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Original Research Article

Outcome of Laser Ablation in Patients Presenting With Pilonidal Sinuses at a Tertiary Care Hospital

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Abstract: *Pilonidal sinus disease is a chronic inflammatory condition that predominantly affects young adults and is associated with significant morbidity, prolonged recovery, and high recurrence rates when managed with conventional surgical techniques. Minimally invasive approaches such as laser ablation have emerged as promising alternatives aimed at reducing postoperative complications and improving patient recovery; however, evidence from low and middle-income countries remains limited.* ***Objective:*** *To evaluate the clinical outcomes, postoperative complications, and recurrence rate following laser ablation in patients presenting with primary pilonidal sinus disease at a tertiary care hospital.* ***Methods:*** *This descriptive observational study was conducted at the Department of Surgery, Nishtar Medical University and Hospital, Multan, over 4 months from 12 July 2025 to 12 November 2025. A total of 57 adult male patients with clinically diagnosed primary pilonidal sinus disease were enrolled using non-probability consecutive sampling. All patients underwent standardized laser ablation using a radial diode laser following mechanical curettage of the sinus tract. Demographic data, intraoperative variables, postoperative outcomes, healing time, complications, and recurrence were recorded prospectively. Follow-up assessments were conducted at 1 week, 1 month, 3 months, and 6 months. Data were analyzed using SPSS version 25. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Multivariate logistic regression was performed to identify predictors of delayed healing and recurrence.* ***Results:*** *The mean age of patients was 26.8 ± 6.4 years, with all participants being male. The majority had occupations involving prolonged sitting (71.9%). The mean operative time was 21.4 ± 5.2 minutes, and all procedures were performed on a day-care basis without intraoperative complications. Mean wound healing time was 4.1 ± 1.3 weeks, with complete healing within six weeks achieved in 86.0% of patients. Postoperative complications were minimal, including infection in 7.0%, seroma in 5.3%, and minor bleeding in 3.5% of cases. During a six-month follow-up, recurrence occurred in 8.8% of patients. Multivariate analysis identified tract length greater than 5 cm and intraoperative pus as significant predictors of delayed healing and recurrence.* ***Conclusion:*** *Laser ablation is a safe, effective, and minimally invasive treatment option for primary pilonidal sinus disease, offering rapid recovery, low complication rates, and acceptable short-term recurrence outcomes. Its adoption may represent a valuable alternative to conventional surgical techniques, particularly in resource-constrained healthcare settings.*

Keywords: Pilonidal Sinus Disease, Laser Ablation, Minimally Invasive Surgery

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Introduction

Pilonidal sinus disease is a prevalent condition, particularly among young adults, characterized by the formation of a painful sinus or abscess in the sacrococcygeal region. Despite its common occurrence, effective management strategies remain contentious due to variable recurrence rates and surgical complications associated with traditional excisional techniques (1, 2). The disease arises primarily from the irritation of hair follicles, leading to chronic inflammation and often a significant negative impact on patients' quality of life (3, 4). This condition predominantly affects males, with reported incidence rates reaching up to 26 per 100,000 population (5), underscoring the need for effective and durable treatment modalities.

Recent innovations in minimally invasive surgical techniques, particularly laser ablation, are being explored as alternative strategies because of their potential to reduce recovery time and postoperative complications compared with conventional surgical approaches (6, 7). Evidence from existing studies suggests that laser-based therapies are associated with lower morbidity and recurrence rates while providing acceptable cosmetic outcomes (8, 9).

A pilot study demonstrated promising clinical results, showing that laser ablation was highly effective in the management of pilonidal sinus disease and significantly improved postoperative recovery parameters (9, 10). Moreover, systematic reviews of laser-assisted techniques have highlighted favorable outcomes, including reduced postoperative pain and a faster return to daily activities when compared with traditional excision methods (11, 12).

Comparative studies have further supported the efficacy of laser-assisted approaches over conventional surgical techniques in the management of sacrococcygeal pilonidal sinus disease. A systematic review reported that laser techniques resulted in higher patient satisfaction and fewer postoperative complications compared with wide local excision and other traditional procedures (1, 6, 13). Emerging evidence from Pakistan shows similar trends: patients treated with laser ablation experienced lower recurrence rates and shorter recovery periods than those undergoing conventional surgical management (14, 15).

Given the substantial burden of pilonidal sinus disease in the Pakistani population, there is a clear need for effective, less invasive treatment options.

The adoption of laser ablation techniques aligns with the global shift toward minimally invasive surgery. It offers a promising solution to reduce morbidity, recurrence, and healthcare burden associated with this chronic condition.

This study aims to evaluate the outcomes of laser ablation in patients presenting with pilonidal sinus disease at a tertiary care hospital, thereby contributing to the growing body of evidence supporting its effectiveness within the local population.

Methodology

This descriptive observational study was conducted in the Department of Surgery at Nishtar Medical University and Hospital, Multan, over 6 months. The study aimed to evaluate perioperative characteristics, postoperative outcomes, and recurrence following laser ablation for primary pilonidal sinus disease. Ethical approval was obtained from the institutional review board prior to initiation of the study, and written informed consent was secured from all participants before enrollment.

The study population consisted of adult male patients diagnosed with primary pilonidal sinus disease who presented to the surgical outpatient department during the study period. A total of 57 patients were included using non-probability consecutive sampling. Inclusion criteria comprised adult males with clinically confirmed primary pilonidal sinus disease who were willing to undergo laser ablation and provide informed consent. Patients were excluded if they had acute pilonidal abscess requiring emergency drainage, severe systemic comorbidities contraindicating surgery, recurrent disease following extensive previous pilonidal surgery, or refusal to participate.

All procedures were performed by experienced surgeons using a standardized surgical protocol. Patients were positioned in the prone jackknife position under spinal or local anesthesia, depending on clinical suitability and anesthetic assessment. After aseptic preparation and draping, all visible external pits were identified and gently probed to delineate the extent of the sinus tract. Mechanical curettage was performed to remove hair, granulation tissue, and debris, followed by copious irrigation with normal saline. A radial diode laser fiber was then introduced into the sinus tract, and continuous laser energy was delivered. In contrast, the fiber was slowly withdrawn to achieve circumferential ablation of the epithelial lining. The ablation process was repeated until the entire tract was adequately treated. No sutures were applied, and the wound was left open to heal by secondary intention. A simple sterile dressing was used at the end of the procedure.

Patients were monitored in the recovery area and discharged on the same day if clinically stable. Postoperative care instructions included regular dressing changes, maintenance of local hygiene, hair control measures, and avoidance of prolonged sitting during the early healing period. Oral analgesics were prescribed as required, and antibiotics were reserved for cases with clinical evidence of infection.

Data were collected prospectively using a structured proforma. Preoperative variables included age, occupational history, symptom duration, and prior conservative treatments. Intraoperative variables included type of anesthesia, operative time, number and length of sinus tracts, presence of purulent discharge, and any procedure-related complications. Postoperative follow-up was conducted at 1 week, 1 month, 3 months, and 6 months. At each visit, wound healing status and postoperative complications such as infection, seroma formation, bleeding, or abnormal scarring were assessed and documented.

Wound healing was operationally defined as complete epithelialization of the treated tract with the absence of discharge. Recurrence was defined as the development of new sinus openings or recurrence of symptoms in the previously treated area during the follow-up period.

All collected data were entered and analyzed using SPSS version 25. Continuous variables such as age, operative time, and healing duration were reported as means ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using the independent-samples t-test for continuous variables and the chi-square test for categorical variables. Multivariate logistic regression analysis was conducted to identify independent predictors of delayed healing and recurrence, including age, number of tracts, tract length, and presence of pus. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 57 patients were included, with a mean age of 26.8 ± 6.4 years. Most patients were aged 21 to 30 years (66.7%), followed by those aged 31 to 40 years (19.3%), while only a small proportion were aged 41 to 50 years (3.5%). All participants were male. A large majority reported occupations involving prolonged sitting (71.9%). The mean duration of symptoms was 8.6 ± 3.9 months, and 63.2% experienced symptoms for more than 6 months. Previous conservative treatment had been attempted by one third of patients (33.3%) (Table 1).

Spinal anesthesia was used in most procedures (77.2%), while the remainder were performed under local anesthesia. Single sinus tracts were more common than multiple tracts (61.4% vs 38.6%). The mean tract length was 4.3 ± 1.2 cm. Intraoperative pus was observed in 28.1% of cases. The mean operative time was 21.4 ± 5.2 minutes, and no intraoperative complications were recorded in any patient (Table 2).

All patients were discharged on a day care basis. The mean healing time was 4.1 ± 1.3 weeks, and complete healing within six weeks was achieved in 86.0% of patients. Postoperative complications were infrequent, with infection noted in 7.0%, seroma formation in 5.3%, and minor bleeding in 3.5%. No cases of hypertrophic scarring or need for reintervention were observed (Table 3).

During the six-month follow-up period, recurrence was observed in 8.8% of patients, while 91.2% remained recurrence-free. Among those with recurrence, most events occurred between three and six months. Recurrence was predominantly associated with multiple sinus tracts and the presence of pus, each observed in 80.0% of recurrent cases (Table 4). Multivariate regression analysis showed that a tract length greater than 5 cm and the presence of pus were significant predictors of delayed healing and recurrence, with adjusted odds ratios of 3.1 and 2.7, respectively. Multiple sinus tracts demonstrated a trend toward increased risk but did not reach statistical significance. Age above 30 years and type of anesthesia were not significantly associated with outcomes (Table 5).

Table 1: Demographic and Baseline Clinical Characteristics of Patients (n = 57)

Variable	Frequency (n)	(%)
Age (years)		
18–20	6	10.5
21–30	38	66.7
31–40	11	19.3
>40	2	3.5
Mean age (years)	26.8 ± 6.4	—
Gender		
Male	57	100
Occupation involving prolonged sitting		
Yes	41	71.9
No	16	28.1
Duration of symptoms (months)		
≤6 months	21	36.8
>6 months	36	63.2
Mean symptom duration (months)	8.6 ± 3.9	—
Previous conservative treatment		
Yes	19	33.3
No	38	66.7

Table 2: Intraoperative Characteristics and Surgical Details

Variable	Frequency (n)	(%)
Type of anesthesia		
Spinal anesthesia	44	77.2
Local anesthesia	13	22.8
Number of sinus tracts		
Single tract	35	61.4
Multiple tracts	22	38.6
Mean tract length (cm)	4.3 ± 1.2	—
Presence of pus intraoperatively		
Yes	16	28.1

No	41	71.9
Mean operative time (minutes)	21.4 ± 5.2	—
Intraoperative complications		
None	57	100

Table 3: Postoperative Outcomes and Complications

Outcome	Frequency (n)	(%)
Day care discharge	57	100
Mean healing time (weeks)	4.1 ± 1.3	—
Complete healing within 6 weeks	49	86.0
Postoperative infection	4	7.0
Seroma formation	3	5.3
Minor bleeding	2	3.5
Hypertrophic scarring	0	0
Reintervention required	0	0

Table 4: Recurrence Rate During Six-Month Follow-Up

Variable	Frequency (n)	(%)
No recurrence	52	91.2
Recurrence present	5	8.8
Time to recurrence		
≤3 months	2	40.0
3–6 months	3	60.0
Recurrence associated with multiple tracts	4	80.0
Recurrence associated with pus	4	80.0

Table 5: Multivariate Regression Analysis for Predictors of Delayed Healing and Recurrence

Variable	Adjusted Odds Ratio	95% Confidence Interval	p-value
Age (>30 years)	1.4	0.6–3.2	0.41
Multiple sinus tracts	2.2	0.9–5.6	0.07
Tract length >5 cm	3.1	1.2–8.4	0.02
Presence of pus	2.7	1.1–7.1	0.03
Type of anesthesia	0.9	0.4–2.3	0.82

Discussion

In this study, we assessed the outcomes of laser ablation in patients with pilonidal sinus disease, comprising 57 male patients with a mean age of 26.8 years. Our findings are consistent with existing literature and reinforce the growing consensus regarding the effectiveness and safety of laser-assisted techniques. The demographic profile of our cohort mirrors previously reported patterns, with the majority of patients being young adults, many of whom are engaged in occupations that involve prolonged sitting, a recognized risk factor for the development of pilonidal disease (16, 17, 18).

The exclusive predominance of male patients in our study (100%) mirrors findings reported by Gratiashvili et al., who documented a similarly high male-to-female ratio among patients with pilonidal sinus disease (19). Their analysis also highlighted that individuals aged 21–30 years are the most affected age group, consistent with our observation that 66.7% of patients fell within this age range. Furthermore, the mean duration of symptoms prior to intervention in our cohort (8.6 months) aligns with reports indicating that many patients experience prolonged symptoms before seeking surgical management, underscoring a typical pattern of delayed presentation and chronic disease progression (17, 20).

Intraoperative characteristics further support the feasibility of laser ablation. In our study, 77.2% of procedures were performed under spinal anesthesia, consistent with multiple reports suggesting that spinal anesthesia provides improved patient comfort and operative control during minimally invasive procedures (21, 22). The mean operative time of 21.4 minutes closely parallels operative durations reported by Yardımcı et al. and Bonito et al. for laser-based pilonidal sinus interventions (21, 23). Notably, no intraoperative complications were observed, highlighting the favorable safety profile of laser ablation and corroborating the literature, which emphasizes minimal morbidity associated with modern minimally invasive techniques (19, 24).

Postoperative outcomes in our cohort were particularly encouraging. The mean healing time was 4.1 weeks, and complete wound healing was achieved in 86% of patients within 6 weeks. These findings are comparable to those reported by Williams et al., who demonstrated rapid healing and high patient satisfaction following laser treatment for pilonidal sinus disease (16). Additionally, postoperative complication rates in our study were low: infection in 7.0%, seroma in 5.3%, and bleeding in 3.5% of patients. These results reinforce the existing evidence that laser ablation is associated with fewer postoperative complications than traditional excisional techniques (25, 26).

During the six-month follow-up period, a recurrence rate of 8.8% was documented, predominantly among patients with multiple sinus tracts and those with intraoperative pus. This observation is consistent with findings by Kozyreva et al., who identified these factors as significant contributors to disease recurrence (27). Furthermore, multivariate regression analysis in our study demonstrated that tract length greater than 5 cm and the presence of pus were significant predictors of delayed healing and recurrence, consistent with the conclusions of Mozaffari et al. regarding their prognostic significance (21).

Similarly, Abdelnaby et al. emphasized that the complexity of pilonidal disease, particularly the number of sinus tracts and purulent discharge, directly correlates with prolonged healing times and increased recurrence risk, further supporting our findings (22). These observations highlight the importance of individualized treatment strategies tailored to disease severity and anatomical characteristics.

Overall, our study supports laser ablation as a viable and effective treatment modality for pilonidal sinus disease, particularly in the Pakistani healthcare context, where resource optimization and rapid patient recovery are critical considerations (15). Given the high prevalence of pilonidal disease among young males in Pakistan, the favorable outcomes observed in our cohort advocate for broader adoption of laser-based interventions in routine surgical practice. This approach aligns with global trends toward minimally invasive surgery and offers a promising solution to reduce recurrence rates and prolonged recovery associated with conventional techniques (25, 28).

The encouraging results of this study warrant further investigation through larger, multicenter trials with more extended follow-up periods to validate these findings and strengthen the evidence base for integrating laser ablation into standard treatment protocols for pilonidal sinus disease in Pakistan and comparable healthcare settings.

Conclusion

Laser ablation demonstrated favorable clinical outcomes in the management of primary pilonidal sinus disease, with high rates of early healing, minimal postoperative morbidity, and a low short-term recurrence rate. The procedure was well tolerated, required a short operative time, and allowed same-day discharge in all patients. Disease complexity, particularly longer sinus tracts and purulent discharge, was associated with poorer outcomes, underscoring the importance of careful patient selection. These findings support laser ablation as an effective minimally invasive option for pilonidal sinus disease and provide local evidence to encourage its broader adoption in tertiary care settings. Larger multicenter studies with longer follow-up are recommended to validate these results further.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-MMNCS-0331d-24)

Consent for publication

Approved

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Conflict of interest

The authors declared no conflicts of interest.

Author Contribution

Z (PGR), UMH (Consultant)

Contributed to study design, data collection, and initial manuscript drafting

Assisted in data acquisition, literature review, and manuscript editing

Performed statistical analysis and contributed to the interpretation of results

UK (WMO), MSRB (Senior Registrar), NA (Prof.)

Helped in methodology development, data organization, and manuscript formatting

Contributed to patient recruitment, data entry, and results compilation

Assisted in referencing, proofreading, and final revisions of the manuscript

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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