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# Long-Term Outcomes of Ligation of the Inter-Sphincteric Fistula Tract Plus Bioprosthetic Anal Fistula Plug (LIFT-Plug) in the Treatment of Trans-Sphincteric Perianal Fistula

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**Background:** The ligation of the inter-sphincteric fistula tract plus bioprosthetic anal fistula plug (LIFT-plug) is a new procedure in the treatment of trans-sphincteric perianal fistulas. The aim of this study was to evaluate its long-term outcomes.

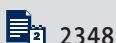
**Material/Methods:** Clinical data of 78 patients with trans-sphincteric perianal fistula who were managed by the LIFT-plug technique between March 2014 to October 2016 were analyzed retrospectively. The operation time, healing rate, postoperative complications, recurrences, and length of stay were reviewed.

**Results:** No serious complications occurred during the operation in all patients. The median follow-up was 30 months (16 to 47 months), clinical healing of the anal fistula occurred in 75 patients (96.2%). The median operative time was 25 minutes (18 to 45 minutes). The mean complete healing time was 16 days (9 to 46 days). The median healing time for the external anal fistula opening was 2 weeks (range, 2 to 3 weeks), and the inter-sphincteric groove incision healing time was 4 weeks (range, 3 to 7 weeks). The median hospital stay after operation was 5 days. Fistula recurred in 2 patients because of spontaneous expulsion of the plug at 7 days post-surgery; perianal abscess occurred in 1 patient. The anal function was evaluated in 70 patients of the 78 patients. Perfect control of continence was recorded for 97.1% of the patients (68 out of 70 patients). Two patients were identified to a rare complication of gas incontinence (Wexner score 1).

**Conclusions:** LIFT-plug procedure for the treatment of trans-sphincteric fistulas is a simple procedure with a high healing rate, minimal invasiveness, quick healing, and without disturbance to anal function. LIFT-plug is an ideal procedure for trans-sphincteric fistula.

**MeSH Keywords:** **Acellular Dermis • Cutaneous Fistula • Outcome Assessment (Health Care) • Surgical Instruments**

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## Background

Anal fistula is a widespread condition in the population worldwide, and has been a troublesome pathology for both patients and physicians throughout surgical history. The incidence in men and women is 12.3 per 100 000 and 5.6 per 100 000, respectively. Symptoms, including pain and discharge of pus from the external opening, often cause great discomfort and may contribute to a decreased quality of life.

As bacteria continuously enter into the fistula through the internal opening and the inflammation inside the fistula persists, the anal fistula cannot heal spontaneously. So, treatment for fistula-in-ano is almost universally surgical. The surgical techniques for treatment of fistula-in-ano include fistulotomy, fistulectomy, cutting setons, and endorectal advancement flaps. However, the procedure has a high incidence rate for incontinence and fistula recurrence. Sphincter preserving techniques, such as fibrin sealant injection, fistula plugs, and the ligation of inter-sphincteric fistula tract (LIFT) procedure have been developed. LIFT was originally introduced by Rojanasakul et al. [1] with an initial success rate of 94%. However, since then, several centers have reported success rates varying from 18% to 94% [2–4]. In order to improve the success rate, Wang et al. modified the LIFT procedure (named LIFT-plug) by combining LIFT with the technique of anal fistula plug [5], and found that the success rate reached 95%.

However, there are few studies on LIFT-plug procedure at present, and the follow-up time is relatively short. This study was conducted to analyze the long-term efficacy of LIFT-plug in the treatment of trans-sphincteric perianal fistula.

## Material and Methods

### Patient selection

From March 2014 to October 2016, 78 patients (54 males, 24 females) with a single trans-sphincteric perianal fistula underwent LIFT-plug operation by the same doctor (WZJ) in Beijing Chaoyang Hospital. If patients were excluded from this study if they had multiple fistula tracts or preexisting incontinence, fistulas with active inflammation or purulence, or fistulas associated with Crohn's disease, cancer, tuberculosis, or acquired immune deficiency syndrome, or if the patient was pregnant, had psychiatric disorders or was unable to comply with protocol requirements.

The diagnosis of trans-sphincteric perianal fistula was made by patient medical history, digital rectal examination, proctoscopy, and endoanal ultrasound examination. The preoperative incontinence rate was measured using the Wexner incontinence

scale. The study protocol was reviewed and approved by the institutional review committee of Beijing Chaoyang Hospital.

The study patients were informed of LIFT-plug procedure 1 day before the surgery and written consent were obtained. Written informed consent with explicit mention of the innovative characteristics of the plug procedure was also obtained.

Clinical healing was determined through physical examination, if the symptoms and signs of anal fistula disappeared, and if the internal opening, external opening, and inter-sphincteric groove wound closed, without wound infection or perianal abscess formation.

### Surgical technique

Intestinal preparation was done by oral administration of 400 g polyethylene glycol 1 day before surgery. Local skin preparation was made in the operative field. If the patient was not allergic to beta-lactam, prophylactic antibiotic (cefoxitin, 2 g, intravenously) was used 30 minutes before surgery. Epidural, lumbar, or general anesthesia and left lateral decubitus position was utilized.

The surgical technique was similar to that as previously described by Han et al. [5]. The external opening was identified and enlarged for drainage. Then a metal fistula probe was inserted into the fistula tract from the external opening to observe the alignment of the fistula and the position of the internal opening. A 1.5 cm to 2.0 cm curvilinear incision was made along the inter-sphincteric groove above the fistula tract. After the tract was dissociated, the probe was removed. A separate fistula was formed between internal and external sphincters and the fistula was cut as close as possible to the internal sphincter, and the fistula opening was sutured at the internal sphincter with a 3/0 absorbable suture. The fistula was retained from the external sphincter to the external opening. The infected granulation tissue was gently scraped away and washed with metronidazole saline. A 3×5 cm sheet of human acellular dermal matrix (ADM) (Qingyuanweiye Inc., Beijing, China) was soaked in saline for 5 minutes and rolled into a conical configuration, trimmed to the appropriate width as a plug, then the ADM was introduced from the external opening into the fistula tract and was sutured and fixed with a 3/0 absorbable sutures at the external sphincter. Excess ADM material that extended from the external opening was trimmed to the skin, without fixation. The wound was sutured intermittently with 3/0 absorbable sutures loosely.

### Postoperative protocol

Antibiotics (cefoxitin) were given for 2 days after surgery. If necessary, the dressing was changed daily to keep the

incision clean. All patients were required to have a fluid diet within 3 days and oral stool softener for 1 week postoperatively. After hospital discharge, using a shower was allowed, but swimming, sexual activity, and lifting weights were not recommended within the first 2 weeks. Patients were required to monitor changes of incision, and if necessary, contact their surgeon in a timely manner.

After discharge, patients were evaluated weekly at the outpatient clinic until the incision healed completely. Anal function was evaluated by the patient filling out a questionnaire (Wexner incontinence scale) at each outpatient review. The healing status of the previous internal and external openings, and the inter-sphincteric incisions were examined during outpatient examinations, and sphincter tension was assessed by rectal digital examination. Data on operating time, healing time, postoperative complications, recurrences, and length of stay, as well as data on other morbidities were collected and analyzed during hospitalization or from the last outpatient visit.

SPSS (version 15.0) was used for statistical analysis of the data. Data was expressed as the median with ranges for continuous variables.

## Results

From March 2014 to October 2016, a total of 78 patients (54 males and 24 females, median age 43 years with age range from 23 to 62 years) underwent the LIFT-plug procedure (Table 1) for trans-sphincteric anal fistula and were included in this retrospective study. The fistula in all patients was confirmed as a trans-sphincteric anal fistula before operation. Each patient had only 1 anal fistula and the median duration of the disease was 9 months (range, 2 to 56 months). The median distance between the external opening and the anal margin was 3 cm (range, 2.5 cm to 5 cm).

Preoperative anal function of all patients was normal (Wexner score 0). There were no intraoperative complications observed. The median admitted time was 8 days (5 to 14 days). The median operating time was 25 minute (18 to 45 minutes). Out of 78 patients, 75 patients (96.2%) had an uneventful healing. One patient developed an abscess in the fistula where the plug was placed at 5 days post-surgery. Then the abscess was drained, and the plug was removed. A fistula recurred in 2 patients because of spontaneous expulsion of the plug at 7 days post-surgery (Table 2).

The median follow-up was 30 months (16 to 47 months), with a success rate of 96.2% of patients (75 out of 78 patients). The mean complete healing time was 16 days (range, 9 to 46 days). The median healing time of external anal fistula opening was

**Table 1.** Demographic and clinical data.

Total number of patients	78
Sex (Male/Female)	54/24
Median age, y (range)	43 (23–62)
Surgical procedures per patient before LIFT-plug	None
Fistula type	Transsphincteric fistula

**Table 2.** Outcomes of LIFT-Plug procedure.

Operation time, median (range)	25 (18–45) minutes
Follow-up period, median (month)	30 (16–47) months
Median time of healing median (range)	16 days (9–46) days
Healing rate	96.2% (75/78)
Recurrence rate	2.67% (2/75)
Postoperative complications	Abscess (1) Spontaneous expulsion of the plug (2) Gas incontinence (2)
Length of stay	8 (5–14) days

2 weeks (range, 2 to 3 weeks), and that of incision between sphincteric procedures was 4 weeks (range, 3 to 7 weeks).

Anal function was assessed at the last follow-up in 70 patients of the 78 study patients. Perfect control of continence was reported for 97.1% of patients (68 out of 70 patients). Two patients were identified to have a rare complication of gas incontinence (Wexner score 1).

## Discussion

LIFT-plug is a novel method for treating trans-sphincteric fistula, which was first proposed and applied in 2011 [5]. So far, there are few studies that have reported on this method, and the reported follow-up time of studies was short. The aim of this study was to evaluate the long-time results and efficacy of the LIFT-plug procedure.

Anal fistula is a pathological connection between the anus and skin in its surroundings. The main reason for the formation of an anal fistula is a bacterial infection of the glands within the anal crypts. Other reported causes include tuberculosis, Crohn's disease, a foreign body, or trauma in the scrotal region. The principles of surgery in the treatment of anal fistula

include elimination of inflammation and bacterial infection, with minimal interference with the anal sphincter apparatus, which might potentially lead to postoperative incontinence of gas and/or stool.

Fistulotomy or fistulectomy is a simple, safe, and effective treatment for low anal fistulas. It is not advised for high anal fistulas, as it might lead to an unacceptable risk of incontinence, postoperative pain, bleeding, and delayed wound healing [6–8]. It is for these reasons that several more complex surgical alternatives have evolved to attempt to cure high fistulas while minimizing the incidence of anal incontinence.

Fibrin glue was first used in the treatment of anal fistulas in the early 1980s with reasonable results [9,10]. Since 1991 [11], more and more articles have been published with favorable results using fibrin glue for the treatment of anal fistulas. But more recently, there have been a lot of doubts due to its poor long-term results [12–14]. Park et al. [15] showed that there was no significant difference between tissue fibrin sealant and autologous fibrin glue in a group of 43 patients. Cirocchi et al. [16] found that the healing rate was higher in a surgical group than in a fibrin glue group. Additionally, the use of fibrin glue sealant with antibiotics does not improve the healing rate. A large number of literature reports have shown that fibrin glue is not always effective in the treatment of anal fistulas [17].

The LIFT procedure was first described by Rojanasakul et al., with very promising initial results. Since then, LIFT has been used as a sphincter-sparing technique to repair anal fistulas. The main advantage of the LIFT procedure is that it is simple, safe, and does not damage the anal sphincter, and rarely causes fecal incontinence. However, the success rate of LIFT varies from 40% to 95%, and the recurrence rate is also high, ranging from 6% to 28% [18].

LIFT-plug was first reported by Wang et al. in 2011 [5]. This method combined the LIFT technique and the use of an anal fistula plug made of ADM. ADM is a kind of allogenic tissue graft derived from human skin, which has been used commercially. Han et al. [19] found that ADM enhances resistance to infection and contamination in an animal model. Also, Beniker et al. [20] reported that ADM may be used as a scaffold for periosteum regeneration by allowing for cellular repopulation and revascularization. ADM has been widely used in the treatment of anal fistulas. Safar et al. [21] used Cook Surgisis AFP™ anal fistula plug for the management of complex anal fistulas, and found the overall success rate was just 13.9%. Adamina et al. [22] studied the use of anal fistula plugs for complex anal fistulas of cryptoglandular origin, and found that a total of 26 patient (56.5%) had a median recurrence time of 24.8 months. The 6-month clinical recurrence rate was 30.7%. After 1 year the recurrence rate increased to 40.2%, and after

2 years it increased to 48.0%. Chan et al. [23] reported that 22 patients (50%) had successful healing following the insertion of a plug with an overall success rate of 23 out of 62 plugs inserted (35%) with a follow-up of 10.5 months. Chan et al. believed that the reasons for such a high plug failure rate may be due to a relatively high rate of infection as a result of premature closure of the external opening and also inadequate preparation of chronic tracts. In our study, the LIFT-plug technique had a 96.2% success during the 30-month median follow-up period, superior to LIFT or ADM alone.

Parthasarathi et al. [24] and Ooi et al. [25] found that the median healing time of LIFT procedure was 4 weeks and 6 weeks, respectively. Vergara-Fernandez [26] reviewed the current literature published from January 2009 to May 2013 about the LIFT procedure, and found that the mean healing time was 5.5 weeks. In our study, the mean time of complete healing was 16 days, significantly shorter than the LIFT procedure. As ADM can be used as a scaffold for periosteum regeneration by allowing for cellular repopulation, revascularization, we propose that this addition of an ADM into the outer part of fistula might accelerate fistula healing.

Continence impairment is an important consideration for surgeons in the treatment of complex anal fistula. The risk depends mainly on the extent of external sphincter muscle injury. Traditional methods, such as cutting seton, fistulectomy, fistulotomy, and advancement flaps, result in varying degrees of incontinence. García-Aguilar et al. [27] and Schouten et al. [28] found respectively that 67% of patients who underwent cutting seton and 35% of patients who underwent advancement flap had fecal incontinence. The procedure of fibrin glue, fistula plug, and LIFT are all sphincter protection techniques, with minimal impact on continence. Similarly, with LIFT procedure, LIFT-plug can also protect the internal and external sphincters by working in the inter-sphincteric plane. Compared with the LIFT procedure, no major incontinence was found in our study.

The current study had several limitations. One limitation was its nonrandomized and retrospective single-institution design. Patients were selected to undergo LIFT-plug treatment, but were not randomly selected, possibly introducing selection bias. A larger prospective, randomized, multicenter study will be needed in the future. Additionally, factors, like smoking, diabetes, Crohn's disease and tuberculosis, which can affect LIFT-plug efficacy were not tracked in the current study. In addition, for some patients who could only be followed up by telephone, it was sometimes difficult to accurately assess the recurrence of anal fistula.

## Conclusions

The advantages of this study included the large sample size and long follow-up time (median 30 months). According to our findings, the LIFT-plug procedure is simple, safe and effective in treating trans-sphincteric fistula with little or no risk of fecal

incontinence. It can be used as a first-line treatment for patients with trans-sphincteric fistula.

## Conflict of interest

None.

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