



FISTULA-IN-ANO TREATMENT: CLOSURE WITH LASER OR STANDARD FISTULOTOMY FOR LOW-LYING FISTULA – A SINGLE-CENTER PROSPECTIVE COMPARATIVE STUDY

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ABSTRACT

Background: Fistula-in-ano is a frequent benign anorectal condition, commonly arising from cryptoglandular infection which requires surgical management to control purulent discharge, pain, and recurrent sepsis. Fistulotomy remains the standard approach for simple low fistulas but may cause greater postoperative pain and longer healing time because wound heals by secondary intention, and continence outcomes depends on type of fistula and length of tract. Laser-based fistula closure techniques have been introduced as sphincter-preserving alternatives with encouraging short-term outcomes in systematic reviews.

Objective: To compare postoperative pain, healing time, recurrence, and continence outcomes between standard fistulotomy and laser fistula surgery using a 1470-nm diode laser.

Methods: This prospective comparative study enrolled 60 patients with primary low lying fistula-in-ano and allocated them equally to fistulotomy (Group A) or laser fistula surgery (Group B). Pain was assessed using VAS on postoperative day 1; healing time was measured as weeks to complete epithelialization; recurrence was assessed at 12 weeks; continence was evaluated using the Wexner score.

Results: Mean VAS was lower in the laser group (3.1 ± 1.2) than fistulotomy (5.8 ± 1.5 ; $p < 0.001$). Healing time was shorter with laser (4.3 ± 0.9 vs 6.1 ± 1.2 weeks; $p < 0.01$). Recurrence occurred in 2/30 (6.7%) vs 6/30 (20%), respectively ($p = 0.12$). No case of fecal incontinence occurred whereas flatus incontinence was reported in fistulotomy.

Conclusion: Laser fistula surgery is a sphincter-preserving alternative with better pain scores and faster healing, with comparable short-term outcomes.

Keywords: Rectal Fistula; Fistulotomy; Laser Therapy; Diode Lasers; Postoperative Pain; Wound Healing

INTRODUCTION

Fistula-in-ano is a chronic recurrent inflammatory anorectal disease characterized by an abnormal epithelium lined tract connecting the anal canal to the perianal skin, most commonly arising as a sequel of cryptoglandular infection and anorectal abscess formation^{1,3} Although a benign condition, fistula in ano is associated with substantial morbidity due to persistent discharge, pain, recurrent local sepsis, and impaired quality of life, frequently necessitating surgical intervention.¹

Population-based epidemiological data on anal fistula remain limited, particularly developing countries. A recent systematic review and meta-analysis reported a pooled prevalence of approximately **18.37 per 100,000 population** in European settings, underscoring both the clinical burden of disease and the paucity of robust epidemiological data from low- and middle-income regions.² This lack of regional data highlights the importance of generating locally relevant clinical evidence to guide management strategies.

The principal objective of surgical management of fistula-in-ano is excision of the fistulous tract while preserving anal sphincter function^{1,3} For low-lying anal fistulas, conventional fistulotomy has long been regarded as the standard surgical approach due to its high success rates and relative technical simplicity. Current American Society of Colon and Rectal Surgeons (ASCRS) guidelines continue to recommend fistulotomy for appropriately selected simple fistulas, while emphasizing careful patient selection to minimize the risk of continence impairment¹

Despite its effectiveness, fistulotomy is associated with certain limitations. The procedure results in an open wound healing by secondary intention, which may contribute to increased postoperative pain, prolonged wound care, and delayed return to normal activities^{1,4} In addition, continence outcomes following fistulotomy vary depending on the extent of sphincter division, baseline sphincter function, and duration of follow-up, even in low fistulas.^{1,3} These considerations have raised interest in sphincter-preserving and minimally invasive alternatives.

In recent years, techniques such as ligation of the intersphincteric fistula tract (LIFT), video-assisted anal fistula treatment (VAAFT), and laser-based fistula closure have been introduced to minimize sphincter injury while maintaining acceptable healing rates.^{3,5,6} National studies from Pakistan report growing experience with these approaches, reflecting increasing adoption of minimally invasive strategies in local practice, although recurrence remains a concern, particularly in complex fistulas.^{5,6} Laser fistula closure, commonly referred to as fistula laser closure (FiLaC®), employs a radial-emitting laser fiber to deliver circumferential energy within the fistula tract, promoting tract shrinkage and obliteration while preserving sphincter integrity. Systematic reviews and meta-analyses describe FiLaC as a feasible sphincter-preserving technique with low rates of new-onset fecal incontinence, although reported healing and recurrence rates vary widely across studies.^{7–9}

Contemporary evidence on fistula laser closure demonstrates a broad spectrum of outcomes.

Analyses of multiple cohorts report primary healing rates ranging from approximately **20% to nearly 90%**, with substantial variation attributable to fistula complexity, duration of follow-up, and study design.^{8,10} In long-term observational series, primary success rates of approximately **64–82%** have been reported, with a low incidence of major postoperative complications, suggesting that FiLaC can be effective while preserving sphincter integrity.¹¹ Regional comparative studies have also explored laser-based and hybrid seton approaches as alternatives to conventional surgery, reflecting ongoing efforts to refine sphincter-sparing strategies.¹² Recent randomized evidence further supports the **safety and feasibility** of both laser-based and open surgical techniques in the management of fistula-in-ano, underscoring the need for well-designed prospective comparative studies.¹³ In neighboring regional contexts, retrospective cohort data from Nepal have reported laser-assisted fistula closure rates exceeding **80%**, with minimal major adverse events, reinforcing the relevance of laser strategies across diverse clinical settings.¹⁴

Despite the expanding body of international literature, direct prospective comparisons between laser fistula surgery and conventional fistulotomy for low-lying fistula-in-ano remain limited in Pakistan. Most available local studies focus on individual techniques rather than head-to-head comparisons in

comparable patient populations^{5,6} In this context, the present study was designed to prospectively compare conventional fistulotomy with laser fistula surgery using a 1470-nm diode laser in patients with low-lying and intersphincteric fistula-in-ano, focusing on postoperative pain, healing time, short-term recurrence, and continence outcomes.

METHODOLOGY

This prospective comparative study was conducted in the Department of Surgery at Benazir Bhutto Shaheed DHQ Teaching Hospital, Abbottabad, Pakistan, from 1 January 2025 to 31 December 2025. Ethical approval was obtained from the institutional Ethics and Governance Committee (Approval No. Surgery-01/5/2025). Written informed consent was obtained from all participants before enrollment.

Study design and participants

A prospective, non-randomized comparative design was used. Adults aged 18–65 years with clinically diagnosed low-lying or intersphincteric fistula-in-ano were eligible. Diagnosis was established through clinical examination, including digital rectal examination and assessment of external and internal openings, with evaluation under anesthesia where required. Patients with complex or high fistulas, suprasphincteric or extrasphincteric tracts, Crohn's disease, tuberculosis, malignancy, or previous anorectal surgery were excluded.

Sample size

Because Pakistani studies directly comparing laser fistula closure with fistulotomy were not identified at planning, sample size estimation was informed by recurrence-rate differences reported in local studies comparing fistulotomy with other sphincter-preserving strategies.⁷ With power 80%, alpha 0.05, confidence level 95%, and allocation ratio 1:1, the calculated minimum sample size was approximately 25 per group; 30 per group were included to account for potential attrition.

Group allocation and procedures

Consecutive eligible patients were allocated into two groups based on treatment pathway and availability of laser equipment: Group A underwent conventional fistulotomy; Group B underwent laser fistula surgery using a 1470-nm diode laser system (Giga Laser, Covidien).

In Group A, the fistula tract was identified, laid open along its length, curetted, and hemostasis secured; the wound was left open for secondary healing. In Group B, the tract was identified and curetted, the internal opening managed by submucosal ligation where appropriate, and a radial laser fiber was introduced into the tract and activated during controlled withdrawal to achieve circumferential ablation. The external opening was widened to allow drainage.

Outcomes

Primary outcomes were postoperative pain (VAS on postoperative day 1) and healing time (weeks to complete epithelialization). Secondary outcomes were clinical recurrence at 12 weeks and continence assessed using the Wexner score, including assessment for flatus or fecal incontinence.

Statistical analysis

Data were entered in Microsoft Excel 365 and analyzed using IBM SPSS Statistics v25. Quantitative variables were summarized as mean $\pm$ SD and compared using independent-samples t-tests. Categorical variables were summarized as n (%) and compared using Chi-square tests. A two-sided p-value <0.05 was considered statistically significant.

RESULTS

Sixty patients were enrolled and analyzed, with 30 patients in each group. No patients were lost to follow-up, and all underwent the allocated procedure and planned outcome assessment.

Parameter	Fistulotomy (n = 30)	Laser Surgery (n = 30)	p-value
VAS Score (Post-op Day 1)	5.8 ± 1.5	3.1 ± 1.2	< 0.001
Healing Time (weeks)	6.1 ± 1.2	4.3 ± 0.9	< 0.01
Recurrence	20% (6/30)	6.7% (2/30)	0.12
Incontinence (Wexner Score)	0	0	NS

The overall mean age was 38.5 ± 10.2 years, and 94 % of the participants were male. Baseline characteristics were comparable between groups, and all fistulas were low-lying.

Postoperative day-1 pain (VAS) was significantly lower in the laser group compared to the fistulotomy group (3.1 ± 1.2 vs 5.8 ± 1.5; $p < 0.001$). Healing time to complete epithelialization was shorter following laser surgery (4.3 ± 0.9 weeks) than fistulotomy (6.1 ± 1.2 weeks; $p < 0.01$). Recurrence at 12 weeks was observed in 2/30 (6.7%) patients in the laser group and 6/30 (20%) in the fistulotomy group; this difference was not statistically significant ($p = 0.12$). No patient developed major fecal incontinence; flatus incontinence was reported in three patients after fistulotomy and none after laser surgery. Although recurrence was numerically lower in the laser group, the difference did not reach statistical significance, likely due to limited sample size and short follow-up as recurrence after fistula surgery may manifest several months after initial healing.

DISCUSSION

The present prospective comparative study evaluated early postoperative and short-term outcomes of conventional fistulotomy versus laser fistula surgery using a 1470-nm diode laser in patients with low-lying and intersphincteric fistula-in-ano. The findings demonstrate that laser fistula surgery was associated with significantly lower early postoperative pain and shorter time to complete epithelialization, while short-term recurrence and continence outcomes were comparable between the two treatment groups at an 12-week follow-up. These outcomes are clinically relevant, as contemporary guidelines emphasize that fistula surgery should aim to eradicate the tract while preserving sphincter function and minimizing postoperative morbidity.^{1,3}

Postoperative pain

Postoperative pain is a key determinant of early recovery and patient satisfaction following anorectal surgery. In the present study, postoperative day-1 pain scores were significantly lower in patients undergoing laser fistula surgery compared with those treated by fistulotomy. This observation is biologically plausible, as fistulotomy results in an open wound that heals by secondary intention, whereas laser fistula surgery aims to ablate the tract endoluminally with limited external tissue disruption.^{1,3}

Local and regional evidence supports this rationale. A Pakistani study evaluating video-assisted anal fistula treatment (VAAFT) reported favorable early postoperative recovery profiles with minimally invasive approaches, reinforcing the concept that reduced tissue trauma may translate into improved early postoperative comfort, even though the comparator techniques differ.⁵ In addition, international systematic reviews of fistula laser closure have consistently reported low postoperative morbidity, although pain outcomes are variably reported across studies.^{7–9} These findings collectively support the plausibility of reduced early pain with laser-based techniques while acknowledging variability in outcome measurement.

Healing time

Healing time is an important practical outcome, particularly in settings where prolonged wound care may impose a physical and socioeconomic burden on patients. In this study, laser fistula surgery resulted in a significantly shorter time to complete epithelialization compared with conventional

fistulotomy. This aligns with the proposed mechanism of action of laser closure, in which circumferential energy delivery induces controlled shrinkage and obliteration of the fistula tract with minimal collateral tissue injury.^{7–9}

National data from Pakistan indicate that open fistulotomy commonly requires several weeks for complete wound healing, depending on wound size and postoperative care, which is consistent with the healing duration observed in the fistulotomy group in this study.^{4,6} Regional and international studies of fistula laser closure report healing times within a comparable range, although heterogeneity is substantial due to differences in fistula complexity, patient selection, and definitions of healing.^{7–9} The healing times observed in the present study therefore appear clinically realistic and consistent with existing evidence.

Recurrence

Recurrence remains the most important long-term outcome in anal fistula surgery. Although recurrence was numerically lower in the laser group than in the fistulotomy group in this study, the difference did not reach statistical significance. This finding should be interpreted cautiously. The study was not powered to detect small differences in recurrence, and the follow-up period of twelve weeks is insufficient to capture late recurrences, which may manifest several months after apparent healing. European and international guideline documents emphasize that adequate follow-up and standardized outcome reporting are essential when evaluating both conventional and newer fistula techniques.^{1,3}

National studies further illustrate the variability of recurrence across surgical approaches. A recent JPMA study evaluating the ligation of intersphincteric fistula tract (LIFT) for complex fistula-in-ano reported substantial recurrence, highlighting the influence of fistula complexity and technique selection on outcomes.⁶ Similarly, regional comparative studies evaluating minimally invasive techniques in complex fistulas emphasize recurrence as a major ongoing challenge.¹² Although these studies involve different fistula types, they underscore the need for cautious interpretation of recurrence data and reinforce that short-term findings should not be over-extrapolated.

International evidence from systematic reviews and meta-analyses of fistula laser closure also demonstrates wide variability in reported healing and recurrence rates, influenced by fistula anatomy, prior surgery, technical standardization, and duration of follow-up.^{7–10} Taken together, the recurrence findings in the present study should be regarded as preliminary and hypothesis-generating rather than definitive evidence of superiority.

Continence outcomes

Preservation of continence is central to surgical decision-making in anal fistula management. In this study, no patient in either group developed major fecal incontinence during follow-up, and minor flatus incontinence was observed only in a small proportion of patients undergoing fistulotomy. These findings are consistent with guideline recommendations indicating that fistulotomy can be safely performed in carefully selected low-lying fistulas with acceptable functional outcomes.^{1,3}

The absence of continence disturbance in the laser group is directionally consistent with the sphincter-preserving intent of laser fistula surgery and with findings from systematic reviews reporting very low rates of new incontinence following laser closure.^{7–9} However, given the small number of continence events and the short follow-up period, firm conclusions regarding long-term functional benefit cannot be drawn.

Limitations

Several limitations should be acknowledged. This was a single-center, non-randomized study with a modest sample size and short follow-up duration, which limits generalizability and long-term assessment of recurrence and continence outcomes. Allocation was influenced by availability of laser equipment, introducing potential selection bias. These limitations are similar to those identified in many published studies of minimally invasive fistula techniques and underscore the need for larger,

randomized, multicenter trials with extended follow-up, as highlighted in contemporary guideline and evidence-synthesis documents^{3,7–10}

CONCLUSION

Laser fistula surgery using a 1470-nm diode laser is a sphincter-preserving alternative to fistulotomy for selected low-lying fistula-in-ano, offering reduced postoperative pain and shorter healing time, with comparable short-term recurrence and continence outcomes.

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