] With standalone EPSiT, multiple case series have reported first-day discharge and patients who are "virtually pain-free," consistent with our observations. [17] Compared with flap surgery, comparative data indicate that SiLaC results in less pain and a shorter hospital stay: a non-randomized comparative study reported a mean length of stay of 7.5 ± 2.1 hours (SiLaC) versus 14.7 ± 4.0 hours (Limberg), and VAS scores on postoperative days 1, 2, and 7 were all lower in the SiLaC group, according to Algazar et al. [18]

In our case series, no postoperative complications were observed; the primary healing rate was 100% (9/9) with a mean time to complete healing of 20.2 days, and no recurrences occurred during a mean follow-up of ~3.4 months (103 days; range, 29–234 days). These early results are comparable to those of Dessily et al. (2019), who reported 94% primary healing and a mean healing time of 19.5 ± 14.4 days, but a 15% postoperative complication rate (9.5% infections) and a 14.9% recurrence rate, with a mean time to recurrence of ~194 days. [7] According to Meinero (2019), the EPSiT technique achieved a mean time to complete wound healing of 29 ± 12 days, which is longer than in our study

as well as in Dessily's series; however, the healing rate reached 95% and the recurrence rate was 5.1% over 16 months of follow-up. The authors reported no early postoperative complications.[19] According to Algazar et al. (2022), the Limberg flap procedure achieved a 100% healing rate with a mean time to healing of 30.51 ± 9.28 days, which is longer than in our study and in Dessily's report. The postoperative infection rate was 12.8%, higher than that reported by Dessily (9.5%). The authors documented a recurrence rate of 4.2% after a mean follow-up of 6 months.[18]

Our cohort demonstrated faster healing, no complications, and no recurrences during short-term follow-up, outperforming the average outcomes reported for other techniques; however, for a fair comparison, longer follow-up and a larger sample size are warranted.

5. Conclusion

SiLaC is a minimally invasive and safe treatment for pilonidal sinus disease, yielding high early-healing rates, low postoperative pain, short hospital stays, and minimal complications. Owing to its tissue-preserving nature—avoiding large incisions and not precluding subsequent options (e.g., EPSiT or off-midline flap procedures) when needed—SiLaC merits consideration as a preferred option in appropriately selected cases and can be repeated if the initial attempt fails.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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