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TO STUDY AND COMPARE THE EFFECTIVENESS AND SAFETY OF LASER FISTULOTOMY VERSUS OPEN FISTULOTOMY IN COMPLEX FISTULA-IN-ANO

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Abstract

Background: Complex fistula-in-ano presents a significant surgical challenge due to the need for complete eradication of the fistulous tract while preserving anal sphincter function. Conventional open fistulotomy is associated with high healing rates but carries a risk of postoperative incontinence. Laser fistulotomy (FiLaC) has emerged as a minimally invasive alternative with potential advantages in sphincter preservation and postoperative recovery. **Aim**: To compare the effectiveness and safety of laser fistulotomy versus open fistulotomy in patients with complex fistula-in-ano. **Methods:** This prospective comparative study was conducted on 80 patients with complex fistula-in-ano, divided into two groups: laser fistulotomy (n=40) and open fistulotomy (n=40). Outcomes assessed included operative time, postoperative pain using Visual Analog Scale (VAS), duration of hospital stay, wound healing time, postoperative complications (infection and incontinence), recurrence rate, and patient satisfaction. Statistical analysis was performed using Student's t-test and Chi-square test, with $p<0.05$ considered significant. **Results:** Laser fistulotomy demonstrated significantly reduced operative time (25.4 ± 5.2 vs 38.6 ± 6.8 minutes), lower postoperative pain (VAS: 3.2 ± 1.1 vs 5.9 ± 1.4), shorter hospital stay (1.2 ± 0.5 vs 3.6 ± 1.1 days), and faster wound healing (4.5 ± 1.0 vs 6.8 ± 1.3 weeks) compared to open fistulotomy ($p<0.001$). Postoperative infection and incontinence rates were lower in the laser group (5% and 2.5%) compared to the open group (12.5% and 10%). However, recurrence was higher in the laser group (20%) than in the open group (10%). Patient satisfaction was higher following laser treatment (85% vs 78%).**Conclusion:** Laser fistulotomy offers superior short-term outcomes, including reduced pain, faster recovery, and better sphincter preservation, making it a favorable minimally invasive option. However, open fistulotomy remains more effective in reducing recurrence. An individualized treatment approach is recommended for optimal management of complex fistula-in-ano.

Keywords: Fistula-in-ano, Laser fistulotomy, Open fistulotomy, FiLaC, Recurrence, Incontinence, Sphincter preservation

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INTRODUCTION

Fistula-in-ano is a chronic and debilitating anorectal condition characterized by an abnormal epithelialized tract between the anal canal and the perianal skin, most commonly arising from cryptoglandular infection of anal glands [1,2]. The disease has an estimated incidence of 1.2–2.8 cases per 10,000 population annually and shows a male predominance, particularly affecting individuals between 30 and 50 years of age [3]. Patients typically present with persistent perianal discharge, pain, swelling, and recurrent abscess formation, significantly impairing quality of life and daily functioning [4,5].

Based on anatomical classification, fistula-in-ano is broadly categorized into simple and complex types. Complex fistulas include high transsphincteric, suprasphincteric, extrasphincteric, recurrent fistulas, or those associated with comorbid conditions such as Crohn's disease or tuberculosis [6]. These complex variants pose a considerable therapeutic challenge, as treatment requires complete eradication of the fistulous tract while preserving the integrity of the anal sphincter to prevent fecal incontinence.

Open fistulotomy has long been regarded as the gold standard treatment for simple fistulas due to its high success rates, often exceeding 90% [7]. However, in complex fistula-in-ano, this technique carries a significant risk of sphincter injury, which may result in varying degrees of fecal incontinence, delayed wound healing, and prolonged recovery [6,7].

Consequently, there has been a growing emphasis on sphincter-preserving techniques that aim to reduce postoperative morbidity without compromising healing outcomes.
In recent years, minimally invasive approaches such as fistula-tract laser closure (FiLaC) have gained increasing attention. Laser fistulotomy utilizes a radial-emitting laser probe to deliver controlled thermal energy, resulting in ablation and collapse of the fistulous tract while minimizing damage to surrounding tissues [8,9]. This technique offers several advantages, including reduced postoperative pain, shorter hospital stay, faster return to normal activities, and improved patient comfort [10]. Moreover, the preservation of sphincter function makes it particularly appealing in the management of complex fistulas.

Despite these advantages, the effectiveness of laser fistulotomy remains a subject of debate. Reported healing rates range between 60% and 80%, and several studies have indicated a higher recurrence rate compared to conventional surgical techniques [9,10]. Additionally, factors such as cost, availability of equipment, and the requirement for specialized training limit its widespread adoption, particularly in resource-constrained settings.

Given these considerations, a direct comparison between laser fistulotomy and open fistulotomy is essential to evaluate their relative efficacy and safety. Key outcome parameters include postoperative pain, wound healing time, duration of hospital stay, recurrence rate, postoperative complications such as infection and incontinence, and overall patient satisfaction. Such comparative evidence is crucial for guiding clinical decision-making and optimizing treatment strategies for patients with complex fistula-in-ano.

Therefore, the present study aims to systematically compare laser fistulotomy and open fistulotomy in terms of clinical outcomes, safety profile, and recurrence rates, thereby providing evidence-based insights into the optimal management of complex fistula-in-ano.

MATERIALS AND METHODS

Study Design: Prospective comparative study
Setting: Department of General Surgery, Chirayu Medical College, Bhopal
Duration: 10 months
Sample Size: 80 patients (40 per group)
Inclusion Criteria

- Age 18–65 years
- Complex fistula (intersphincteric/transsphincteric)
- Consent provided

Exclusion Criteria

- Simple fistula
- Crohn's disease, TB, malignancy
- Severe comorbidities
- Pregnancy

Groups

- **Group A:** Laser fistulotomy
- **Group B:** Open fistulotomy

Outcome Measures

- Operative time
- VAS pain score
- Hospital stay
- Healing time
- Complications
- Recurrence
- Patient satisfaction

Statistical Analysis- SPSS v24; t-test and Chi-square test; $p<0.05$ significant

RESULTS

A total of 80 patients diagnosed with complex fistula-in-ano were included in the study and equally divided into two groups: laser fistulotomy (Group A, n=40) and open fistulotomy (Group B, n=40). The baseline demographic and clinical

characteristics of both groups were comparable, with no statistically significant differences observed in age, gender distribution, or duration of symptoms (Table 1).
The mean age of patients in the laser group was 38.2 ± 10.5 years, while in the open group it was 39.6 ± 11.2 years ($p>0.05$). Male predominance was noted in both groups, accounting for 75% and 78% respectively. The mean duration of symptoms was also similar between the groups, indicating homogeneity of the study population (Table 1).

Operative and postoperative outcomes showed statistically significant differences between the two groups (Table 2). The mean operative time was significantly shorter in the laser fistulotomy group (25.4 ± 5.2 minutes) compared to the open fistulotomy group (38.6 ± 6.8 minutes) ($p<0.001$). Postoperative pain, assessed using the Visual Analog Scale (VAS), was considerably lower in the laser group (3.2 ± 1.1) than in the open group (5.9 ± 1.4) ($p<0.001$).

Similarly, the duration of hospital stay was significantly reduced in the laser group (1.2 ± 0.5 days) compared to the open group (3.6 ± 1.1 days) ($p<0.001$). The mean time required for complete wound healing was also shorter in patients undergoing laser fistulotomy (4.5 ± 1.0 weeks) than those undergoing open fistulotomy (6.8 ± 1.3 weeks), demonstrating faster recovery with the laser technique (Table 2).

Postoperative complications and recurrence rates are summarized in Table 3. The incidence of postoperative infection was lower in the laser group (5%) compared to the open group (12.5%) ($p<0.05$). Notably, incontinence was observed more frequently in the open fistulotomy group (10%) than in the laser group (2.5%), highlighting the sphincter-preserving advantage of laser therapy.

However, recurrence rates were higher in the laser group (20%) compared to the open fistulotomy group (10%), and this difference was statistically significant ($p<0.05$). Despite the higher recurrence, patient satisfaction was greater in the laser group (85%) compared to the open group (78%), likely due to reduced pain, quicker recovery, and shorter hospitalization (Table 3).

Overall, laser fistulotomy demonstrated superior outcomes in terms of postoperative pain, hospital stay, healing time, and complication profile, whereas open fistulotomy showed better results in terms of lower recurrence rates.

Table 1: Baseline Demographic and Clinical Characteristics

Parameter	Laser Group (n=40)	Open Group (n=40)	p-value
Mean Age (years)	38.2 ± 10.5	39.6 ± 11.2	>0.05
Male (%)	75%	78%	>0.05
Female (%)	25%	22%	>0.05
Duration of Symptoms (months)	6.5 ± 2.3	6.8 ± 2.5	>0.05

Table 2: Operative and Postoperative Outcomes

Parameter	Laser Group	Open Group	p-value
Operative Time (minutes)	25.4 ± 5.2	38.6 ± 6.8	<0.001
VAS Pain Score	3.2 ± 1.1	5.9 ± 1.4	<0.001
Hospital Stay (days)	1.2 ± 0.5	3.6 ± 1.1	<0.001
Healing Time (weeks)	4.5 ± 1.0	6.8 ± 1.3	<0.001

Table 3: Postoperative Complications and Recurrence

Outcome	Laser Group (%)	Open Group (%)	p-value
Infection	5%	12.5%	<0.05
Incontinence	2.5%	10%	<0.05
Recurrence	20%	10%	<0.05
Patient Satisfaction	85%	78%	<0.05

DISCUSSION

The management of complex fistula-in-ano remains a significant surgical challenge, primarily due to the need to achieve complete eradication of the fistulous tract while preserving anal sphincter function. The present study provides a comparative evaluation of laser fistulotomy and open fistulotomy, highlighting their respective advantages and limitations in terms of clinical outcomes, safety, and recurrence.

In this study, baseline characteristics between the two groups were comparable, ensuring that the observed differences in outcomes were attributable to the surgical techniques rather than confounding variables. The findings demonstrated that

laser fistulotomy was associated with significantly reduced operative time, postoperative pain, shorter hospital stay, and faster wound healing compared to open fistulotomy. These results are consistent with previous studies by Tümer et al. [13] and Rahman et al. [15], which reported improved postoperative recovery and early return to daily activities with laser-based techniques. The minimally invasive nature of laser therapy, involving controlled radial energy delivery and minimal tissue disruption, likely explains these favorable outcomes.

Postoperative pain, a critical determinant of patient satisfaction and recovery, was significantly lower in the laser group. This aligns with the findings of Khan et al. [17], who reported reduced Visual Analog Scale (VAS) scores in patients undergoing laser fistula treatment. Reduced pain can be attributed to the absence of large open wounds and limited sphincter division, which are inherent to conventional fistulotomy.

Similarly, the duration of hospital stay and wound healing time were significantly shorter in the laser group. Early wound healing observed with laser fistulotomy may be due to precise tissue ablation and reduced inflammatory response. Comparable findings have been reported by Darwish et al. [12], who demonstrated shorter hospitalization and quicker recovery in patients treated with FiLaC. These advantages not only improve patient comfort but also reduce healthcare burden and costs associated with prolonged hospital stays.

Despite these benefits, the present study observed a higher recurrence rate in the laser fistulotomy group compared to open fistulotomy. This finding is in agreement with studies by Patel et al. [16] and Duda et al. [14], which reported moderate healing rates and increased recurrence following laser procedures. The higher recurrence may be due to incomplete obliteration of the fistulous tract, inadequate closure of internal openings, or inappropriate patient selection, particularly in complex or branching fistulas. These findings suggest that while laser fistulotomy is less invasive, it may compromise long-term disease control in certain cases.
On the other hand, open fistulotomy demonstrated lower recurrence rates, reaffirming its role as a definitive surgical procedure. However, this benefit comes at the cost of increased postoperative morbidity. In the present study, the incidence of fecal incontinence was higher in the open fistulotomy group, which is consistent with previous literature [6,7]. Sphincter division during open surgery can impair continence mechanisms, especially in high or complex fistulas, making this approach less desirable in selected patients.

An important observation in this study was the significantly lower rate of incontinence in the laser group, highlighting its sphincter-preserving advantage. This finding supports the growing preference for minimally invasive techniques in patients where continence preservation is a priority. The balance between recurrence and continence remains a key consideration in choosing the appropriate surgical modality.
Patient satisfaction was higher in the laser group, likely due to reduced pain, quicker recovery, and shorter hospitalization. These factors play a crucial role in modern surgical practice, where patient-centered outcomes are increasingly emphasized alongside clinical success.

Overall, the findings of this study suggest that laser fistulotomy offers superior short-term outcomes and improved quality of life, whereas open fistulotomy provides better long-term disease control with lower recurrence rates. Therefore, the choice of surgical technique should be individualized based on fistula complexity, patient comorbidities, risk of incontinence, and available resources.

Strengths of the Study

- Prospective comparative design
- Equal sample distribution between groups
- Evaluation of multiple clinically relevant outcomes

Limitations

- Relatively small sample size
- Short follow-up duration (3 months), which may underestimate recurrence
- Single-center study limiting generalizability

Future Recommendations

Further multicentric randomized controlled trials with larger sample sizes and longer follow-up periods are required to establish standardized treatment protocols and to better define the role of laser fistulotomy in complex fistula-in-ano.

CONCLUSION

The present study demonstrates that both laser fistulotomy and open fistulotomy are effective surgical options for the management of complex fistula-in-ano, each with distinct advantages and limitations. Laser fistulotomy offers clear benefits in terms of reduced postoperative pain, shorter hospital stay, faster wound healing, and superior preservation of

anal sphincter function, resulting in lower rates of incontinence and higher patient satisfaction. These findings support its role as a minimally invasive, patient-friendly alternative, particularly in individuals where sphincter preservation is of paramount importance.

However, the higher recurrence rates observed with laser fistulotomy indicate that its long-term efficacy may be inferior to that of open fistulotomy. In contrast, open fistulotomy remains a more definitive procedure with lower recurrence rates, albeit at the expense of increased postoperative morbidity and a higher risk of continence disturbances.

Therefore, the choice of surgical technique should be individualized, taking into account fistula complexity, patient-specific factors, risk of incontinence, and available expertise. Laser fistulotomy may be preferred for selected patients prioritizing quicker recovery and continence preservation, whereas open fistulotomy continues to be a reliable option where complete eradication of disease is the primary goal.

Future large-scale, multicentric randomized controlled trials with longer follow-up are essential to further validate these findings and to establish standardized guidelines for the optimal management of complex fistula-in-ano.

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