Techniques in Coloproctology (2019) 23:1009–1013
https://doi.org/10.1007/s10151-019-02087-7

TECHNICAL NOTE

Fissurectomy with vertical non-full-thickness sphincterotomy for chronic anal fissure

A. Tsunoda[1] · T. Takahashi[1] · H. Kusanagi[1]

Received: 10 January 2019 / Accepted: 8 September 2019 / Published online: 24 September 2019

Introduction

Lateral internal sphincterotomy (LIS) remains the mainstay of treatment for chronic anal fissure (CAF) [1]. This procedure commonly involves division of the internal anal sphincter (IAS) from its distal end to either the proximal end of the fissure or the dentate line. Overall healing rates after LIS are 94%, but 3.4–4.4% of patients develop anal incontinence [1]. The risk of fecal incontinence specifically is reported as low but significant to the patient [2].

There has been an interest recently in sphincter-sparing surgery, including fissurectomy and anal advancement flap (AAF). Fissurectomy was combined with posterior midline sphincterotomy, but this technique can be complicated by "key-hole" deformity of the anal canal with fecal soiling [3]. "Key-hole" deformity is occasionally seen as a late complication of CAF [4].

Vertical non-full-thickness sphincterotomy (VNTS) in the bed of the fissure, using intraoperative endoanal ultrasound (EAUS), was developed to avoid "key-hole" deformity and to promote healing by decreasing anal hypertonia. The aim of this study was to evaluate the safety and efficacy of fissurectomy combined with the VNTS in the treatment of CAF.

Materials and methods

Selection criteria

Consecutive patients with CAF seen by a single proctologist at the district hospital from November 2014 through June 2018 were recruited in the primary cohort. One hundred and eleven patients with CAF, none of whom suffered from incontinence or had an abnormally low sphincter pressure on anal manometric examination were assigned to a ≥ 6-week course of medical therapy with 2% diltiazem gel twice a day applied to the edge and just inside the anal canal [1]. Patients were followed for 2 months after this treatment, and 30 patients with non-healed or recurrent fissure were eligible for the study. Of the 30 patients, 26 decided to proceed to surgery. Anal continence was evaluated using the Fecal Incontinence Severity Index (FISI) score [5]. A retrospective analysis of prospectively collected data was performed. The study was approved by the Ethics Committee of Kameda Medical Center (reference number 14-052), and all patients gave written informed consent. Since this was a preliminary study which evaluated the feasibility of the novel procedure using intraoperative EAUS, the sample size of 26 is appropriate.

Surgical procedure

All patients were operated on under spinal anesthesia by the same surgeon (A.T.) specialized in coloproctology. Patients with posterior fissure were placed in lithotomy position and those with anterior fissure in prone jackknife position. After examination of the fissure using a bivalve speculum, the fibrotic edges were removed with diathermy. Then, a triangle piece of perineal skin was excised at the distal edge of the fissure allowing wound drainage. If present, a sentinel skin tag or a hypertrophied anal papilla was excised. Then, EAUS was performed using a B–K Medical ultrasound system, an endoprobe with a 6–12 MHZ linear transducer (Type 8838) covered with a water-filled hard sonolucent plastic cap, which is 17 mm in diameter (B-K Medical, Herlev, Denmark). To divide approximately half the thickness of the IAS vertically, intraoperative EAUS was used. The examination was performed by a single colorectal surgeon with experience in EAUS (T.T.). After the speculum

✉ A. Tsunoda
tsunoda.akira@kameda.jp

[1] Department of Gastroenterological Surgery, Kameda Medical Center, 929 Higashi-cho, Kamogawa City, Chiba 296-8602, Japan

was extracted, a straight fistula dissector was put onto the fissure, so that the image of the metal along the fissure could be taken on the linear (two-dimensional) image. After the dissector was pulled back, the thickness of IAS on the fissure at about 2–4 mm and 6–8 mm from the distal edge of the IAS was measured, and the average thickness of the IAS was computed. Inserting the speculum again, vertical division of the IAS on the fissure was carried out from the lower edge of the IAS up to the fissure apex. The IAS was divided using a number 15 knife blade linearly, little by little, and as equal in the depth as possible along the original vertical incision. Every time the IAS was divided slightly, the thickness of the remaining IAS was measured using EAUS and the average thickness was calculated in the same manner described for the calculation of average thickness before division. The division was repeated until the remaining IAS was approximately half its original thickness. Patients with fissures on both anterior and posterior sides underwent the HDHS on the more significant lesion, and fissurectomy only on the other lesion. The speculum was opened ≤ 3 cm in diameter and was in place less than 30 min during surgery.

Assessments and follow-up

Clinical follow-up

Outpatient follow-up examinations were carried out on a monthly basis until the wounds had healed completely. Three months after surgery, anal continence was assessed using the FISI score. Further clinical follow-up was performed for those with continuing symptoms. Patients were followed by phone or through outpatient visits depending on their preference or the severity of symptoms. The primary outcomes were the resolution of pain and bleeding. Postoperative complications and recurrence were recorded.

Anorectal manometry

Anorectal manometry was performed before and 3 months after surgery. Anal pressure was measured with a catheter-tip pressure transducer. All evaluations of manometric data were performed by the same examiner.

Statistical analysis

All data analyses were performed using the SPSS™ statistical software package (SPSS, Chicago, IL, USA). Continuous variables were compared using the Wilcoxon singed rank test for paired data, and categoric variables were compared using the Chi squared test or the Fisher's exact test. The results are expressed as the median and 95% confidence interval (CI). A value of $p < 0.05$ was considered statistically significant.

Results

Patient demographics and anal fissure details are shown in Table 1. There were 26 patients, 19 men and seven women with a median age of 42 years (95% CI 39–52 years). The fissure was on the posterior midline in 20 patients, anterior in three, and on both sides in three patients.

The median operating time was 37 min (95% CI 32–40 min). Four patients had an associated anal procedure (i.e., two had hemorrhoidectomy and three had rubber band ligation). The median length of hospital stay was 2 days (95% CI 2.0–2.2 days) and median duration of follow-up was 23 months (95% CI 19–31 months). There were no postoperative complications and no cases of "key-hole" deformity. Fissure healing was achieved in 25 (96%) of patients within 4 months after the procedure. Before surgery, all patients had complained of anal pain or bleeding. Twenty-five patients had complete resolution of their symptoms following the procedure and one who had an unhealed fissure, continued to be symptomatic. This patient underwent advancement flap repair 5 months postoperatively and her symptoms resolved. At diagnosis, five patients had an intersphincteric fistula under the fissure, located less than 4 mm from the distal edge of the IAS. Lay open of the fistula and vertical division of half thickness of the remaining IAS at the level of the fissure were performed in these patients.

During the VNTS procedure, EAUS was repeated two or three times until the remaining IAS was approximately half its original thickness (Fig. 1a, b). The ultrasound scans of the IAS before division and the half-divided IAS under the fissure are shown in Fig. 2a, b. The median thickness of the IAS at the level of the fissure before and after HDHS was 1.7 mm (95% CI 1.5–1.9 mm) and 0.8 mm (95% CI

Table 1 Patients and fissure characteristics

Age (years)	42 (38–52)
Sex	
Male	19
Female	7
Presenting symptoms	
Pain	25
Bleeding	25
Constipation	6
Fissure position	
Posterior	20
Anterior	3
Both sides	3
Associated with fistula	5
Duration of symptoms (months)	10 (17–101)

Values are presented as *n* or median (95% confidence interval)

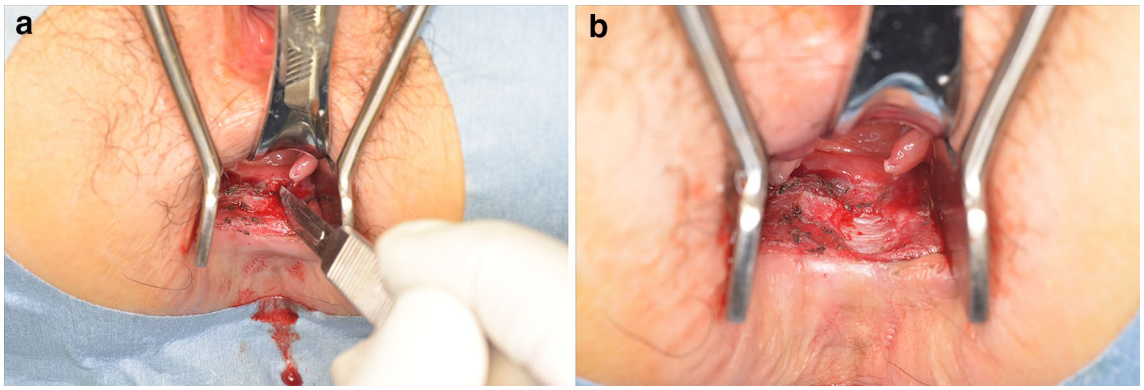

Fig. 1 **a** After fissurectomy, the internal anal sphincter is divided linearly using a number 15 knife blade. **b** Approximately, half the thickness of the internal sphincter was divided vertically up to the fissure apex

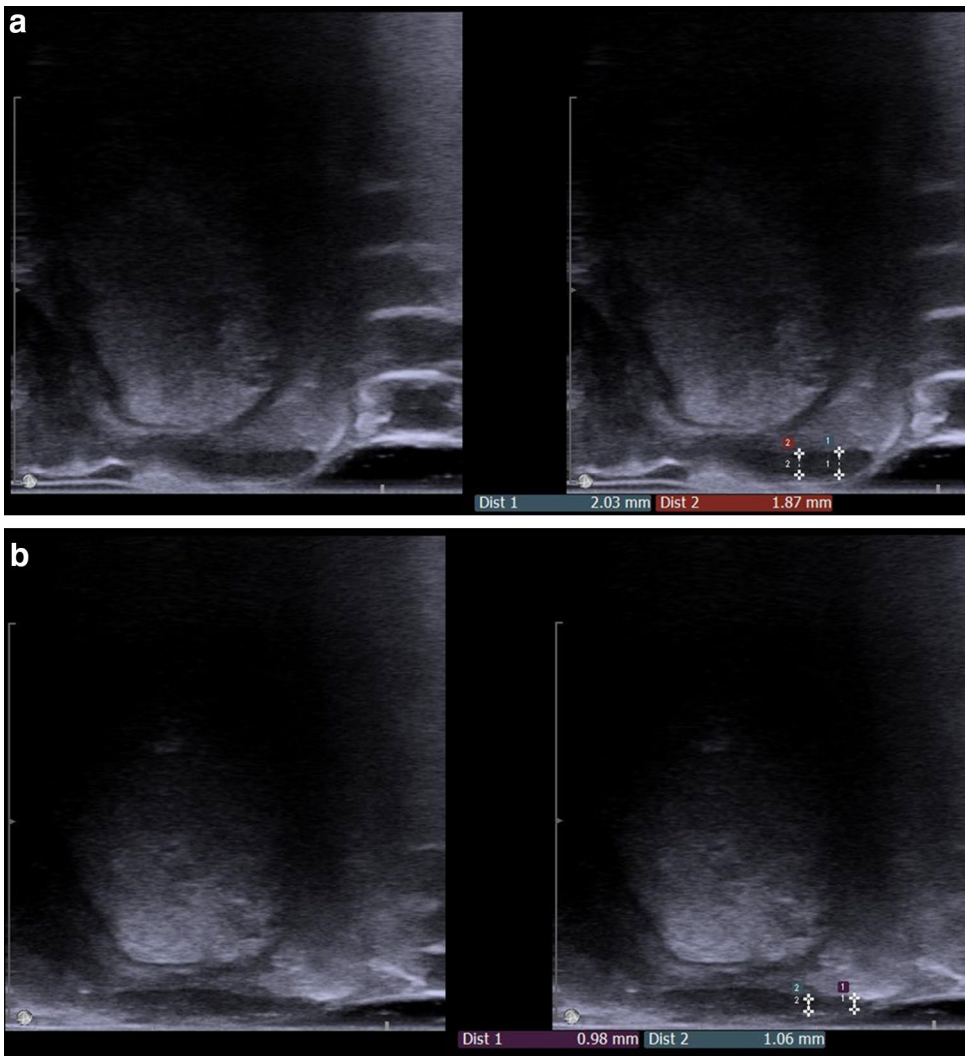

Fig. 2 **a** The ultrasound scan of the internal anal sphincter under the fissure. The mean thickness of the internal anal sphincter was 2.0 mm. **b** The ultrasonography after non-full-thickness sphincterotomy up to the fissure apex. The mean thickness of the remaining internal anal sphincter was 1.0 mm

0.8–1.0 mm), respectively ($p < 0.0001$) (Fig. 3). Twenty-one patients (81%) underwent a manometric study before and after surgery. Five refused the examination postoperatively (Table 2). Maximum anal resting pressure was significantly reduced 3 months after surgery [141 cmH_2O (95% CI 123–162) versus 117 cmH_2O (95% CI 106–133), $p = 0.01$],

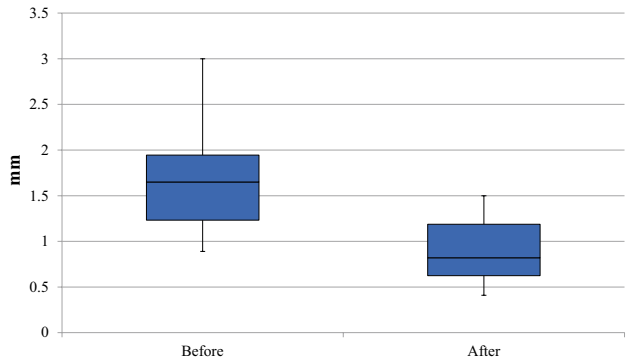

Fig. 3 Thickness of the internal anal sphincter before and after surgery. Boxes show median values with upper and lower quartiles. The vertical line extends from the minimum to the maximum values

Table 2 Manometric measurements before and 3 months after horizontal division of half the internal anal sphincter

Anal pressure, cmH_2O	Before ($n=21$)		After ($n=21$)		p^a
	Median	95% CI	Median	95% CI	
Resting pressure	141	123–162	117	106–133	0.01
Squeeze pressure	390	310–428	358	305–418	0.79

CI confidence interval

[a]Wilcoxon signed rank test

Table 3 Incontinence before and 3 months after horizontal division of half the internal anal sphincter

	Before	After
Gas	0	0
Mucus	0	1
Liquid stool	0	0
Solid stool	0	0

but maximum anal squeeze pressure did not change significantly. The preoperative FISI score was 0 in all patients. The median follow-up FISI score was 0 (95% CI –0.2 to 0.6). One patient had mucus discharge at 3 months but at telephone follow-up at 6 months reported that this has resolved (Table 3).

Discussion

This study demonstrated that fissurectomy in combination with VNTS achieved an excellent healing rate of 96% after a median follow-up of 23 months. The procedure was safe with low morbidity, and only 1 patient reported mucus discharge at 3 months. Intraoperative EAUS was effective for evaluating the thickness of the IAS in this study, although the use of ultrasound examination has not been the standard of sphincter evaluation in fissure surgery.

The theoretical advantage of VNTS is that avoids total vertical division of the IAS like LIS and, therefore, may reduce the risk of incontinence. Also, VNTS was not complicated by "key-hole" deformity of the anal canal, which can occur with fecal soiling after posterior midline sphincterotomy [5–7]. Concomitant lesions such as fibrotic edges, sentinel tags or hypertrophied papilla were removed during fissurectomy, because it is recognized that these lesions are the major causes of recurrence after sphincterotomy [6]. Since a 4-cm dilation of the anal canal alone was shown in a randomized trial to have a high cure rate (94%) in CAF, without incontinence [7], the present procedure should be compared to pneumatic balloon dilation, or LIS as a gold standard procedure.

EAUS has been acknowledged as the standard for evaluation of the anal sphincter complex in anorectal surgery [8]. Modern ultrasound technology includes a variety of probes. The BK 2052 type probe (BK Medical, Herlev, Denmark) has been especially popular because of its higher frequency and automatic acquisitions that produce reliable measurements [9]. A new probe type 8838 was claimed to produce images with higher resolution compared to the standard BK 2052 [10]. The 2052 transducer produces axial two-dimensional images at the beginning, before creating three-dimensional images and longitudinal images of the anal sphincter complex. However, it can be difficult to point out the exact fissure site on the images and to measure the thickness of the IAS under the fissure. After the fissure site was indicated using a fistula dissector placed on the fissure, the thickness or length of dividing IAS on the fissure were measured easily by using the 8838 transducer intraoperatively.

VNTS has some disadvantages. First, intraoperative EAUS evaluation of the IAS is needed. Second, great care is required when dividing the IAS linearly using a knife blade. Third, the median length of time for the wound to heal in this series was 3 months, which was longer than that after LIS or AAF [3].

In this study, half the thickness of the IAS was divided vertically up to the fissure apex, which caused a postoperative decrease in resting anal pressure, and may contribute to heal the fissure by improving anal blood flow. It is not certain, however, how far the IAS should be divided vertically. Dividing one third of the thickness of the IAS vertically may be enough to achieve satisfactory results or dividing two-third thickness of the IAS may deteriorate continence. Nevertheless, it may not be easy to control the extent of division, because of the thickness of the IAS under the fissure which was 1–3 mm in our study.

The presence of a fistula at the site of the fissure is not a contraindication because the fistula could be treated at the time of fissure surgery as it was the case in 5 patients in this study, who underwent lay open of the fistula and the

vertical division of half thickness of the remaining IAS on the fissure.

Our study has several limitations. First, sample size was small. Second, postoperative pain was not evaluated with a pain score. Third, postoperative EAUS was not performed. Fourth, this is was a controlled study. Fifth, the median follow-up of 23 months is rather short.

Conclusions

Although fissurectomy combined with VNTS needs a meticulous control when dividing the IAS, it is safe and effective, and is not associated with postoperative anal incontinence and "key-hole" deformity. Further studies are required to confirm our results.

Acknowledgements The authors thank Yuko Tsunoda for her assistance in the statistical analysis.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This study was approved by the Ethical Committee of Kameda Medical Center.

Informed consent Informed consent was obtained from individual participants included in the study.

References

1. Nelson RL, Manuel D, Gumienny C, Spencer B, Patel K, Schmitt K et al (2017) A systematic review and meta-analysis of the treatment of anal fissure. Tech Coloproctol 21:605–625
2. Casillas S, Hull TL, Zutshi M, Trzcinski R, Bast JF, Xu M (2005) Incontinence after a lateral internal sphincterotomy: are we underestimating it? Dis Colon Rectum 48:1193–1199
3. Bennett RC, Goligher JC (1962) Results of internal sphincterotomy for anal fissure. Br Med J 2:1500–1503
4. Yüksel O, Bostanci H, Leventoğlu S, Sahin TT, Menteş BB (2008) Keyhole deformity: a case series. J Gastrointest Surg 12:1110–1114
5. Rockwood TH, Church JM, Fleshman JW, Kane RL, Mavrantonis C, Thorson AG et al (1999) Patient and surgeon ranking of the severity of symptoms associated with fecal incontinence: the fecal incontinence severity index. Dis Colon Rectum 42:1525–1532
6. Gupta PJ, Kalaskar S (2003) Removal of hypertrophied anal papillae and fibrous anal polyps increases patient satisfaction after anal fissure surgery. Tech Coloproctol 7:155–158
7. Renzi A, Brusciano L, Pescatori M, Izzo D, Napoletano V, Rossetti G et al (2005) Pneumatic balloon dilatation for chronic anal fissure: a prospective, clinical, endosonographic, and manometric study. Dis Colon Rectum 48:121–126
8. Haylen BT, de Ridder D, Freeman RM, Swift SE, Berghmans B, Lee J, Monga A et al (2010) An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. Int Urogynecol J 21:5–26
9. Santoro GA, Wieczorek AP, Dietz HP, Mellgren A, Sultan AH, Shobeiri SA et al (2011) State of the art: an integrated approach to pelvic floor ultrasonography. Ultrasound Obstet Gynecol 37:381–396
10. Rostaminia G, White D, Quiroz L, Shobeiri SA (2015) Is a new high-resolution probe better than the standard probe for 3D anal sphincter and levator ani imaging? Ultrason Imaging 37:168–175