Original Article

Video assisted Laser Ablation of Pilonidal Sinus: A Minimally Invasive Technique with High Success and Rapid Return to Normal Activity: A Long term Retrospective Study Over 5 Years

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Abstract

Background: Pilonidal sinus disease (PSD) predominantly affects young adults and is known for its recurrent nature and significant morbidity. Conventional surgical approaches are often associated with prolonged recovery, high recurrence, and patient discomfort. Minimally invasive procedures such as video-assisted laser ablation of pilonidal sinus (VALAPS) are emerging as promising alternatives. **Objective:** The objective of the study was to evaluate the clinical outcomes, postoperative recovery, complications, and recurrence rates following VALAPS and assess its efficacy as a minimally invasive treatment option for PSD. **Materials and Methods:** This retrospective study included 362 patients who underwent VALAPS at a single center. Baseline demographics, comorbidities, sinus characteristics, and intraoperative and postoperative data were collected. Statistical analyses included logistic regression, Chi-square, Fisher's exact test, Mann–Whitney *U* test, Kruskal–Wallis test, and correlation studies to identify factors influencing outcomes such as recurrence, healing, and postoperative pain. **Results:** The mean patient age was 22.8 years, with a male predominance (78%). Obesity was present in 23.8% of patients, and 28% had recurrent disease. Active pus discharge was noted in 63.7% of cases. The mean operative time was 30 min. Over 95% of patients resumed normal activity by postoperative day 2, and standard wound healing occurred in 4–6 weeks. Delayed healing (>8 weeks) occurred in 10.2% of patients and was the only significant predictor of recurrence ($\chi^2 = 27.73$, $P < 0.0001$; logistic regression $P < 0.00001$). The recurrence rate was 3.8%, and pain scores dropped to zero by postoperative day 21. Obese patients experienced slightly higher pain scores ($P < 0.0001$), but obesity and recurrence were not statistically associated. **Conclusion:** VALAPS is a safe, effective, and minimally invasive technique for treating PSD. It offers rapid postoperative recovery, early return to normal activity, low recurrence, and minimal complication rates. Delayed wound healing remains the key predictor of recurrence, underscoring the need for targeted postoperative care in such cases.

Keywords: *Diode laser, laser ablation, minimally invasive surgery, pilonidal sinus, recurrence, retrospective study, video-assisted, video-assisted laser ablation of pilonidal sinus, wound healing*

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Introduction

Pilonidal disease is an infection under the skin in the gluteal cleft. Pilonidal literally means a "nest of hair." It affects an estimated 26 per 100,000 persons,[1] occurring primarily in young adults with a 3:1 male

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predilection. Known risk factors include family history, local trauma, sedentary occupation, and obesity.[2]

Herbert Mayo is credited with the first description of this disease in 1833,[3] and Hodges coined the term pilonidal in 1880.[4] Buie noted its prevalence in male, military recruits who drove jeeps and thus characterized it as "jeep disease." Pilonidal disease was most notable during World War II when an estimated 80,000 soldiers became afflicted and lost significant time from active duty.[5]

There is still a significant morbidity related to pilonidal sinus disease (PSD) despite treatment options. The one significant problem associated with PSD is the tendency to recur after excision.[6] This may lead to repetitive operations and prolonged sick leave. PSD is usually a disease of working age, so in addition to a personal burden, it can cause a significant financial burden for society.[7]

Traditional ways to treat PSD include excision with midline closure, off-midline closure with various forms of subcutaneous flaps, as well as excision and healing by secondary intention.[8-12] In recent years, the use of minimally invasive techniques has increased in the treatment of PSD. These techniques include sinotomy, sinusectomy, and destroying skin pits, sinus tracts, and cavities with phenol or endoscopic ablation.[7,13,14] The advantages of minimally invasive techniques include their less traumatic nature and faster recovery time after the procedure.[15-18] Lately, promising results have been obtained by using laser ablation of the sinus tracts.[15-20]

Despite many treatment options, the consensus on the optimal care of PSD has yet to be determined.[6,10]

Materials and Methods

This retrospective study was carried out from a single center in India. Patients who underwent video-assisted laser ablation of pilonidal sinus (VALAPS) surgery between November 2019 and July 2025, were included in the study. The laser procedure was introduced in our unit in November 2019, after which it quickly became the first-line treatment of all PSD patients. The study was done for 68 months with an average of 35 months of followup.

VALAPS is a minimally invasive procedure performed with the patient in the prone position under local, regional, or general anesthesia. After antiseptic preparation, the sinus openings are identified, and a fistuloscope or rigid endoscope is introduced into the primary opening with continuous saline irrigation [Figure 1]. The entire sinus tract and any secondary branches are visualized, debrided using endoscopic instruments to remove hair and debris, and then treated using a 1470 nm radial fiber diode

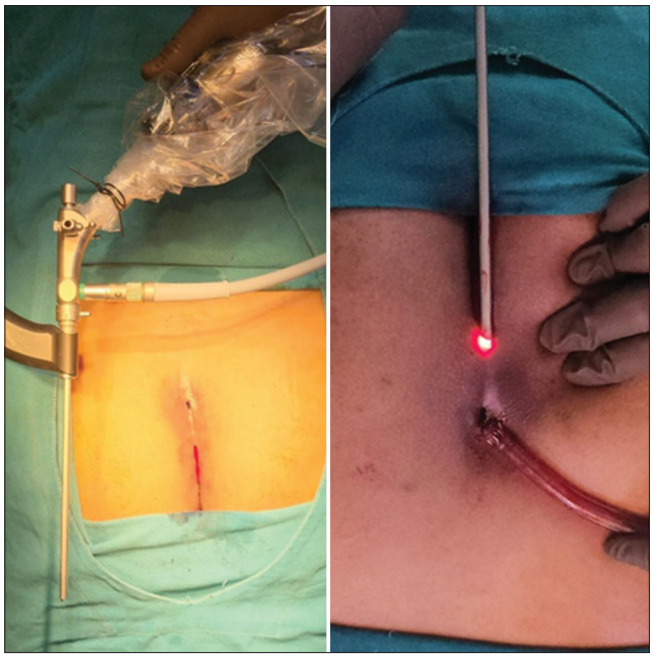

Figure 1: VALAPS probe and procedure of valaps

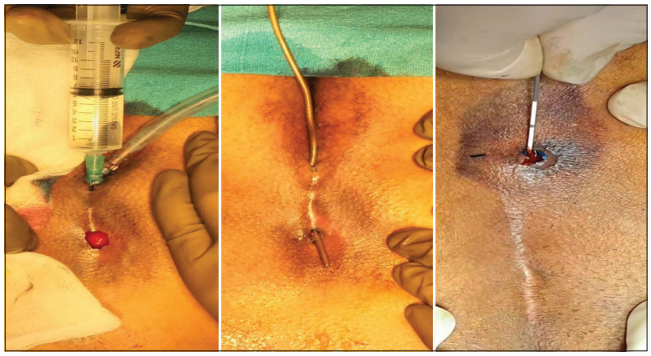

Figure 2: Methodology- irrigation of the tract, probing of the tract, laser fulguration

Figure 3: Laser used in multiple tracts

laser at 12joules/s in continuous mode. The laser probe is slowly withdrawn at 1 mm/s while delivering energy circumferentially to ablate the tract epithelium and induce fibrosis [Figure 2]. No sutures are required; the tract is left open to heal by secondary intention. Postoperatively, patients experience minimal pain.

Special surgical considerations

1. All surgeries were performed in prone/jack-knife postion
2. For the patients who presented with active infection/ pus discharge, preoperative antibiotics were given to reduce infections. Infection is not a contraindication for a laser procedure, as principally pilonidal sinus is an infective condition
3. An abscess cavity with pus is an absolute contraindication for a laser procedure because laser fiber as ineffective in an abscess cavity
4. About 10%–15% cases are of fistula in ano and pilonidal sinus, but because of the opening at 6 o'clock, diagnosis is confused, these should be treated as a combination of pilonidal sinus and fistula in ano
5. Multiple tracts are not a contraindication for the procedure [Figure 3]
6. For VALAPS, any scope which are 3–4 mm in diameter can be used, preferably with a working channel for the removal for hair
7. If there is a single pilonidal sinus opening, after probing the tract, make another opening at the tip of the probe for proper irrigation and curettage during surgery and the postoperative period
8. For tortuous tracts and tracts of variable caliber, we need to use the method of railroading by using the sinus probe, infant feeding tube (after cutting its tip), and in the end, the radial fiber
9. The highest cause of recurrence of pilonidal sinus is hair remaining in the sinus cavity due to incomplete removal
10. In 10%–15% cases, 8–10 cm long hair were removed from the sinus tract which also indicates that one of the important causative factors of pilonidal sinus is very poor hygiene of natal cleft for very long duration because these lengths of hair are broken from the cleft and caught in natal cleft for very long duration and from there sucked in subcutaneous space to create the pilonidal sinus.

Inclusion criteria

- Clinically diagnosed pilonidal sinus
- Both primary and recurrent disease
- Willingness to undergo minimally invasive laser treatment.

Exclusion criteria

Exclusion criteria were extensive abscess formation.

Preoperative assessment

All patients underwent a detailed clinical evaluation, including documentation of:

- Number and position of sinus tracts (single vs. multiple)
- Disease chronicity and prior interventions
- Presence of active discharge or infection
- Body mass index (BMI) and comorbidity status
- Patients with active pus discharge were treated with preoperative antibiotics, and hair in the sacrococcygeal region was trimmed.

Postoperative care and Follow-up

Patients were discharged on the same day or the next morning and instructed on local hygiene. Follow-up visits were scheduled at 1 week, 1 month, 3 months, and 6 months, with assessment for:

- Pain (Visual Analogue Scale [VAS] score)
- Wound healing
- Return to normal activity
- Recurrence
- Complications (abscess, fistula, bleeding, hematoma).

Data were statistically analyzed using appropriate tests (analysis of variance, Chi-square, and logistic regression). $P < 0.05$ was considered significant.

Results

Statistical summary

Overview

This study evaluated the outcomes of VALAPS in 362 patients. A comprehensive statistical analysis was conducted to assess recurrence rates, postoperative recovery, pain trends, and associated risk factors. The study was done for 68 months with an average of 35 months of followup.

Key statistical findings

1. Recurrence
   - Observed in 14 patients (3.8%)
   - Recurrence occurred in 3.9% of patients and was not significantly higher than expected benchmark of 5% ($P = 0.163$). This proves that the open technique does not have any significant advantage over VALAPS
   - Delayed healing was strongly associated with recurrence ($\chi^2 = 52.72$, $P < 0.00001$).
2. More than 95% of patients resumed normal daily activity by postoperative day 2, demonstrating rapid functional recovery and minimal disruption to quality of life.
3. Pain scores:
   - Kruskal–Wallis test showed no significant difference in VAS pain scores over time ($H = 5.00$, $P = 0.4159$)
   - Spearman correlation showed a moderate

but nonsignificant negative trend with time ($\rho = -0.65$, $P = 0.1583$).

4. Logistic regression (predictors of recurrence):
   - Delayed healing was the only significant predictor (coef = +2.26, $P < 0.00001$)
   - Obesity, recurrent disease, and pus discharge were not significant
   - Model fit was acceptable (BIC = 174.93).
5. Fisher's exact test:
   - No significant association between obesity and recurrence ($P = 0.7944$, odds ratio [OR] = 0.76).
6. Mann–Whitney *U* test:
   - Obese patients had significantly higher postoperative pain scores than nonobese patients ($U = 17822.0$, $P < 0.0001$).

Conclusion

The VALAPS technique demonstrated a low recurrence rate and minimal complications. Delayed healing was a strong predictor of recurrence. Pain levels were low (vas = 2) even 6 h after surgery and decreased rapidly and reached zero by day 21 postoperatively. The findings support VALAPS as an effective and minimally invasive treatment for PSD.

Results

Preoperative findings

Patient demographics and clinical profile

This section summarizes the baseline characteristics of the 362 patients who underwent VALAPS. The mean age of the cohort was 22.8 years. A male predominance was observed, with 78% male and 22% female patients [Table 1].

Clinical and disease-specific characteristics [Table 1]

- 23.8% of patients were classified as obese
- 28% of the cohort had previously undergone surgical intervention, indicating recurrent disease
- 42.6% of patients had a single pilonidal sinus tract, while the remainder had multiple tracts or openings
- 63.7% of patients presented with active pus discharge at the time of evaluation; these were managed with preoperative antibiotics.
- All patients were classified as American Society of Anesthesiologists Grade I and II
- Six patients had Type I diabetes mellitus; no other comorbidities were reported.

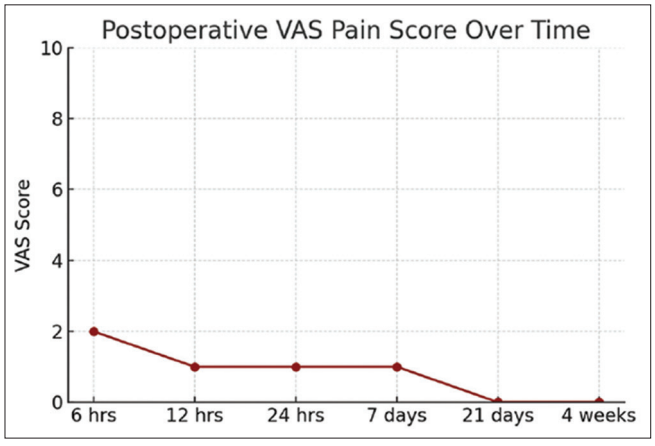

Figure 4: Pain score trend. VAS: Visual Analog Scale

A total of 362 patients underwent VALAPS. The mean operative duration was 30 min. The cohort had a male predominance (78%), with a mean age of 22.8 years. The majority of patients (over 95%) returned to normal daily activities by postoperative day 2, demonstrating rapid functional recovery and minimal disruption to quality of life, and standard wound healing occurred within 4–6 weeks in most cases.

Large-scale randomized study with long follow-up (more than 5 years) validates the durability of VALAPS compared to conventional surgical techniques. Hence, the results of this study support the integration of laser-assisted methods as a first-line surgical treatment for PSD.

Recurrence was documented in 14 patients (3.8%). A binomial test indicated that this rate was not significantly higher than the expected 5% benchmark ($P = 0.2025$). However, recurrence was strongly associated with delayed healing (>8 weeks), which occurred in 37 patients (10.2%). A Chi-square test showed a statistically significant association between delayed healing and recurrence ($\chi^2 = 27.73$, $P < 0.0001$).

Pain scores assessed through the VAS demonstrated rapid postoperative relief. Median scores were 2 at 6 h, 1 from 12 h through day 7, and 0 by day 21. The Kruskal–Wallis test revealed no significant variation in pain scores across time points ($H = 5.00$, $P = 0.4159$), and Spearman correlation showed a negative, though nonsignificant, trend between pain and time ($\rho = -0.65$, $P = 0.1583$) [Figure 4].

Logistic regression analysis identified delayed healing as the only statistically significant independent predictor of recurrence (coefficient = +2.26, $P < 0.00001$). Other variables, including obesity, recurrent disease, and presence of preoperative pus discharge, did not significantly impact recurrence risk. The model fit was adequate (BIC = 174.93).

Additional analysis using Fisher's exact test demonstrated no significant association between obesity and recurrence ($P = 0.7944$; OR = 0.76). However, a Mann–Whitney *U*-test showed that obese patients experienced significantly higher pain scores compared to nonobese counterparts ($U = 17822.0$, $P < 0.0001$).

Table 1: Preoperative characteristics of patients (*n*=362)

Characteristic	Value, *n* (%)
Mean age (years)	22.8
Sex distribution	
Male	282 (78)
Female	80 (22)
Obesity	86 (23.8)
Recurrent disease	101 (28)
Type I diabetes mellitus	6 patients
ASA grade	
I	94.6%
II	5.4
Number of tracts	
Single	154 (42.6)
Multiple	208 (57.4)
Pus discharge	231 (63.7), managed with preoperative antibiotics

ASA: American Society of Anesthesiologists

No cases of postoperative anal stenosis, incontinence, or fistula formation were recorded. Only three patients (0.8%) developed a postoperative abscess, and all were managed conservatively.

Discussion

Minimally invasive laser-based techniques for sacrococcygeal pilonidal sinus, including video-assisted laser ablation (VALAPS), Sinus Laser Closure, and laser obliteration with limited excision (LOLE), demonstrate encouraging outcomes in terms of healing rates, recovery time, and complication profiles. Our results align with Gratiashvili *et al*., who reported a 97.4% healing rate and 7.9% recurrence for LOLE versus wide excision, with significantly shorter wound healing times (6.5 vs. 14.5 weeks).[21] A systematic review of recurrent PSD treated with laser ablation found pooled healing of 81.9%, decreasing modestly over longer follow-up,[22] suggesting durability, albeit with slight attrition.

Sluckin *et al*.'s multicenter cohort of 311 patients showed single-session healing of 74% and up to 98% success after multiple sessions. Pappas and Christodoulou confirmed effectiveness in recurrent cases and advocated repeat procedures for persistent disease.[22] Studies comparing SiLaC with flap surgeries, such as Limberg found SiLaC competitive, in healing and recurrence, with shorter operative time, less pain, and quicker discharge.[16,24]

Pilot data on VALAPS using a diode laser (1470 nm, 10–15 W) under videoscopic guidance report healing in ~82%–94% of primary cases and patient return to work in ~3–4 days.[25,26] A meta-analysis across 971 patients using 1470 nm radial laser showed a weighted recurrence of 3.8% and a 10% complication rate.[21,27] Mechanistically, laser achieves tract epithelial destruction, granulation, and cavity contraction while preserving surface skin, contributing to minimal morbidity.[20,26]

Compared to traditional wide excision and flap techniques, laser methods offer reduced invasiveness, less postoperative pain, no need for drains, and earlier return to daily activities.[28,29] Patients report high satisfaction, minimal pain, and short recovery (3–8 days).[30,31] However, laser treatment efficacy long-term (>3–5 year) recurrence data remain limited.[32]

Moreover, adjunctive preoperative pit picking or limited excision "DO NOT" mirror the outcomes of a standalone laser.[33] Technical advantages include radially directed energy for thorough tract sealing and the ability to retreat persistent tracts with minimal additional risk.[23]

Limitations of current literature include heterogeneity in study designs, variation in laser parameters, and a paucity of randomized comparisons against open techniques. While short-term outcomes are promising, long-term follow-up (≥5 years), cost-effectiveness analyses, and clear patient selection criteria (e.g. BMI thresholds, sinus complexity) are needed.

Conclusion

Minimally invasive approaches to the treatment of PSD, particularly video-assisted laser ablation techniques, represent a significant advancement over traditional wide excision and flap-based surgeries. In this study, the application of VALAPS demonstrated promising outcomes in terms of operative efficiency, postoperative pain control, early recovery, and low complication rates. The patient cohort showed a rapid decline in postoperative pain, as evidenced by a reduction in VAS scores from 4 at the 1st h to <2 by 12 and 24 h, reflecting excellent postoperative comfort and effective pain management. Furthermore, the majority of patients were able to resume sitting and return to work within a relatively short time frame (within 2 days postoperative).

The recurrence rate, both early (residual disease) and late (true recurrence), was low, and the majority of patients achieved complete healing without the need for further intervention. The minimally invasive nature of the procedure reduced the incidence of postoperative complications such as wound infection, hematoma, and only a small fraction of patients required re-operation. These outcomes underscore the efficacy of VALAPS in managing both primary and recurrent PSD.

The advantages of this technique – early return to normal activities, minimal tissue damage, no need for drainage, daycare feasibility, and excellent cosmetic outcomes – make it an appealing option, especially for young, active individuals.

Large-scale randomized study with long follow-up (more than 5 years) validates the durability of VALAPS compared to conventional surgical techniques. Hence, the results of this study support the integration of laser-assisted methods as a first-line surgical treatment for PSD.

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Author contributions

Dr. Neeraj goyal-conceptualisation, methodology, supervision, final manuscript writing, correspondance with the journal, literature review Dr. Purvi varma-manuscript editing, patient followup, clinical assistance, statistical analysis, literature review Dr. Nikhil chaudhary-data collection, manuscript writing, prepartion of figures and table.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Data availability statement

All Data Generated Or Analysed During This Study Are Publicly Available And Can Be Provided By The Corresponding Author Upon Reasonable Request.

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