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Original Article

Ligation of the intersphincteric fistula tract vs. fistulotomy for complex anal fistula: a retrospective study

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Abstract: Objectives: To evaluate the clinical efficacy and functional outcome of ligation of the intersphincteric fistula tract (LIFT) versus fistulotomy in patients with complex anal fistulas. Methods: A retrospective review was conducted of patients with complex anal fistulas treated at The Affiliated People's Hospital of Ningbo University from May 2020 to May 2022. To reduce confounding and selection bias, 1:1 matching was performed based on key baseline variables such as fistula type and patient comorbidities. A total of 100 matched patients were assigned to either the LIFT group (n=50) or the fistulotomy group (n=50). Results: The LIFT procedure required more operative time but resulted in significantly less intraoperative blood loss, faster wound healing, and shorter hospital stay (all $P<0.05$). Postoperative pain scores on days 1, 3, and 7 and Wexner incontinence scores at 1, 2, and 7 months were all significantly lower in the LIFT group (all $P<0.05$). After a median follow-up of 18.5 months, no significant difference in recurrence-free survival was observed between the two groups (log-rank $P=0.695$). The LIFT group had a significantly lower overall complication rate (4.00% vs. 16.00%, $P<0.05$) and a higher overall treatment efficacy rate (96.00% vs. 82.00%, $P<0.05$). Cox regression identified diabetes mellitus - but not surgical procedure - as an independent predictor of recurrence. Conclusions: LIFT offers advantages in sphincter preservation, reduced bleeding, faster recovery, and fewer complications, while providing comparable long-term recurrence outcomes to fistulotomy.

Keywords: Fistulotomy, complex anal fistula, propensity score matching, ligation of the intersphincteric fistula tract

Introduction

Anal fistula is a pathologic tract that occurs around the anorectal junction and connects |the anal canal to the perianal skin. It typically presents with symptoms such as a localized mass, discharge, abscess, pain, and discomfort, and it remains a common condition in colorectal surgery [1, 2]. This disease predominantly affects middle-aged men, and due to its anatomic location and chronic course, it imposes a significant burden on patients' physical and psychological well-being and daily life [3-5]. Complex anal fistulas are among the most challenging to diagnose and treat. These are generally defined as fistulas other than low intersphincteric or low transsphincteric types, often involving extensive or deep tracks, multiple openings, or long and tortuous tracts [6-9]. Their diverse etiology and complex morphology result in even greater effect on patients.

Complex anal fistulas cannot heal spontaneously and are usually treated with surgery. During the entire surgical process, it is necessary to ensure the effective removal of all internal orifices and epithelialized fistula tracts to minimize damage to the anal sphincter [10-12]. Fistulotomy is a common procedure for complex anal fistulas and involves opening the fistula tract and completely removing the fistula wall to expose healthy tissue, without suturing the wound. Anal fistulotomy is characterized by a relatively simple operation and short operative time and has traditionally been associated with acceptable recurrence rates. However, it generally requires a larger incision, takes longer to heal, and is associated with greater postop-

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erative pain and risk of sphincter dysfunction [13]. If the wound is large, partial suturing with the remainder left open may still achieve a cure. Although the internal and external orifices and fistula tract are removed in a single procedure, the extensive wound often results in slow healing, significant scarring or tissue loss, and considerable pain [14-16]. With advances in medical technology, anorectal surgical techniques have evolved. Ligation of intersphincteric fistula tract (LIFT) can effectively preserve anal sphincter function, avoid postoperative complications, and reduce postoperative pain, and has become an important focus in anorectal surgery [17-19]. LIFT involves dissection and ligation of the fistula tract within the intersphincteric groove. Dissection parallel to the direction of the muscle fibers helps avoid injury to the sphincter muscles and preserves muscle integrity [20-22]. Both surgical approaches have advantages and disadvantages, but few clinical studies have investigated which method is superior for patients with complex anal fistula.

Therefore, this study selected the clinical data of 188 patients with complex anal fistula admitted to The Affiliated People's Hospital of Ningbo University from May 2020 to May 2022 for retrospective analysis to explore the clinical outcomes of LIFT and fistulotomy, providing a reference for clinical surgical treatment. Given the limited comparative data specifically within the Chinese population and the scarcity of studies applying robust statistical methods like propensity score matching (PSM) to minimize selection bias in this context, our work aims to provide higher-level evidence comparing these two techniques.

Patients and methods

Study design and participants

A retrospective analysis was conducted on the clinical data of 188 patients with complex anal fistulas admitted to The Affiliated People's Hospital of Ningbo University from May 2020 to May 2022, including 90 patients in the control group and 98 patients in the observation group. The patients in the control group underwent fistulotomy, whereas the patients in the observation group underwent LIFT.

This study was submitted to Ethics Committee of The Affiliated People's Hospital of Ningbo University and was approved. As this study is a retrospective analysis and patient data were anonymized, the requirement for informed consent was waived.

The inclusion criteria were as follows: (1) aged >18 years; (2) diagnosed with complex anal fistula based on clinical and imaging findings, classified as Garg types III-V [23], as assessed by two senior colorectal surgeons with >10 years of experience; (3) had complete clinical data; (4) had a duration of illness of ≥3 months; (5) met the surgical indications; and (6) participated in the entire research process. The exclusion criteria were as follows: (1) had other infectious diseases; (2) had coagulopathy; (3) had serious heart, brain, liver or other organ diseases; (4) had neurological system diseases or cognitive impairment; (5) had polyps, ulcers or other anorectal diseases; (6) were lactating or pregnant; and (7) had fistulas of specific etiologies such as Crohn's disease, radiation-induced fistulas, or recurrent fistulas after previous surgical intervention.

The assignment to either the fistulotomy group (control) or the LIFT group (observation) was based on clinical practice patterns and surgeon preference during the study period, rather than randomization. With the increasing adoption of sphincter-preserving techniques in the hospital's Department of Colorectal Surgery over time, there is potential for selection bias, as patients with more complex fistula characteristics may have been preferentially assigned to the LIFT procedure. To reduce the effect of these potential confounding factors and ensure comparability between the two groups, PSM was used.

Setting

Fistulotomy: Preoperative imaging, including ultrasound using the Mindray DC-75 color Doppler ultrasound system and magnetic resonance imaging with a GE Brivo MR355 1.5T scanner, was used to localize the fistula tract and internal openings. Following standardized bowel preparation (enema, perianal cleansing, hair removal), patients underwent lumbar anesthesia in the lateral decubitus position. Intraoperative fistula mapping was performed by infusing glycine-mannitol solution through the external orifice under fistuloscopic guidance. Layered dissection exposes the fistulous tract, followed by complete curettage of necrotic debris. The intersphincteric groove and incision were closed with absorbable sutures, routine drainage was placed, and the curvilinear perianal incision was finally closed with fine sutures.

LIFT: Epidural anesthesia was administered using the same preoperative protocols as in the control group. Through a 3-cm curvilinear intersphincteric incision, sharp dissection was used to isolate the fistula tract. Dual ligation was performed under fistuloscopic visualization: proximal ligation at the internal sphincter junction was confirmed by hydrogen peroxide patency testing (bubble-negative closure), followed by distal ligation at the external sphincter interface. The intervening tract was excised using the tunneling technique, with meticulous removal of granulation tissue. The incisions were closed with absorbable sutures, and routine drainage was placed.

All surgical procedures were performed by senior colorectal surgeons with over 10 years of experience in anorectal surgery. Throughout the study period, both LIFT and fistulotomy were conducted in accordance with the hospital's established standard operating procedures, which were derived from consensus techniques described in the literature. Although this was a retrospective study and a formal, prospective standardization protocol (e.g., mandatory pre-study training) was not implemented, the consistent application of these standards aimed to minimize major technical variations across operators.

Observation indicators: This retrospective analysis systematically evaluated (1) demographic parameters (sex, age, educational attainment), (2) clinical and fistula-related characteristics (fistula topography according to the Garg classification [23], number of external openings, history of diabetes mellitus, smoking history, and body mass index [BMI] as indicators of obesity), (3) perioperative metrics (hemorrhage volume, procedural duration, wound healing time, hospitalization duration), and (4) functional outcomes through standardized instruments: serial visual analog scale measurements [24] (postoperative days 1, 3, and 7; 0-10 scale; the higher the score, the more intense the pain) and Wexner incontinence scoring [25] (assessed at 7 days, 1 month, and 2 months post-operatively; 0-20 scale; the higher the score, the greater the severity of incontinence). Postoperative surveillance revealed complications (urinary retention, localized infection, and anal malformation). Anal malformation was defined as a persistent, symptomatic structural abnormality (e.g., stricture, significant asymmetry, or keyhole deformity) observed on clinical examination that was attributable to the surgery and associated with functional impairment or patient concern. Recurrence was defined as the persistence or reappearance of fistulous symptoms and/or drainage from the external opening upon clinical examination during follow-up. Therapeutic efficacy was stratified at the last follow-up into remission (complete symptom resolution with epithelial closure of the external opening), improvement (significant symptomatic relief evidenced by a reduction in drainage volume or frequency by >50% compared to preoperative status, and improvement in associated pain or discomfort, yet without complete healing), or failure (unchanged or worsened pathology). The total effective rate was calculated as [(number of remission cases + number of improvement cases)/total N] × 100%. Patients were regularly followed up at the outpatient clinic at 1 month, 3 months, 6 months, and then annually postoperatively. The recurrence-free survival (RFS) time was defined as the duration from the date of surgery to the date of recurrence confirmation or the last follow-up for censored data. The median follow-up time for the entire cohort was 18.5 months (range, 12-24 months).

Statistical analysis

Statistical analysis was performed using SPSS 25.0 (IBM, Armonk, NY, USA). Categorical variables are expressed as percentages and were compared using the χ^2 test. Continuous variables are expressed as mean ± standard deviation ($\bar{x}\pm s$) and were tested for homogeneity of variance. For comparisons, a two-sample t-test was used regardless of whether the homogeneity of variance assumption was met (P>0.05 or P≤0.05 for Levene's test). A *P* value <0.05 was considered significant. RFS curves were generated using the Kaplan-Meier method, and between-group comparisons were performed using the log-rank test. To adjust for potential confounders and evaluate the independent effect of surgical procedure on recurrence, univariate and multivariate Cox proportional hazards regression models were constructed. Variables with P<0.1 in univariate analysis or those considered clinically important were entered into the multivariate model. Results are presented as hazard ratios (HRs) with 95% confidence intervals (CIs). To reduce selection bias inherent in this non-randomized retrospective study, PSM was performed. The propensity score, defined as the probability of a patient undergoing LIFT given baseline covariates, was estimated using a multivariate logistic regression model. Matching factors included age, sex, BMI, diabetes mellitus, smoking status, fistula type according to the Garg classification, and number of external openings. Nearest-neighbor 1:1 matching was applied with a caliper width of 0.02. A total of 188 patients (90 fistulotomy, 98 LIFT) were initially enrolled; after matching, 100 well- balanced patients (50 per group) were included in the final analysis. Covariate balance before and after matching was assessed using both hypothesis testing (χ^2 or t-test) and standardized mean differences (SMD). An absolute SMD <0.1 was considered indicative of successful balance.

Results

Comparison of general characteristics between the two groups

A total of 188 patients with complex anal fistulas were enrolled in this study. Before PSM, significant differences were observed in age (P=0.002) and the number of external openings (P=0.003) between the two groups, indicating potential selection bias. The PSM model incorporated key demographic, clinical, and fistula-related characteristics to minimize confounding. After 1:1 PSM, 50 well-matched pairs were generated. As detailed in **Table 1**, all recorded baseline characteristics, including patient-related factors (e.g., diabetes mellitus, smoking history, and BMI) and fistula topography, were well balanced between the matched groups, with no significant differences (all P>0.05). The effectiveness of the matching procedure was further confirmed by the calculation of the SMD, with all absolute SMD values below the threshold of 0.1 after matching, demonstrating successful achievement of covariate balance. These results indicate that the two matched groups were comparable for subsequent outcome analyses.

Comparison of surgery-related indicators

The operation time of the observation group was longer than that of the control group (24.71±3.25 min vs. 22.88±3.12 min; P=0.005). However, observation group had significantly less intraoperative blood loss (24.87±3.34 mL vs. 26.57±3.55 mL P=0.015), shorter wound healing time (13.57±2.15 days vs. 15.11±2.33 days; P=0.001), and shorter hospital stay (8.13±1.39 days vs. 8.86±1.52 days; P=0.014) compared to the control group (**Table 2**).

Comparison of postoperative pain levels

Postoperative pain was evaluated via the visual analog scale. Compared with the control group, the observation group presented decreased pain levels on postoperative day 1 (2.95±0.31 vs. 3.15±0.33; P=0.002), day 3 (2.12±0.22 vs. 2.30±0.30; P=0.001), and day 7 (1.25±0.15 vs. 1.33±0.16; P=0.011), as shown in **Table 3**.

Comparison of sphincter function scores

Compared with the control group, the observation group had significantly lower Wexner incontinence scores at 7 days (3.34±0.35 vs. 3.55±0.40; P=0.006), 1 month (1.31±0.15 vs. 1.42±0.14; P=0.001), and 2 months (0.52±0.12 vs. 0.63±0.18; P=0.001) postoperatively (**Table 4**).

Comparison of complication and recurrence rates

Differences in complications, including urinary retention, infection and anal malformation, between the control and observation groups were investigated. The total incidence of complications in the observation group (4.00%) was lower than that in the control group (16.00%) (P=0.046) (**Table 5**). The recurrence rates of the two groups were essentially the same (6.00% vs. 8.00%; P=0.695) (**Table 5**).

Comparison of clinical effects

The total effective rate of the observation group (96.00%) was greater than that of the control group (82.00%) (P=0.025), as shown in **Table 6**.

Follow-up and RFS analysis

All 100 matched patients completed a minimum follow-up of 12 months. The median follow-up time was 18.2 months (range, 12-24 months) in the observation group and 18.8 months (range, 12-24 months) in the control group, with no significant difference (P=0.752).

Table 1. Comparison of general characteristics between the two groups before and after propensity score matching

Index	Before matching				After matching				SMD (After Matching)
	Control group (n=90)	Observation group (n=98)	x^2/t	P	Control group (n=50)	Observation group (n=50)	x^2/t	P	
Demographics									
Gender (n, %)			0.022	0.883			0.170	0.680	0.082
Male	56 (62.22)	62 (63.27)			30 (60.00)	32 (64.00)			
Female	34 (37.78)	36 (36.73)			20 (40.00)	18 (36.00)			
Age (years)	33.12±3.45	34.78±3.68	3.183	0.002	34.10±3.42	34.13±3.44	0.044	0.965	0.009
Education level (n, %)			0.073	0.787			0.045	0.832	0.042
High school or below	35 (38.89)	40 (40.82)			16 (32.00)	17 (34.00)			
Junior college or above	55 (61.11)	58 (59.18)			34 (68.00)	33 (66.00)			
Payment method (n, %)			0.022	0.883			0.045	0.832	0.042
Medical insurance	56 (62.22)	62 (63.27)			33 (66.00)	34 (68.00)			
Other	34 (37.78)	36 (36.73)			17 (34.00)	16 (32.00)			
Monthly income (n, %)			0.020	0.889			0.160	0.689	0.080
≤5000 yuan	45 (50.00)	50 (51.02)			27 (54.00)	25 (50.00)			
>5000 yuan	45 (50.00)	48 (48.98)			23 (46.00)	25 (50.00)			
Clinical & fistula characteristics									
Course of disease (month)	5.72±0.58	5.78±0.59	0.702	0.483	5.75±0.58	5.76±0.57	0.087	0.931	0.018
Body mass index (kg/m^2)	21.85±2.19	21.90±2.20	0.156	0.876	21.86±2.19	21.88±2.20	0.046	0.964	0.009
Diabetes mellitus (n, %)	5 (5.56)	6 (6.12)	0.030	0.862	3 (6.00)	3 (6.00)	0.000	1.000	0.000
Smoking history (n, %)	28 (31.11)	32 (32.65)	0.052	0.820	16 (32.00)	15 (30.00)	0.046	0.830	-0.043
Number of external openings	2.21±0.31	2.35±0.32	3.042	0.003	2.28±0.30	2.29±0.31	0.164	0.870	0.033
Fistula location (n, %)			0.064	0.968			0.565	0.754	-
Anterior	22 (24.44)	25 (25.51)			12 (24.00)	14 (28.00)			0.091
Posterior	38 (42.22)	40 (40.82)			25 (50.00)	26 (52.00)			0.040
Lateral	30 (33.33)	34 (34.69)			13 (26.00)	10 (20.00)			-0.146
Fistula type (Garg classification) (n, %)			0.211	0.900			0.184	0.912	-
Transsphincteric	70 (77.78)	78 (79.59)			40 (80.00)	39 (78.00)			-0.050
Suprasphincteric	12 (13.33)	12 (12.24)			6 (12.00)	7 (14.00)			0.059
Extrasphincteric	8 (8.89)	8 (8.16)			4 (8.00)	4 (8.00)			0.000

SMD: standardized mean difference. For categorical variables with more than two levels (e.g., Fistula location), the SMD is calculated for each level against the reference group (Anterior); hence, multiple values are presented.

Table 2. Comparison of surgery-related indicators between the two groups after matching ($\bar{x}\pm s$)

Group	n	Intraoperative blood loss (mL)	Operative time (min)	Wound healing time (days)	Hospitalization time (days)
Observation group	50	24.87±3.34	24.71±3.25	13.57±2.15	8.13±1.39
Control group	50	26.57±3.55	22.88±3.12	15.11±2.33	8.86±1.52
t	-	2.466	2.872	3.435	2.506
P	-	0.015	0.005	0.001	0.014

Table 3. Comparison of postoperative pain levels between the two groups after matching ($\bar{x}\pm s$)

Group	n	1 day after operation	3 days after operation	7 days after operation
Observation group	50	2.95±0.31	2.12±0.22	1.25±0.15
Control group	50	3.15±0.33	2.30±0.30	1.33±0.16
t	-	3.123	3.421	2.579
P	-	0.002	0.001	0.011

Table 4. Comparison of sphincter function scores between the two groups after matching ($\bar{x}\pm s$)

Group	n	7 days after operation	1 month after operation	2 months after operation
Observation group	50	3.34±0.35	1.31±0.15	0.52±0.12
Control group	50	3.55±0.40	1.42±0.14	0.63±0.18
t	-	2.794	3.547	3.595
P	-	0.006	0.001	0.001

Table 5. Comparison of complication and recurrence rates between the two groups after matching (n, %)

Group	n	Urinary retention	Infection	Anal malformation	Total incidence	Recurrence rate
Observation group	50	1 (2.00)	1 (2.00)	0 (0.00)	2 (4.00)	3 (6.00)
Control group	50	3 (6.00)	5 (10.00)	0 (0.00)	8 (16.00)	4 (8.00)
x^2	-	-	-	-	4.000	0.154
P	-	-	-	-	0.046	0.695

Table 6. Comparison of clinical effects between the two groups after matching (n, %)

Group	n	Recovery	Improvement	Ineffective	Total effective rate
Observation group	50	30 (60.00)	18 (36.00)	2 (4.00)	48 (96.00)
Control group	50	22 (44.00)	19 (38.00)	9 (18.00)	41 (82.00)
x^2	-	-	-	-	5.005
P	-	-	-	-	0.025

During the follow-up period, 3 recurrences (6.00%) were observed in the observation group, and 4 recurrences (8.00%) were observed in the control group. The Kaplan-Meier survival analysis (**Figure 1**) revealed no significant difference in the RFS rate between the two groups (log-rank test, P=0.692).

To further investigate the factors associated with recurrence, Cox proportional hazards regression analysis was performed (**Table 7**). According to the univariate analysis, the type of surgical procedure (LIFT vs. fistulotomy) was not a significant predictor of recurrence (HR=0.74, 95% CI: 0.16-3.35; P=0.698). Among the covariates analyzed, the presence of diabetes mellitus (HR=3.85, 95% CI: 1.02-14.56; P=0.047) was significantly associated with a greater risk of recurrence. According to the multivariate model adjusted for surgical procedure

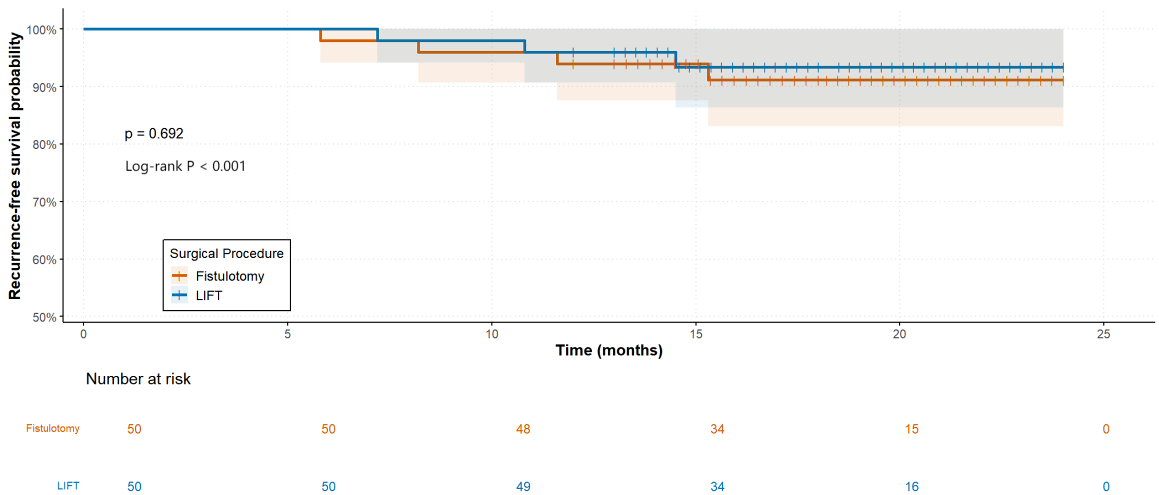

Figure 1. Kaplan-Meier recurrence-free survival curves Kaplan-Meier survival curves compare recurrence-free survival between patients who underwent fistulotomy (orange line, n=50) and LIFT procedure (blue line, n=50). LIFT: ligation of the intersphincteric fistula tract. The solid lines represent the survival estimates, and the shaded areas indicate 95% confidence intervals. Vertical tick marks along the curves denote censored observations (patients without recurrence events at the end of follow-up). The number at risk table below the graph shows the number of patients remaining under observation at each time point. Survival curves were compared using the log-rank test. P=0.692.

Table 7. Univariate and multivariate Cox regression analyses of factors associated with recurrence in the matched cohort

Variable	Category	Univariate analysis			Multivariate analysis		
		HR	95% CI	P	HR	95% CI	P
Surgical procedure	LIFT (Ref: Fistulotomy)	0.74	0.16-3.35	0.698	0.70	0.15-3.23	0.648
Age	(Per year increase)	1.02	0.88-1.19	0.770			
Gender	Male (Ref: Female)	1.25	0.30-5.25	0.758			
Diabetes mellitus	Yes (Ref: No)	3.85	1.02-14.56	0.047	3.92	1.03-14.94	0.045
Smoking history	Yes (Ref: No)	1.58	0.42-5.94	0.499			
BMI	(Per kg/m^2 increase)	0.98	0.74-1.29	0.867			
Fistula type	Transsphincteric (Ref)	1.00					
	Suprasphincteric	1.65	0.31-8.73	0.558			
	Extrasphincteric	1.52	0.18-12.78	0.698			

HR: hazard ratio; CI: confidence interval; LIFT: ligation of the intersphincteric fistula tract; Ref: reference category. The multivariate model included variables with P<0.1 in the univariate analysis (diabetes mellitus) and the primary variable of interest (surgical procedure).

and diabetes mellitus status, the LIFT procedure was not associated with an increased risk of recurrence compared to fistulotomy (adjusted HR=0.70, 95% CI: 0.15-3.23; P=0.648). Diabetes mellitus remained an independent risk factor for recurrence (adjusted HR=3.92, 95% CI: 1.03-14.94; P=0.045).

Discussion

Complex anal fistula is a common condition in colorectal practice, second only to hemorrhoids in incidence. Complex fistulas do not heal spontaneously and typically require surgical intervention. The present study found that the LIFT procedure was associated with a longer operative time than fistulotomy, but resulted in significantly less intraoperative blood loss, shorter wound healing time, shorter hospital stay, lower postoperative pain scores, and better sphincter function preservation. These findings are consistent with previous reports. Zhang et al. [26] reported that LIFT effectively reduces wound healing time, hospital stay, intraoperative bleeding, and postoperative pain.

Rezk et al. [27] demonstrated that LIFT is a valid sphincter-preserving technique for complex anal fistula that maintains anal sphincter integrity. The longer operative time of LIFT may be attributed to its minimally invasive nature and the technical demand of precisely dissecting and ligating the fistula tract within the intersphincteric plane while remaining parallel to the muscle fibers. The procedure requires accurate identification of the intersphincteric fistula, complete excision of the tract, and thorough curettage of granulation tissue, all without incising the anal sphincter. This approach minimizes anal sphincter damage, allows closure of the internal orifice and associated anal gland tissue, and facilitates postoperative recovery. The smaller surgical wound results in less pain, reduced blood loss, faster healing, and shorter hospitalization. In addition, reduced trauma to the anal canal contributes to better preservation of anal function. It should be noted, however, that LIFT is technically more demanding than fistulotomy and requires a higher level of surgical skill, which may account for the longer operative time observed in this and previous studies.

Although LIFT is a minimally invasive procedure, its longer operative time warrants mention. This may be attributed to the inherent technical complexity of the procedure and the associated learning curve [28]. Unlike fistulotomy, which involves direct incision of the fistula tract, LIFT requires meticulous dissection within the intersphincteric plane to identify, ligate, and divide the tract while preserving the anal sphincter. This precise and technically demanding approach contributes to the increased operative time [29]. As a relatively newer technique, LIFT is associated with a substantial learning curve; studies have shown that less experienced surgeons require significantly longer operative times than their more experienced counterparts [30]. Intraoperative challenges - such as fibrosis from prior infection or surgery, and anatomical variations - can further complicate identification and excision of the tract, thereby prolonging the procedure [31]. Despite the longer operative time, LIFT offers clear advantages, including reduced intraoperative blood loss, accelerated wound healing, shorter hospital stay, decreased postoperative pain, and better preservation of sphincter function. These findings are consistent with those of previous studies [32].

The recurrence rates of the two groups were almost the same. The total incidence of complications in the observation group was lower than that in the control group. The overall effective rate of the observation group was higher than that of the control group. Furthermore, time-to-event analysis confirmed that the recurrence rates were comparable between the two groups. Kaplan-Meier survival curves and Cox regression showed that the LIFT procedure did not substantially increase the risk of recurrence compared to traditional fistulotomy at a median follow-up of approximately 18 months, after adjustment for diabetes mellitus (which was identified as a risk factor for recurrence). Although fistulotomy is considered the standard procedure with a historically low recurrence rate [33], we found that the LIFT procedure had a similar recurrence rate but offered advantages in terms of less pain, quicker recovery, and better functional preservation. Therefore, given comparable recurrence rates, the overall benefit profile favored LIFT for complex anal fistulas. Celayir et al. [34] suggested that LIFT converts complex anal fistula into simple anal fistulas, allowing treatment with less sphincter injury, fewer postoperative complications, and greater clinical success. The wound after fistulotomy is left open. Postoperatively, patients often experience severe pain, and the wound is in close proximity to the anus. Fecal contamination of the wound surface may occur after defecation, potentially leading to infection or urinary retention. In contrast, LIFT results in less surgical trauma, reduced postoperative pain, and fewer postoperative complications. Patients who undergo LIFT recover faster, report fewer clinical complaints, and have fewer complications, leading to better overall clinical outcomes.

While fistulotomy is generally associated with high success rates (85-95%) for simple fistulas, LIFT tends to have lower reported success rates, typically around 70-85%. However, LIFT offers a significant advantage in terms of sphincter preservation, resulting in much lower rates of fecal incontinence [15]. Studies have shown that LIFT is associated with better postoperative Wexner scores (indicating better continence) than fistulotomy for complex cases. Although the overall complication rate of LIFT is low (approximately 1.4%), complications such as wound separation have been reported. In contrast, although the overall complication rate of fistulothomy is slightly higher, the greater damage to the sphincter is a more serious concern, particularly in patients with complex anal fistulas [15]; Therefore, the choice between LIFT and fistulotomy involves balancing cure rates against the priority of preserving continence and avoiding long-term functional loss [35].

Both fistulotomy and LIFT are valid procedures for complex anal fistula. However, comparative studies, particularly well-controlled ones in the Chinese population, are scant. Our main contribution is the use of PSM to minimize selection bias inherent in retrospective studies. This strengthens the validity of our findings. The results demonstrate that LIFT offers advantages including less intraoperative bleeding, faster recovery, reduced postoperative pain, better sphincter preservation, fewer complications, and comparable RFS. Therefore, our study supports LIFT as a worthwhile option for treating complex anal fistulas.

This study contains many useful insights, but there were some methodological limitations inherent in studies of anal fistula surgery. First is the risk of selection bias due to the retrospective, non-randomized design. Although we used PSM to balance all observed baseline covariates, this statistical method can adjust only for measurable confounders. Unmeasured factors - such as individual surgeon experience or subtle anatomical complexities (e.g., horseshoe extensions or additional tracts) - may still influence outcomes. In addition, as the acceptance and technical refinement of LIFT evolved over the study period, there may be temporal trends that are difficult to capture retrospectively. Second, this was a single-center study, which limits the generalizability of our findings. Differences in institutional protocols, surgical teams, and patient populations may affect the reproducibility of our results in other settings. The relatively modest sample size after matching (50 per group) may also limit statistical power to detect small but clinically meaningful differences, particularly for rare complications or subgroup analyses. Despite the use of PSM, our study remains susceptible to unmeasured confounders such as surgeon experience with the LIFT technique, anatomical variations not fully captured by the Garg classification, and differences in postoperative care protocols. Future studies should systematically collect data on surgeon volume and procedural experience to better adjust for these factors. It is noteworthy that this study did not analyze the correlation between individual surgeon experience (e.g., case volume) and operative outcomes within the LIFT group. Such analysis could provide valuable insights into the learning curve and inform training requirements. The retrospective nature of this study limited the availability of granular data for such analysis, highlighting the need for prospective data collection in future research. Finally, while the median follow-up of 18.5 months is adequate for assessing short-to-medium term outcomes, it may be insufficient to capture very long-term recurrence and sphincter function stability, as complex fistulas can recur years later. Therefore, future multicenter studies with larger cohorts and extended follow-up periods of 3-5 years are warranted to confirm the durability of treatment effects.

Conclusions

Both LIFT and fistulotomy are viable options for complex anal fistulas. LIFT was associated with reduced intraprocedural bleeding, faster postoperative recovery, better sphincter preservation, and fewer complications. Fistulotomy required a shorter operative time. However, there was no significant difference in recurrence risk between the two procedures. Therefore, the clinical choice should weigh anatomical preservation and long-term benefits against individual patient characteristics and expected functional outcomes.

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Disclosure of conflict of interest

None.

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References

[1] Schneider J, Heinze T, Laubert T, Kahlke V, Wedel T and Heimke M. Anal fistula disease: ana-

tomical foundations and surgical procedures. Chirurgie (Heidelb) 2025; 96: 728-736.
[2] Jiang Z and Wu K. Anal fistula with concomitant perianal cyst: a case report and literature review. Medicine (Baltimore) 2025; 104: e43887.
[3] Sanchez-Haro E, Vela E, Cleries M, Vela S, Tapiolas I, Troya J, Julian JF and Parés D. Clinical characterization of patients with anal fistula during follow-up of anorectal abscess: a large population-based study. Tech Coloproctol 2023; 27: 897-907.
[4] La Torre M, Goglia M, Micarelli A, Fiori E, D'Andrea V, Grossi U, Tierno SM, Tomassini F and Gallo G. Long term results of video-assisted anal fistula treatment for complex anal fistula: another shattered dream? Colorectal Dis 2023; 25: 2017-2023.
[5] Cano-Valderrama Ó, Miguel TF, Bonito AC, Muriel JS, Fernández FJM, Ros EP, Cabrera AMG and Cerdán-Santacruz C. Surgical treatment trends and outcomes for anal fistula: fistulotomy is still accurate and safe. Results from a nationwide observational study. Tech Coloproctol 2023; 27: 909-919.
[6] Zahra A, Malla J, Selvaraj R, Dhanoa RK, Venugopal S, Shoukrie SI, Selvamani TY, Hamouda RK and Hamid P. A comparison of different surgical treatments for complex anal fistula: a systematic review. Cureus 2022; 14: e28289.
[7] Chase TJG, Quddus A, Selvakumar D, Cunha P and Cuming T. VAAFT for complex anal fistula: a useful tool, however, cure is unlikely. Tech Coloproctol 2021; 25: 1115-1121.
[8] Zhang H, Lin M, Nan Z, Zhang Y, Liu S, Li A and Li G. Comparing the efficacy and safety of different thread-drawing surgery method for treating high complex anal fistula: a systematic review and network meta-analysis. Int J Colorectal Dis 2023; 38: 228.
[9] Giarratano G, Shalaby M, Toscana C and Sileri P. Video-assisted anal fistula treatment for complex anal fistula: a long-term follow-up study. Colorectal Dis 2020; 22: 939-944.
[10] Kumar A, Sharma A, Gupta SJ and Verma A. Complex anal fistula treated with IFTAK (Interception of fistulous track with application of ksharsutra) technique- A case report. J Ayurveda Integr Med 2023; 14: 100686.
[11] Uribe N, Balciscueta Z, Martín MC, Tabet J and López M. Rectal advancement flap for complex anal fistula-a video vignette. Colorectal Dis 2021; 23: 1278.
[12] Emile SH, Garoufalia Z, Aeschbacher P, Horesh N, Gefen R and Wexner SD. Endorectal advancement flap compared to ligation of intersphincteric fistula tract in the treatment of complex anal fistulas: a meta-analysis of randomized clinical trials. Surgery 2023; 174: 172-179.
[13] Garg P, Sodhi GS, Yagnik VD and Bhattacharya K. Subcutaneous incision of the fistula tract procedure is principally similar to submucosal ligation of anal fistula tract. Colorectal Dis 2023; 25: 1537-1538.
[14] Sahara R and Koizumi M. Reply to comment on "Subcutaneous incision of the fistula tract and internal sphincterotomy (SIFT-IS): a novel surgical procedure for transsphincteric anal fistula". Colorectal Dis 2023; 25: 1536-1537.
[15] Bhat S, Xu W, Varghese C, Dubey N, Wells CI, Harmston C, O'Grady G, Bissett IP and Lin AY. Efficacy of different surgical treatments for management of anal fistula: a network meta-analysis. Tech Coloproctol 2023; 27: 827-845.
[16] Cai Q, Ge Z, Zhang B and Gong W. Comparison of the modified ligation of intersphincteric fistula tract (LIFT) with incision thread drawing method on serum IgA and IL-10 levels in high simple anal fistula. J Pak Med Assoc 2023; 73: 792-795.
[17] Wanitsuwan W, Junmitsakul K, Jearanai S and Lohsiriwat V. Video-assisted ligation of intersphincteric fistula tract for complex anal fistula: technique and preliminary outcomes. Dis Colon Rectum 2020; 63: 1534-1540.
[18] Madbouly KM, Emile SH, Issa YA and Omar W. Ligation of intersphincteric fistula tract (LIFT) with or without injection of platelet-rich plasma (PRP) in management of high trans-sphincteric fistula-in-ano: short-term outcomes of a prospective, randomized trial. Surgery 2021; 170: 61-66.
[19] Cianci P, Tartaglia N, Fersini A, Giambavicchio LL, Neri V and Ambrosi A. The ligation of intersphincteric fistula tract technique: a preliminary experience. Ann Coloproctol 2019; 35: 238-241.
[20] Rojanasakul A, Booning N, Huimin L, Pongpirul K and Sahakitrungruang C. Intersphincteric exploration with ligation of intersphincteric fistula tract or attempted closure of internal opening for acute anorectal abscesses. Dis Colon Rectum 2021; 64: 438-445.
[21] Lohsiriwat V. Intersphincteric exploration and ligation of the intersphincteric fistula tract for acute anorectal abscess: worth doing? Dis Colon Rectum 2021; 64: e382.
[22] Emile SH, Khan SM, Adejumo A and Koroye O. Ligation of intersphincteric fistula tract (LIFT) in treatment of anal fistula: an updated systematic review, meta-analysis, and meta-regression of the predictors of failure. Surgery 2020; 167: 484-492.
[23] Garg P, Bhattacharya K, Yagnik VD and Mahak G. Recent advances in the diagnosis and treatment of complex anal fistula. Ann Coloproctol 2024; 40: 321-335.
[24] Shafshak TS and Elnemr R. The visual analogue scale versus numerical rating scale in

measuring pain severity and predicting disability in low back pain. J Clin Rheumatol 2021; 27: 282-285.
[25] Jangö H, Langhoff-Roos J, Rosthøj S and Sakse A. Wexner score and quality of life in women with obstetric anal sphincter injury. Int Urogynecol J 2020; 31: 1115-1121.
[26] Zhang J, Hao X, Zhu Y and Luan R. Efficacy and safety of ligation of intersphincteric fistula tract in the treatment of anal fistula: a protocol for systematic review and meta-analysis. Medicine (Baltimore) 2021; 100: e23700.
[27] Rezk M, Emile SH, Fouda EY, Khaled N, Hamed M, Omar W, Khafagy W and AbdelMawla A. Ligation of intersphincteric fistula tract (LIFT) with or without injection of bone marrow mononuclear cells in the treatment of trans-sphincteric anal fistula: a randomized controlled trial. J Gastrointest Surg 2022; 26: 1298-1306.
[28] Al Sebai OI, Ammar MS, Mohamed SH and El Balshy MA. Comparative study between intersphinecteric ligation of perianal fistula versus conventional fistulotomy with or without seton in the treatment of perianal fistula: a prospective randomized controlled trial. Ann Med Surg (Lond) 2021; 61: 180-184.
[29] Mongiu A and Colvin D. Ligation of intersphincteric fistula tract. Dis Colon Rectum 2025; 68: 1371.
[30] Han JG, Yi BQ, Wang ZJ, Zheng Y, Cui JJ, Yu XQ, Zhao BC and Yang XQ. Ligation of the intersphincteric fistula tract plus a bioprosthetic anal fistula plug (LIFT-Plug): a new technique for fistula-in-ano. Colorectal Dis 2013; 15: 582-586.
[31] Leventoglu S, Mentes B, Sahin C, Balci B and Kozan R. Ligation of the intersphincteric fistula tract: a video vignette. Colorectal Dis 2023; 25: 1547-1548.
[32] Awad PBA, Hassan BHA, Awad KBA, Elkomos BE and Nada MAM. A comparative study between high ligation of the inter-sphincteric fistula tract via lateral Approach Versus Fistulotomy and primary sphincteroplasty in High Trans-Sphincteric Fistula-in-Ano: a randomized clinical trial. BMC Surg 2023; 23: 224.
[33] Virji SN and Khan S. Ligation of intersphincteric fistula tract: a retrospective, single centre, individual surgeons' experience for the management of complex fistula in ano. J Pak Med Assoc 2024; 74: 1603-1607.
[34] Celayir MF, Bozkurt E, Aygun N and Mihmanli M. Complex anal fistula: long-term results of modified ligation of intersphincteric fistula tract=LIFT. Sisli Etfal Hastan Tip Bul 2020; 54: 297-301.
[35] Fuschillo G, Pata F, D'Ambrosio M, Selvaggi L, Pescatori M, Selvaggi F and Pellino G. Failure rates and complications of four sphincter-sparing techniques for the treatment of fistula-in-ano: a systematic review and network meta-analysis. Tech Coloproctol 2025; 29: 116.