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Original Article

## Open versus closed lateral internal anal sphincterotomy for chronic anal fissure: A prospective randomized comparative study.

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Page | 1

### Abstract

#### Background

Chronic anal fissure is frequently associated with internal anal sphincter hypertonia and persistent post-defecatory pain. Lateral internal anal sphincterotomy (LIAS) remains the definitive surgical treatment, but open and closed techniques differ in operative exposure and tissue handling.

Objectives: To compare open and closed LIAS with respect to operative and early postoperative outcomes, including pain, length of stay, complications, and recurrence.

#### Methods

A prospective randomized comparative study was conducted at St. Philomena Hospital, Bengaluru, between December 2020 and June 2022. Sixty adults with chronic anal fissure were randomized to open LIAS (Notaras technique) or closed LIAS (n=30 each). Outcomes included type of anesthesia, duration of surgery, hospital stay, postoperative pain scores (VAS) at 12 and 24 hours, complications (bleeding, hematoma, infection/abscess), continence status, and recurrence during follow-up.

#### Results

Baseline characteristics were comparable between groups. Closed LIAS was performed predominantly under spinal anesthesia and had a shorter operative duration (13.36±3.11 vs 16.60±2.49 minutes). Hospital stay was shorter after closed LIAS (1.30±0.74 vs 2.36±0.80 days). Pain scores were lower in the closed group at 12 hours (2.83±0.87 vs 3.50±1.27) and 24 hours (3.23±0.85 vs 5.30±1.08). Bleeding and hematoma occurred only after open LIAS (6.7% each). No fecal or flatus incontinence was recorded in either group. Recurrence occurred in 6.7% of open LIAS and none after closed LIAS.

#### Conclusion

Closed LIAS provided faster surgery, earlier discharge, and lower early postoperative pain, with a low complication profile and no continence impairment in this cohort.

#### Recommendations

Where surgical expertise is available, the closed technique can be preferred for an uncomplicated chronic anal fissure, alongside standardized analgesia, fiber supplementation, and scheduled follow-up.

**Keywords:** Anal fissure; lateral internal anal sphincterotomy; open technique; closed technique; postoperative pain; hospital stay.

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stay, postoperative pain at 12 and 24 hours, postoperative complications (bleeding, hematoma, infection/abscess), continence outcomes, and recurrence during follow-up.

## **Materials and methods**

### **Study design**

This study was conducted as a prospective, parallel-group, randomized controlled trial with a 1:1 allocation ratio to compare open lateral internal anal sphincterotomy (LIAS) and closed lateral internal anal sphincterotomy in patients with chronic fissure in ano. The study was carried out in the Department of General Surgery, St. Philomena Hospital, Bengaluru.

### **Study period and setting**

Participant recruitment and follow-up were conducted from December 2020 to June 2022 at St. Philomena Hospital, Bengaluru, as part of an institutional evaluation of surgical outcomes in patients undergoing operative treatment for chronic fissure in ano.

### **Study population**

Adults aged more than 18 years with chronic fissure in ano of more than 6 weeks' duration and clinical features of chronicity, including sentinel pile, hypertrophied anal papilla, and/or exposed internal sphincter fibers, were considered eligible for inclusion. Patients younger than 18 years, those with anal dilatation, fissure associated with inflammatory bowel disease, fistula in ano, anal stenosis, anorectal malignancy, or systemic comorbidities likely to interfere with wound healing were excluded. Patients undergoing concomitant anorectal procedures and those with a history of previous sphincterotomy were also excluded.

### **Sample size**

The sample size was calculated on the basis of previously reported complication rates of 18% for the closed technique and 58% for the open technique. The minimum estimated sample size was 28 participants in each group. To compensate for possible attrition and to improve the robustness of the comparison, the sample size was increased

## **Introduction**

Anal fissure is a linear ulcer in the distal anal canal that produces severe post-defecatory pain, bleeding, and sphincter spasm. Chronic anal fissure is commonly defined by persistence beyond 6 weeks and by stigmata such as a sentinel pile, hypertrophied anal papilla, or exposure of internal sphincter fibers [1,2]. Contemporary practice guidelines recommend a stepwise approach beginning with optimization of stool consistency, sitz baths, and topical agents that lower internal sphincter tone, while reserving surgery for refractory disease [3].

The pathophysiology of chronic fissure is multifactorial, but increased resting anal pressure and reduced anodermal perfusion contribute to a cycle of pain, spasm, and impaired healing[4]. Notaras described lateral subcutaneous internal sphincterotomy as a method to interrupt this cycle and promote healing by reducing sphincter hypertonia [5]. Lateral internal anal sphincterotomy (LIAS) continues to provide the most reliable symptom resolution and fissure healing, with durable outcomes compared with medical therapy alone [6]. However, the procedure is not without risks, particularly postoperative bleeding, hematoma formation, infection, and concerns about long-term continence impairment [13].

Open LIAS allows direct visualization of the internal sphincter through an intersphincteric incision, enabling controlled division of the lower sphincter fibers. Closed LIAS, in contrast, relies on tactile guidance using a scalpel introduced through a small stab incision, offering minimal skin disruption and potentially less postoperative pain. Several randomized trials have reported comparable healing between open and closed LIAS, but differences in early postoperative discomfort, operative time, and complication rates remain clinically relevant for patient counselling and resource planning [7-9]. Recent meta-analyses suggest that technique-related differences in incontinence and delayed healing are small, although careful patient selection and standardized operative methods are important [13].

In high-volume surgical units, the choice between open and closed LIAS should account for operative efficiency, postoperative recovery, and safety, particularly in settings where early discharge is desirable. Local evidence from institutional cohorts is valuable because patient profiles, anesthesia practices, and perioperative protocols can influence measured outcomes. Therefore, this study was designed to compare open and closed techniques of LIAS in adult patients with chronic anal fissure. The specific objectives were to evaluate the duration of surgery, hospital



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by 10%, and the final sample comprised 30 participants in each group, yielding a total sample size of 60.

### Randomization

Eligible participants were randomized into two equal groups, namely the open LIAS group and the closed LIAS group, using a computer-generated random allocation sequence created through the GraphPad online randomization tool. Simple randomization was used, and allocation was performed in a 1:1 ratio.

### Allocation concealment

Group allocation was concealed using serially numbered, opaque, sealed envelopes prepared according to the pre-generated randomization sequence. Each envelope was opened only after the participant had been enrolled and confirmed to meet the eligibility criteria.

### Implementation

The random allocation sequence was generated before the start of participant enrollment by a person not involved in outcome assessment. Eligible patients were enrolled by the treating surgical team, and the assigned intervention was determined after opening the sealed allocation envelope immediately before surgery.

### Blinding

Blinding of the operating surgeon was not feasible because of the inherent technical differences between the open and closed sphincterotomy procedures. Participant blinding was also not feasible because of the differences in the nature of the surgical wound and postoperative local care. Postoperative outcomes were, however, assessed using predefined objective criteria, and postoperative pain was recorded using the Visual Analogue Scale at fixed time points.

### Preoperative preparation

All patients underwent routine pre-anesthetic evaluation before surgery. Written informed consent was obtained from all participants before enrollment. Patients were kept nil per oral for 4 to 6 hours before the procedure. Prophylactic

antibiotics were administered before induction of anesthesia in accordance with the institutional protocol.

### Surgical techniques

All procedures were performed with the patient in the lithotomy position under either spinal anesthesia or general anesthesia. In the open LIAS group, corresponding to the Notaras technique, the intersphincteric groove was identified, and a 1 cm incision was made over the groove. The internal sphincter was carefully separated from the adjacent mucosa, and the lower one-third of the internal sphincter was divided under direct vision. Hemostasis was achieved by pressure application and diathermy when necessary, and the skin incision was closed with 4-0 polyglactin sutures.

In the closed LIAS group, a 1 cm stab incision was made in the intersphincteric groove. A Von Graefe's scalpel was introduced through the incision, and the lower one-third of the internal sphincter was divided under tactile guidance. The stab incision was left open to heal secondarily.

### Postoperative care and follow-up

Postoperatively, all patients received intravenous paracetamol and/or tramadol for 24 to 36 hours unless contraindicated. Pain intensity was assessed using a 10-point Visual Analogue Scale at 12 hours and 24 hours after surgery. A sitz bath was advised for all patients. The anal pack, when used, was removed on the first postoperative day. Patients were discharged on oral analgesics and laxatives once clinically stable.

Follow-up assessments were scheduled at 2 weeks, 4 weeks, 6 weeks, and 12 weeks after surgery, and subsequently at 6 months. During these visits, patients were evaluated for postoperative complications, continence status, wound healing, and recurrence of fissure.

### Outcome measures

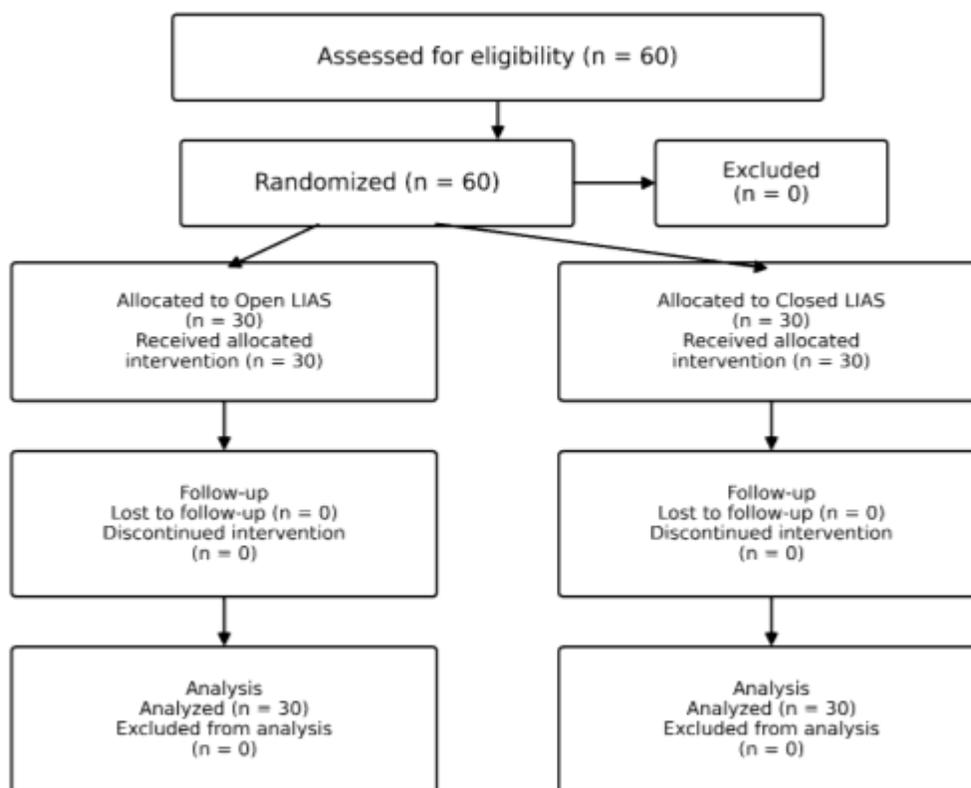
The primary outcome measures were operative duration, duration of hospital stay, and postoperative pain scores measured by the Visual Analogue Scale at 12 hours and 24 hours. Secondary outcome measures included postoperative bleeding, hematoma formation, wound infection or abscess, fecal incontinence, flatus incontinence, and recurrence during follow-up.

## Statistical analysis

Data were entered and analyzed using appropriate statistical methods. Continuous variables were expressed as mean  $\pm$  standard deviation, while categorical variables were presented as frequencies and percentages. Continuous

variables between the two groups were compared using the independent samples t-test. Categorical variables were compared using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

## Results



**Figure 1: Participant flow diagram**

A total of 60 patients with chronic anal fissure were randomized equally into open LIAS (n=30) and closed LIAS (n=30). Baseline demographic and clinical parameters were comparable between the groups, with no statistically

significant differences in age distribution, sex, presenting symptoms, physical findings, fissure location, constipation history, or duration of symptoms (Table 1).



**Table 1. Baseline demographic and clinical characteristics of study participants (N = 60)**

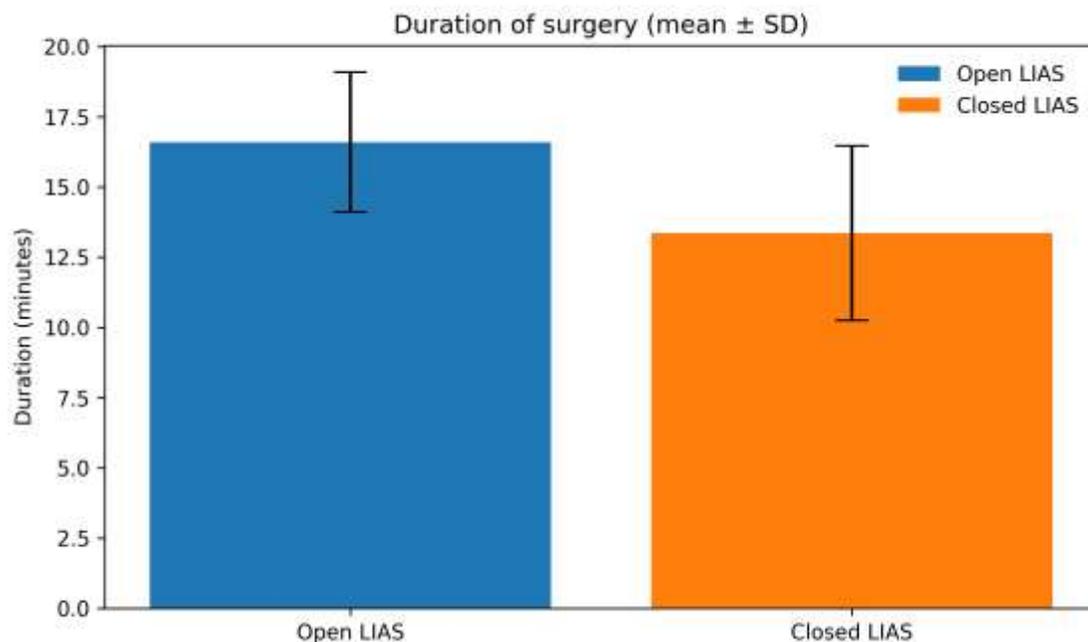
Variable	Category	Open LIAS (n = 30) n (%)	Closed LIAS (n = 30) n (%)	p value
Age (years)	<20	4 (13.3)	0 (0.0)	0.17
	21–30	13 (43.3)	14 (46.7)	
	31–40	10 (33.3)	14 (46.7)	
	41–50	3 (10.0)	2 (6.7)	
	Mean ± SD	29.50 ± 7.79	30.76 ± 5.91	
Gender	Male	14 (46.7)	20 (66.7)	0.12
	Female	16 (53.3)	10 (33.3)	
Presenting complaints	Pain during/after defecation	4 (13.3)	7 (23.3)	0.32
	Pain + bleeding during/after defecation	26 (86.7)	23 (76.7)	
Physical examination findings	F1, S1, P2, L2, Ss1	4 (13.3)	5 (16.7)	0.72
	F2, S1, P2, L2, Ss1	26 (86.7)	25 (83.3)	
Diagnosis	Chronic anterior fissure	4 (13.3)	5 (16.7)	0.72
	Chronic posterior fissure	26 (86.7)	25 (83.3)	
Constipation history	Present	27 (90.0)	27 (90.0)	1.00
	Absent	3 (10.0)	3 (10.0)	
Duration of symptoms (months)	1–5	18 (60.0)	14 (46.7)	0.55
	6–10	11 (36.7)	14 (46.7)	
	>11	1 (3.3)	2 (6.7)	
	Mean ± SD	4.53 ± 2.70	5.43 ± 2.81	

Intraoperatively, spinal anesthesia was used more frequently in the closed LIAS group (93.3%) than in the open LIAS group (50.0%), and this difference was statistically significant ( $p=0.0002$ ). The mean duration of surgery was

significantly shorter with the closed technique ( $13.36\pm 3.11$  minutes) compared with the open technique ( $16.60\pm 2.49$  minutes;  $p=0.002$ ) (Table 2 and Figure 1).

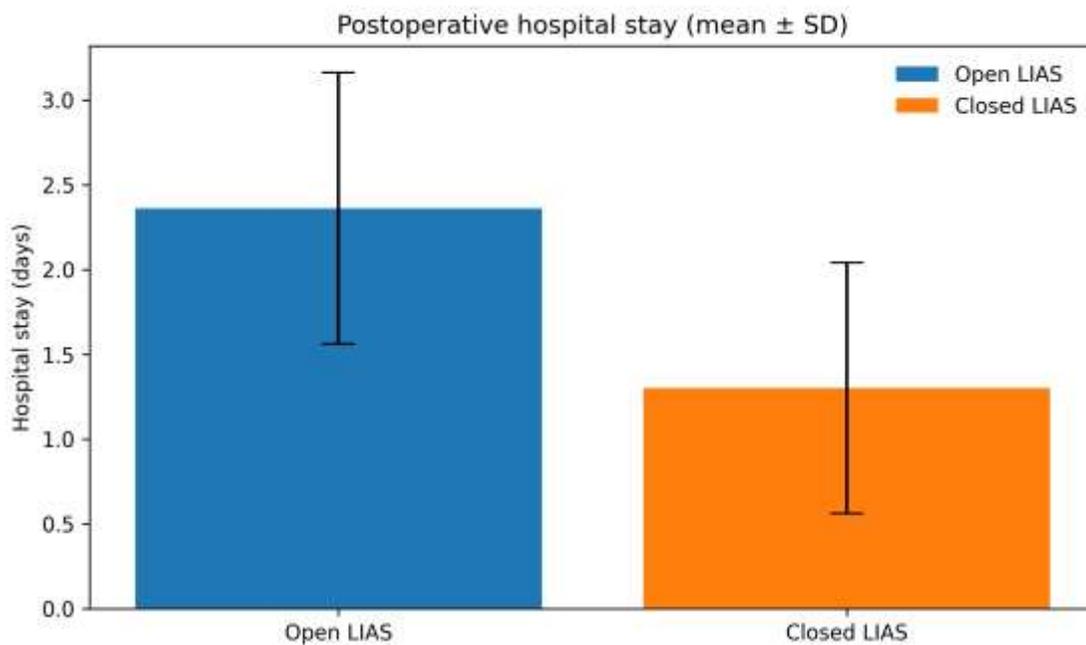
**Table 2. Intraoperative characteristics of the two surgical techniques**

Variable	Category	Open LIAS (n = 30) n (%)	Closed LIAS (n = 30) n (%)	p value
Type of anesthesia	Spinal anesthesia (SA)	15 (50.0)	28 (93.3)	0.0002*
	General anesthesia (GA)	15 (50.0)	2 (6.7)	
Duration of surgery (minutes)	10–15	12 (40.0)	25 (83.3)	0.002*
	16–20	16 (53.3)	5 (16.7)	
	>21	2 (6.7)	0 (0.0)	
	Mean $\pm$ SD	16.60 $\pm$ 2.49	13.36 $\pm$ 3.11	



**Figure 1. Duration of surgery in the two techniques (mean  $\pm$  SD).**

Postoperative recovery differed between the techniques. The closed LIAS group demonstrated a shorter mean hospital stay ( $1.30 \pm 0.74$  days) than the open LIAS group ( $2.36 \pm 0.80$  days;  $p=0.0004$ ) (Table 3 and Figure 2).



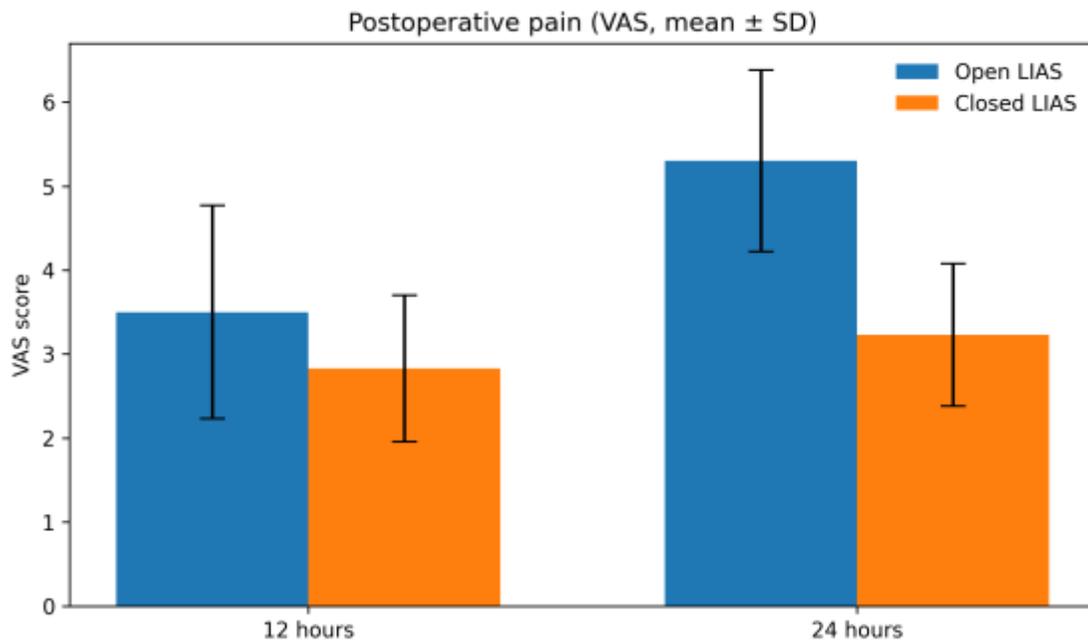
**Figure 2. Postoperative hospital stay (mean  $\pm$  SD).**

Pain scores were significantly lower after closed LIAS at both 12 hours ( $2.83 \pm 0.87$  vs  $3.50 \pm 1.27$ ;  $p=0.02$ ) and 24 hours ( $3.23 \pm 0.85$  vs  $5.30 \pm 1.08$ ;  $p=0.0001$ ) (Table 3 and Figure 3).



**Table 3. Postoperative recovery outcomes**

Outcome	Category	Open LIAS (n = 30) n (%)	Closed LIAS (n = 30) n (%)	p value
Hospital stay (days)	0	0 (0.0)	3 (10.0)	0.0004*
	1	4 (13.3)	17 (56.7)	
	2	13 (43.3)	8 (26.7)	
	3	11 (36.7)	2 (6.7)	
	4	2 (6.7)	0 (0.0)	
	Mean ± SD	2.36 ± 0.80	1.30 ± 0.74	
Pain (VAS) at 12 hours	2	6 (20.0)	14 (46.7)	0.02*
	3	11 (36.7)	7 (23.3)	
	4	9 (30.0)	9 (30.0)	
	5	2 (6.7)	0 (0.0)	
	7	2 (6.7)	0 (0.0)	
	Mean ± SD	3.50 ± 1.27	2.83 ± 0.87	
Pain (VAS) at 24 hours	2	0 (0.0)	5 (16.7)	0.0001*
	3	1 (3.3)	15 (50.0)	
	4	3 (10.0)	9 (30.0)	
	5	18 (60.0)	0 (0.0)	
	6	4 (13.3)	1 (3.3)	
	7	2 (6.7)	0 (0.0)	
	8	2 (6.7)	0 (0.0)	
	Mean ± SD	5.30 ± 1.08	3.23 ± 0.85	



**Figure 3. Postoperative pain scores (VAS) at 12 and 24 hours (mean ± SD).**

Postoperative complications were infrequent overall. Bleeding and hematoma were observed only in the open LIAS group (6.7% each), while no infection/abscess was recorded in either group. No patient developed fecal or flatus

incontinence. Recurrence was documented in two patients (6.7%) after open LIAS and in none after closed LIAS; this difference did not reach statistical significance (Table 4).

**Table 4. Postoperative complications and recurrence**

Complication/outcome	Open LIAS (n = 30) n (%)	Closed LIAS (n = 30) n (%)
Bleeding	2 (6.7)	0 (0.0)
Hematoma	2 (6.7)	0 (0.0)
Infection/abscess	0 (0.0)	0 (0.0)
Fecal incontinence	0 (0.0)	0 (0.0)
Flatus incontinence	0 (0.0)	0 (0.0)
Recurrence	2 (6.7)	0 (0.0)

Note: Data are expressed as n (%) unless stated. Continuous variables are expressed as mean ± SD. \*Statistically significant (p < 0.05).



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Although recurrence was numerically higher after open LIAS, the difference was not statistically significant in this sample. Recurrence after sphincterotomy is generally low when adequate sphincter division is achieved, and postoperative stool regulation is maintained [3,5]. The absence of recurrence in the closed group in this cohort is consistent with the durability reported in earlier trials, but longer follow-up provides stronger confidence in recurrence estimates [6,9].

**Generalizability:** The observed advantages of closed LIAS apply to adult patients with uncomplicated chronic anal fissure managed in tertiary-care surgical units using standardized perioperative protocols. The findings are most transferable to centres with experience in tactile-guided sphincter division and structured postoperative counselling on diet, laxatives, and hygiene. Extrapolation to complicated fissures, patients with inflammatory bowel disease, prior anorectal surgery, or baseline continence compromise requires cautious interpretation because these groups were excluded.

### **Conclusion**

In this prospective randomized institutional study, closed lateral internal anal sphincterotomy demonstrated superior early postoperative recovery compared with the open technique. The closed approach achieved a significantly shorter operative duration, reduced length of hospital stay, and lower pain scores at both 12 and 24 hours. Postoperative bleeding and hematoma were infrequent and occurred only after open sphincterotomy. No patient developed infection, fecal incontinence, or flatus incontinence, and recurrence was low in both groups during follow-up. Overall, closed sphincterotomy offered a favorable balance of efficiency, comfort, and safety for uncomplicated chronic anal fissure when performed using a standardized technique.

### **Limitations**

This study was conducted at a single institution with a modest sample size, limiting precision for uncommon outcomes such as recurrence and continence disturbance. Follow-up was limited to six months, restricting assessment of delayed recurrence and long-term incontinence. Manometric measurements were not performed, and fissure healing was not quantified using an objective, validated scale. Blinding of surgeons and participants was not feasible due to the nature of the procedures.

## **Discussion**

This prospective randomized comparative study evaluated early postoperative outcomes after open and closed lateral internal anal sphincterotomy for chronic anal fissure. Both techniques were performed in a uniform institutional setting with standardized analgesia and follow-up. Baseline clinical profiles were similar across groups, supporting a valid comparison of perioperative outcomes.

In the present cohort, closed LIAS demonstrated shorter operative duration and earlier discharge. These findings align with randomized trials indicating that the closed technique reduces operative handling and tissue exposure, thereby shortening procedure time and facilitating outpatient-style recovery [10-12]. Wiley and colleagues reported comparable healing rates between open and closed techniques, while highlighting the importance of technique selection for optimizing postoperative comfort [11]. In this study, the difference in operative time was clinically meaningful and is relevant for workflow efficiency in busy operating lists.

Postoperative pain was significantly lower after closed LIAS at both 12 and 24 hours. Early pain is a practical outcome that influences mobilization, urinary function, patient satisfaction, and demand for analgesics. Similar reductions in postoperative discomfort with closed LIAS have been reported previously, particularly when the skin incision is minimal, and the sphincter division is targeted [6,12]. A tailored approach to sphincter division has also been advocated to preserve continence while maintaining high healing rates [8].

Complications in this series were uncommon. Minor bleeding and hematoma occurred only after open LIAS, which is plausible given the larger incision and need for wound closure. Importantly, no infection or abscess was seen, and no patient experienced fecal or flatus incontinence. Continence outcomes are a central concern after sphincterotomy, as long-term incontinence has been documented in systematic reviews and meta-analyses, especially with extended sphincter division or inadequate patient selection [13]. Contemporary clinical practice guidelines emphasize balancing the excellent healing of LIAS with individualized risk assessment for continence impairment, particularly in older patients or women with prior obstetric injury [1,2].



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### Author contributions

GS-Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript. VS- Design of the study, results interpretation, review of literature, preparing the first draft of the manuscript, and revision of the manuscript. DS-design of the study, results interpretation, review of literature, and preparation of the first draft of the manuscript. Statistical analysis and interpretation, revision of the manuscript

### Data availability

Data Available

### Author biography

Dr. G. Surendhar is an Assistant Professor in the Department of General Surgery at Government Medical College, Mahabubabad, Telangana, India. He completed his MBBS from Kakatiya Medical College, Warangal, and subsequently obtained DNB (General Surgery) in Bangalore, India. His clinical and academic interests include comprehensive general surgical care, perioperative decision-making, and structured training of undergraduate and postgraduate learners, with a strong focus on patient safety and evidence-based practice. ORCID iD: <https://orcid.org/0009-0006-9661-2539>

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Dr. D. Surender is an Assistant Professor in the Department of General Surgery at Government Medical College, Mahabubabad, Telangana, India. He completed his MBBS

### Recommendations

Closed LIAS can be adopted as the preferred surgical technique for uncomplicated chronic anal fissure in centres where surgeons are trained in tactile-guided sphincter division. Standardized discharge pathways with early mobilization, stool softeners, a high-fiber diet, and sitz baths should be reinforced to improve comfort and prevent recurrence. Routine documentation of VAS pain and structured complication surveillance support quality improvement. Future multicentre trials with larger samples, longer follow-up, and objective measures of healing and continence are recommended to strengthen the evidence and guide technique selection across diverse patient populations.

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### Abbreviations

CAF - Chronic anal fissure  
LIAS - Lateral internal anal sphincterotomy  
Open LIAS - Open lateral internal anal sphincterotomy  
Closed LIAS - Closed lateral internal anal sphincterotomy  
VAS - Visual Analogue Scale  
SA - Spinal anesthesia  
GA - General anesthesia  
NPO - Nil per oral  
PAC - Pre-anesthetic check-up  
SD - Standard deviation

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### Conflict of interest

The authors declare no conflict of interest.



from RIMS, Kadapa, and obtained his MS (General Surgery) from Kakatiya Medical College, Warangal. Before his current academic appointment, he served as Senior Resident at Government Medical College, Mahabubabad. His professional work focuses on comprehensive general surgical care, perioperative decision-making, and surgical training of undergraduate and postgraduate learners, with a consistent emphasis on patient safety and evidence-based practice.

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