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ORIGINAL ARTICLE

# LIFT procedure: postoperative outcomes, risk factors for fistula recurrence and continence impairment

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## Abstract

Ligation of the intersphincteric fistula tract has been recently employed as definitive treatment of anal fistulas. However, it carries a potential risk of continence impairment, fistula recurrence, and repeated operations. This study aimed to assess postoperative outcomes related to this procedure and evaluate the potential influence of preoperative and intraoperative features. Patients who underwent LIFT procedure between June 2012 and September 2021 were retrospectively analyzed. Patients were divided according to whether they developed fistula recurrence and on the history of a surgery prior to the LIFT. Preoperative features, postoperative outcomes, and risk factors adverse outcomes were analyzed. Forty-eight patients were included, of which 25 received primary LIFT, being the high transsphincteric fistula pattern the most frequent (62.5%). The median follow-up was 13.3 months, with a recurrence rate of 20.8%, of which the majority presented an intersphincteric fistula pattern (50%); and continence impairment rate of 16.7%. A higher prevalence of diabetes ($p=0.026$) and a trend towards a higher prevalence of patients with a history of high transsphincteric fistula (0.052) were observed in the group with fistula recurrence. The history of diabetes and the operation time with a cut-off value $\geq 69$ min showed a trend as a risk factors for developing fistula recurrence (0.06) and postoperative continence impairment (0.07), respectively. The LIFT procedure seems to be safe in terms of morbidity, with a reasonable incidence of recurrences, showing better results when it is primarily performed. Preoperative characteristics should be considered as they may impact outcomes.

**Keywords** Anal fistula · LIFT · Transsphincteric fistula · Recurrence

## Background

Treatment of anal fistulas is not innocuous, carries a potential risk of compromising sphincteric function, could develop fistula recurrence, or require repeated operations [1]. Therefore, an essential factor in treatment is to favor the cure rate by maintaining as much sphincteric function as possible.

In recent years, ligation of the intersphincteric fistula tract (LIFT) has been increasingly employed as definitive management for transsphincteric fistulas, and not much is known about features such as the location of the internal fistula opening, specific modifications to the LIFT technique, operation time, and their relationship with the recurrence of the fistula and continence impairment rates.

This study aimed to assess postoperative outcomes related to this procedure and evaluate the potential influence of preoperative and intraoperative features on adverse outcomes, emphasizing continence impairment and recurrence rates.

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## Materials and methods

A retrospective analysis of medical records of patients who underwent LIFT procedure as management of perianal fistula between June 2012 and September 2021 was performed. Patient data came from two tertiary care centers in Mexico City, Mexico: Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán; and Hospital de Especialidades-Centro Médico Nacional Siglo XXI. All adult patients admitted to these institutions who underwent LIFT procedures were included. Patients with incomplete data were excluded from the analysis.

The study was approved by the corresponding Institutional Review Boards and performed in line with the principles of the Declaration of Helsinki. The competent authorities waived informed consent due to anonymized data and its retrospective nature.

### Surgical technique

The surgical technique for the LIFT procedure generally consists of dissection of the intersphincteric space, identification of the fistulous tract, ligation of the intersphincteric fistulous tract, and resection of the intersphincteric fistulous tract [2, 3]. In details, during the ligation of the intersphincteric fistulous tract, in all the procedures, we used Vicryl 2–0 stiches, to close both sites of the tract, one near to the external anal sphincter and the other close to the internal anal sphincter. Moreover, in all cases, the intersphincteric wound was sutured with Vicryl 3–0.

### Outcomes

The primary outcome was to describe the postoperative results related to the LIFT procedure, emphasizing fistula recurrence (FR) and postoperative continence impairment (PCI). The secondary outcomes were to identify the risk factors associated with the development of FR and PCI and to describe the management received in cases of FR.

### Data collection

Variables were recorded in a digital database, including demographic parameters, intraoperative variables, and postoperative outcomes. Demographic parameters included: age (in years), sex, any comorbidities, smoking history, body mass index expressed in kg/m$^2$ (BMI), preoperative hemoglobin levels (in g/dL), leukocytes count, total neutrophil count, total platelet count. Moreover, patients were evaluated in a detailed preoperative coloproctological assessment, including data collection on bowel function, anal continence (evaluate via Cleveland Clinic Fecal Incontinence Severity Scoring System – CCIS, also termed Wexner score) [4], presence of inflammatory bowel diseases (IBD), previous surgical treatment, the method used for fistula characterization (i.e., physical examination, endoanal ultrasound, magnetic resonance, computed tomography), the type of fistula (low, medium, high transphincteric fistula, ano-vaginal/ano-introital fistula), and the localization of the internal opening of the fistula (anterior, posterior, right-left lateral).

The intraoperative variables included the type of closure of the fistulous tract, the use of intraoperative corticosteroids (mainly dosing for prevention of postoperative nausea and vomiting), intraoperative blood loss (ml), and operative time (mins).

The postoperative outcomes recorded included morbid events during hospitalization, overall hospital stay (days), and morbidity events during the follow-up such as PCI using the Cleveland Clinic Fecal Incontinence Severity Scoring System (CCIS/ also termed Wexner score) [4], successful healing of the fistula (using clinical criteria, specifically epithelization at the external opening and/or the absence of drainage) [5], FR (defined as the reappearance of a fistula after the initial wound had healed) [6], time to the recurrence (months), type of fistula in the recurrence, treatment of the recurrent fistula and the overall time of postoperative follow-up (months). Regarding the assessment of continence in the postoperative course, if the score exceeds 3 points, the patient would be referred to endoanal manometry. However, in the current series, no patient experienced the aforementioned clinical scenario.

### Statistical analysis

A retrospective comparative analysis was performed. The continuous variables were expressed as medians and ranges, and frequencies and proportions were used for categorical variables. The Mann–Whitney U test was used to compare the continuous data due to the non-parametric distribution of these variables. The Chi-squared test and the Fisher's exact test were employed to analyze categorical variables. All clinically relevant variables with a $P < 0.2$ in the univariate analysis were included in the multivariable regression analysis to assess potential factors associated with FR and PCI. The variables representing the lowest risk for each complication were considered the reference group (OR = 1). Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated for the risk of FR and PCI. A two-tailed $P$ value $< 0.05$ was considered to be statistically significant. Data analysis was performed using SPSS Statistics (version 25.0; Armonk, NY: IBM Corp.).

## Results

Forty-eight patients were retrospectively analyzed, of which 45 were male (93.8%), with a mean overall age of 45.48 (± 12.4) years, and 13 (27.1%) patients were active smokers at the intervention (LIFT) time. Twenty-five patients received LIFT as a primary intervention, and 23 had undergone previous surgical treatment for anal fistula (Table 1).

### Primary outcomes

The median overall follow-up after surgery was 13.3 months (12.2–86.6), with an overall recurrence rate of 20.8% ($n = 10$). When comparing the primary-LIFT group versus the group with previous surgery, a higher prevalence of diabetes ($p = 0.001$) and a higher rate of high transsphincteric fistulas ($p = 0.015$) was observed in the group with previous surgery; In contrast, a higher rate of low transsphincteric fistulas ($p = 0.019$) was seen in the primary-LIFT group (Table 1).

No differences were observed in the LIFT technique employed between groups. However, the primary-LIFT group registered a higher intraoperative bleeding ($p = 0.005$). The group with previous surgery reported a tendency to have a higher incidence of morbid events during follow-up ($p = 0.06$) (Table 2).

In general, fistula recurrence was identified in ten patients (20.8%) with a mean overall time to recurrence after LIFT procedure of 8.7 (± 3.2) months; of these ten recurrences, four (40%) occurred within the first 6 months after surgery. Analyzing the incidence of FR in patients undergoing primary LIFT and in those with a previous surgery for fistula management, the following was observed: A recurrence rate of 12% ($n = 3$) in the primary-LIFT group, with an estimated time from LIFT to fistula recurrence of 8.67 (± 2.52) months and procedure success rate of 88% ($n = 22$) at a median follow-up of 12.5 months (12.06–86.6); In the group with a previous surgery, recurrence was observed in 30.4% ($n = 7$) after the LIFT procedure, with an estimated time from LIFT to fistula recurrence of 8.71 (± 3.64) months, and a success rate of 69.6% ($n = 16$) at a median follow-up of 14.65 months (12.4–40.4). There were no differences when comparing the FR rates between those both groups ($p = 0.116$) (Table 2).

Additionally, a higher prevalence of patients with diabetes ($p = 0.026$), a higher preoperative leukocyte count ($p = 0.016$) and a trend towards a higher prevalence of patients with a history of high transsphincteric fistula (0.052) were observed in the group that developed FR compared to the group without FR (Table 1).

In general, PCI was reported in 16.7% ($n = 8$), with gas incontinence being more frequent (14.6%, $n = 7$), persistent continence impairment standing out in 6.3% ($n = 3$), with a median time from LIFT to remission of PCI of 5.53 (1.9–6.86) months. No difference in the rate of persistent PCI was observed when evaluating between the different groups.

### Secondary outcomes

Preoperative variables including age, BMI, Hb, leucocyte count, total neutrophil count, total lymphocyte count, and total platelets count, as well as intraoperative blood loss and operation time (mins.) were assessed using ROC curves for the development of FR, and PCI.

The ROC curve for PCI showed a cut-off value ≥ 69 min, with AUC of 0.740, ED 0.108, [95%CI 0.529–0.952], $p = 0.034$; with sensitivity of 75% [95% CI 34.91–96.81] and specificity of 64.1% [95% CI 47.18–78.80]; + LR: 2.09 [CI 95%: 1.17–3.73], and NPV: 92.59% [95%CI 78.63–97.70] (Fig. 2). The binary logistic regression analysis reported operation time ≥ 69 with a trend to be a risk factor for the development PCI, OR:5.35 [95%CI 0.95–30.18], $p = 0.057$(Fig. 1).

No clinically relevant findings were obtained when analyzing the other variables.

Preoperative and intraoperative factor associated with postoperative FR and PCI are shown in Table 3.

The multivariate logistic regression analysis did not show any variable as an independent risk factor for developing FR; however, a history of diabetes showed a trend as a risk factor for this outcome [OR: 5.292, 95% CI 0.929–30.138, $p = 0.060$].

No variables were found as risk factors for the development of PCI; however, operative time ≥ 69 min. [OR: 16.34; CI95%: 0.790–338.163, $p = 0.07$] and history of seton placement + abscess drainage as pre-LIFT management [OR:5.980; CI95%: 0.807–44.328, $p = 0.08$] showed a trend as risk factors for this outcome.

## Discussion

One of the most expected postoperative outcomes following a LIFT procedure is the recurrence of the fistula. In this regard, some studies have reported recurrence rates after LIFT of 29–63% [7–10]. This contrasts with the overall recurrence rate of 20.8% observed in our patients. When analyzing the patients with a history of previous surgery, the recurrence rate after the LIFT procedure has been reported in 53% of these patients [10]; interestingly, our analysis showed a recurrence rate of only 30.4% in patients with this condition.

**Table 1** Demographic and preoperative features

| Variable | All patients ($N=48$) | Fistula with recurrence ($N=10$) | Fistula without recurrence ($N=38$) | $p$ | Group of primary LIFT ($N=25$) | Group with a previous procedure ($N=23$) | $p$ |
|---|---|---|---|---|---|---|---|
| Age | 45.48 (±12.44) | 46 (±14) | 45 (±12) | 0.995 | 44 (±14) | 47 (±10) | 0.359 |
| Sex | | | | 0.582 | | | 0.235 |
| Male | 45 (93.8) | 9 (90%) | 36 (94.7%) | | 22 (88%) | 23 (100%) | |
| Female | 3 (6.3%) | 1 (10%) | 2 (5.3%) | | 3 (12%) | 0 (0%) | |
| [a]BMI | 28.35 (±4.37) | 28.79 (±4.57) | 28.24 (±4.37) | 0.727 | 27.72(±3.92) | 29.04 (±4.81) | 0.303 |
| History of smoking | | | | | | | |
| Active smoking | 13 (27.1%) | 4 (40%) | 9 (23.7%) | 0.302 | 6 (24%) | 7 (30.4%) | 0.748 |
| No smoker | 26 (54.2%) | 5 (50%) | 21 (55.3%) | 0.766 | 19 (76%) | 16 (69.6%) | 0.246 |
| Ex-smoker | 9 (18.8%) | 1 (10%) | 8 (21.1%) | 0.661 | 3 (12%) | 6 (26.1%) | 0.279 |
| Systemic hypertension | 14 (29.2%) | 1 (10%) | 13 (34.2%) | 0.134 | 5 (20% | 9 (39.1%) | 0.207 |
| Diabetes mellitus | 8 (16.7%) | 4 (40%) | 4 (10.5%) | 0.026* | 0 (0%) | 8 (34.8%) | 0.001* |
| Immunosuppressed | 8 (16.7%) | 1 (10%) | 7 (18.4%) | 0.525 | 7 (28%) | 1 (4.3%) | 0.049 |
| Solid tumor | 6 (12.5%) | 1 (10%) | 5 (13.2%) | 0.788 | 4 (16%) | 2 (8.7%) | 0.668 |
| [b]IBD | 1 (2.1%) | 0 (0%) | 1 (2.6%) | 0.604 | 1 (4%) | 0 (0%) | 1.0 |
| [c]HIV | 4 (8.3%) | 1 (10%) | 3 (7.9%) | 0.830 | 4 (16%) | 0 (0%) | 0.111 |
| Other comorbidities | 4 (8.3%) | 0 (0%) | 4 (10.5%) | 0.566 | 4 (16%) | 0 (0%) | 0.111 |
| Preoperative Wexner score, mean | 0 (0–10) | 0 (0–4) | (0–10) | 0.830 | 0 (0–3) | 0 (0–10) | 0.07 |
| Fistula with a previous surgical treatment | 23 (47.9) | 7 (70%) | 16 (42.1%) | 0.116 | 0 (0%) | 23 (100%) | <0.001* |
| Surgical procedures done prior to the LIFT procedure* | | | | | | | |
| Abscess drainage with seton placement | 14 (29.2%) | 5 (50%) | 9 (23.7%) | 0.103 | 0 (0%) | 14 (60.9%) | 0.000002* |
| Fistulectomy | 3 (6.3%) | 1 (10%) | 2 (5.3%) | 0.582 | 0 (0%) | 3 (13%) | 0.102 |
| Fistulotomy | 10 (20.8%) | 3 (30%) | 7 (18.4%) | 0.422 | 0 (0%) | 10 (43.5%) | 0.00017* |
| Method used for characterization of the fistula previous to the LIFT procedure | | | | | | | |
| [d]EAUS | 31 (64.6%) | 9 (90%) | 22 (57.9%) | 0.059 | 15 (60%) | 16 (69.6%) | 0.556 |
| [e]MRI | 1 (2.1%) | 0 (0%) | 1 (2.6%) | 0.604 | 0 (0%) | 1 (4.3%) | 0.479 |
| [f]CT | 1 (2.1%) | 0 (0%) | 1 (2.6%) | 0.604 | 0 (0%) | 1 (4.3%) | 0.479 |
| [g]PE | 15 (31.3%) | 1 (10%) | 14 (36.8%) | 0.103 | 10 (40%) | 5 (21.7%) | 0.221 |
| Type of fistula | | | | | | | |
| Low transsphincteric fistula | 12 (25%) | 1 (10%) | 11 (28.9%) | 0.218 | 10 (40%) | 2 (8.7%) | 0.019* |
| Medium transsphincteric fistula | 5 (10.4%) | 0 (0%) | 5 (13.2%) | 0.226 | 2 (8%) | 3 (13%) | 0.660 |
| High transsphincteric fistula | 30 (62.5%) | 9 (90%) | 21 (56.8%) | 0.052* | 11 (45.8%) | 19 (82.6%) | 0.015* |

**Table 1** (continued)

| Variable | All patients ($N=48$) | Fistula with recurrence ($N=10$) | Fistula without recurrence ($N=38$) | $p$ | Group of primary LIFT ($N=25$) | Group with a previous procedure ($N=23$) | $p$ |
|---|---|---|---|---|---|---|---|
| Ano-vaginal/ano-introital fistula | 1 (2.1%) | 0 (0%) | 1 (2.6%) | 1.0 | 1 (4%) | 0 (0%) | 1.0 |
| Localization of the internal opening | | | | | | | |
| Anterior | 14 (29.2%) | 3 (30%) | 11 (28.9%) | 0.948 | 9 (36%) | 5 (21.7%) | 0.349 |
| Posterior | 11 (22.9%) | 4 (40%) | 7 (18.4%) | 0.149 | 4 (16%) | 7 (30.4%) | 0.311 |
| Right lateral | 12 (25%) | 2 (20%) | 10 (26.3%) | 0.682 | 4 (16%) | 8 (34.8%) | 0.187 |
| Left lateral | 11 (22.9%) | 1 (10%) | 10 (26.3%) | 0.275 | 8 (32%) | 3 (13%) | 0.173 |
| Preoperative laboratory findings | | | | | | | |
| Hb (g/dL) | 15.74 (±1.51) | 15.79 (±2.11) | 15.73 (±1.35) | 0.914 | 15.59 (±1.41) | 15.9 (±1.63) | 0.484 |
| White blood cells | 7.83 (±2) | 9.31 (±2) | 7.44 (±2) | 0.016* | 7 (±2) | 8.45 (±2) | 0.064 |
| Total neutrophil count | 3669 (±2325) | 3629 (±3428) | 3679 (±2002) | 0.952 | 3561(±235) | 3785 (±2339) | 0.742 |
| Total platelet count | 245,708 (±54,155) | 259 900 (±61,850) | 24 1973 (±52 213) | 0.357 | 247,160 (±54,923) | 244,130 (±54,494) | 0.849 |

*some patients needed more than one surgical treatment prior to the LIFT procedure

[a]*BMI* body mass index

[b]*IBD* inflammatory bowel disease

[c]*HIV* human immunodeficiency virus infection

[d]*EAU* Endoanal ultrasound

[e]*MRI* magnetic resonance

[f]*CT* computed tomography

[g]*PE* physical examination

Some studies have evaluated risk factors for developing FR after the LIFT procedure, reporting horseshoe fistulas, Crohn's disease, and previous fistula surgery as predictors of failure [11]. Our study found that the history of diabetes showed a trend as a risk factor for this outcome (0.06), which could suggest the necessity of strict glycemic control in these patients to improve this outcome.

Recent studies have shown interest in the potential relationship between the location of the primary fistula orifice and postoperative outcomes; in our study, no relationship was observed between this feature and the development of FR or PCI. Although the anterior location of the primary orifice was generally more frequent in our group, when evaluating patients with FR we observed a higher number of patients with a history of posterior primary orifice location, similar to that reported by Sarmiento-Cobos et al. [12]

Although no significant difference was observed in the PCI rate when comparing the primary-LIFT group and the group with previous surgery, a trend for a longer operative time was observed in the group with previous surgery; which could be explained by the distortion of the anatomical structures and greater complexity of the procedure in this context. Interestingly, patients with an operative time ≥ 69 min showed a trend to a greater risk of PCI ($p=0.07$); in addition, it should be noted that the two patients who had persistent PCI had a history of previous surgery. Therefore, it should be kept in mind that the history of previous surgery could impact postoperative functional outcomes. It would be interesting to perform additional studies to assess postoperative outcomes concerning this, including a larger number of patients with long-term follow-up.

It is noteworthy that of those cases with FR, half presented as intersphincteric fistula and the procedure most frequently employed for treating recurrences was simple fistulotomy; suggesting that FR may present with less complex patterns feasible to be treated with relatively more simple techniques as noted by Emile et al. in systematic review [11].

Since its introduction, the LIFT procedure has been our first management option for treating transsphincteric fistulas, even over advancement-flaps and fistulotomies. In cases of ano-vaginal fistula and also lower recto-vaginal fistula, it is possible to perform modified LIFT adding primary sphincteroplasty to improve postoperative outcomes and prevent incidence of fistula recurrence [13].

Although our study is a case series with a modest size and postoperative follow-up period, it confirms the

**Table 2** Intraoperative and postoperative variables about different types of closure of the fistulous tract

| Variable | All patients ($N=48$) | Fistula with recurrence ($N=10$) | Fistula without recurrence ($N=38$) | $p$ | Group of primary LIFT ($N=25$) | Group with a previous procedure ($N=23$) | $p$ |
|---|---|---|---|---|---|---|---|
| Tract ligation | 31 (64.6%) | 5 (50%) | 26 (68.4%) | 0.278 | 16 (64%) | 15 (65.2%) | 1.0 |
| Transfixing stitches in both sides of the tract | 16 (33.3%) | 5 (50%) | 11 (28.9%) | 0.209 | 9 (36%) | 7 (30.4%) | 0.765 |
| Tract ligation + transfixing stitches in both sides of the tract | 1 (2.1%) | 0 (0%) | 1 (2.6%) | 1.0 | 0 (0%) | 1 (4.3%) | 0.479 |
| Intraoperative use of corticosteroids | 6 (12.5%) | 2 (20%) | 4 (10.8%) | 0.440 | 3 (12.5%) | 3 (13%) | 1.0 |
| Intraoperative blood loss (mL) | 15 (5–80) | 10 (5–80) | 15 (5–50) | 0.326 | 20 (5–50) | 10 (5–80) | 0.005* |
| Surgery duration (mins) | 60 (13–211) | 63 (37–120) | 60 (13–210) | 0.795 | 51 (13–211) | 70 (35–155) | 0.082 |
| Postoperative variables | | | | | | | |
| Morbidity events during hospitalization (including postoperative bleeding and urinary retention) | 0 (0%) | 0 (0%) | 0 (0%) | – | 0 (0%) | 0 (0%) | – |
| Overall hospital stay (days) | 1 (1–3) | 1 (1–2) | 1 (1–3) | 0.363 | 1 (1–3) | 1 (1–3) | 0.491 |
| Patients with morbidity events during follow-up | 16 (33.3%) | 10 (100%) | 6 (15.8%) | < 0.001* | 5 (20%) | 11 (47.8%) | 0.066 |
| Postoperative continence impairment (any impairment during follow-up) | 8 (16.7%) | 2 (20%) | 6 (15.8%) | 0.751 | 2 (8%) | 6 (26.1%) | 0.130 |
| Wexner score (CCIS[a]) | 6 (0–10) | 3 (0–5) | 6 (0–10) | 0.140 | 1 (0–5) | 5 (1–10) | 0.07 |
| Incontinence to gas | 7 (14.6%) | 1 (10%) | 6 (15.8%) | 1.0 | 2 (8%) | 5 (21.7%) | 0.237 |
| Incontinence to liquids | 4 (8.3%) | 1 (10%) | 3 (7.9%) | 1.0 | 1 (4%) | 3 (13%) | 0.338 |
| Incontinence to solids | 1 (2.1%) | 0 (0%) | 1 (2.6%) | 1.0 | 0 (0%) | 1 (4.3%) | 0.479 |
| Persistent continence impairment | 3 (6.3%) | 1 (10%) | 2 (5.3%) | 0.512 | 0 (0%) | 3 (13%) | 0.102 |
| Time from LIFT to remission of continence impairment (months) | 5.53 (1.90–6.86) | 6.70 (6.53–6.86) | 4.40 (1.90–5.53) | 1.0 | 5.47 (4.40–6.53) | 5.53 (1.90–6.86 | 1.0 |
| Successful healing of the fistula | 38 (79.16%) | 10 (100%) | 38 (100%) | < 0.001* | 22 (88%) | 16 (69.6%) | 0.116 |
| Recurrence of the fistula | 10 (20.8%) | 10 (100%) | 0 (0%) | < 0.001* | 3 (12%) | 7 (30.4%) | 0.162 |
| Time to the recurrence (months) | 8.7 (± 3.2) | 8.7 (± 3.2) | – | – | 8.67 (± 2.52) | 8.71 (± 3.64) | 0.984 |

**Table 2** (continued)

| Variable | All patients ($N=48$) | Fistula with recurrence ($N=10$) | Fistula without recurrence ($N=38$) | $p$ | Group of primary LIFT ($N=25$) | Group with a previous procedure ($N=23$) | $p$ |
|---|---|---|---|---|---|---|---|
| Type of fistula in the recurrence | | | | | | | |
| Intersphincteric | 5 (10.4%) | 5 (50%) | 0 (0%) | 0.00014* | 2 (8%) | 3 (13%) | 0.660 |
| Low transsphincteric | 3 (6.3%) | 3 (30%) | 0 (0%) | 0.007* | 1 (4%) | 2 (8.7%) | 0.601 |
| Medium transsphincteric | 1 (2.1%) | 1 (10%) | 0 (0%) | 0.208 | 0 (0%) | 1 (4.3%) | 0.479 |
| High transsphincteric | 1 (2.1%) | 1 (10%) | 0 (0%) | 0.208 | 0 (0%) | 1 (4.3%) | 0.479 |
| Treatment of the recurrent fistula* | 9 (18.75%) | 9 (90%) | 0 (0%) | < 0.001* | 3 (12%) | 6 (26.1%) | 0.212 |
| Fistulectomy + sphincteroplasty | 1 (2.1%) | 1 (10%) | 0 (0%) | 0.208 | 0 (0%) | 1 (4.3%) | 0.479 |
| Simple fistulotomy | 6 (12.5%) | 6 (60%) | 0 (0%) | 0.000017* | 3 (12%) | 3 (13%) | 1.0 |
| Fistulotomy + sphincteroplasty | 1 (2.1%) | 1(10%) | 0 (0%) | 0.208 | 0 (0%) | 1 (4.3%) | 0.479 |
| Modified Hanley procedure | 1 (2.1%) | 1 (10%) | 0 (0%) | 0.208 | 0 (0%) | 1 (4.3%) | 0.479 |
| Overall postoperative follow-up (months) | 13.3 (12.2–86.6) | 13.1 (12.6–28.3) | 12.5 (12.2–86.6) | *0.496 | 12.5 (12.06–86.6) | 14.65 (12.4–40.4) | *0.723 |

*One patient who had recurrence in the form of a high transsphincteric fistula did not receive additional treatment

[a]*CCIS* cleveland clinic fecal incontinence severity scoring system

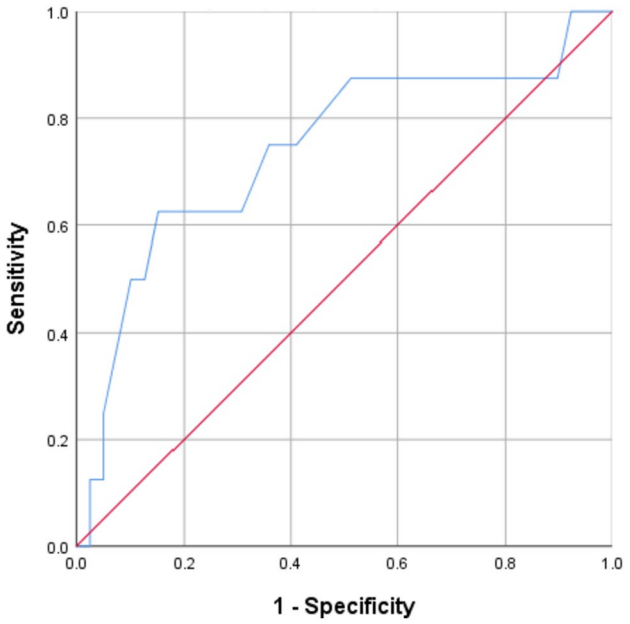


**Fig. 1** ROC curve of operation time (mins) for postoperative continence impairment

usefulness of LIFT both in patients who will receive primary treatment and in those with a history of previous surgery to manage anal fistula. However, further studies are needed to evaluate preoperative features and their relationship with the long-term outcomes, which could potentially impact decision-making.

The LIFT procedure seems to be safe in terms of morbidity, with a reasonable incidence of recurrences, showing better results when it is primarily performed. Preoperative characteristics should be considered as they may impact decisions regarding surgical planning and postoperative outcomes.

**Table 3** Risk factors for the development of fistula recurrence and continence impairment, univariate analysis

| Variables | Fistula recurrence | | Continence impairment (any impairment during follow-up) | |
|---|---|---|---|---|
| | OR (95% CI) | *P* | OR (95% CI) | *P* |
| BMI ≥ 25 | 0.903 (0.156–5.214) | 0.909 | – | – |
| Active smoking | 2.148 (0.494–9.340) | 0.308 | 0.879 (0.154–5.028) | 0.885 |
| No smoker | 0.810 (0.201–3.266) | 0.767 | 1.508 (0.317–7.177) | 0.606 |
| Ex-smoker | 0.417 (0.046–3.792) | 0.437 | 0.571 (0.061–5.335) | 0.623 |
| Systemic hypertension | 0.214 (0.024–1.875) | 0.164* | 0.297 (0.033–2.670) | 0.278 |
| Diabetes mellitus | 5.667 (1.104–29.073) | 0.038* | 4.200 (0.759–23.240) | 0.100* |
| Immunosuppressed | 0.492 (0.053–4.543) | 0.532 | – | – |
| Solid tumors | 0.733 (0.076–7.098) | 0.789 | – | – |
| HIV | 1.296 (0.120–13.989) | 0.831 | – | – |
| Fistula with a previous surgical treatment | 3.208 (0.717–14.350) | 0.127* | 4.059 (0.728–22.637) | 0.110* |
| Procedures performed prior to the LIFT | | | | |
| Abscess drainage with seton placement | 3.222 (0.758–13.705) | 0.113* | 5.741 (1.145–28.786) | 0.034* |
| Fistulectomy | 2.0 (0.163–24.588) | 0.588 | – | – |
| Fistulotomy | 1.898 (0.390–9.231) | 0.427 | 2.829 (0.545–14.690) | 0.216 |
| Type of fistula | | | | |
| Low transsphincteric fistula | 0.273 (0.031–2.417) | 0.243 | 0.377 (0.41–3.424) | 0.386 |
| High transsphincteric fistula | 6.857 (0.786–59.814) | 0.081* | 4.870 (5.45–43.523) | 0.157* |
| Localization of the internal opening | | | | |
| Anterior | 1.052 (0.229–4.826) | 0.948 | 0.778 (0.137–4.419) | 0.777 |
| Posterior | 2.952 (0.654–13.335) | 0.159* | 0.429 (0.047–3.923) | 0.453 |
| Right lateral | 0.700 (0.127–3.868) | 0.683 | 1.0 (0.173–5.772) | 1.0 |
| Left lateral | 0.311 (0.035–2.776) | 0.296 | 2.400 (0.471–12.200) | 0.292 |
| Types of closure of the fistulous tract | | | | |
| Tract ligation | 0.462 (0.112–1.901) | 0.284 | 1.800 (0.321–10.088) | 0.504 |
| Transfixing stitches in both sides of the tract | 2.455 (0.591–10.197) | 0.217 | 0.619 (0.110–3.482) | 0.586 |
| Intraoperative use of corticosteroids | 2.062 (0.320–13.313) | 0.447 | 2.917 (0.434–19.609) | 0.271 |
| Operation time ≥ 69(mins) | 0.0875 (0.211–3.629) | 0.854 | 5.35 (0.95–30.18) | 0.057* |

*$p$ values ≤ 0.2

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## Declarations

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