

The Seton Technique in Perianal Fistula Surgery: Clinical Outcomes of Two Different Types of Seton Material

Perianal Fistül Cerrahisinde Seton Tekniği: İki Farklı Seton Materyalinin Klinik Sonuçları

Abstract

Aim: In this study we aimed to compare the recurrence, incontinence and treatment success rates in patients with perianal fistulas (PF) who were operated on using two different seton materials.

Methods: We retrospectively reviewed the medical records (PF characteristics, length of hospital stay and follow-up, postoperative complications, and presence of recurrence and incontinence) of a total of 66 patients who were diagnosed with PF and operated on using the seton method in a medical faculty hospital between January 2016 and May 2020. The patients were divided into two groups according to the seton material used (Prolene or elastic band material obtained from surgical gloves). Incontinence assessments were made using the Jorge–Wexner incontinence scoring system.

Results: Of the patients, 48 (72.7%) were male and 18 (27.3%) were female. Prolene and elastic seton materials were used in the surgery of 26 (39.4%) and 40 (60.6%) patients, respectively. The general recovery rate was 93.9%, recurrence rate was 7.6%, and incontinence rate was 6.1%. Although the recurrence and incontinence rates were higher in the Prolene group, there was no statistically significant difference between the two groups ($p=0.074$ and $p=0.292$, respectively).

Conclusion: Elastic material obtained from surgical gloves can be used as a seton in PF surgery, with low rates of recurrence and acceptable rates of incontinence similar to those with traditional cutting seton materials.

Keywords: anal fistula; elastic seton; incontinence

Öz

Amaç: Bu çalışmada iki farklı seton materyali kullanılarak ameliyat edilen perianal fistül (PF) hastalarında nüks, inkontinans ve tedavi başarı oranlarını karşılaştırmak amaçlanmıştır.

Yöntem: Ocak 2016–Mayıs 2020 döneminde bir tıp fakültesi hastanesinde PF tanısı alan ve seton yöntemi kullanılarak ameliyat edilen toplam 66 hastanın tıbbi verileri (fistül özellikleri, hastanede kalış ve takip süreleri, postoperatif komplikasyonlar, nüks ve inkontinans varlığı) retrospektif olarak incelendi. Hastalar, kullanılan (Prolene veya cerrahi eldivenlerden elde edilen elastik bant) seton materyaline göre iki gruba ayrıldı. İnkontinans değerlendirmesi için Jorge–Wexner inkontinans skorlama sistemi kullanıldı.

Bulgular: Hastaların 48'i (%72,7) erkek, 18'i (%27,3) kadındı. Yirmi altı hasta (%39,4) Prolene, 40 hasta (%60,6) elastik bant seton kullanılarak ameliyat edilmişti. Genel iyileşme oranı %93,9, nüks oranı %7,6, inkontinans oranı %6,1 idi. Prolene grubunda nüks ve inkontinans oranları daha yüksek olmasına rağmen iki grup arasında istatistiksel olarak anlamlı fark yoktu (sırasıyla $p=0,074$ ve $p=0,292$).

Sonuç: Cerrahi eldivenden elde edilen elastik materyal, geleneksel kesici seton materyalleri gibi düşük nüks ve kabul edilebilir inkontinans oranları ile PF cerrahisinde seton olarak kullanılabilir.

Anahtar Sözcükler: anal fistül; elastik seton; inkontinans

Murat Yıldırım¹, Hüseyin Bakır²

¹ Department of General Surgery, Faculty of Medicine, Gaziosmanpaşa University

² Department of General Surgery, Yozgat City Hospital

Received/Geliş : 25.03.2021
Accepted/Kabul: 02.07.2021

DOI: 10.21673/anadoluklin.903232

Corresponding author/Yazışma yazarı

Hüseyin Bakır

Genel Cerrahi/Cerrahi Onkoloji Kliniği,
Yozgat Şehir Hastanesi, Yozgat, Turkey
E-mail: drhbakir@gmail.com

ORCID

Murat Yıldırım: 0000-0003-2682-8570
Hüseyin Bakır: 0000-0002-4282-7351

INTRODUCTION

Perianal fistula (PF) is one of the most common anal diseases that require surgery. The first accounts of PF date back to the 4th century BCE, reporting a patient in whom Hippocrates used horsehair to create a cutting seton for treatment (1). The most common etiological theory is that following infection of the anal crypt gland the inflammation moves to the sphincter area and creates an abscess that leads to fistula development. Other etiologies include Crohn's disease, trauma, anal fissures, anorectal tumors, previous radiation therapy, and infections such as tuberculosis. The incidence of fistula development following an abscess is approximately 33% (2). The disease is more common between the ages of 30 and 50 years and in males (with a male/female ratio of 2/1). Fistulas can cause perianal swelling, pain, bleeding, discharge, and various non-specific symptoms. The diagnosis involves digital rectal examination, anal manometry, fistulography, rectosigmoidoscopy, magnetic resonance imaging (MRI) and computerized tomography (CT) (3).

Although there are various types of classification, the currently commonly accepted and used one is the classification of Parks et al., where anal fistulas are divided into 4 groups: intersphincteric, transsphincteric, extrasphincteric, and suprasphincteric fistulas, among which intersphincteric anal fistulas are the most common, with a rate of 45% (4).

The most effective treatment is surgery. The ideal surgical treatment should eliminate the fistula tract, protect the sphincter functions, prevent recurrence, and also should not cause incontinence (2). Various techniques have been reported for use in fistula treatment. The most common ones are fistulotomy, fistulectomy, and seton methods. Recently, anal fistula plugs, fibrin adhesive sealants, ligation of intersphincteric fistula tracts (the LIFT procedure), and flap procedures have been used to treat complex fistulas, although the superiority and success rates of these treatments remain controversial (5).

In the treatment of complex PFs, the seton method is still the most widely used method in order to minimize fecal incontinence by preserving the sphincter (6). The seton used is generally a loose seton or a tighter cutting seton. In inflammatory bowel diseases or chronic inflammatory diseases, generally a loose seton

is placed in the perianal region for obstruction prevention and fistula drainage. On the other hand, PFs due to other causes, which constitute the majority of fistula cases, are treated with a cutting seton. Selection of the correct seton material is essential for sustainable quality of life and recovery with a minimum number of surgeries (7). Accordingly, in the present study we aimed to compare the recurrence, incontinence and treatment success rates in PF patients who were operated on using two different seton materials.

MATERIALS AND METHODS

We retrospectively reviewed the medical records of consecutive patients diagnosed with PF and operated on at the general surgery clinic of the Tokat Gaziosmanpaşa University Medical Faculty between January 2016 and May 2020. The hospital information system was searched using the International Classification of Diseases code of K60.3 and the operation code "61057". Patient data (age and sex, fistula type and degree, comorbidities, American Society of Anesthesiologists scores, postoperative hospital stay, postoperative complications, presence of incontinence, operation time, the seton material used, preoperative MRI and rectosigmoidoscopy/colonoscopy findings were processed in a database. We excluded patients who were younger than 18 years of age, who had a history of malignancy or fistulas developing secondary to trauma, and who were not operated on using the seton technique. All patients were examined by a general surgery specialist who was an academic member of the clinic. Pretreatment evaluations included clinical examination of the perineum and anorectum, history of surgical treatment in this region, and pelvic MRI and rectosigmoidoscopy when necessary.

Surgical procedure

In all patients, preoperative intestinal cleansing was performed by applying 210 ml sodium dihydrogen phosphate + disodium hydrogen phosphate enema (BT Enema). The operations were performed in the lithotomy position under general and spinal anesthesia. Prophylactic intravenous first-generation cephalosporin was administered. Anorectal examination was performed to exclude external and internal openings

Table 1. Patient demographic and clinical characteristics

		n (%)
Sex	Male	48 (72.7)
	Female	18 (27.3)
Recurrence	-	61 (92.4)
	+	5 (7.6)
Recovery	-	4 (6.1)
	+	62 (93.9)
Incontinence	-	62 (93.9)
	+	4 (6.1)
Magnetic resonance imaging	-	1 (1.5)
	+	65 (98.5)
Rectosigmoidoscopy / Colonoscopy	-	10 (15.2)
	+	56 (84.8)
Additional disease	None	56 (84.8)
	Asthma	2 (3)
	DM	4 (6.1)
	UC	1 (1.5)
	Crohn's disease	2 (3)
	CAD	1 (1.5)
Seton material	Prolene	26 (39.4)
	Elastic band	40 (60.6)
		Mean±SD (min.-max.)
Age (years)		44±13.78 (22-78)
Hospital stay (days)		1.27±0.48 (1-3)
Operation time (min)		32.68±11.78 (20-90)
Follow-up (months)		18.85±16.30 (5-60)

CAD: coronary artery disease; DM: diabetes mellitus; max.: maximum; min.: minimum; SD: standard deviation; UC: ulcerative colitis

of the fistula, accompanying abscess formations, and other anorectal pathologies. Following the first examination, the fistula tract was identified with a stylet wire (Figure 1). In cases where it was difficult to find the internal opening, hydrogen peroxide prepared in a suitable solution was used. In this application, after hydrogen peroxide was administered from the external opening, the internal opening was detected by detecting the hydrogen peroxide coming from the internal opening when viewed with the help of anal retractors. Fistulas were classified according to the Parks classification (4). Elastic or cutting seton (no. 1 Prolene) was applied with a non-absorbable material in complicated and high-type fistulas. The elastic seton was created by cutting a thick circular strip from a surgical glove (no. 7 latex surgical glove, Beybi® Istanbul, Tur-

key). Then, 1/0 silk suture connected to the stylet wire was passed through the fistula tract, and the elastic seton was placed in the canal under the guidance of the silk suture (Figure 2). It was attached to the sphincters without excessive tension. The internal opening of the fistula was curetted. The skin and anoderm on the fistula tract were cut. The same procedures were performed in the Prolene group.

At the 6th hour after the operation, the patients were allowed to eat normally after liquid food, and analgesia was provided with non-steroidal anti-inflammatory drugs. They were informed about the use of Prolene and elastic seton material. They were warned that the anal area would be washed with warm water after defecation and the seton materials be moved intermittently, and that serous discharge might occur

Table 2. Demographic and clinical comparison of the study groups

		Prolene (n=26)	Elastic band (n=40)	p
		n (%)	n (%)	
Sex	Female	17 (35.4)	31 (64.6)	0.280 ^a
	Male	9 (50)	9 (50)	
Fistula type	Intersphincteric	10 (43.5)	13 (56.5)	0.710 ^b
	Transsphincteric	9 (37.5)	15 (62.5)	
	Suprasphincteric	3 (27.3)	8 (72.7)	
	Extrasphincteric	3 (42.9)	4 (57.1)	
Recurrence	-	22 (36.1)	39 (63.9)	0.074 ^b
	+	4 (80)	1 (20)	
Recovery	-	3 (75)	1 (25)	0.292 ^b
	+	23 (37.1)	39 (62.9)	
Incontinence	-	23 (37.1)	39 (62.9)	0.292 ^b
	+	3 (75)	1 (25)	
Etiology	Abscess	12 (37.5)	20 (62.5)	0.786 ^b
	IBD	2 (66.7)	1 (33.3)	
	Idiopathic	11 (37.9)	18 (62.1)	
	Uncertain	1 (50)	1 (50)	
		Median (min.–max.) (Mean±SD)	Median (min.–max.) (Mean±SD)	
Age (years)		41.46±11.22 38 (24–64)	45.65±15.12 42.5 (22–78)	0.230 ^c
Hospital stay (days)		1 (1–2) (1.19±0.40)	1 (1–3) (1.33±0.52)	0.312 ^d
Operation time (min)		31 (20–90) (35.35±15.51)	30 (20–60) (30.95±8.32)	0.260 ^d
Follow-up (months)		12 (6–48) (20.77±15.01)	9 (5–60) (17.60±17.16)	0.071 ^d

IBD: inflammatory bowel disease; max.: maximum; min.: minimum; SD: standard deviation

^a chi-square test

^b Fisher's exact test

^c Mann–Whitney U test

^d Student's t-test

before recovery. All patients received postoperative institutional information as they were discharged.

All patients were called for a follow-up visit within the first week. In addition, they were recommended to come to the clinic in case of seton drop. Then, they were called for weekly and monthly follow-ups for seton, wound, recurrence, and incontinence assessments.

The PF recurrence was defined as permanent discharge from the perianal wound or fistula development in and/or near the original canal during postoperative follow-up. The presence of recurrence was also confirmed by MRI. In all patients, incontinence assessment was performed using the Jorge–Wexner

incontinence scoring system (8).

The Jorge–Wexner system is the most commonly used tool for the effectiveness evaluation of surgical PF treatments in terms of frequency and presentation of different types of anal incontinence (gas/liquid/solid incontinence / pad use / lifestyle changes), based on a total score ranging from 0 to 20 (0=perfect continence, 20=complete incontinence). The patients with a score ≥ 1 were classified as incontinent.

Statistical analysis

Statistical analysis was performed using the SPSS (v. 22.0) software package (SPSS Inc., Chicago, IL, USA). Descriptive statistics were presented as mean±standard

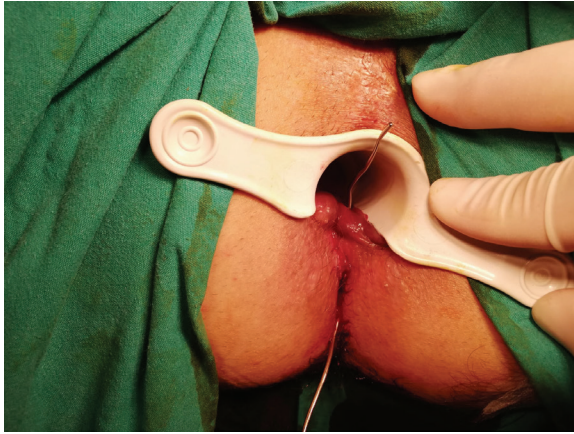


Figure 1. Fistula tract identification with a stylet wire

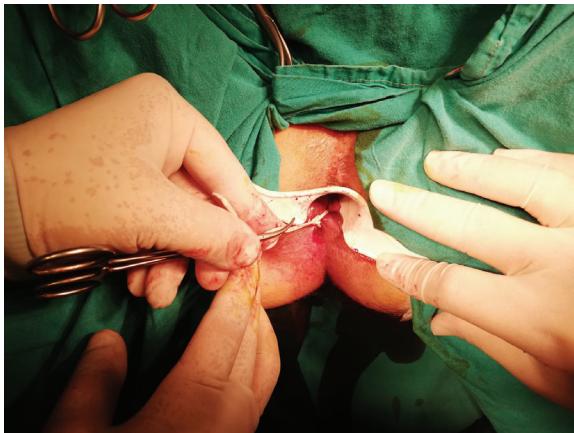


Figure 2. Placement of elastic seton material in the fistula canal

deviation (minimum–maximum) for numerical data and as number and percentage for categorical data. Normality of the data was checked using the Shapiro–Wilk test. In numerical variable comparisons between two independent groups, Student's *t*-test was used for normally distributed variables and the Mann–Whitney U test for non-normally distributed variables. Relationships or ratio comparisons between categorical variables were investigated using the chi-square test or Fisher's exact test according to the number of data in the Jorge–Wexner system crosstab cells. $p < 0.05$ was considered statistically significant.

Study ethics

The permission to use clinical data of the patients included was granted by the Ethics Committee of the Tokat Gaziosmanpaşa University Medical Faculty (19-KAEK-222). All procedures were performed in

accordance with the ethical standards of the responsible institutional and national committees on human experimentation and the principles of the Declaration of Helsinki. Informed consent was also obtained from all patients.

RESULTS

The seton technique was applied in 66 (56.9%) of a total of 116 patients who underwent surgical PF treatment, and all of these 66 patients were included. Of the patients included, 48 (72.7%) were male and 18 (27.3%) were female. The mean patient age, operation time, hospital stay, and follow-up were 44 ± 13.78 (22–78) years, 32.68 ± 11.78 (20–90) minutes, 1.27 ± 0.48 (1–3) days, and 18.85 ± 16.30 (5–60) months, respectively. Four patients underwent PF surgery previously, and one had a history of hemorrhoidectomy. Patient demographic and clinical characteristics are presented in Table 1.

The PF etiology was perianal abscess in 32 (48.5%) patients, idiopathic in 29 (43.9%), and inflammatory bowel disease in 3 (4.5%) (Figure 3).

According to the examination performed under anesthesia and pelvic MRI results, 24 (36.4%) fistulas were transsphincteric, 23 (34.8%) were intersphincteric, 11 (16.7%) were suprasphincteric, and 7 (10.6%) were extrasphincteric (Figure 4).

Pelvic MRI and rectosigmoidoscopy/colonoscopy were performed preoperatively in 98.5% and 84.8% of the patients, respectively. Two patients underwent polypectomy for polyps detected in the sigmoid colon during colonoscopy. Colonoscopy findings compatible with Crohn's disease were observed in a patient who had no previous diagnosis.

All patients were discharged on the first or second postoperative day. After discharge none of them needed narcotic analgesics or re-hospitalization or developed infective complications or significant bleeding.

Of all patients, 26 (39.4%) were operated on using Prolene and 40 (60.6%) using elastic band seton. Demographic and clinical characteristics of the two groups are compared in Table 2. No statistically significant intergroup difference was found in sex distribution, fistula type, hospital stay, operation time, and recovery, incontinence and recurrence rates ($p > 0.05$) (Table 2).

Recovery after surgical treatment was achieved in 93.9% of all patients. Two of the 4 patients who could not recover had Crohn’s disease, and the other two developed recurrence. The overall recurrence rate was 7.6% (n=5). The recurrence rate was higher in the Prolene group (p=0.07).

Postoperative incontinence was observed in 4 (6.1%) patients (Figure 5). The mean Jorge–Wexner Score was 1.67 for the Prolene group and 1.00 (with incontinence) for the elastic seton group. Although the incidence of incontinence was higher in the Prolene group, the difference was not significant (p=0.2).

Subgroup analyses of the Jorge–Wexner incontinence assessment results showed that, while there was no patient with solid incontinence, fluid incontinence was detected in 1 patient (in the Prolene group) and gas incontinence in 3 patients (2 in the Prolene group and 1 in the elastic seton group), with no pad use or lifestyle change.

DISCUSSION AND CONCLUSION

PF management continues to be a problem for surgeons due to two important complications: recurrence and incontinence. In our study, we evaluated the results of PF treatment using two different types of seton material, which are easy to obtain, durable, affordable, and supplied in sterile packaging. In both of our study groups, the recovery, recurrence, and incontinence rates were similar to those reported in the literature. The recurrence and incontinence rates did not significantly differ between the two groups, although they were higher in the Prolene group.

In PF, surgical treatments vary depending on the surgical technique and the surgeon’s experience. The traditional surgical treatment is principally aimed at the prevention or minimization of incontinence and recurrence, in addition to general recovery with no sepsis. This requires careful cutting of the internal and external anal sphincters (9). While simple and low fistulas can be safely treated with fistulotomy alone without sphincter damage, complex fistulas are more difficult to manage. Varying degrees of damage to the sphincter muscles can occur and cause functional consequences that are difficult to repair. Many treatment methods have been developed to preserve the complex

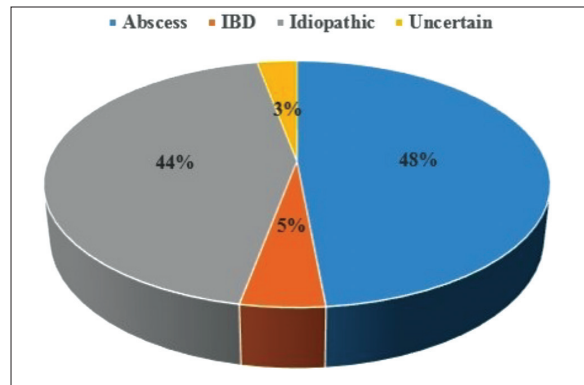


Figure 3. Etiological distribution
IBD: inflammatory bowel disease

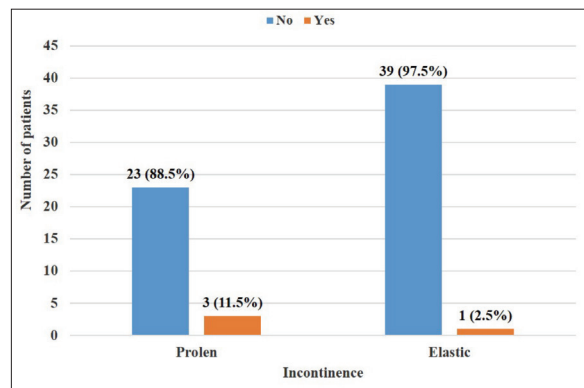


Figure 4. Presence of incontinence in the study groups

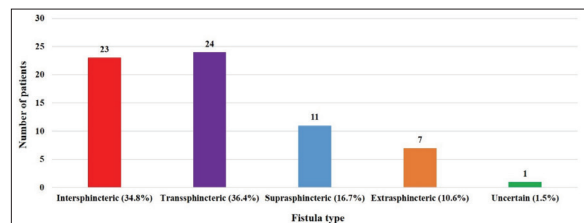


Figure 5. Distribution of fistula types

sphincter mechanism, including the use of cutting seton, loose seton, rectal mucosa advancement flaps, LIFT, anal fistula plugs, and fibrin glue (10–13). Nonetheless, it remains controversial which of these methods is superior or ideal. For example, the LIFT procedure, aimed at protecting both internal and external anal sphincters, was first defined in 2006 by Rojana-sakul et al. (10) and attracted attention due to its high success and low incontinence rates. There have been studies showing that with this method continence is preserved effectively with recovery rates of 47 to 98% (14–16), despite the ongoing need for prospective,

randomized, long-term studies with objective evaluations of incontinence. Another accepted method is the use of fibrin glue. Though initially promising, this method has been found to be associated with recovery rates of 14 to 74% in long-term follow-up (17–18). Also, there is a lack of evidence on the success of these alternative methods when used in complex recurrent fistulas and inflammatory bowel disease.

The use of a seton in management of anal fistulas was first described centuries ago, with the term seton deriving from the Latin word “seta” meaning “bristle”. It is a relatively simple technique with a good cure rate that is universally accepted (19). Setons are widely used to prevent fecal incontinence and recurrence in the treatment of complex and high fistulas (1), protecting sphincter function and preventing fistula formation by providing abscess drainage. Cutting setons, with low rates of incontinence and recurrence and high rates of recovery, have been successfully applied in patients with high extrasphincteric and complex fistulas as well as in patients with Crohn’s disease who are among the difficult-to-treat patients (20–21).

Seton selection and patient management depend on the surgeon’s choice and experience. A wide variety of seton materials have been described, including suture materials such as silk and Prolene, plastic locking cables, stainless steel wires, chemical materials, silicone and rubber bands. In an international survey on surgeons’ choices of seton materials (22), silicone (72%) was found to be the most preferred, followed by silk (23%), rubber band (11%), and Prolene (10%).

Although Prolene suture is used as cutting seton material in our clinic, we also use elastic seton material obtained from surgical gloves as defined by Chuang-Wei et al. (23) and Menteş et al. (24). Menteş et al. reported that they achieved a 100% success rate in their series of 20 patients. They subsequently published a prospective study using the same seton method, which they called “hybrid seton”, in 128 consecutive patients (25). They reported that hybrid setons could be a viable alternative for use in high anal fistulas with no need for postoperative adjustment.

Various rates of recovery and recurrence have been reported in the use of setons. In our series, the overall recovery and recurrence rates were 93.6% and 7.6%, respectively. While 15.3% in the Prolene group,

the recurrence rate was 2.5% in the elastic seton group. Menteş et al. (24) reported that the recovery and recurrence rates were respectively 100% and 5% in their series of 20 patients. Chuang-Wei et al. (23) reported a recurrence rate of 0.9% in their study where they used elastic bands. In another study using Prolene suture, recurrence rate was calculated as 2.4% (26). Two studies using cutting Prolene (27) and another slow-cutting seton material (28) reported a recurrence rate of 6.3% and 12%, respectively. We were able to find a limited number of studies comparing different seton materials, with one of them being a prospective study comparing silk and Prolene seton materials. The authors reported that there was no significant difference between the two groups in terms of recurrence, and the mean number of operations required was higher in the silk group, where the feeling of comfort was also greater (7). However, in most of these studies, inflammatory bowel disease was excluded. In our series, 2 of the patients who did not recover had Crohn’s disease and 2 were recurrence patients who had been operated on at least twice before. Although the recurrence rate was higher in the Prolene group, the difference from the elastic seton group was not significant.

The rate of postoperative fecal incontinence following seton treatment ranges widely from 0 to 70% (26,29). Such a wide range may be due to differences in the surgical materials and techniques used and the numbers of patients investigated. It is also possible that patients may give incorrect information out of embarrassment, especially in rural populations. Indeed, the incontinence rates in two different studies where elastic seton material was used were 20% and 3.6% (24,30), while a meta-analysis of larger series where different seton materials were used reported a mean fecal incontinence rate of 12% (31). In our series, while there was no solid fecal incontinence, the mean rate of incontinence was 6.1%, with liquid incontinence in 1 patient and gas incontinence in 3. Although it was more common in the Prolene group, there was no significant difference between the two groups. All patients recovered during long-term follow-up without additional treatment.

Since there was no difference between the use of elastic seton material and Prolene suture in terms of revealing the fistula tract and placing the material,

there was no significant difference between our study groups in terms of hospital stay and operation time. However, although there was no significant difference in terms of rates of recurrence and incontinence, we think that treatment with elastic seton material offers some advantages, such as more comfort, elasticity, thinness, low cost, easy availability, and soft texture.

Finally, the main limitation of our study was the retrospective design, not allowing postoperative pain scorings and quality-of-life assessments, while one of its specific aspects was that we used an internationally valid tool for incontinence assessment. In conclusion, in the surgical treatment of PF, elastic seton material as obtained from surgical gloves can be a good choice with low rates of recurrence and acceptable rates of incontinence similar to those with traditional cutting seton materials. Slow and careful cutting of the sphincters contributes to the prevention of incontinence. However, there is still a need for prospective randomized controlled studies with larger series.

Conflict of Interest and Financial Disclosure

The authors declare that they have no conflict of interest to disclose. The authors also declare that they did not receive any financial support for the study.

REFERENCES

1. Malik AI, Nelson RL. Surgical management of anal fistulae: a systematic review. *Colorectal Dis.* 2008;10(5):420–30.
2. Cariati A. Fistulotomy or seton in anal fistula: a decisional algorithm. *Updates Surg.* 2013;65(3):201–5.
3. Bleier JI, Moloo H. Current management of cryptoglandular fistula-in-ano. *World J Gastroenterol.* 2011;17(28):3286–91.
4. Parks AG, Gordon PH, Hardcastle JD. A classification of fistula-in-ano. *Br J Surg.* 1976;63(1):1–12.
5. Sileri P, Cadeddu F, D'Ugo S, Franceschilli L, Blanco GV, Luca E, et al. Surgery for fistula-in-ano in a specialist colorectal unit: a critical appraisal. *BMC Gastroenterol.* 2011;11:120.
6. Leventoğlu S, Menteş BB. Anal fistula plug for treatment of complex anorectal fistula. *Turk J Colorectal Dis.* 2007;17:211–4.
7. Akici M, Ersen O. The effect of suture selection in complex anal fistulas on the success of cutting seton placement and patient comfort. *Pak J Med Sci.* 2020;36(4):816–20.
8. Jorge JM, Wexner SD. Etiology and management of fecal incontinence. *Dis Colon Rectum.* 1993;36(1):77–97.
9. Memon AA, Murtaza G, Azami R, Zafar H, Chawla T, Laghari AA. Treatment of complex fistula in ano with cable-tie seton: a prospective case series. *ISRN Surg.* 2011;2011:636952.
10. Rojanasakul A, Pattanaarun J, Sahakitrungruang C, Tantiphlachiva K. Total anal sphincter saving technique for fistula-in-ano; the ligation of intersphincteric fistula tract. *J Med Assoc Thai.* 2007;90(3):581–6.
11. Sentovic SM. Fibrin glue for anal fistulas. *Dis Colon Rectum.* 2003;46:498–502.
12. Ellis CN, Rostas JW, Greiner FG. Long-term outcomes with the use of bioprosthetic plugs for the management of complex anal fistulas. *Dis Colon Rectum.* 2010;53:798–802.
13. Subhas G, Bhullar JS, Al-Omari A, Unawane A, Mittal VK, Pearlman R. Setons in the treatment of anal fistula: review of variations in materials and techniques. *Dig Surg.* 2012;29:292–300.
14. Lehmann JP, Graf W. Efficacy of LIFT for recurrent anal fistula. *Colorectal Dis.* 2013;15:592–5.
15. Lo O, Wei R, Foo D, Law WL. Ligation of intersphincteric fistula tract procedure for the management of cryptoglandular anal fistula. *Surg Pract.* 2012;16:120–1.
16. Tan KK, Tan IJ, Lim FS, Koh DC, Tsang CB. The anatomy of failures following the ligation of intersphincteric tract technique for anal fistula: a review of 93 patients over 4 years. *Dis Colon Rectum.* 2011;54:1368–72.
17. Buchanan GN, Bartram CI, Phillips RK, Gould SW, Halligan S, Rockall TA, et al. Efficacy of fibrin sealant in the management of complex anal fistula: a prospective trial. *Dis Colon Rectum.* 2003;46:1167–74.
18. Patrlj L, Kocman B, Martinac M, Jadrijevic S, Sosa T, Sebecic B, et al. Fibrin glue-antibiotic mixture in the treatment of anal fistulae: experience with 69 cases. *Dig Surg.* 2000;17:77–80.
19. Goldberg SM, Garcia-Aguilar J. The cutting seton. In: Phillips RKS, Luniss PJ (ed.), *Anal Fistula.* London: Chapman & Hall Medical; 1996:95–102.
20. Tyler KM, Aarons CB, Sentovich SM. Successful sphincter-sparing surgery for all anal fistulas. *Dis Colon Rectum.* 2007;50:1535–9.
21. Takesue Y, Ohge H, Yokoyama T, Murakami Y, Imamura Y, Sueda T. Long-term results of seton drainage on complex anal fistulae in patients with Crohn's disease. *J Gastroenterol.* 2002;37:912–5.
22. Ratto C, Grossi U, Litta F, Di Tanna GL, Parello A, De

- Simone V, et al. Contemporary surgical practice in the management of anal fistula: results from an international survey. *Tech Coloproctol.* 2019;23(8):729-41.
23. Chuang-Wei C, Chang-Chieh W, Cheng-Wen H, Tsai-Yu L, Chun-Che F, Shu-Wen J. Cutting seton for complex anal fistulas. *Surgeon.* 2008;6:185-8.
 24. Menten BB, Oktemer S, Tezcaner T, Azili C, Leventoğlu S, Oğuz M. Elastic one-stage cutting seton for the treatment of high anal fistulas: preliminary results. *Tech Coloproctol.* 2004;8:159-62.
 25. Ege B, Leventoğlu S, Menteş BB, Yılmaz U, Öner AY. Hybrid seton for the treatment of high anal fistulas: results of 128 consecutive patients. *Tech Coloproctol.* 2014;18(2):187-93.
 26. Theerapol A, So BY, Ngoi SS. Routine use of setons for the treatment of anal fistulae. *Singapore Med J.* 2002;43:305-7.
 27. Zbar AP, Ramesh J, Beer-Gabel M, Salazar R, Pescatori M. Conventional cutting vs. internal anal sphincter-preserving seton for high trans-sphincteric fistula: a prospective randomized manometric and clinical trial. *Tech Coloproctol.* 2003;7(2):89-94.
 28. Lykke A, Steendahl J, Wille-Jørgensen PA. Høje analfistler behandlet med langsomt skaerende seton [Treating high anal fistulae with slow cutting seton]. *Ugeskr Laeger.* 2010;172(7):516-9.
 29. Garcia-Aguilar J, Belmonte C, Wong DW, Goldberg SM, Madoff RD. Cutting seton versus two-stage seton fistulotomy in the surgical management of high anal fistula. *Br J Surg.* 1998;85:243-5.
 30. Mylonakis E, Katsios C, Godevenos D, Nousias B, Kappas AM. Quality of life of patients after surgical treatment of anal fistula; the role of anal manometry. *Colorectal Dis.* 2001;3:417-21.
 31. Ritchie RD, Sackier JM, Hodde JP. Incontinence rates after cutting seton treatment for anal fistula. *Colorectal Dis.* 2009;11(6):564-71.