Original Research Paper

Volume - 16 | Issue - 11 | November - 2026 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Surgery

FIVE SURGICAL APPROACHES TO COMPLEX ANAL FISTULA: A PROSPECTIVE COMPARISON OF HEALING, RECURRENCE, AND CONTINENCE OUTCOMES

Anuj Kumar* — General Surgery, Ganesh Shankar Vidyarthi Memorial (GSVM) Medical College, Kanpur, IND *Corresponding Author

Ramendra K. Jauhari — General Surgery, Ganesh Shankar Vidyarthi Memorial (GSVM) Medical College, Kanpur, IND

Priyesh Shukla — General Surgery, Ganesh Shankar Vidyarthi Memorial (GSVM) Medical College, Kanpur, IND

ABSTRACT **Background:** Complex anal fistulas remain a persistent challenge in colorectal surgery. The central dilemma is eradicating the fistulous tract while preserving sphincter function. **Methods:** This prospective cohort study, conducted from May 2025 to March 2026, enrolled 99 patients aged 18–65 years with complex anal fistula at a tertiary hospital in Kanpur, India. Five surgical approaches were compared: fistulectomy (n=30), ligation of the intersphincteric fistula tract (LIFT; n=20), partial fistulectomy with seton placement (n=17), fistulectomy with sphincter repair (n=16), and fistula-tract laser closure (FiLaC; n=16). Outcome measures included healing time, operative time, hospital stay, postoperative pain (Visual Analogue Scale), recurrence, faecal incontinence (Wexner score), and patient satisfaction. Data were analysed using one-way ANOVA, chi-square test, Pearson correlation, and Student's t-test. **Results:** The mean patient age was 38.8 ± 11.4 years, with males comprising 85.9% of the cohort; 43.4% had undergone prior fistula surgery. FiLaC achieved the shortest healing time (4.94 ± 0.93 weeks) and the lowest postoperative pain scores (POD1 VAS 4.25 ± 0.86), with significant between-group differences (ANOVA $F=101.8$, $p<0.001$). Hospital stay was shortest following LIFT (1.90 days) and FiLaC (2.00 days). Overall recurrence was 23.2%, with the highest rate observed in the FiLaC group (50.0%) and the lowest in the fistulectomy group (10.0%) ($\chi^2=9.73$, $p=0.045$). Faecal incontinence occurred in 4.0% of patients, all of Wexner grade 1, and was confined to the fistulectomy and sphincter-repair groups. Patient satisfaction scores were highest following fistulectomy (8.06 ± 1.53) and FiLaC (8.00 ± 0.63). **Conclusions:** Sphincter-preserving procedures, particularly LIFT and FiLaC, offer faster healing, reduced pain, and better preservation of continence, though FiLaC is associated with a substantially higher recurrence rate in complex, previously operated fistulas. Fistulectomy, combined with structured weekly wound surveillance, achieved the lowest recurrence rate and highest patient satisfaction. Individualised, anatomy-driven decision-making remains essential in selecting the optimal surgical approach.

KEYWORDS : Complex Anal Fistula, Fistulectomy, LIFT Procedure, FiLaC, Sphincter-preserving Surgery, Recurrence, Faecal Incontinence, Healing Time.

INTRODUCTION

Fistula-in-ano is an abnormal communication between the anal canal and the perianal skin, arising predominantly from cryptoglandular infection of the intersphincteric space. It causes chronic pain, discharge, recurrent sepsis, and impaired quality of life. Simple, low-lying fistulas respond well to fistulotomy, but complex fistulas those involving more than 30% of the external sphincter, suprasphincteric or extrasphincteric extension, multiple tracts, or recurrence remain an enduring surgical challenge [1,2]. The central dilemma is eradicating the tract while preserving the sphincter mechanism and faecal continence, since post-operative incontinence is the most feared complication and a principal determinant of technique choice. A spectrum of options has evolved accordingly, from conventional fistulectomy to sphincter-preserving techniques such as ligation of the intersphincteric fistula tract (LIFT), fistula-tract laser closure (FiLaC), video-assisted anal fistula treatment, and advancement flaps, with no single technique established as universally optimal [3-5].

Evidence on complex fistula outcomes is largely derived from Western series. Prospective comparative data from the Indian subcontinent where the disease profile is shaped by a high burden of tuberculosis, delayed presentation, a large proportion of recurrent and previously operated fistulas, and limited access to specialist colorectal care remain comparatively scarce [6]. This prospective cohort study was therefore designed to compare five surgical procedures for complex anal fistula at a high-volume tertiary general surgery unit in North India.

MATERIALS AND METHODS

Study Design and Setting

This prospective cohort study was conducted at the Department of General Surgery, GSVM Medical College and Lala Lajpat Rai Hospital, Kanpur, India a tertiary hospital affiliated to Atal Bihari Vajpayee Medical University, Lucknow from May 2025 to March 2026.

Participants

Patients aged 18–65 years with complex anal fistula (high transsphincteric, suprasphincteric, or extrasphincteric tracts involving more than 30% of the external sphincter; recurrent fistulas; or multiple tracts) were enrolled after written informed consent. Patients with immunocompromise, Crohn's-associated fistula, active tuberculosis, bleeding disorders, anorectal malignancy, prior pelvic radiotherapy, or simple fistulas (less than 30% sphincter involvement) were excluded.

Sample Size

A sample of 80 patients was calculated from an expected 65% healing success in sphincter-preserving procedures ($\alpha=0.05$, power=80%). Ninety-nine eligible patients were ultimately enrolled, reflecting actual patient flow during the study period.

Surgical Procedures

Five procedures were compared in this study. Fistulectomy involved complete excision of the fistulous tract followed by healing through secondary intention. Fistulectomy with sphincter repair involved tract excision with primary suture reconstruction of the divided sphincter ends. Partial fistulectomy with seton placement involved excision of the infrasphincteric portion of the tract and placement of a loose vessel-loop seton through the sphincter-bearing segment. The ligation of the intersphincteric fistula tract (LIFT) procedure involved intersphincteric ligation and curettage of the tract, with intraoperative conversion to fistulectomy when dense fibrosis precluded safe dissection. Fistula-tract laser closure (FiLaC) was performed using radial-emission diode laser ablation of the tract (FiLaC®, Biolitec) followed by suture closure of the internal opening. All patients underwent preoperative MRI fistulography and examination under anaesthesia, and the procedures were performed under spinal or general anaesthesia with the patients positioned in either the lithotomy or prone jack-knife position. . MRI fistulogram reports and operative records were reviewed using a predefined data abstraction form. Fistula tract type was categorized according to the available Parks classification terminology in the radiological reports. Horseshoe configuration, multiple tracts or openings, and supralevator extension were recorded separately when explicitly documented. Reports that described a complex fistula without a clearly specified tract category were classified as 'tract type not explicitly specified.

Post-operative Surveillance and Outcome Measures

Standardised analgesia, laxatives, and wound care were provided.

Weekly wound review was performed for the fistulectomy and partial fistulectomy groups throughout secondary healing, with prompt disruption of premature superficial bridging under local anaesthesia; follow-up occurred at weeks 1–4 and months 1, 3, and 6. The primary outcome was healing time (weeks). Secondary outcomes were recurrence, faecal incontinence (Wexner score at 2 weeks and 3 and 6 months), operative time, hospital stay, post-operative pain (VAS 0–10 on POD1, POD3, POD7), and patient satisfaction (0–10 scale).

Statistical Analysis

Data were analysed using SPSS version 25. Continuous variables (mean ± SD) were compared by one-way ANOVA with Tukey's HSD post-hoc test or Student's t-test; categorical variables were compared using the chi-square or Fisher's exact test; Pearson's correlation coefficient assessed associations. A two-tailed $p<0.05$ was considered statistically significant. Comparisons among the five surgical procedure groups were performed using one-way analysis of variance for normally distributed continuous variables, with appropriate post-hoc testing where applicable.

Ethics Approval

The study was approved by the Institutional Ethics Committee, GSVM Medical College, Kanpur. Written informed consent was obtained from all participants, and patient data were anonymised throughout.

RESULTS

Demographic and Pre-operative Characteristics

Ninety-nine patients with complex anal fistula were enrolled. Mean age was 38.8 ± 11.4 years (range 18–60 years). Males comprised 85.9% of the study participants (n=85; M:F ≈ 6:1), consistent with published epidemiology. Forty-three patients (43.4%) had a history of prior fistula surgery (Table 1). Table 1 summarises pooled demographics only; per-procedure distributions are given in Table 2. Age was comparable across the five groups (one-way ANOVA F=0.32, p=0.862). Sex distribution varied, with FiLaC having the highest proportion of women (43.8%) and fistulectomy comprising exclusively male patients (100%).. Prior fistula surgery was markedly unevenly distributed (χ^2=25.51, df=4, $p<0.001$): patients selected for fistulectomy with sphincter repair had the highest rate of prior surgery (81.2%), followed by fistulectomy (60.0%), while LIFT (15.0%) and FiLaC (12.5%) were disproportionately used in treatment-naïve patients reflecting a pattern of reserving sphincter-preserving techniques for first-presentation disease and reserving more extensive excisional procedures for recurrent, previously scarred anatomy.

MRI Fistulogram Findings

All 99 patients underwent pre-operative MRI fistulogram for anatomical mapping (Table 3). On Parks classification, the tract was transsphincteric in 31 patients (31.3%), intersphincteric in 24 (24.2%), and suprasphincteric in eight (8.1%); no extrasphincteric tracts were identified. In 36 patients (36.4%) the report described a complex fistula without an explicit Parks-type descriptor. A horseshoe configuration was present in 13 patients (13.1%), multiple tracts or external openings in 10 (10.1%), and supralevator extension was noted in 12 (12.1%). Tract type showed a significant association with surgical procedure (Fisher's exact test, $p<0.001$), reflecting deliberate procedure selection based on anatomical complexity intersphincteric and low transsphincteric tracts were preferentially managed by LIFT and FiLaC, while suprasphincteric and multiply-tracted disease was more often treated by fistulectomy or fistulectomy with sphincter repair.

Fistula anatomy on MRI fistulogram also differed markedly by procedure (Table 3), consistent with anatomy-driven selection rather than random allocation. Intersphincteric tracts predominated in the partial fistulectomy with seton group (52.9%), while transsphincteric tracts were most frequent in fistulectomy with sphincter repair (56.2%). Multiple tracts or openings were concentrated in LIFT (20.0%) and fistulectomy with sphincter repair (25.0%), and supralevator extension was disproportionately noted in the sphincter-repair group (50.0%) reflecting selection of the most extensive, high-complexity disease for excisional repair with reconstruction. No patient undergoing LIFT had a fistula record specifying intersphincteric, suprasphincteric, or supralevator extension despite LIFT being an intersphincteric-plane procedure by definition; this reflects the incompleteness of the free-text MRI/operative notes (see Table 3 footnote) rather than a true anatomical absence, and is a limitation of the study coding of these fields.

Operative Time, Hospital Stay, and Healing Time

All three operative parameters differed significantly across procedures (Table 5). FiLaC required the shortest operative time (68.9 ± 22.1 min), followed by LIFT (75.6 ± 13.3 min); fistulectomy with sphincter repair took longest (116.9 ± 22.8 min). Hospital stay was shortest for LIFT (1.90 ± 0.58 days) and FiLaC (2.00 ± 0.82 days), versus 4.03–4.31 days for conventional procedures. Healing time differed markedly across groups (one-way ANOVA F=101.8, $p<0.001$): FiLaC healed fastest (4.94 ± 0.93 weeks), followed by LIFT (8.10 ± 1.65 weeks), fistulectomy (12.1 ± 2.1 weeks), and fistulectomy with sphincter repair (16.4 ± 2.1 weeks, longest).

Post-operative Pain (VAS Scores)

Fistulectomy with sphincter repair produced the highest pain scores throughout (POD1 7.12 ± 0.81; POD7 4.19 ± 0.40), while FiLaC produced the lowest (POD1 4.25 ± 0.86; POD7 1.69 ± 0.60), followed by LIFT. POD1 and POD7 scores correlated strongly across all patients (Pearson r=0.654, $p<0.001$), indicating that higher early pain predicted sustained pain at one week and underscoring the importance of adequate early analgesia (Table 6; Figure 1).

Recurrence, Faecal Incontinence, and Patient Satisfaction

The overall recurrence rate was 23.2% (23/99). FiLaC had the highest recurrence (50.0%, 8/16), followed by LIFT (25.0%, 5/20) and fistulectomy with sphincter repair (25.0%, 4/16); fistulectomy had the lowest (10.0%, 3/30). Procedure type was significantly associated with recurrence (χ^2=9.734, df=4, p=0.045), whereas prior surgical history was not (χ^2=1.43, p=0.232). Faecal incontinence occurred in four patients (4.0%), all minor (Wexner grade 1)three after fistulectomy with sphincter repair (18.75%) and one after fistulectomy (3.3%); none occurred with LIFT, FiLaC, or seton placement. Satisfaction was highest with fistulectomy (8.06 ± 1.53) and FiLaC (8.00 ± 0.63), and did not differ significantly between patients with and without recurrence (t=0.176, p=0.861), suggesting that intensive follow-up and timely re-intervention attenuated the impact of recurrence on patient experience (Table 7; Figure 2).

Table 8 demonstrates significant differences in follow-up duration among the five surgical procedure groups ($F = 6.482$, $p < 0.001$). The longest mean follow-up duration was observed in patients undergoing fistulectomy with sphincter repair (5.68 ± 0.31 months), followed by fistulectomy (5.43 ± 0.61 months), whereas the FiLaC group had the shortest mean follow-up duration (4.72 ± 0.87 months). This variation in follow-up duration should be considered when interpreting procedure-specific recurrence rates, as shorter surveillance periods may reduce the opportunity to detect delayed recurrence. Patients with and without recurrence were further compared to explore factors associated with treatment failure. Age and previous surgical history were not significantly associated with recurrence. Duration of symptoms showed a borderline association with recurrence, whereas higher POD1 pain scores were significantly associated with subsequent recurrence ($p = 0.048$). Operative time, hospital stay, healing time, POD3 and POD7 pain scores, patient satisfaction, and follow-up duration did not differ significantly between patients with and without recurrence (Table 9).Correlation analysis demonstrated significant positive associations between healing time and several indicators of postoperative recovery. Healing time showed a strong positive correlation with POD1 pain score ($r = 0.739$, $p < 0.001$), POD3 pain score ($r = 0.719$, $p < 0.001$), POD7 pain score ($r = 0.686$, $p < 0.001$), and hospital stay ($r = 0.695$, $p < 0.001$). A moderate positive correlation was also observed between healing time and operative time ($r = 0.576$, $p < 0.001$), whereas duration of symptoms demonstrated a weaker but statistically significant positive association with healing time ($r = 0.265$, $p = 0.008$). No statistically significant association was observed between healing time and patient satisfaction ($r = -0.151$, $p = 0.134$) (Table 10).

DISCUSSION

This prospective study of five surgical approaches for complex anal fistula in a North Indian tertiary setting demonstrates clinically important differences in healing time, post-operative pain, hospital stay, recurrence, and continence. The mean age (38.8 years) and marked male predominance (85.9%; M:F ≈ 6:1) mirror published epidemiology, attributed to anal gland anatomy and androgen-driven secretory activity [7]. The high proportion of previously operated patients (43.4%) reflects the recurrent, refractory case-mix typical of North Indian tertiary referral practice.

Healing, Pain, and the Recurrence Trade-off with FiLaC

FiLaC achieved the shortest healing time (4.94 weeks) and least pain, consistent with Giamundo et al. and Lauretta et al., where

circumferential laser ablation of the tract lining with internal-opening closure produces a smaller perineal wound than open excision, accelerating healing and reducing pain and hospital stay [8,9]. However, FiLaC's 50.0% recurrence substantially exceeded the 64–71% primary success rates reported in European series [9], likely reflecting our study participant's high burden of recurrent, previously operated, and multi-branched fistulas a population under-represented in Western studies and increasingly linked to FiLaC failure [8]. Careful patient selection is therefore essential before offering laser closure, particularly after prior surgical failure. Conversely, fistulectomy's low recurrence (10.0%) reinforces that complete, meticulous excision, where anatomically feasible, offers durable eradication, consistent with Ayyar and Dharap [10].

Value of Structured Post-operative Surveillance

A notable, and to our knowledge under-reported, finding is the contribution of structured weekly wound review to fistulectomy's low recurrence. Secondary healing progresses by granulation and contracture from the wound base upward; premature superficial bridging where skin closes over an incompletely healed cavity traps unhealed tissue and predisposes to recurrent infection. Weekly review with prompt disruption of early bridging under local anaesthesia directly addressed this common, avoidable cause, and we advocate its adoption as a standard of care for fistulectomy patients.

Intraoperative Conversion and Sphincter Preservation

A subset planned for LIFT required intraoperative conversion to fistulectomy where dense intersphincteric fibrosis from prior surgery obliterated anatomical landmarks, precluding safe tract ligation without risking inadvertent sphincter injury. Patients with multiple prior procedures should be counselled about this possibility, and surgeons undertaking LIFT in recurrent cases should be prepared to convert. Overall minor incontinence was low (4.0%, all Wexner grade 1) and absent entirely in the LIFT, FiLaC, and seton groups, affirming the continence benefit of sphincter-sparing approaches. The higher rate after sphincter repair (18.75%, all minor) reflects the expected consequence of deliberate sphincter division, supporting selective use of this technique; reassuringly, no patient progressed beyond minor incontinence.

Comparison with Published Literature

Our findings broadly concur with the comparative literature. Ayyar and Dharap reported shorter operative time, less pain, and preserved continence with LIFT over fistulectomy, with 8–17% recurrence [10]; Vinay and Balasubrahmanya reported three-week LIFT healing with no incontinence but 12% recurrence [11]; and Mushaya et al.'s systematic review of 479 patients found a 74.6% LIFT success rate with no permanent incontinence [12], consistent with our experience. Our 50% FiLaC recurrence, however, contrasts with the 64–71% success reported at 12 months [9], attributable to our population's high proportion of recurrent, multi-operated disease. The low recurrence observed in the fistulectomy group occurred in the context of structured weekly wound surveillance. Although this observational study cannot establish a causal effect of postoperative wound management on recurrence, prevention of premature superficial closure may represent a potentially important component of postoperative care and warrants further prospective evaluation.

Limitations

Unequal group sizes reflect real-world clinical decision-making rather than randomised allocation, introducing selection bias. The relatively short mean follow-up (approximately five months) may underestimate long-term recurrence, particularly for FiLaC and LIFT, where delayed failures are recognised. The absence of a fistula-complexity scoring system applied uniformly across patients limits precise inter-group comparability, and surgeon experience and learning-curve effects particularly for FiLaC, which requires dedicated training and equipment may have influenced outcomes. Multicentre randomised trials with longer follow-up and standardised classification are needed to confirm these findings.

CONCLUSIONS

Surgical management of complex anal fistula requires an individualised, anatomy-driven approach. LIFT and FiLaC offer clear advantages in healing time, post-operative pain, hospital stay, and continence preservation over conventional surgery, but FiLaC's substantially higher recurrence in complex, previously operated fistulas warrants cautious patient selection. Fistulectomy, in appropriately selected patients supported by rigorous weekly wound surveillance to prevent premature superficial closure, achieved the lowest recurrence and highest patient satisfaction. Surgeons planning LIFT in recurrent cases with dense intersphincteric fibrosis should be prepared for intraoperative conversion, and partial fistulectomy with seton placement remains a valid staged strategy when extensive sphincter involvement precludes safe primary excision. These findings support individualised, sphincter-conscious surgical decision-making and highlight structured post-operative surveillance as an under-recognised but critical determinant of durable cure.

Table 1. Demographic and Pre-Operative Characteristics of Study Patients (n=99)

Characteristic	Value	P value
Age, years		
Mean ± SD	38.8 ± 11.4	-
Range	18–60	-
Sex, n (%)		
Male	85 (85.9%)	0.002
Female	14 (14.1%)	
History of previous anal fistula surgery, n (%)	43 (43.4%)	<0.001
No previous surgery, n (%)	56 (56.6%)	
MRI fistulogram findings, n (%)		
Transsphincteric fistula	31 (31.3%)	
Intersphincteric fistula	24 (24.2%)	
Suprasphincteric fistula	8 (8.1%)	
Extrasphincteric fistula	0 (0.0%)	
Complex fistula without explicitly specified Parks classification	36 (36.4%)	
Horseshoe configuration	13 (13.1%)	
Multiple tracts/openings	10 (10.1%)	
Supralevator extension	12 (12.1%)	

Table 2. Demographic and Prior-surgery Characteristics by Surgical Procedure (n=99)

Procedure	N	Age (yrs, mean ± SD)	Sex, M:F	Prior surgery, n (%)
Fistulectomy	30	37.2 ± 12.6	30:0	18 (60.0%)
LIFT	20	40.9 ± 12.5	18:2	3 (15.0%)
Partial fistulectomy + seton	17	38.1 ± 13.1	15:2	7 (41.2%)
Fistulectomy + sphincter repair	16	38.8 ± 8.9	13:3	13 (81.2%)
FiLaC	16	39.5 ± 9.7	9:7	2 (12.5%)
Statistical test	—	F=0.32, p=0.862	—	χ^2=25.51, p<0.001

Table 3. MRI Fistulogram Tract Characteristics (n=99)

Characteristic	N	%
Fistula tract type (Parks classification)		
Transsphincteric	31	31.3%
Intersphincteric	24	24.2%
Suprasphincteric	8	8.1%
Extrasphincteric	0	0.0%
Not explicitly specified on report*	36	36.4%
Associated tract features		
Horseshoe configuration	13	13.1%
Multiple tracts / openings	10	10.1%
Supralevator extension noted	12	12.1%

Table 4. Fistula Tract Anatomy and Complexity by Surgical Procedure, n (%)

Procedure	n	Trans-sphincteric	Inter-sphincteric	Supra-sphincteric	Not specified*	Horse-shoe	Multiple tracts	Supra-levator ext.
Fistulectomy	30	9 (30.0%)	5 (16.7%)	2 (6.7%)	14 (46.7%)	4 (13.3%)	0 (0.0%)	3 (10.0%)
LIFT	20	6 (30.0%)	0 (0.0%)	0 (0.0%)	14 (70.0%)	4 (20.0%)	4 (20.0%)	0 (0.0%)
Partial fistulectomy + seton	17	1 (5.9%)	9 (52.9%)	3 (17.6%)	4 (23.5%)	2 (11.8%)	0 (0.0%)	1 (5.9%)
Fistulectomy + sphincter repair	16	9 (56.2%)	4 (25.0%)	1 (6.2%)	2 (12.5%)	3 (18.8%)	4 (25.0%)	8 (50.0%)
FiLaC	16	6 (37.5%)	6 (37.5%)	2 (12.5%)	2 (12.5%)	0 (0.0%)	2 (12.5%)	0 (0.0%)

Total	99	31 (31.3%)	24 (24.2%)	8 (8.1%)	36 (36.4%)	13 (13.1%)	10 (10.1%)	12 (12.1%)
Statistical test*		χ^2=36.4, p<0.001 (MC)				χ^2=3.7, p=0.463 (MC)	χ^2=11.5, p=0.020 (MC)	χ^2=27.3, p<0.001 (MC)

**Tract type (transsphincteric/intersphincteric/suprasphincteric/not specified) was tested as a single overall association with procedure (4×5 table); horseshoe configuration, multiple tracts, and supralevator extension were each tested individually as binary features (2×5 tables) since they are not mutually exclusive categories and can co-occur with any tract type or with each other. Several cells had expected counts <5, so the standard χ^2 approximation is not strictly valid; p-values shown are Monte Carlo permutation estimates (MC, 20,000 permutations of procedure labels) rather than the asymptotic χ^2 distribution.*

Table 5. Operative Parameters by Surgical Procedure (Mean ± SD)

Procedure	n (%)	Op time (min)	Hosp stay (days)	Healing time (wks)
Fistulectomy	30 (30.3%)	95.6 ± 19.4	4.03 ± 0.67	12.1 ± 2.1
LIFT	20 (20.2%)	75.6 ± 13.3	1.90 ± 0.58	8.10 ± 1.65
Partial fistulectomy + seton	17 (17.2%)	94.0 ± 24.8	4.18 ± 0.73	13.4 ± 1.9
Fistulectomy + sphincter repair	16 (16.2%)	116.9 ± 22.8	4.31 ± 0.60	16.4 ± 2.1
FiLaC	16 (16.2%)	68.9 ± 22.1	2.00 ± 0.82	4.94 ± 0.93
p-value (ANOVA)		<0.001 (F=14.4)	<0.001 (F=60.8)	<0.001 (F=101.8)

Table 6. Post-operative VAS Pain Scores by Surgical Procedure (Mean ± SD)

Procedure	POD1	POD3	POD7	Pearson r (POD1 vs POD7)
Fistulectomy	6.40 ± 0.86	4.47 ± 0.68	2.80 ± 0.71	r=0.654, p<0.001 (all groups pooled)
LIFT	4.70 ± 0.66	3.00 ± 0.52	1.95 ± 0.39	—
Partial fistulectomy + seton	5.88 ± 0.70	3.88 ± 0.69	2.59 ± 0.51	—
Fistulectomy + sphincter repair	7.12 ± 0.81	5.50 ± 0.73	4.19 ± 0.40	—
FiLaC	4.25 ± 0.86	2.44 ± 0.73	1.69 ± 0.60	—

Table 7. Summary of Surgical Outcomes by Procedure (n=99)

Procedure	n	Recurrence, n (%)	Incontinence (Wexner Gr1)	Satisfaction (mean ± SD, 0–10)
Fistulectomy	30	3 (10.0%)	1	8.06 ± 1.53
LIFT	20	5 (25.0%)	0	7.59 ± 0.48
Partial fistulectomy + seton	17	3 (17.6%)	0	7.35 ± 0.70
Fistulectomy + sphincter repair	16	4 (25.0%)	3	7.12 ± 0.81
FiLaC	16	8 (50.0%)	0	8.00 ± 0.63
Total / overall	99	23 (23.2%)	4 (4.0%)	7.68 ± 1.05
Chi-square (recurrence)	—	χ^2=9.73, df=4	—	p=0.045

Table 8: Follow-up Duration and Requirement for Reoperation According to Surgical Procedure (N = 99)

Surgical procedure	n	Follow-up duration, months (Mean ± SD)	Reoperation needed, n (%)
Fistulectomy	30	5.43 ± 0.61	2 (6.7)
LIFT	20	4.85 ± 0.80	3 (15.0)
Partial fistulectomy with seton placement	17	5.13 ± 0.55	1 (5.9)
Fistulectomy with sphincter repair	16	5.68 ± 0.31	3 (18.8)
FiLaC	16	4.72 ± 0.87	6 (37.5)
Overall	99	5.17 ± 0.71	15 (15.2)
Test statistic	—	F = 6.482	χ^2 = 9.194
p-value	—	<0.001	0.056

Table 9: Exploratory Comparison of Patients with and without Recurrence

Variable	t	p-value
Age, years	-0.06	0.956
Duration of symptoms, months	-1.93	0.058
Operative time, minutes	-0.63	0.530
Hospital stay, days	-1.61	0.118
Healing time, weeks	-1.03	0.313
POD1 pain score (VAS)	-2.07	0.048
POD3 pain score (VAS)	-1.50	0.142
POD7 pain score (VAS)	-0.97	0.339
Patient satisfaction score	-0.20	0.845
Follow-up duration, months	-0.84	0.405

Table 10: Correlation of Healing Time with Perioperative and Postoperative Outcomes

Variable	Pearson correlation with healing time (r)	p-value
Duration of symptoms	0.265	0.008
Operative time	0.576	<0.001
Hospital stay	0.695	<0.001
POD1 pain score	0.739	<0.001
POD3 pain score	0.719	<0.001
POD7 pain score	0.686	<0.001
Follow-up duration	0.403	<0.001
Patient satisfaction score	-0.151	0.134

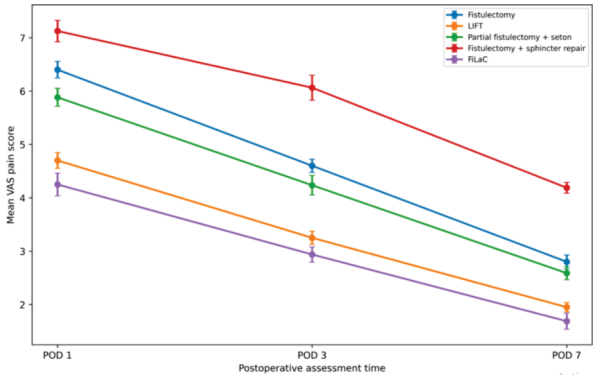


Figure 1: Postoperative Pain Trajectory Across Surgical Procedures

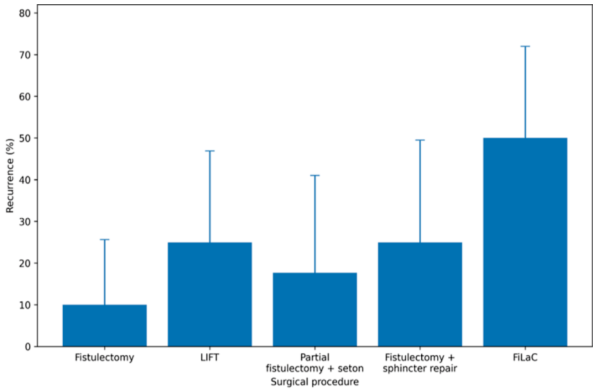


Figure 2: Procedure-specific Recurrence Rates with 95% Confidence Intervals

Additional Information

Author Contributions

Concept and Design: Anuj Kumar, Ramendra K. Jauhari, Priyesh Shukla

Acquisition, Analysis, or Interpretation of Data: Anuj Kumar, Ramendra K. Jauhari

Drafting of the Manuscript: Anuj Kumar

Critical Review of the Manuscript for Important Intellectual Content: Anuj Kumar, Ramendra K. Jauhari, Priyesh Shukla

Supervision: Ramendra K. Jauhari, Priyesh Shukla

Disclosures

Human Subjects: Consent was obtained or waived by all participants in this study. The Institutional Ethics Committee, GSVM Medical College, Kanpur issued approval on file with the corresponding author.

Animal Subjects: All authors have confirmed that this study did not involve animal subjects or tissue.

Conflicts of Interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Payment/Services Info: All authors have declared that no financial support was received for the submitted work.

Financial Relationships: All authors have declared that they have no financial relationships at present, or within the previous three years, with any organisations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgments

We thank the Department of Histopathology and the Department of Radiodiagnosis, GSVM Medical College, Kanpur, for their contributions to specimen and imaging assessment.

REFERENCES

1. Steele SR, Kumar R, Feingold DL, et al: Practice parameters for the management of perianal abscess and fistula-in-ano. Dis Colon Rectum. 2011, 54:1465-1474. doi: 10.1097/DCR.0b013e31823122b3
2. Garcia-Aguilar J, Belmonte C, Wong WD, et al: Anal fistula surgery: factors associated with recurrence and incontinence. Dis Colon Rectum. 1996, 39:723-729. doi: 10.1007/BF02054434
3. Parks AG, Gordon PH, Hardcastle JD: A classification of fistula-in-ano. Br J Surg. 1976, 63:1-12. doi: 10.1002/bjs.1800630102
4. Garg P: Comparing existing classifications of fistula-in-ano in 440 operated patients: is it time for a new classification?. Int J Surg. 2017, 42:34-40. doi: 10.1016/j.ijsu.2017.04.019
5. Meinero P, Mori L: Video-assisted anal fistula treatment (VAAFT): a novel sphincter-saving procedure for treating complex anal fistulas. Tech Coloproctol. 2011, 15:417-422. doi: 10.1007/s10151-011-0769-2
6. Garg P: Comparing existing classifications of fistula-in-ano in 440 operated patients: Is it time for a new classification? A Retrospective Cohort Study. Int J Surg. 2017, 42:34-40. doi: 10.1016/j.ijsu.2017.04.019.
7. Akiba RT, Rodrigues FG, da Silva G: Management of complex perineal fistula disease. Clin Colon Rectal Surg. 2016, 29:92-100. doi: 10.1055/s-0036-1580631
8. Giamundo P, Geraci M, Tibaldo L: Fistula-tract laser closure (FiLaC): long-term results and new operative strategies. Tech Coloproctol. 2015, 19:449-453. doi: 10.1007/s10151-015-1282-9
9. Giamundo P, Geraci M, Tibaldi L, et al: Closure of fistula-in-ano with laser--FiLaC™: an effective novel sphincter-saving procedure for complex disease. Colorectal Dis. 2014 16(2):110-5. doi: 10.1111/codi.12440
10. Ye S, Chen W, Zhang Y, et al: Ligation of the intersphincteric fistula tract vs. fistulotomy for complex anal fistula: a retrospective study. Am J Transl Res. 2026 18(4):3190-3200. doi: 10.62347/DUXL7184.
11. Vinay G, Balasubrahmanya KS: Comparative study on efficacy of fistulotomy and ligation of intersphincteric fistula tract (LIFT) procedure in management of fistula-in-ano. Int Surg J. 2017, 4:3406-3408.doi: 10.18203/2349-2902.isj20174505
12. Mushaya C, Bartlett L, Schulze B, Ho Y-H: Ligation of intersphincteric fistula tract compared with advancement flap for complex anorectal fistulas requiring initial seton drainage. Am J Surg. 2012, 204:283-289. doi: 10.1016/j.amjsurg.2011.10.025
13. Rojanasakul A: LIFT procedure: a simplified technique for fistula-in-ano. Tech Coloproctol. 2009, 13:237-240. doi: 10.1007/s10151-009-0522-2
14. Halligan S, Stoker J: Imaging of fistula in ano. Radiology. 2006, 239:18-33. doi: 10.1148/radiol.2391041043
15. Buchanan GN, Halligan S, Bartram CI, et al: Effect of MRI on clinical outcome of recurrent fistula-in-ano. Lancet. 2002, 360:1661-1662. doi: 10.1016/S0140-6736(02)11605-9.
16. Yogesh Kumar N Modiya, Jainam K Shah, Meet Dagda, et al: Comparison of various techniques in the management of fistula in ano. Indian Journal of Applied-Basic Medical Sciences, 22(34), 111-117. doi:10.48165/ijabms.2020.22110 .