Anal advancement flap versus conventional surgical technique in management of chronic anal fissure

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Background and Study aims
Chronic anal fissures (CAF) are common and associated with reduced quality of life. Partial posterior internal sphincterotomy (PPIS) is frequently carried out and involves partial division of the internal anal sphincter. It carries a risk of anal incontinence, which can be as high as 14%. Anal advancement flap (AAF) combined with fissurectomy has emerged as an alternative, 'sphincter-preserving' procedure. Fissurectomy involves excision of the underlying fissure, effectively converting a chronic fissure to an acute one, whereas AAF involves the transfer of well-vascularized, healthy tissue onto the fissure base. The objective of this study was to compare the conventional PPIS and the AAF, using a V-Y advancement flap, regarding healing, anal continence, operative time, postoperative pain, and postoperative bleeding.

Patients and methods
Our study included 200 consecutive patients who presented at Kasr Al-Ainy colorectal outpatient clinic with CAF, who were randomized and divided into two groups. Group A underwent V-Y advancement flap, whereas group B underwent PPIS. Patients were followed up in the outpatient clinic at 1 week, 6 weeks, and 3 months postoperatively.

Results
The current study shows group A had lower healing rate (82%) compared with group B (96%). However, there were no recorded cases of anal incontinence postoperatively in group A compared with 14% in group B. Operative time was much less in group B. There were no significant differences regarding postoperative bleeding or pain.

Conclusion
We recommend the AAF for the surgical management of patients with CAF who are at high risk of developing anal incontinence. Further studies with bigger sample sizes are required to properly assess the rate of healing of the AAF compared with PIS.

Keywords:
anal advancement flap, chronic anal fissure, sphincterotomy

Introduction

Anal fissure was first described by Lockhart-Mummery [1] as a slit-like defect in the mucosa that extends from the anal verge to the dentate line. It is considered the most common cause of severe anal pain in adults [2]. Patients with anal fissure comprise a great majority of Kasr Al-Ainy colorectal outpatient clinic workload; most of them present with chronic anal fissure (CAF), which is more refractory to conservative management.

An acute fissure is characterized by a simple tear in the anoderm, whereas a chronic fissure is defined by symptoms lasting longer than 6–12 weeks and is often seen together with a sentinel skin tag, hypertrophied anal papillae, and visible fibers of the internal anal sphincter (IAS) in the ulcer base [3].

Although acute fissures usually heal with conservative management [such as Sitz baths, dietary changes, and glyceryl trinitrate (GTN)] solely, most chronic fissures require surgical interventions [4]. Partial internal sphincterotomy (PIS) involves partial division of the IAS muscle fibers attempting to reduce IS pressure and promote healing. It is the most commonly used surgical procedure for CAF; however, it carries a noticeable risk of fecal incontinence that can be as high as 14% [5].

This potentially debilitating complication has called for a search for a 'sphincter-preserving' strategy, which includes fissurectomy and anal advancement flap (AAF) [6].

The AAF was first described in 1970 by Samson and Stewart [7]. Fissurectomy includes excision of the fissure, efficiently converting a chronic fissure to an acute one while preserving the integrity of the IAS muscle. On the contrary, AAF involves the introduction of healthy, vascularized tissue onto the fissure area, and adding fissurectomy to the procedure improves fissure healing and reduces anal stenosis risk [8]. Numerous techniques have been described in literature, for example, V-Y flaps [9], rotation flaps [10], and island advancement flaps [11].

We aimed to compare the PIS and AAF procedures regarding the rate of healing and postoperative complications such as fecal incontinence, postoperative pain, and postoperative bleeding.

Patients and methodology

A total of 200 consecutive patients, who presented with CAF at the general surgery outpatient clinic of Cairo University hospital (Kasr Al-Ainy), Cairo, Egypt, during the period from November 2020 to May 2021 were eligible for this randomized clinical trial.

The diagnosis of CAF was based upon the presence of typical symptoms and signs, such as visible horizontal fibers of the anal sphincter at the base of the lesion or fibrosis of the base of the ulcer with or without sentinel pile, bleeding, and anal pain related to defecation lasting for more than 6 weeks.

The procedure and the study were explained for all individuals participating in the study and all of them signed a written consent for agreement.

Inclusion criteria
Patients presented with symptoms and signs of CAF lasting for more than 6 weeks were included.

Exclusion criteria
The following were the exclusion criteria:

Patients known to have inflammatory bowel disease.

Acute fissure (<6 weeks).

Atypical fissures (multiple, irregular, and off the midline).

Associated perianal fistula.

Patients with previous anal surgery.

Patients with prior sphincter damage, baseline incontinence, or chronic diarrhea.

Vulnerable groups (pregnancy, children, cognitively impaired, or mentally disabled).

Ethical committee approval
The study was approved by the Research Ethics Committee of Cairo University.

History taking
On the first visit, detailed clinical history was taken regarding onset of symptoms, duration, previous anal surgeries, history of trauma, history of obstetric trauma (episiotomy and breech delivery), comorbidities, bowel habits, and baseline continence.

Anal incontinence was defined as the involuntary passage of stool (liquid or solid) or flatus, and it was assessed using the Wexner scoring system [12] (Table 1).

Proper physical examination
The perianal skin is inspected for scars of previous operations, episiotomies, atypical fissures, associated perianal fistulas, and signs of CAF (skin tag, hypertrophied papilla, and indurated fissure with visible internal sphincter fibers).

Table 1 Wexner scoring system

Type of incontinence	Frequency				
	Never	Rarely	Sometimes	Usually	Always
Solid	0	1	2	3	4
Liquid	0	1	2	3	4
Gas	0	1	2	3	4
Wear pads	0	1	2	3	4
Lifestyle alteration	0	1	2	3	4

0=fully continent, 20=full incontinence. Never=0. Rarely=less than once per month. Sometimes=more than once per months but less than once a week. Usually=more than once a week Always=more than once a day. The continence score is calculated by adding points from the Wexner scoring table, which takes into consideration the type and frequency of incontinence and the extent to which it alters the patient's life.

Randomization

Patients were divided into two groups via random allocation using computer-generated randomization. Group A included patients undergoing the AAF, and group B included patients undergoing posterior partial internal sphincterotomy (PPIS).

Preoperative assessment

Patients were assessed regarding fitness for surgery.

Operative details

Both groups were offered saddle anesthesia and received prophylactic antibiotics dose, 1 g cefazolin, and put in lithotomy position.

Group A received the V-Y AAF. First, any skin tags are removed and fissure base was curetted with a scalpel without damaging the internal sphincter fibers. A V-shaped island flap is formed from the perianal skin via sharp dissection (Fig. 1). Closure of the perianal skin of the donor site first with interrupted sutures allows for easier manipulation of the flap (Fig. 2). The pedicled flap is sutured to the fissure base. Suture material used is Vicryl Rapide 3.0. (Fig. 3).

Group B received open PPIS (Eisenhammer procedure) [13], where sphincterotomy is made in the fissure bed after removal of associated skin tags. The anal speculum is introduced exposing the fissure, and the lower half of the internal sphincter is divided through an incision in the posterior midline of the anal canal (i.e. through the floor of the fissure) extending from just above the pectinate line to 0.5 cm beyond the anal verge. The incision is gradually deepened through the internal sphincter until the intersphincteric plane has been reached, which is indicated by the absence of the transversely running fibers. The internal sphincter fibers are cut with electrocautery up to the level of the dentate line. The wound is then left to heal by secondary intention.

Postoperative care and follow-up

Both groups received the same postoperative treatment, that is, ibuprofen 400 mg q6H; metronidazole 500 mg q8H; Sitz baths, where the patients sit in a hot water bath three times a day 20 min each; and sodium docusate as a stool softener twice daily. All patients were discharged day 1 postoperatively.

Postoperative pain score was recorded on day 0 using a verbal rating scale for pain: none, mild, moderate, and severe [14].

Figure 2

Closure of the perianal defect of the donor site vertically.
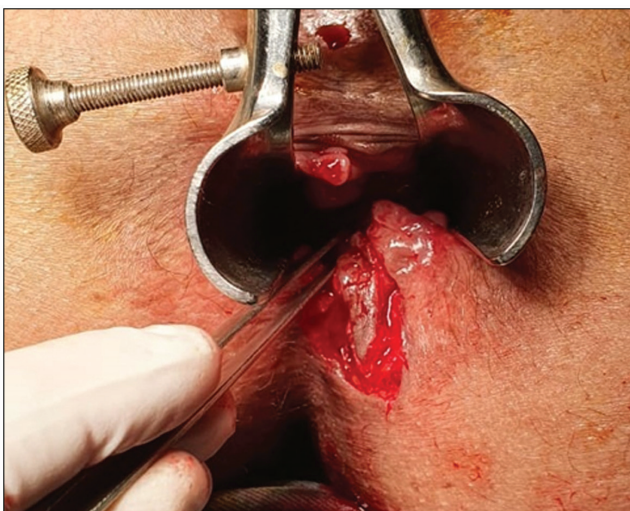
Figure 1

Formation of the V-shaped island flap.

Figure 3

Suturing to the fissure site.

Patients were followed up in the outpatient clinic 1 week, 6 weeks, and 3 months postoperatively via interview and clinical examination to assess fissure healing, wound complications, flap viability, attacks of bleeding, and fecal continence.

Fissure healing was graded into 4 different stages as described by Lindsey *et al.* [15].

(1) Fissure healed with complete resolution of symptoms.
(2) Fissure unhealed but symptoms resolved.
(3) Fissure unhealed with satisfactory improvement of symptoms.
(4) Fissure unhealed, symptoms did not improve, and surgery required.
(5) Fissure healing was defined as complete resolution of symptoms (stages 1 and 2), as per Scholz *et al.*[16].

Statistical methods
All collected data were checked for completeness and accuracy. Precoded data were entered into a computer using the Statistical Package for the Social Sciences software program, version 21 (IBM Corp., Armonk, NY, USA), to be statistically analyzed. Data were summarized using mean and SD for quantitative variables and number and percent for qualitative variables. Comparison between quantitative variables were done using independent *t* test and paired *t* test for variables that were normally distributed. Nonparametric data were compared using Mann–Whitney test and Wilcoxon test for quantitative variables that were not normally distributed. Spearman correlation was used to test for linear relations between variables [17].

P value less than 0.05 was considered statistically significant.

Results
A total of 200 patients were presented with CAF at the colorectal surgery outpatient clinic of Cairo University Hospital (Kasr Al-Ainy), Cairo, Egypt, during the period from November 2020 to May 2021 and were included in our final analysis.

Patients were divided into two groups via random allocation using computer-generated randomization: group A (*n*=100) included patients undergoing the AAF, and group B (*n*=100) included patients undergoing PPIS.

Demographic data
Females represented the majority of the sample (64% of group A and 82% of group B, with *P* value of 0.17).

The mean age in group A was 34.8 ± 11 SD years, and in group B was 32 ± 10.1 SD years (*P*=0.34). Meanwhile, 88% of included patients had no comorbidities and 12% had chronic illnesses such as hypertension and diabetes (*P*=0.63). It is to be noted that there was no statistically significant difference between the two groups in terms of sex, age, and comorbidities. Table 2 shows the demographic data.

Primary outcome
Regarding postoperative healing of the fissure, the healing rates were low for both groups at 1 week postoperatively (64% for group A and 73% for group B, with *P*=0.51). These rates rose up to 82% for the first group and 96% for the second, 6 weeks postoperatively (*P*=0.15), yet these results failed to reach statistical significance (Table 3).

Continence was assessed using the Wexner scoring system at 3 months postoperatively. There was a significant difference between the two groups, as 14 cases in group B showed mild incontinence with a Wexner score less than 5, whereas group A was fully continent (*P*=0.05) (Table 3).

Secondary outcomes
Postoperative pain was assessed using the verbal rating scale. The majority of patients in both groups reported mild pain (68 patients in group A and 82 in group B). However, 32 patients following AAF reported moderate pain compared with only 18 patients following PPIS (*P*=0.29). The pain was very well

Table 2 Demographic data

	Groups		*P* value
	A [*n* (%)]	B [*n* (%)]	
Sex			
Male	36 (36)	18 (18)	0.17
Female	64 (64)	82 (82)	
Comorbidities			
No	86 (86)	90 (90)	0.63
Yes	14 (14)	10 (10)	
Mean age	34.8 ± 11 SD	32.0 ± 10.1 SD	0.34

Table 3 Results of primary outcome

	Groups		*P* value
	A [*n* (%)]	B [*n* (%)]	
Healing at 1 week			
Healed	64 (64)	73 (73)	0.51
Unhealed	36 (36)	27 (27)	
Healing at 6 weeks			
Healed	82 (82)	96 (96)	0.15
Unhealed	18 (18)	4 (4)	
Continence at 3 months, Wexner score			
Fully continent	100 (100.0)	86 (86)	0.05
Mild incontinence	0	14 (14)	

Table 4 Results of secondary outcome

	Groups		P value
	1 [*n* (%)]	B [*n* (%)]	
Postoperative pain score (verbal rating scale)			
Mild	68 (68)	82 (82)	0.29
Moderate	32 (32)	18 (18)	
Severe	0	0	
Postoperative bleeding attacks			
None	68 (68)	82 (82)	0.43
1 minor attack	28 (28)	18 (18)	
2 Minor attacks	4 (4)	0	
Wound complications			
None	77 (77)	90 (90)	0.29
Wound infection	13 (13)	10 (10)	
Partial flap necrosis	10 (10)	0	

Table 5 Operative time

	Groups				P value
	A		B		
	Mean	SD	Mean	SD	
Operative time in minutes	23.8	4.5	14.0	2.7	<0.0001

controlled using NSAIDS and Sitz baths, which did not reach statistically significant values (Table 4).

Regarding postoperative bleeding, 32 patients following AAF experienced minor bleeding. In group B, only 18 patients experienced postoperative bleeding (*P*=0.43). However, these attacks were all self-limited and stopped spontaneously (Table 4).

The rate of wound complications was higher following AAF, as 13 patients had wound infection and 10 patients showed partial flap necrosis, compared with only 10 patients with wound infection following PPIS (*P*=0.29).

However, there was no statistically significant difference between the two groups regarding postoperative pain, postoperative bleeding, and wound complications.

Table 4 shows the comparison of secondary outcomes between both groups.

There was a statistically significant difference in operative time, as group B had much shorter operative time than group A, with *P* value less than 0.0001 (Table 5).

Discussion

Anal fissure was first described by Lockhart-Mummery as a slit-like defect in the mucosa that extends from the anal verge to the dentate line [1].

It is considered the most common cause of severe anal pain in adults [2].

Patients with anal fissure comprise a great majority of Kasr Al-Ainy colorectal outpatient clinic workload; most of them present with CAF, which is more refractory to conservative management.

Conservative treatment is used as a first-line treatment of CAF, which includes dietary modifications, GTN, calcium channel blockers, and botulinum toxin injection [18]. Medical treatment using GTN and diltiazem for 6–8 weeks may show cure rates of up to 60% of patients with CAF, with a recurrence rate of 35% at 18 months [3]. The injection of Botulinum toxin is rather expensive and produces cure rates of ~66%, which is not markedly different from the GTN and diltiazem [19].

Surgery has been the traditional treatment for CAF once medical treatment fails. The surgery of choice has progressed from the archaic manual anal dilatation, which destroys, in some cases, the whole internal sphincter, to the partial internal anal sphincterotomy, whether lateral or posterior [20]. Partial internal anal sphincterotomy (PIS) has been recommended by the American Society of Colon and Rectal Surgeons (ASCRS) [18] and the Association of Coloproctology of Great Britain and Ireland (ACPGBI) [21] to be the first-line surgical treatment of CAF that is refractory to medical treatment, with healing rates varying between 85 and 96%, as stated by Sahebally *et al.* [22] in a meta-analysis in 2017.

A fundamental pitfall to the PIS is the potential risk for fecal incontinence. This is mostly caused by arbitrary and extensive division of the IAS. García-Granero *et al.* [23] conducted an endosonographic study and concluded that the division of the IS was more extensive than required. The actual risk of fecal incontinence (FI) has been markedly variable. Boland *et al.* [19] recorded some degree of FI in 10% of their patients. Other studies showed marked variability of FI rates between 1.3 and 36% [22]. Our study shows incontinence rate of 14% in the PIS group, which is consistent with these studies.

The myth of exclusive keyhole deformity following the PPIS was refuted by Nelson *et al.* [24]. Using ultrasonographic evaluation, Nelson concluded in his systematic review that both lateral and posterior sphincterotomy can potentially cause keyhole deformity with equal rates of incontinence.

Employment of the AAF for the treatment of anal fissure has been first described by Samson

and Stewart [7] using a sliding skin flap. Since then, it has been introduced as a sphincter-sparing procedure for treatment of CAF to avoid any possible internal sphincter damage and the associated risk of incontinence [9].

The AAF has been recommended by the ACPGBI for treatment of CAF in patients with low resting anal pressures, as shown by anorectal physiological studies. Various flaps have been described in the ACPGBI statement, but a V-Y advancement flap has been suggested to reduce wound complications [21].

It has been shown by William Chambers that the AAF can be used as a first-line treatment of CAF regardless of anal tone with a high rate of healing and no downsides [9].

Our study included 200 patients. Their mean age in the AAF group A was 34.8 years (range, 19–56), whereas in the PIS group B was 32 (range, 18–54) years. There was an apparent female predominance of about 73% among the included patients. This is in concordance with an epidemiological study of anal fissure in a population-based cohort by Mapel *et al.* [2], which included 1243 patients, where 60% were females.

The current study depicts that 96% of the patients who underwent PIS had healed fissures, whereas 82% showed healing in the AAF group in the 6-week follow-up period. However, these results failed to show any statistical significance (P=0.15). A systematic review conducted by Boland *et al.* [19] showed similar healing rates for PIS. Singh *et al.* [10] used a rotational skin flap in 14 patients, and 12 (85%) showed complete healing. A much lower healing rate was achieved by Magdy *et al.* [25], where only 70% of patients showed complete healing after AAF at 6 months postoperatively, whereas healing occurred in 88% in the PIS group (P=0.001). It is worth nothing that Magdy did not incorporate fissurectomy into the AAF technique, which may have resulted in lower healing rates.

The current study shows better healing rates following PPIS than AAF which is surprising as, in theory, it brings well-vascularized tissue to cover the anal fissure. This trend is in disagreement with the results of Patel *et al.* [26] who achieved a healing rate of 96% in the AAF group and 88% after internal sphincterotomy (P=0.27). In 2010, Hancke *et al.* [27] used rectangular advancement flap on 30 patients with CAF with complete healing in all patients, which is identical to the rate of healing in the control group of 30 patients who underwent lateral internal sphincterotomy (P=0.05). Same results were achieved by Chambers *et al.* [9],

with a 100% healing rate in 54 patients following V-Y advancement flap.

Nonetheless, these results need to be interpreted with caution. The majority of these studies failed to reach statistical significance. The definition of healing varied among these studies. Magdy and colleagues in their study defined healing as complete epithelization of fissure bed with no regard to symptom improvement, whereas others did not define fissure healing. Different follow-up periods ranging from 1 month up to 9 months were reported. This contributes to different healing rates at each point of time.

Regarding fecal incontinence, 14% of the PIS group showed a degree of mild incontinence in the 3-month follow-up period; nine patients had a Wexner score of 4 (two events of liquid stool soiling in the follow-up period) and five patients with a score of 2 (minor incontinence to flatus), which Wexner classifies as minor incontinence [12], whereas the rest were fully continent. This is consistent with the rates documented in literature as mentioned before.

On the contrary, there was a significant difference in the patients who underwent AAF as they were all fully continent (P=0.05). This is in agreement with the results published by Sahebally *et al.* [22] and Boland *et al.* [19].

Postoperative bleeding has been recorded in 18 patients in the PIS group and 32 patients in the AAF one; however, these were all minor events that occurred on day 0, which is consistent with the results published by Theodoropoulos *et al.* [28] and Chambers *et al.* [9]. No other events of bleeding occurred in the follow-up period.

Pain was assessed using verbal rating scale [14]. Overall, 75% of the patients in both groups were described as having mild, and 25% of both groups were described as having moderate pain that responded to oral NSAIDs and Sitz baths. There was no significant statistical difference between the two groups (P=0.29).

Operative time was significantly lower using PIS (14 ± 2.7 min) compared with AAF (23.8 ± 4.5 SD), with P value less than 0.0001. Yet, this increase in operative time shows no effect on patients' morbidity or mortality. This is similar to the operative time results published by Theodoropoulos *et al.* [28] and Hancke *et al.* [27]. Operative time was contradicted by Leong and Seow-Choen [29], who showed much less operative time for the two operations, with a mean of 5 min for PIS and 10 for AAF. This can be attributed

to the fact that the operators were the two authors, FRCSE consultants of colorectal surgery.

There were several limitations of our study. First, the relatively short follow-up period. Our follow-up period was 3 months; had this been longer, the healing rates of AAF patients may have improved. A major drawback for AAF is the slower rate of healing. Theodoropoulos *et al.* [28] had two patients with unhealed fissure following AAF, which healed after conservative management by the third month of follow-up. Chambers *et al.* [9] had three cases of wound dehiscence that healed spontaneously by the sixth month.

Second, the difference in healing rates between the two groups failed to reach statistical significance, which could become more relevant with a bigger sample size.

Third, there was marked heterogeneity in the operators' experience in colorectal surgery among both groups. Although both procedures are relatively simple to perform, evidence in the literature suggests that better outcomes positively correlate with surgeon experience. Edgar Hancke, a colorectal surgeon with more than 20 years of experience at the time of his study, was the sole operator in his study and achieved a healing rate of 100% among both groups [27].

Conclusion

In this study, we were able to show that the AAF is associated with a much lower rate of fecal incontinence, as none of our patients experienced continence problems postoperatively.

Importantly, it was noted that the incidence of unhealed fissures following AAF was higher than that of PPIS; however, this failed to reach statistical significance.

Furthermore, the difference in operation time between the two operations is significant, with PPIS being the faster procedure, yet this had no effect on the morbidity or mortality of the patients.

For the time being, we recommend the AAF for the surgical management of patients with CAF who are at high risk of developing anal incontinence, for example, females with multiple vaginal deliveries, patients with prior sphincter damage, and patients with recurrent fissure after previous sphincterotomy. Further studies with bigger sample sizes are required to properly assess the rate of healing of the AAF compared with PIS as most studies in literature lack statistical significance.

Conflicts of interest
There are no conflicts of interest.

References

1 Lockhart-Mummery JP. Diseases of the rectum and colon and their surgical treatment. Second. London: Bailliere, Tindall, and Cox 1934; 8:616 + viii, with 247 illustrations.

2 Mapel DW, Schum M, Worley AV. The epidemiology and treatment of anal fissures in a population-based cohort. BMC Gastroenterol 2014; 14:129.

3 Nelson R. Anal fissure and lateral internal sphincterotomy: an overview. Coloproctology 2020; 42:445–449.

4 Lin JX, Krishna S, Su'a B, Hill AG. Optimal dosing of botulinum toxin for treatment of chronic anal fissure: a systematic review and meta-analysis. Dis Colon Rectum 2016; 59:886–894.

5 Garg P, Garg M, Menon GR. Long-term continence disturbance after lateral internal sphincterotomy for chronic anal fissure: a systematic review and meta-analysis. Colorect Dis 2013; 15:e104–e117.

6 Patti R, Famà F, Tornambè A, Asaro G, Di Vita G. Fissurectomy combined with anoplasty and injection of botulinum toxin in treatment of anterior chronic anal fissure with hypertonia of internal anal sphincter: a pilot study. Tech Coloproctol 2010; 14:31–36.

7 Samson RB, Stewart WRC. Sliding skin grafts in the treatment of anal fissures. Dis Colon Rectum 1970; 13:372–375.

8 Patti R, Famà F, Barrera T, Migliore G, Di Vita G. Fissurectomy and anal advancement flap for anterior chronic anal fissure without hypertonia of the internal anal sphincter in females. Colorect Dis 2010; 12:1127–1130.

9 Chambers W, Sajal R, Dixon A. V-Y advancement flap as first-line treatment for all chronic anal fissures. Int J Colorectal Dis 2010; 25:645–648.

10 Singh M, Sharma A, Gardiner A, Duthie GS. Early results of a rotational flap to treat chronic anal fissures. Int J Colorectal Dis 2005; 20:339–342.

11 Nyam DC, Wilson RG, Stewart KJ, Farouk R, Bartolo DC. Island advancement flaps in the management of anal fissures. Br J Surg 1995; 82:326–328.

12 Jorge J, Marcio N, Wexner SD. Etiology and management of fecal incontinence. Dis Colon Rectum 1993; 36:77–97.

13 Eisenhammer S. The surgical correction of chronic internal anal (sphincteric) contracture. South Afr Med J 1951; 25:486–489.

14 Haefeli M, Elfering A. Pain assessment. Eur Spine J 2006; 15 (S1):S17–S24.

15 Lindsey I, Cunningham C, Jones OM, Francis C, Mortensen NJMCC. Fissurectomy-Botulinum toxin: a novel sphincter-sparing procedure for medically resistant chronic anal fissure. Dis Colon Rectum 2004; 47:1947–1952.

16 Scholz TH, Hetzer FH, Dindo D, Demartines N, Clavien PA, Hahnloser D. Long-term follow-up after combined fissurectomy and botox injection for chronic anal fissures. Int J Colorectal Dis 2007; 22:1077–1081.

17 Chan YH. Biostatistics 103: qualitative data – tests of independence. Singapore Med J 2003; b44:498–503.

18 Stewart DB, Gaertner W, Glasgow S, Migaly J, Feingold D, Steele SR. Clinical practice guideline for the management of anal fissures. Dis Colon Rectum 2017; 60:7–14.

19 Boland PA, Kelly ME, Donlon NE, Bolger JC, Larkin JO, Mehigan BJ, McCormick PH. Management options for chronic anal fissure: a systematic review of randomised controlled trials. Int J Colorectal Dis 2020; 35:1807–1815.

20 Fischer JE, Ellison EC, Upchurch GR, Galandiuk S, Gould JC, Klimberg V, *et al.* Fischer's mastery of surgery. seventh. Netherlands: Wolters Kluwer Health Adis (ESP); 2018;2689.

21 Cross KLR, Massey EJD, Fowler AL, Monson JRT, ACPGBI. The management of anal fissure: ACPGBI position statement. Colorect Dis 2008; 10 (Suppl 3):1–7.

22 Sahebally SM, Walsh SR, Mahmood W, Aherne TM, Joyce MR. Anal advancement flap versus lateral internal sphincterotomy for chronic

anal fissure – a systematic review and meta-analysis. Int J Surg 2018; 49:16–21.

23 García-Granero E, Sanahuja A, García-Botello SA, Faiz O, Esclápez P, Espí A, *et al*. The ideal lateral internal sphincterotomy: clinical and endosonographic evaluation following open and closed internal anal sphincterotomy. Colorect Dis 2009; 11:502–507.

24 Nelson RL, Manuel D, Gumienny C, Spencer B, Patel K, Schmitt K, *et al*. A systematic review and meta-analysis of the treatment of anal fissure. Tech Coloproctol 2017; 21:605–625.

25 Magdy A, El Nakeeb A, Fouda EY, Youssef M, Farid M. Comparative study of conventional lateral internal sphincterotomy, V-Y anoplasty, and tailored lateral internal sphincterotomy with V-Y anoplasty in the treatment of chronic anal fissure. J Gastrointest Surg 2012; 16:1955–1962.

26 Patel SD, Oxenham T, Praveen BV. Medium-term results of anal advancement flap compared with lateral sphincterotomy for the treatment of anal fissure. Int J Colorectal Dis 2011; 26:1211–1214.

27 Hancke E, Rikas E, Suchan K, Völke K. Dermal flap coverage for chronic anal fissure: lower incidence of anal incontinence compared to lateral internal sphincterotomy after long-term follow-up. Dis Colon Rectum 2010; 53:1563–1568.

28 Theodoropoulos GE, Spiropoulos V, Bramis K, Plastiras A, Zografos G. Dermal flap advancement combined with conservative sphincterotomy in the treatment of chronic anal fissure. Am Surg 2015; 81:133–142.

29 Leong AF, Seow-Choen F. Lateral sphincterotomy compared with anal advancement flap for chronic anal fissure. Dis Colon Rectum 1995; 38:69–71.