Ligation of intersphincteric fistula tract: What is the evidence in a review?

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Abstract

Broadly, complex fistulas are those that are not low transsphincteric or intersphincteric. The objectives of surgical management are to achieve fistula healing, prevent recurrences and maintain continence. The risk of incontinence associated with treatment ranges from 10% to 57%. The objective of this manuscript is to review the current literature to date on the ligation of the intersphincteric fistula tract procedure (LIFT procedure) as a treatment option in these types of fistula. A search was conducted in Medline, PUBMED, EMBASE and ISI Web of Knowledge, and studies published from January 2009 to May 2013 were included. The primary outcomes were fistula healing rates, mean healing time and patient satisfaction with this surgical technique. Eighteen studies were included in this review. The total number of patients included was 592 (65% male). The median age reported was 42.8 years. The most common type of fistula included was transsphincteric (73.3% of cases). The mean healing rate reported was 74.6%. The risk factors for failure discovered were obesity, smoking, multiple previous surgeries and the length of the fistula tract. The mean healing time was 5.5 wk, and the mean follow-up period was 42.3 wk. The patient satisfaction rates ranged from 72% to 100%. No de novo incontinence developed secondary to the LIFT procedure. There is not enough evidence that variants in the surgical technique achieve better outcomes (Bio-LIFT, LIFT-Plug, LIFT-Plus). This review indicates that the LIFT procedure is primarily effective for transsphincteric fistulas with an overall fistula closure of 74.6% and has a low impact on fecal continence. This procedure produces better outcomes at the first surgical attempt.

Core tip: We review the current literature published until today about the ligation of intersphincteric fistula tract -procedure. The paper describes the different types of fistulas in which the technique has been used; the cure rates achieved; the reported recurrence rates; types of failures and morbidity related to it. The paper analyzes the prognostic factors for the success; describes the various modifications of the surgical technique and the results obtained with them. The manuscript classifies the types of failures and gives options for their proper treatments. With all these, it sets the achievements and limitations of the technique, with the scientific evidence available today.

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INTRODUCTION

Perianal abscess and fistulas represent two stages of

the same disease. The main etiology is cryptoglandular. Perianal abscess and fistulas are two of the oldest human surgical entities[1]. The objectives of treatment are to achieve fistula healing, prevent recurrences and maintain continence. The risk of incontinence associated with treatment ranges from 10% to 57%[2]. The disease has an incidence of 8.6 per 100000 people and nearly 20000 to 25000 fistulas are treated annually in the United States[1]. The incidence of fistulae after perianal abscess is 27% to 60%[3]. Traditionally, a "complex fistula" is defined by a high risk of recurrence or incontinence following treatment. Broadly, complex fistulas are those that are not low trans-sphincteric or intersphincteric fistulas. The surgical options for these fistulas include fibrin application, plug placement, endorectal advancement flap (ERAF), fistulotomy with primary sphincter repair, partial fistulotomy with seton placement, ultra-low anterior resection and coloanal anastomosis, the ligation of the intersphincteric fistula tract (LIFT) procedure and recently, the video-assisted fistula tract procedure (VAAFT). Trans-sphincteric fistulas comprise 20%-25% of all fistula cases[3]. Although plug placement and applying fibrin are still being used, at present, there is a preference for the ERAF and LIFT procedures. The LIFT procedure, which is the topic of this review, involves the following principles: (1) identification of the internal opening; (2) incision at the intersphincteric groove; (3) dissection of the intersphincteric space; (4) identification of the intersphincteric fistula tract; (5) securing ligation and excision of the intersphincteric tract; (6) confirming the removal of correct fistulous tract; (7) opening and curetting the external opening; and (8) closure of the intersphincteric wound. A search was conducted in the Medline, PUBMED, EMBASE and ISI Web of Knowledge databases, using the following terms: LIFT, anal fistula, perianal fistula, fistula-in-ano, rectal fistula, complex anal fistula, ligation of intersphincteric fistula tract, sphincter sparing procedures, clinical trials, outcomes, recurrence, failure, morbidity and incontinence. All of the studies published in the English language from January 2009 to May 2013 were included in this review. We initiated the review from 2009 because the surgical technique was first described in that year. In the studies reported by the same group of authors, the outcomes considered for the analysis were those with a longer follow-up and a larger number of patients[4-7].

REVIEW OF THE LITERATURE

In the present review, we included 18 papers: eleven were retrospective, two were retrospective and prospective, four were prospective and one was a randomized controlled trial (Table 1). The total number of patients was 592, and 385 were male (65%). The average age reported was 42.82 years. Only a few studies included patients with the following characteristics: rectovaginal fistula, 3 studies with 6 patients in total; cigarette smoking, 2 studies with 21 patients; inflammatory bowel disease, 2 studies; diabetes, 3 studies; HIV, 1 study; and using corticosteroids, 1

study. Other special characteristics mentioned but not numerically specified were the presence of obesity, ischemic heart disease, rheumatoid arthritis and cancer. The most common type of fistula included was trans-sphincteric (73.3%). The percentage of "low" transsphincteric fistulas was 13.5%. The remaining fistulas were classified as horseshoe or hemi horseshoe (48), intersphincteric (11), suprasphincteric (9) and rectovaginal (6). In addition, 34.4% of the population had been previously operated using the same or another surgical technique. The mean operative time reported was 36.16 min. Only two studies reported the length of hospital stay (2.5 d and 1.4 d, respectively), but most of the surgeries were performed on an outpatient basis. The mean healing rate was 74.6% (range: 40%-95%), and the mean healing time was 5.5 wk. The percentage of the population who had a drainage seton before the LIFT procedure was 56% (226/402).

In 2009, Rojanasakul[8] first described the technique and reported a success rate of 94%. They included 18 patients, with a recurrence rate of 5.6%.

Bleier *et al*[4] conducted a retrospective and prospective trial. They included 39 patients, 51.3% of whom were male. The mean age of the population was 49 years. The average number of previous surgeries to treat perianal fistulas was 2. In addition, 74% of the population had at least one previous failed surgical treatment. The average follow-up period was 20 wk. The success rate was 57%. The latency time to recurrence was 10 wk. Of the total recurrences, 4 recurrences were intersphincteric, 3 were transsphincteric and 1 was a horseshoe type. The incontinence rate was 0%. This represents the first experience in the United States. The same group, recently reported on the treatment of 93 patients (61% male), with a mean age of 43 years[5]. A 32% had been previously operated. A drainage seton was placed in 92% of the total patients. The healing rate dropped to 40% with a failure rate of 34%, and 26% of patients suffered a recurrence. The mean recurrence time was 7 mo. Nine patients had a down-staging of the fistula to intersphincteric and were treated with fistulotomy, achieving a secondary healing rate of 57%. The average Wexner score reported was 1. No patient had solid stool incontinence.

Shanwani *et al*[9] performed a prospective study. A total of 45 patients were included. In total, 71.1% of patients were male, and the mean age was 41.5 years. The mean operative time was 67.5 min. The average hospital stay was 2.5 d (range: 2-5 d). During an average follow-up period of 9 mo, the cure rate was 82.2%, with an average healing time of 7 wk. The recurrence rate was 17.8%, and the recurrence occurred between 3 and 8 mo after surgery. There were no reported cases of fecal incontinence or morbidity.

There are also variations to the conventional LIFT procedure. Ellis, based on the treatment of rectovaginal fistulas with approximately 92% of success, described the use of a bioprosthetic graft to reinforce the ligation and the closure of the fistula tract, calling it the BioLIFT procedure in a prospective study of 31 patients[10,11]. Twenty-

Table 1 Summary of the published articles

Ref.	Year	Study design	n	Age (yr)	Gender	Fistula classification	Preperative evaluation	Healing rate	Failure or recurrence rate	Morbidity	Incontinence	Follow-up	Comments
Rojanasakul[8]	2009	Retro	18	NA	NA	13 LITS 5 HS	NA	94%	R 5.6%	NA	NA	NA	Healing time 4 wk
Bleier et al[4]	2010	Retro/pros	39	49	51.3% male	28 TS, 7 HS, 1 SP, 2 RV	NA	57%	43%	2: Anal fissure and pain	0 (NAO)	20 wk (0-58)	PS mean 3 (0-9) 74% PS R time 10w (2-38)
Shanwani et al[9]	2010	Pros	45	41.5 (27-56)	71.1% male	33 TS	44% colonoscopy 48.80% anal USG	82.20%	R 17.7%	0	0 (NAO)	9 mo (2-16)	11.1% PS MOT 67.5 min (35-100) LOS 2.5 d (2-5) Healing time 7 wk (4-10) R time 3-8 mo
Ellis[11]	2010	Pros	31	48 (30-68)	22 male	31 TS	NA	94%	R 2 (6%)	NA	NA	15 mo (12-30)	Bio-LIFT Include: CD, CS, DM patients. 100% previous seton 18 PS (PLUG) Satisfaction 100%
Ooi et al[12]	2011	Retro	25	40 (21-67)	17 male	6 IS, 18 TS, 1 SP	MRI 72%	68%	R 28% (all IS)	0	Basal WS 2 PostOp Global WS 4 Heal WS 0	22 wk (3-43)	PS 40% MOT 39 min (17-100) Healing time 6 wk (3-17) R time 13.5 wk (7-20) Satisfaction 72%
Aboulian et al[6]	2011	Retro	25	39	68% male	NA	NA	68%	Fa 32%	2 Vaginal Candidiasis	NA	27 wk (8-158)	Previous seton 65% PS 27%
Sileri et al[13]	2011	Pros	18	39 (4-62)	10 male	15 TS 1HS 2 RV	100% MRI or anal USG Manometry	83%	R 3 (17%; 1 IS, 2 TS)	1 Thrombosed external hemorrhoid	NA	6 mo (4-10)	EC: CD. Previous seton 100%
Tan et al[14]	2011	Retro	93	40 (14-71)	82.8% male	89.2% TS (39 LITS, 44 HITS) 4 IS, 22 HS 6 SP	Anal USG 100%	86%	R 6.4% Fa 7.5% (4 IS, 3 sinus)	NA	NA	23 wk (1-85)	PS 28% Previous seton 17.2% Healing time 4 wk (1-12) R time 22 wk (15-24) Describes types of failures.
Wallin et al[5]	2012	Retro/Pros	93	43 (21-76)	61% male	16 HS 77 TS	NA	40% Secondary 57%	Fa 34% R 26%	NA	WS 1 0%-10% Solid incontinence none (NAO)	19 mo (44-55)	EC: less 3 mo FU, RV, CD, IAR, LI, PL. 32% PS 92% Previous seton R time 7 mo (0.8-27)
Abcarian et al[15]	2012	Retro	40	43	NA	TS	NA	74% 1st 90% 2nd 75% 3rd 65%	26% RFUVA: obesity, CS, PS	NA	0 (NAO)	18 wk (2-64)	Include: HIV, CD, Obesity, CS, DM. EC: acute abscess PS: 2 (0-12).
Tan et al[16]	2012	Retro	31ERAF 24 LIFT	ERAF 49 (19-74); LIFT 41 (16-75)	ERAF 87.1% male; LIFT 87.50% male	High fistulas	100% anal USG	ERAF 93.5%; LIFT 62.5%. $P = 0.006$	ERAF Fa 6.5%; LIFT Fa 37.5%. $P = 0.006$	NA	NA	ERAF 6 mo (2-26); LIFT 13 mo (4-67)	Previous Seton 100% EC: VIH, CD. ERAF PS: 58.8%; LIFT PS: 25%

Ref	Year	Design	N	Age	Gender	Fistula type (HTS)	100% Anal USG or MRI	Healing at 1 mo	R	Complications	NAO	Follow-up	Comorbidities / Comments
Mushaya et al [17]	2012	RCT	39 LIFT 25 ERAF 14	47.8	LIFT 17 males ERAF 10 males		100% Anal USG or MRI	ERAF 85% vs LIFT 68% Finally 93% vs 92%	ERAF 7% vs LIFT 8%, P = NS	LIFT 4% bleeding, 8% dehiscence IS wound. ERAF 7% dehiscence apex	Report equal functional outcomes	20 mo	Comorbidities: DM, RA, Ca, IHD (33%) EC: CD MOT LIFT 10 min MOT ERAF 42.5 min Pain less with LIFT Satisfaction LIFT 9.8 vs ERAF 8.1, P < 0.001. RNA favored LIFT (P = 0.016)
Han et al [18]	2012	Retro	21	38 (25-56)	19 male	NA	100% Anal USG	95%	NA	0	Mean WS 0 (5% WS 1).	14 mo (12-15)	LIFT-PLUG PS 0 EC: CD, FI, MT, acute abscess, HIV, Tb. MOT 20 min (15-40) Healing time faster
van Onkelen et al [21]	2012	Retro	22	45 (17-59)	13 male	All LTS	100% MRI	82% Secondary 100%	0	NA	0 (Rockwood)	19.5 mo (3-35)	PS 10 patients EC: CD, RV Female all healed with first LIFT
van Onkelen et al [22]	2012	Retro	41	42 (20-69)	32 male	TS	NA	51% Secondary 71%	Fa 20 (8 IS alone)	NA	Rockwood PreOp 10 PostOp 7	15 mo (7-21)	ERAF + LIFT PS 48% 3 previous ERAF EC: RV, CD
Liu et al [7]	2013	Retro	38	42	74% male	38 TS	NA	61%	Fa 15 12 early type 3 late type	NA	0 (NAO)	26 mo (3-44)	68% more 12 mo FU. 18% PS. Previous seton 76%. Length of fistula tract correlates with healing rate. Healing time 8 wk (4-36). F time 4 mo
Lehmann et al [20]	2013	Retro	17	49 (30-76)	9 male	All recurrent fistulas. 15 TS (3 LTS, 12 HTS) 2 RV	NA	Complete 47%	40% R 13% Fa	1 Local Hematoma 1 Subcutaneous infection	0 (NAO)	13.5 mo (8-26)	Previous Seton 4 MOT 35 min LOS 1.4 d
Sirikurnpiboon et al [23]	2013	Pros	41 20 LIFT 21 LIFT plus	40.7	31 male	36 TS (3 LTS, 33 HTS), 4 HS, 1 SP	NA	83% LIFT 83% vs LIFT-plus 85% P = 0.059.	Fa 7 LIFT 4 LIFT-plus 3	LIFT-plus 1 Anal fissure, 1 local hemorrhage LIFT 1 Anal fissure	0 (NAO)	19 wk	Healing time 4 wk R time 12 wk

Ca: Cancer; CD: Crohn's disease; CS: Cigarette smoking; DM: Diabetes; EC: Exclusion criteria; Fa: Failure; HIV: Human immunodeficiency syndrome; HS: Horseshoe fistula; HTS: High trans-sphincteric; IAR: Ileo anal reservoir; IHD: Ischemic heart disease; IS: Intersphincteric fistula; LI: Loop ileostomy; LOS: Length of stay; LTS: Low trans-sphincteric; MOT: Mean operative time; NAO: Not assessed objectively; NA: Not available; PL: Patients lost; PostOp: Post-operative; Pros: Prospective; PS: Previous surgeries; R: Recurrence; RA: Rheumatoid arthritis; RCT: Randomized controlled trial; RNA: Resumption normal activities; Retro: Retrospective; RFUVA: Risk factor in univariate analysis; RV: Rectovaginal fistula; SP: Supra-sphincteric fistula; TS: Trans-sphincteric fistula; WS: Wexner score.

two of these patients were men, with an average age of 48 years. The patch was derived from the submucosa of the porcine small intestine with a size of 4 cm × 7 cm, which overlaps the fistula tract for 1-2 cm. Fixation was performed to the puborectalis muscle and to the external anal sphincter with absorbable material. BioLIFT achieved a 94% success rate during an average follow-up period of 15 mo. There were two recurrences (one intersphincteric and one hemi-horseshoe). There was local induration and drainage from the operative wound that resolved without any intervention other than routine postoperative care in 12 patients. The degree of satisfaction reported was 100%.

Ooi *et al*[12] conducted a trial including 25 patients (17 males). The mean age was 40 years. Approximately 40% of the patients had been previously operated on, and the preoperative Wexner score of the cohort was 2. The healing rate was 68% with a mean follow-up period of 22 wk. The mean operative time was 39 min. There was no morbidity. The global postoperative Wexner score was 4. In the subgroup of patients who achieved healing, the Wexner score was 0. The mean healing time was 6 wk. All the recurrences (28%) were in the form of intersphincteric fistulas. The authors achieved a 72% patient satisfaction rate.

Aboulian *et al*[6] treated 25 patients (68% male) with 26 LIFT procedures. The mean age was 39 years. Of those patients, 65% had been previously operated on by drainage seton placement, and 27% of patients had failed to heal after treatment with another previous fistula technique. An average follow-up period of 27 wk was achieved. The healing rate was 68%. The morbidity reported was low and unrelated to the surgical procedure. In a later report of their series with a larger cohort and longer follow-up, patients who healed completely were contacted every 6 mo thereafter to assess for any recurrence of symptoms[7]. This group categorized patients with persistent symptoms or reappearance of symptoms before 6 mo as early failures. Late failures were those with resolution in the early period but return of symptoms after 6 mo. A total number of 38 patients were followed. The mean follow-up period was 26 mo, but 68% of patients had a follow-up period in excess of 12 mo. Only 18% of patients had previous fistula surgery, but 76% had received a drainage seton prior to the LIFT procedure. The study described a 61% healing rate after the first LIFT procedure. A total of 15 patients with failures were reported with a median time to the diagnosis of 4 mo. Of these patients, 12 failures were early type, and 3 failures were late type. Taking into account all failures, 4 were blind infected sinus, 2 occurred in the form of intersphincteric fistula (down-staging effect), and 9 occurred as the same trans-sphincteric fistula. In this series, the median healing time was 8 wk. No incontinence or morbidity was reported.

Sileri *et al*[13], in a prospective study, treated 18 patients (10 of them male), with a mean age of 39 years. All the patients had a history of abscess drainage and seton placement over a period of 6 to 8 wk. The healing rate was 83% with only 3 recurrences (one was intersphincteric treated with fistulotomy, and the others were 2 transsphincteric fistulas treated with seton placement and ERAF). The average follow-up period was 6 mo. The only morbidity reported was a thrombosed external hemorrhoid.

In one of the largest series described, Tan *et al*[14] analyzed the outcomes of 93 patients (82.8% male). The mean age reported was 40 years. Of the patients, 28% had been operated with another surgical technique before, and only 17.2% had a seton drainage for a mean time interval of 11 wk. The average follow-up period was 23 wk. The success rate was 86%, with a mean healing time reported of 4 wk. The recurrence rate was 6.4%, and the failure rate was 7.5%. Of the 7 patients with failure, 4 were down-staged the fistula to intersphincteric and treated with fistulotomy, and 3 patients had a blind sinus treated with silver nitrate and antibiotics. There were 6 recurrent transsphincteric fistulas. The mean time interval between treatment and failure was 22 wk. The authors described three types of failure. Type 1 is a localized failure or blind sinus characterized by secretion or discharge in the intersphincteric wound without evidence of primary opening and adequate granulation of the external orifice. Type 2 is a partial failure with down-staging of the fistula tract (the fistula is now intersphincteric), and type 3 is a total failure with the same previous fistula tract but without involvement of the intersphincteric wound.

Abcarian *et al*[15] reported the results of 40 patients with a mean age of 43 years. The cohort had an average of 2 previous surgeries. The healing rate was 74%, but those patients primarily treated with the LIFT procedure had a healing rate of 90%. In contrast, the patients with one previous surgery had a healing rate of 75%, and the patients with two or more previous surgeries had a success rate of 65%. The mean follow-up period was 18 wk. The authors did not report any functional change in continence.

Tan *et al*[16], in a retrospective study, compared endorectal advancement flap (ERAF) *vs* the LIFT procedure after all the patients had been operated on with seton placement. A total of 31 ERAF procedures were performed. The mean age of this population was 49 years (87.1% male). In this group, 58.8% of patients had been previously operated on, and the time interval between seton placement and ERAF was 13 wk. The total healing rate was 93.5%, with an average follow-up period of 6 mo. A total of 24 patients were included in the group treated by the LIFT procedure, with 87.5% of the patients being male and a mean age of 41 years. Only 25% of patients had been previously operated on, and the time interval between seton placement and the LIFT procedure was 14 wk. The mean follow-up period was 13 mo. A success rate of 62.5% was reported. The ERAF procedure was more effective in this study [healing: ERAF (93.5%) *vs* LIFT (62.5%); failure: ERAF (6.5%) *vs*

LIFT (37.5%), *P* = 0.006].

Mushaya *et al*[17], in a randomized and controlled trial, compared the LIFT and ERAF procedures. A total of 39 patients were included with a mean age of 47.8 years. In the LIFT group, there were 25 patients (17 males), and in the ERAF group, there were 14 patients (10 males). The mean follow-up period was 20 mo. The mean operative time of LIFT group was 10 min *vs* 42.5 min in the ERAF group (*P* < 0.001). The postoperative pain was greater in the ERAF group (visual analogue scale: ERAF 1 *vs* LIFT 0, *P* = 0.017). The satisfaction rate favored the LIFT procedure (9.5 *vs* 8.1, *P* < 0.001). The morbidity did not differ between procedures (4% bleeding in LIFT group, 7% partial dehiscence at the apex in ERAF group, and 8% dehiscence at perianal wound in LIFT group). The healing rate at one month was 85% and 68% for the ERAF and LIFT groups, respectively. At the end of the study, the success rates were 93% and 92%, respectively. The recurrence rates were similar (7% in the ERAF group and 8% in the LIFT group, *P* = NS). The interval between surgery and resumption of daily activities favored the LIFT procedure (*P* = 0.016). The functional outcomes were equal between both techniques.

In another attempt to improve the results, Han *et al*[18] described a technique using the insertion of a bioprosthetic anal plug in the fistula tract (LIFT-PLUG procedure). They reported their experience in 21 patients (19 of the male gender), and none had previously received an operation. The mean operative time was 20 min. The healing rate achieved was 95% over an average follow-up period of 14 mo. In this series, the mean healing time of the secondary opening was 2 wk, and at the intersphincteric wound, it was 4 wk (faster than previously reported). There was no morbidity. Only 5% of patients reported a Wexner score of 1. A larger randomized, multicenter prospective trial comparing LIFT-Plug with LIFT is in progress, including selected cases without previous surgeries (clinical trial number NCT01478139)[19].

Lehmann *et al*[20] reported the efficacy of the LIFT for recurrent anal fistulas exclusively. They included 17 patients, including 9 males, with a mean age of 49 years. In total, 47% of the fistulas were located posteriorly. Eleven patients had more than two previous surgeries, and six patients had more than 3 surgeries. Only 4 patients had been placed a seton drainage previously (the mean time of latency until the LIFT was 15 mo). The healing rate reported was 76.4%, but only 65% of patients presented complete healing during the mean follow-up period of 13.5 mo. The operative time was 35 min. In addition, 41% of patients received an operation on an outpatient basis with a length of stay in the cohort of 1.4 d. Only 2 complications were reported (local hematoma and subcutaneous infections). In the follow-up, 2 patients developed a recurrence, and 1 patient had a sinus. The complete healing rate was 47%, and the incomplete healing rate was 13% (a total of 60%). In addition, 40% of patients had persistence or recurrent fistula. No *de novo* incontinence was reported.

There are two interesting studies that have attempted to expand the existing indications for the procedure. In the first, van Onkelen *et al*[21] described 22 patients who had low transsphincteric fistula. Thirteen patients were male, and the mean age of the cohort was 45 years. Of the 9 female patients, 8 had an anterior fistula, and 10 patients of the cohort had previously received an operation. The healing rate was 82%, with 4 down-stages to an intersphincteric fistula treated by simple lay open. With these patients, the final success rate was 100%. All of the female patients achieved complete healing using the first LIFT procedure. The mean follow-up period was 19.5 mo. There was no fecal incontinence reported (using the Rockwood fecal incontinence severity index). The same group raises the possibility of use in conjunction the ERAF and LIFT procedure to prevent recurrence due to infection at the residual tissue[22]. The researchers analyzed the results of a series with 41 patients (32 of them male). The mean age was 42 years. In total, 48% had received previous operations (3 ERAF procedures). The LIFT procedure was performed first followed by the ERAF. A healing rate of 51% was reported with a mean follow-up period of 15 mo. Of the failures, 12 of the failures had drainage in the external opening and the intersphincteric wound, and only 8 had drainage in the intersphincteric wound alone. This subgroup of patients was treated by lay open fistulotomy with a secondary healing rate of 71%.

With a new modification of the surgical technique, Sirikurnpiboon *et al*[23] compared the effectiveness of adding a partial fistulotomy until the external sphincter (called the LIFT-PLUS procedure) in a prospective study of 41 patients. A total of 20 patients underwent the LIFT procedure (with only curettage of the tract and widening of the external opening), and 21 underwent the LIFT-plus procedure. The average age of the population was 40.7 years. The healing rate achieved was 83%, with a mean follow-up period of 19 wk. The median wound healing time was 4 wk, and the mean time to recurrence was 12 wk. There was no incontinence reported. Morbidity cases included one anal fissure and one local bleeding in the LIFT-plus group and one anal fissure in the regular procedure group. There were 7 treatment failures: 4 in the LIFT group (3 recurrences and 1 sinus abscess) and 3 in the LIFT-plus group (2 recurrences and 1 intersphincteric fistula). All of these patients were healed using the same technique without morbidity or change in continence status. The healing rate by group was 81% in the LIFT-procedure and 85% in the LIFT-plus group, respectively (*P* = 0.0529).

Lastly, a patient who underwent stapled hemorrhoidopexy and subsequently developed a remnant sinus tract that was successfully treated with the LIFT procedure[24].

COMPARISON OF THE RESULTS

In 1993, Matos *et al*[25] described a technique of excision of intersphincteric anal gland infection. They excised the

entire fistula tract, in addition to primary repair, by means of an intersphincteric approach by suturing the internal anal sphincter defect. Their success with 20 patients was only 45%. These poor results were attributed to blood supply issues that resulted in wound breakdown.

In the two studies comparing the ERAF against LIFT procedure, the results reported effectiveness of 94% *vs* 62.5% and 93% *vs* 92%, respectively[16,17]. In the former study, the follow-up was shorter for the ERAF group[16]. It is also important is the larger proportion of patients with previous fistula surgeries in the ERAF group, a possible selection bias. The reported success rate of the ERAF group was unusually higher than previously reported in other trials[26,27]. In these previous studies, the authors did not objectively evaluate functional outcomes. Nevertheless, there have been reports citing incontinence rates of up to 35% after ERAF[28].

Not all studies specifically stated the types of fistulas treated. Although the procedure is theoretically ideal for high transsphincteric fistulas, the most common type of fistula was transsphincteric. In addition, van Onkelen *et al*[21] described the results of the procedure in the treatment of low transsphincteric fistulas. They reported a final and secondary healing rate of 100% without effect on continence. Bokhari *et al*[29] reported that major and minor incontinence after fistulotomy for low fistulas reached up to 5% and 11%, respectively. These authors noted that the other factors taken into account for a greater risk of incontinence are female sex and anterior fistulas or at-risk for obstetric history[29]. Garcia-Aguilar *et al*[30] reported major and minor incontinence after fistulotomy for low transsphincteric fistulas in 44% of their patients. They also observed that female sex and an internal opening located in the midline anteriorly were predictive factors of impaired continence after fistulotomy[30]. Cavanaugh *et al*[31] demonstrated that only the amount of external anal sphincter divided correlated with fecal incontinence in severity index scores. It appears possible that the division of the lower part of the external anal sphincter can be avoided in the treatment of transsphincteric fistula using the LIFT procedure.

Two studies reported the routine ligation of the primary internal orifice in their application of the LIFT technique[5,6]. During the LIFT procedure, Wallin *et al*[5] no-touched the primary opening in 87% of cases, ligated them in 8% of cases, performed a partial internal sphincterotomy in 4% of cases, used Alloderm® in 5% of cases and created a mucosal flap in 1% of cases. In a univariate analysis, only the use of biologic mesh displayed a tendency for healing, but the proportions of patients were scarce and did not reach statistical significance. In the study written by Aboulain *et al*[6], the primary internal opening was closed in the mucosal side within the anal canal to prevent the entry of new infective agents. They achieved a healing rate of 68%.

Specifically, the use of a bioprosthetic mesh (Bio-LIFT procedure) reported a 94% success rate, and the use of a plug (LIFT-PLUG procedure) resulted in a reported cure rate of 95%[11,18]. The BioLIFT technique has two potential disadvantages. First, it requires a more extensive dissection in the intersphincteric space. The physiologic consequences of this dissection have not been studied and are unknown. The second disadvantage of both techniques is the relatively high cost of the bioprosthetic materials. The healing time in the study that used the PLUG was 2 wk for the secondary external orifice and 4 wk for the intersphincteric wound (faster than previously reported)[18]. These series do not conclusively demonstrate a benefit that would justify the increased cost of the use of a bioprosthetic material. The addition of the partial excision of the fistula tract (partial fistulotomy) until the external anal sphincter is reached (LIFT-plus), or the use of both techniques (LIFT and ERAF procedures) simultaneously in the same patients, did not display any advantage[22,23]. To date, there have been no prospective randomized trials comparing the modifications made to the original technique.

Although most studies include a high percentage of previously treated patients, the results in a series of patients with only recurrent fistulas indicated a cure rate of 47%. The scarring following the resolution of the inflammatory post-surgical response can result in fibrosis and obliteration of the intersphincteric space. This makes the dissection in the intersphincteric plane difficult. Tan *et al*[16] concluded that given the simplicity of the LIFT procedure, clinicians should still perform the LIFT procedure in patients presenting for the first time and recommend the ERAF procedure in patients with multiple previous surgeries and a scarred perianal region.

Only one trial classified the therapeutic failures as early (80%) and late (20%)[7]. In this trial, Aboulain *et al*[6] recommended that in patients with persistent symptoms it may be prudent to observe and manage symptoms with local care up to 6 mo before planning for additional treatment. The researchers affirmed that it is important to individualize all cases because some patients may require earlier intervention if their symptoms worsen or develop significant sepsis[6,7]. Tan *et al*[16] considered that meticulous dissection along the intersphincteric plane while maintaining the integrity of the internal sphincter and the anal mucosa is critical. Any breach or buttonhole of the anal canal mucosa during the procedure can lead to a higher risk of failure. Taking into account the classification previously described for recurrences and the results of 12 studies, nine cases were type 1 (blind sinus), thirty-two cases were type 2 (intersphincteric fistula) and forty-seven cases were type 3 (transsphincteric fistula)[4-7,12-14,16,17,21-23]. The recommended treatments are local measures for type-1 failures, fistulotomy for type-2 failures, and reperforming the LIFT procedure or ERAF procedures for type-3 recurrences.

The risk factors for failure were obesity, smoking, multiple previous surgeries and the length of the fistula track[7,15]. In a retrospective study, the healing rate for patients without previous surgery was 95%, whereas the rate for those with multiple surgeries was 65%[15]. A pre-

viously unreported finding was that for every one centimeter increase in fistula length, the odds ratio for healing decreased by 0.55 (95%CI: 0.34-0.88, $P = 0.01$). In this study, the median length of fistula tract was shorter in the healed group compared with the failed group (4 cm *vs* 6 cm, $P = 0.004$). After choosing 3 cm as an arbitrary cutoff point, fistula tracts under three centimeters had significantly higher primary healing (85% *vs* 48%, $P = 0.04$). In addition, 66% of this cohort had a tract length of more than 3 cm[7]. van Onkelen *et al*[22] reported that a past history of previous surgeries, seton placement, lateral localization of primary opening and horseshoe extension showed a trend for recurrence. Sirikurnpiboon *et al*[23] described that body mass index was the only predictor factor for failure in a univariate analysis. Failure to identify the fistula tract occurred more often in obese patients with a body mass index of more than 30 kg/mt^2 ($P = 0.001$).

There were fourteen complications, which included anal fissures (4), bleeding (3), intersphincteric wound dehiscence (2), vaginal candidiasis (2), chronic anal pain (1), a thrombosed external hemorrhoid (1), and a subcutaneous infection (1). All these were mild and resolved with conservative treatment. It is important to mention that only four trials used a standardized scale to assess functional outcomes[12,18,21,22]. In summary, no de novo incontinence developed secondary to the LIFT procedure with an overall follow-up period of 42.3 wk.

Only 10 of 18 studies reported the use of a seton before LIFT procedure[5,7,11,13,14,16,17,20-22]. For the LIFT procedure be effective, an epithelialized well-formed tract is advised. In theory, if the tract is inflamed or in the absence of enough granulation tissue, there may not be adequate tissue strength to permit ligation. However, Mitalas *et al*[32], found no correlation between prior seton drainage and the presence of epithelium. None of the studies in this review indicated a benefit in using a seton before LIFT procedure.

CONCLUSION

The currently available information indicates that the LIFT procedure is a feasible and effective surgical technique, with low impact on fecal continence. Its main indication is for transsphincteric fistulas in patients without previous surgery and with short fistula tracts. Patients with more complex fistulas, especially with multiple previous surgeries, should be considered for the ERAF procedure. There is a lack of evidence to recommend the combined use of prosthetic materials or to perform the combined LIFT-ERAF procedure. Further randomized controlled trials are needed to recommend routinely the LIFT procedure against other surgical techniques for anal fistulas.

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