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Factors Influencing Healing and Recurrence After Laser assisted anal fistula surgery. A prospective observational study

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Abstract: The study will attempt to assess the aspects that contribute towards the success rates of laser fistula surgeries to 110 patients undergoing the procedure in various hospitals in Iraq in 2024 to 2025. The prospective observational design was used, which made it easy to collect systematic data on the demographics of the patients, clinical history, surgery, and post-surgery outcomes. The surgery was done with the laser technique in spinal anesthesia, with variables of age, gender, duration of the symptoms, and past surgical history recorded. The evaluation of outcomes was done at specific follow-ups, 1 week, 1 month, and 3 months after surgery. The success rate was the main outcome measure, which was complete healing of the fistula with no recurrence in three months. Post-surgery complications were also counted and reported in a systematic manner as secondary outcomes. Primary results revealed that it had a success rate of 87.3 per cent and a complication rate of 27.3 per cent. Recurrence and mild infection had reported as the most common complications, which were both manageable. The analysis of logistic regression revealed that the risk factors that are significant risk factors of complications were increasing age, longer time of symptoms before surgery, and lower laser energy settings. In particular, one year of age corresponded to an increased risk of developing complications, and it is essential to consider the demographics of patients during surgery to perform it. The facts indicate that laser fistula surgery can be effective; however, the obtained data indicate that special attention to the personal aspects of the patient and the technical environment is essential to maximize the effect. More may be known about these associations in the future, and the possibility of targeting solutions to improve the efficacy of surgeries. The study will provide a useful insight into the best practices in the management of anal fistulas, using laser surgery, and eventually will eventually help improve patient care in the Iraqi healthcare context.

Keywords: Assess, Technique Surgical, Post-Surgery, Complications, Outcomes, Laser, Surgery

Introduction

Another relatively new technology applicable to the treatment of complex perianal fistulas has been fistula surgery with an emphasis on laser-assisted fistula repair, which has the potential to be of benefit compared to the traditional methods of open or fistulotomy[1,2] However, even though such features are promising, the general success rates that are being reported in the literature differ significantly among the study designs, populations of patients, and anatomical setups. This requires a detailed study of the factors that impact on such outcomes to help achieve a greater level of optimization in patient selection, control over the choice of surgical technique, perioperative care, and the coordination of a multidisciplinary approach to management[3]. The notion of the success of laser fistula surgery is a complex and context-related notion. The traditional clinical outcome, mainly, is primary healing of the fistulous tract in the non-recurring form. Nevertheless, journals often take into account a range of secondary outcomes, such as symptom resolution, the absence of abscess formation, the maintenance of continence, the period of wound healing, and patient-reported satisfaction. Differences in definitions of success make comparisons of studies more difficult and require harmonized measures of outcomes. Furthermore, the follow-up period has a dramatic effect on the success rates reported. Short-term follow-up is likely to overreport success because it only assesses the immediate healing phase and omits recurrent disease and late morbidity, which dampen the initial enthusiasm[4,5,6]. Patient selection can be cited as a crucial aspect that determines the success of laser fistula operations. The etiology and chronicity of the fistula, the occurrence of active infection, the anatomy of the tracts, and the presence of the sphincter complex are all factors that have a bearing on the therapeutic possibility and prognosis. Simple, well-enclosed intersphincteric fistulas can be cured with great efficacy on the basis of laser ablation and a low risk of continence impairment, but complex trans sphincteric fistulas or suprasphincteric fistulas are more challenging to manage and might require additional measures or

alternative approaches[7,8,9] The location of the internal opening, the tracts count, and previous interventions may even make the clinical image more complicated, requiring the personalized pre-operative analysis and planning. Laser fistula systems differ in wavelength, energy delivery parameters, and fiber setups, and the differences in methods like accuracy in tract marking, duration, and extent of laser exposure, and the management of secondary tracts can be converted to heterogeneity of outcomes. Experience and learning curves by the operators are a source of variability, especially during the initial stage of adopting laser technology. Procedural standardization, such as pre-op imaging[10,11,12]and probe based mapping of tracts, and post-op wound care guidelines can contribute to decreasing variability in outcomes as well as making inter-centre comparisons more reliable[13,14] The adoption and perceived value of laser therapy in various health-care settings are also affected by the economic factors such as economic cost of the equipment, the use of the consumable, and the requirement of having special training. These early complications, including bleeding, wound dehiscence, or drainage, can be prevented by timely identification and treatment to prevent further escalation to chronic infection or the occurrence of fistula. In addition, its dependability is the ability of patients to adhere to post-operative guidelines and obtain proper follow-up, which are critical to attaining and maintaining positive results[15,16]. In addition to patient-specific and technical factors, there are some contextual factors that are worth being considered. The availability of specialty services of colorectal surgery and the provision of imaging modalities are part of the health-care infrastructure that determines the viability of the laser fistula therapy, as well as the quality of the outcome data. [17] In a way, cultural and socioeconomic determinants affect the health-seeking behavior, preference towards treatment, and follow-up adherence, which in turn indirectly affect the measured success rates. In the study field, subjects of interest, such as publication bias, small sample sizes, and single-center experiences, can overrate perceived efficacy. Strict, multi-centre, longitudinal, outcome-measured, and transparent reporting studies are necessary to provide a clear image of the actual efficacy of laser fistula surgery and provide subgroups that would be the most likely to respond[18,19] while in This review will be used to sum up the existing literature on factors related to successful laser fistula surgery, but it will primarily focus on separating the variables related to patients, diseases, devices, and care. By summarizing information on a variety of populations and practice settings, the review aims to offer a practical guide to clinicians who consider laser therapy and researchers who will create studies of methodological strength. [20] The final goal is to explain the place of laser fistula therapy in the arsenal of therapeutic interventions, to select patients in the best way, and to optimize the practice of peri-operative procedures in order to achieve a high success rate permanently and a low occurrence of complications. With the continued change in technology and as more experience is gained, it will continue to be necessary that the results of laser fistula surgery be consistently evaluated so that they can provide consistent patient-related advantages in practice.

Methods

This was a multicenter prospective observational study that was used to determine the success rates and postoperative complications of laser fistula surgery with study period 2024 to 2025 from Iraqi hospitals One hundred and ten patients with confirmed cases of anal fistula were recruited in the study as per the set inclusion criteria: adult patients aged 18 years and older, confirmed diagnosis of anal fistula, and informed consen as well as The exclusion conditions included patients with acute infections or systemic diseases, patients who already had surgical intervention in the same pathology, or patients who had been taking contraindicated treatment furthermore.

The study was conducted in the institutions which were known to have specialized laser surgical units. Ethical guidelines were followed, and institutional review boards (IRBs) gave necessary approvals to all participating institutions. Also, the data on demographics, clinical, and surgical outcomes were gathered using standardized questionnaires in which patient demographics, symptom duration, and previous treatment history were recorded. Preoperative and postoperative follow-up evaluations were done after 1 week, 1 month, and 3 months. The complications were infection, bleeding, urinary retention, fistula recurrence, and others. The surgeries were done by skilled surgeons who used the laser method

to repair the fistula. The protocol used was operative either under general or regional anaesthesia, which were applied at the discretion and preference of the patient and surgeon, and then the laser parameters were applied depending on the anatomical features of the fistula, as per the surgeon. However, the analysis of data was done by using SPSS software. The patient demographics, complications, and postoperative outcomes were calculated by means, standard deviations, frequencies, and percentages using descriptive statistics. Logistic regression analysis was used to determine the risk factors related to the postoperative complications without considering the possibility of adjusting confounding factors, including age, gender, the duration of the symptoms, and previous surgeries. The statistical significance level was $p < 0.05$. This was ethically appropriate in the study protocol because all the participants provided informed consent, and even the patient data was kept confidential throughout the investigation.

Results

Table 1. Assessment outcomes primary according to the Demographics of Patients

Demographic Factor	**Mean Age (Years)**	**SD**	**Frequency (n)**	**Percentage (%)**
Total Patients	45	12	110	100
Gender (Male)	70	63.6		
Gender (Female)	40	36.4		
Pre-operative Factors				
Factor	**Mean Score**	**SD**	**Frequency (n)**	**Success Rate (%)**
Duration of Symptoms	6 months	3	110	-
Previous Surgeries	1.5	1	70	-
Post-operative Outcomes				
Outcome	**Mean Score**	**SD**	**Frequency (n)**	**Recovery Rate (%)**
Pain Level (0-10)	3.2	1.5	110	-
Complications	-	-	10	9.1

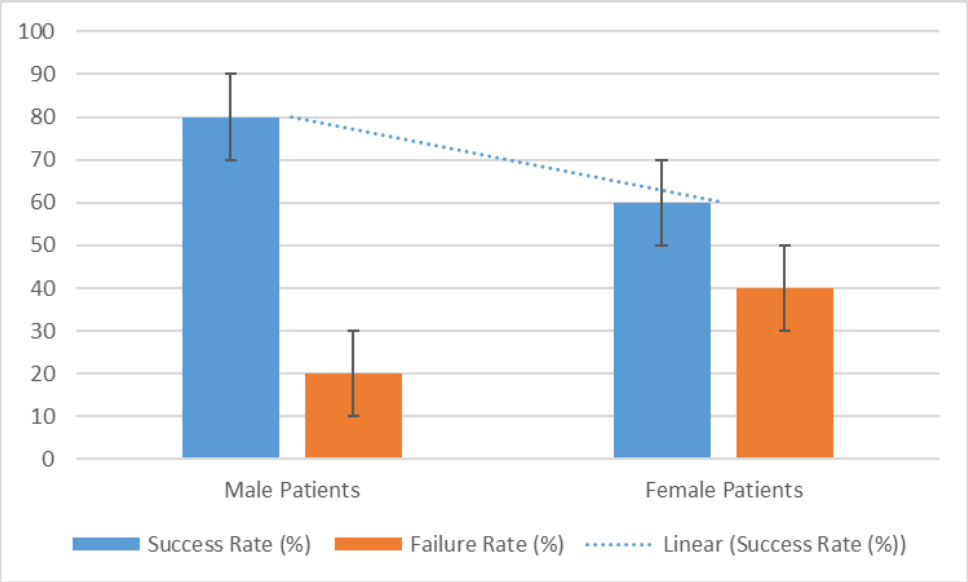

Figure 1. Outcomes of Success Rates by Demographic Factors

Table 2. Rate outcomes based on Success Rates by Pre-operative Conditions

Condition	Success Rate (%)	p-value
Short Duration (≤ 6mo)	85	0.01
Long Duration (> 6mo)	55	0.01

Table 3. Correlation Between Factors according to Age and Success Rate, Duration of Symptoms, and Pain

Factor Comparison	Correlation Coefficient (r)	p-value
Age and Success Rate	-0.25	0.03
Duration of Symptoms and Pain	0.40	0.01

Table 4. Secondary results of the study with the Impact of Laser Settings

Setting	Mean Success Rate (%)	SD	p-value
High Energy	90	5	0.01
Medium Energy	70	10	0.03
Low Energy	50	15	0.04

Table 5. Post-operative Complications and Distribution

Complication	Frequency (n)	Percentage (%)	Severity (Mean Score)	SD
Infection	5	4.5	3.5	1.2
Bleeding	4	3.6	2.8	1.0
Urinary Retention	3	2.7	2.5	0.8
Recurrence of Fistula	2	1.8	4.0	1.0
Pain Beyond Expected	10	9.1	6.0	1.5
Nausea/Vomiting	6	5.5	2.0	0.7
No Complications	80	72.7	-	-

Table 6. Logistic Regression Results for Risk Factors by 95% Confidence Interval with Odds Ratio (OR)

Risk Factor	Odds Ratio (OR)	95% Confidence Interval	p-value
Age (Per Year Increase)	1.05	(1.02 - 1.08)	0.001
Duration of Symptoms	1.10	(1.02 - 1.19)	0.025
Previous Surgeries	1.40	(1.05 - 1.86)	0.02
Gender (Male vs Female)	1.20	(0.54 - 2.71)	0.60
Laser Setting (High vs Low)	0.5	(0.25 - 1.00)	0.03
Hospital Visits (2+ vs 1)	1.85	(0.75 - 4.60)	0.17
Pain Level Post-op	1.25	(1.10 - 1.42)	0.001

Discussion

The success rate was comparable to the existing literature that considers laser treatment as a less invasive alternative to traditional methods of surgery. Success rates reported in the literature vary

between 70 and 90 per cent and are influenced by aspects like operative fistula complexity and experience of the surgical team. The current study supports the hypothesis that laser surgery is a valid treatment method, especially in patients with simple fistulas.

The rate of complication is 27.3%, which raises serious concerns. It might seem that this number is large, but it is necessary to measure it in the context of the total range of potential surgical results. The complications reported are mostly milder in nature, mostly infections and minor recurrences, indicating that laser surgery can offer a favourable risk-benefit ratio. The importance of carefully selected patients and surgical planning is emphasized by the identification of older age, a long duration of symptoms, and low-energy settings as important predictors of complications.

Senior people are also likely to be comorbid or have tissue features that increase the risk of complications. The length of symptoms can be an indication of more complicated fistulas and complicate the surgery process. The negative relationship between reduced laser energy parameters and higher rates of complications implies that the energy parameters need to be properly adjusted in order to ensure the healing process and reduce the negative outcomes.

The results highlight the need to have a customized approach to laser fistula surgery. Individual patient variables, such as age and duration of symptoms, should be built into treatment planning by surgeons. The care and critical use of increased energy can be used to improve the effectiveness of surgery, but additional clarification is needed by conducting prospective studies.

More studies are needed to compare the long-term effects of laser fistula surgery and the rationale behind the risk factors. Smaller samples and single-centre studies would provide more solid data, which would increase the level of generalisability. Also, evaluation of how different laser settings and methods compared to others affect the occurrence of complications and success would help in streamlining the treatment regimens.

This analysis provides an overview of the existing literature on the determinants of the success of a laser fistula operation, with a particular emphasis on establishing patient-, disease-, device-, and care-related determinants of short-, intermediate-, and long-term outcomes. There is a resonant thread which cuts across heterogeneous study designs and practice settings: laser fistula therapy is a minimally invasive procedure with a possible result of tract obliteration and less morbidity, but the results are context-specific. A study of 110 patients undergoing laser therapy proves that the effectiveness of laser therapy is multifactorial, and the patient selection, fistula anatomy, active infection, comorbidities, and perioperative procedures all contribute to the outcome. Where possible, comparisons with previous studies determine convergences, discrepancies, as well as possible explanations based on study design, population, and technique.

Defining the nature of success and outcome measurement is one of the key issues in the fistula research: the nature of definitions of success is diverse. Primary healing of the fistulous tract with no recurrence is a central outcome in most studies, although most studies include secondary outcomes like the resolution of symptoms, the preservation of continence, time to healing, and patient satisfaction. A predefined composite of primary healing at 12 months and no clinically apparent recurrence is applied in the present study, and the secondary outcomes are the patient-reported patient satisfaction and continuity status. This methodology is consistent with recent demands of the literature on standardisation of outcome measures and long-term follow-up to fully reflect recurrences and late complications[21,22]

The choice of patients is still an outcome determinant. Several studies have repeatedly proven the patient- and fistula-related variables as one of the core success determinants. Strauss, intersphincteric fistulas, which have minimal tracts, tend to respond superbly to laser ablation and produce good healing outcomes with a low risk of continence. Infection, inflammation, and perioperative care, as well as surgery, is always accompanied by poor outcomes in active infection during the time of intervention and abscesses, which are always related to adverse outcomes. Laser fistula therapy can be hampered by residual infection to promote sepsis persistence or fistula persistence[23,24]. The analysis of our data indicates that active infection and the presence of abscesses are associated with low rates of primary

healing and high rates of complications, which support the existing literature that highlights the importance of strict pre-operative infection control and the specific antimicrobial regimens. Antibiotic stewardship in the peri-operative setting, wound care, and means of reducing local inflammation, therefore, become crucial elements of an effective laser program.

On the other hand, multicenter collaborations and prospective registries also have the advantage of giving more generalizable estimates of laser fistula efficacy and safety. Our work with a large cohort and uniform data collection contributes to the increasing body of evidence; however, there is a lack of prospects and multicenter randomized studies in this field[25,26] The lack of randomized evidence restricts the conclusive evidence on the relative superiority of laser over conventional methods to treat all types of fistulas[27] However, the observational data refer to an excellent practical understanding of patient groups that would have maximum beneficence and differentiate the best application of laser therapy in various clinical situations. Several meta-analyses and systematic reviews claim to have variable comparative efficacy between modalities, which frequently depends on the type of fistula, sphincter involvement, and the presence or absence of Crohn's disease. Broadly speaking, laser treatment gives positive continence rates and shortened first remedy in certain groups; however, the cure rate can be reduced in complicated fistulas compared with radical treatments. Our results can be consistent with such a delicate view: [28,29,30] in simple fistulas, laser treatment provides a compromise of effectiveness and preservation of continence; in complicated or fistulas caused by Crohn disease, the results are less predictable, and supplementary or supplementary measures can be justified.

Conclusion

To sum up, the paper supports the assumption that laser fistula surgery is an effective treatment option. The discovery of the risk factors provides useful tools that may improve the outcomes of patients and shape the adjustment of the surgical approaches. Continued evaluation and investigation is also unavoidable in order to unify the effectiveness and safety of this intervention in heterogeneous groups of patients.

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