

Comparison of Loose and Cutting Seton Methods in Anal Fistula Treatment

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ABSTRACT

The main objective in anal fistula surgery is the protection of continence. The incontinence rates after surgical treatment in cases with fistulas that contain more than 30% of external anal sphincter are increasing. In our study, we used the loose seton application with aim of comparing to the primary treatment like cutting seton. We aimed to determine the efficacy of treatment while comparing the results of patients treated with loose seton and cutting seton.

The diagnosis of anal fistula in medical records between the date of January 2010-January 2020 was searched. The patients were divided into two groups as cases treated with loose seton (group 1, n:126) and cases with cutting seton (group 2, n:64). The groups were evaluated for demographic characteristics, clinical findings, complications, pain scores, clinical follow-up results, and recurrences.

190 patients were included in the study and their mean age was 38.7 years. 145 cases were male and 45 were female. 115 cases were operated for lower transsphincteric fistula and 75 ones for higher transsphincteric fistula. The mean length of the fistula tract was 2,2 cm (2-5,5). 39(20,6%) patients had a diagnosis of diabetes. The mean operation time was 19,8 minutes (13-35). 24(12,6%) patients had complications. The mean falling time of setons was 51.1 days (21-77) in 59 cases ; whereas, 73(34-122) days in the loose seton group and 44 days (21-93) in the cutting seton group.

No significant meaningful difference was found for treatment success despite a higher incidence of pain and incontinence in cutting seton applications.

Keywords: Anal fistula, loose seton, cutting seton

Introduction

The optimal surgical option in anal fistula treatment should protect the sphincter function, has low recurrence rates, and lead to minimize negative effects on the quality of life during recovery time. The protection of continence is the main aim during anal fistula surgery made for anal abscess and sepsis treatment. The most frequently accepted theory for the pathogenesis of anal fistula is the development of secondary abscess following crypto glandular infection. The other causes for etiology are trauma, foreign body, and crohn's disease.(1) The treatment of posteriorly located simple fistulas is easy and effective, however, the difficulties in the treatment of anteriorly located long and complex fistulas are continuing.(2) The incontinence rates after surgical treatment in cases with fistulas that contain more than 30% of external anal sphincter are increasing. The complication rates are increasing in cases of obesity, with previous

surgeries, Crohn disease and anteriorly located fistulas.(3,4)

The seton treatment that is defined for fistulas with higher sphincteric locations is known to be one of the oldest surgical techniques.(5) The main aim in seton treatment is to provide drainage from infected or abscessed tissue with synthetic material and to cut the sphincters slowly and in a controlled manner. At the same time, the continence protection is allowed while development of fibrosis and muscle healing around the seton. Silk, elastic bands, wire, penrose drains and nylon were used as setons for centuries. Loose seton application is frequently used for aim of a preparation of second surgery after abscess drainage. The cutting seton is applied to cut the fistula tract for primary treatment aim. (6) In our study, we used loose seton for primary treatment purposes such as cutting seton. We aimed to evaluate the efficacy of the treatment by comparing the results of the patients treated with cutting seton and the patients treated with the loose seton.

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Material and Methods

The files of 1345 patients in the electronic database of Adana Seyhan State hospital who were operated for anal fistula between 2010-2020 were accessed. Follow-up forms and files of the patient were reviewed retrospectively. Patients who were applied cutting and loose seton were included in the study. History of colorectal malignancy, perianal and pelvic radiotherapy treatment, presence of inflammatory bowel disease, pregnancy and anal incontinence were determined as exclusion criteria. 190 patients were included in the study and divided into the two groups as loose seton (group 1) and cutting seton (group 2). The demographic data of the patients like gender and age were analyzed. The presence of diabetes and smoking status were analyzed. The length of fistula which is one of the examination findings and its relationship with the sphincter were evaluated. The completion status of the treatment with fistulotomy after seton application for fistula was investigated. The previous anal abscess surgery was investigated. The preferred anesthesia type in patients who underwent surgery was evaluated. The operation time, pain scores, length of hospital stay, the need for the second surgery, complications, time for falling of seton, transient incontinence, recurrence, permanent incontinence, complete recovery time and follow up time were evaluated in groups. Bleeding, abscess, urinary retention and complications that did not need surgical intervention were accepted as a minor complications; whereas, incontinence and complication that needed surgery were accepted as major. Fistula recurrence was determined as a persistent discharge from the perianal wound site 6 months after the operation. The results of the Visual Analogue Scale (VAS), which is used as a pain assessment scale in postoperative patients, are recorded in the files. The VAS obtained from the files was analyzed. (7) The Wexner Continence Rating Scale with degrees from 0 (full continence) to 20 (complete incontinence) was used to evaluate fecal incontinence. (8)

Surgical Technique; The fistula tract is found with the help of a stylet from the external opening to the internal opening in anal fistula treatment with loose seton. The methylene blue was given from the external orifice to find the fistula tract in patients with an undetermined internal openings. The fistula tract is resected, together with the external opening and surrounding infected tissue, up to the sphincter muscles. The defect that developed is marsupialized with 2/0 vicryl sutures.

The loose seton technique is applied by ligating the remaining tract with a number 0 prolene suture without tension. Free drainage was provided while not tightening the knots including controls. In the cutting seton technique, all the steps are applied in the same way, but the seton material which is placed differently in the last stage is tightly tied. The patients were followed for control on the 7, 15 and 30. days, the nodal pressure of the cutting seton was gradually increased.

The study obtained approval from Çukurova University Medical Faculty Ethical board with date and number of 04.09.2020/103.

Statistics: The data were analyzed with the statistical package program SPSS 23.0. The continuous measurements were studied as mean, deviation and minimum-maximum. Categorical measurements were determined as numbers and percentages. The Shapiro-Wilk test was used for normal distribution. The Chi-Square test and Fischer test were used for categorical variables comparison. Independent Student's t-test was used for data with normal distribution, and Mann Whitney U test was used for data not normally distributed. 0.05 value was accepted as statistical significance.

Results

The mean age of 190 patients included in the study between January 2010 and January 2020 was 38.7 years. Of the patients, 145 were male and 45 were female. Surgical drainage due to perianal abscess was determined at any time before surgery in 73 (38.5%) of the patients. When evaluated in terms of operation history due to perianal fistula other than abscess drainage, 33 patients (17.4%) had a history of surgery. Anal fissures and hemorrhoidal disease were found to be the most common causes of other proctological surgeries. 115 patients were operated for low transsphincteric fistula and 75 patients for high transsphincteric fistula. The mean length of the fistula tract was 2.2 cm (2-5.5). 39(20.6%) patients had a diagnosis of diabetes. 97(51%) patients had history of smoking use. 180 patients were operated in the Jack Knife position with four quadrants under marcaïn local anesthesia In addition to ketamine dornicum sedation anesthesia, and 10 patients who underwent spinal anesthesia were operated in the lithotomy position. The mean operation time was 19.8 minutes (13-35). Complications developed in 24 (12.6%) patients. Major complication was

Table 1: Demographic and Clinical Findings

	n	%
Gender		
Female	45	23,7
Male	145	76,3
Age	38,7	
Anesthesia		
Sedation +local	180	94,7
Spinal	10	5,3
Diabetes mellitus	39	20,6
Smoking	97	51
History of fistula surgery	33	17,4
Fistula location		
Low transsphincteric	115	60,5
High transsphincteric	75	39,5
Fistula tract length, mean	2,2 cm	
Operation time	19,8 minute	
Mean follow-up time	3,4 month	
Mean Total recovery time	63,4 day	
Complication	16/190	8,42
Recurrence	21	11

Table 2: Comparison of Demographic and Clinical Findings of Loose and Tight Seton Groups

	Group 1 (n=126)	Group 2(n=64)	p
Age	37,8	40,5	0,243
Gender (Female/Male)	37/89	8/56	0,007
Diabetes (Present/Absent)	16/110	23/41	0,000
Smoking (Present/Absent)	64/62	33/31	0,521
Fistula location (Low TS/High TS)	81/45	34/30	0,09
History of fistula surgery	21	12	0,379
Operation time / min	19,8	19,59	0,384
Seton falling time /week	8,56	7,47	0,001
Addition of fistulotomy	26	5	0,017
Incontinence	1	5	0,017
Recurrence	15	6	0,397
Follow up time/ Month	5,9	5,8	0,859
Complete recovery time /Day	73	44	0,000
Minor complication	9/117	7/57	0,438
VAS	0,59	4,23	0,000

observed in 6 (3.1%) patients who developed complete or partial incontinence. No recurrence was observed in 169 (88.9%) patients during follow-up. Demographic and clinical information of all patients are summarized in Table 1. There were 126 patients in Group 1 with loose seton and 64 patients in Group 2 with cutting seton. Average

falling time of setons; It was 51.1 (21-77) days in 59 (92.1%) patients who underwent cutting seton. Seton did not fall in 5 (7.8%) patients. Loose seton fell in 60(23-84) days in 100(79.4%) patients, however, it did not fall in 26(20.6%) patients. Comparative results between groups are presented in Table 2. Minor complications such as

total bleeding and abscess were observed in 16 (8.4%) patients in both groups. Incontinence (liquid and/or solid) was determined in 6 (3.1%) patients. All patients were hospitalized for 1 day. While the mean time for complete recovery was 63.4 days for all patients, it was 73 (34-122) days in patients with loose seton and 44 (21-93) days in patients with cutting seton. The mean follow-up period of all patients was 5.8 months (1-34). There were 15 (11.9%) recurrences in the loose seton group, and 6 (9.37%) recurrences in the cutting seton group. The pain score and information about the patients who developed incontinence are presented in Table 2.

Discussion

Currently, no standard treatment method has been defined in the treatment of anal fistula. Complex anatomy, the relationship of the infectious process and sphincter muscles with the disease complicates the treatment. Seton drainage method, which has been used since Hippocrates and ancient Egyptians, is still the most frequently and safely used surgical technique, especially in complex perianal fistulas.(9) There are basically available two different methods: loose-drainage and cutting method. Loose-drainage seton is commonly used as an alternative to fistulotomy.

The seton material passed through the tract is left loose, providing drainage of the fistula and maturing the tract. It provides a safe anatomy for the fistulotomy to be performed in cases where the seton material does not fall. The main purpose of the operations; It provides the continuity of normal sphincter continence while treating existing perianal sepsis. The success of the surgical techniques for anal fistula generally depends on; determination of the inner mouth of fistula, excision of fistula tract and preservation of anal sphincter function.(10) While it provides high success in recovery, postoperative pain and incontinence rates are not at the desired level. While cutting seton applications are successfully applied in complex fistulas, there is a risk of causing deterioration in the anorectal muscle ring due to the rapid cutting process. Although the sphincter complex is better preserved in loose seton applications,, it may cause recurrences due to the failure of adequate drainage in complex fistulas.

There is a significantly higher predominance of male gender for anal fistula in the literature.(11) 76.3% of the patients included in our study were male. It was similar to the rates reported in the literature. Male predominance supports the hypothesis of local androgen conversion in cryptoglandular anal glands.

There are clinical studies reporting that smoking is a risk-increasing factor for the development of anal abscess and fistula.(12) Salah et al. reported the rate of smoking in their studies as 52.9%, which was similar to the rates we determined in our study (51.1%). (6) There are studies reporting that smoking is a risk factor for cutaneous infection and abscess development.(12) While there was no statistically significant difference in the distribution of patients to whom we applied loose and cutting seton in terms of age and smoking, the number of male patients was significantly higher in both groups.($p=0,007$)

Another factor that will affect the success of the Seton technique is the low or high transsphincteric nature of the fistula. This situation can also be effective on complications that may develop on continence. High transsphincteric fistulas involve a large part of the external sphincter, which may increase the risk. In our study, it was observed that there was no difference between the groups in terms of the distribution of low and high transsphincteric fistulas.($p=0,09$) It was noted that twenty of cases were high trans sphincteric in the evaluation of 21 relapsed cases independent of group distribution.($p<0,001$)

Lihua et al. reported the seton fall time as 30 (40-50) days after combined loose tight seton application in patients with high transsphincteric fistula in their study.(13) we observed in our study that seton decreased in 60 (23-84) days in patients with loose seton and in 51.1 (21-77) days in patients with cutting seton. While seton did not fall in 5 (7.8%) patients in the cutting seton group (Group 2), it did not fall in 26 (20.6%) patients in the loose seton group (Group 1)

Although the difference between seton cutting times was not statistically significant, the mean time was shorter in group 2 and the requirement for fistulotomy was less than in Group 1. It was thought that this time could be reduced by increasing the pressure of the loosened seton during the more frequent controls in the cutting seton group.

Short-term success rates have been reported to be between 44-83 % in loose seton applications. (14,15) There are studies reporting this rate of 61-78% in cutting seton applications.(16,17) In our study, 15 (15.8%) recurrences occurred in long-term follow-ups in patients who were applied loose seton, and 6 (9.37%) recurrences occurred in patients who were applied cutting seton. It was thought that our higher success rates than those reported in the literature may be due to the fact that the practices are performed by the team dealing specifically with perianal surgery and the exclusion criteria. The mean operation time is reported to be 38.9 ± 6.5 minutes in both loose and tight seton applications.(18) The mean operation time

was 19.8 minutes in our study and there was no difference between the groups. The duration of hospitalization is reported as 1 day in the literature, which is consistent with our study.(19)

Qiuxiong Yu et al. reported complications in 8.3% of patients who were applied cutting seton, and 1.7% of patients who were applied loose seton. Urinary retention was observed to be the most seen complication.(20) Our minor complications' rate such as bleeding, abscess and urinary retention was found to be 8.42% for all patients when we evaluated incontinence separately. Minor complication was higher in cutting seton group although it was not statistically significant. ($p=0.438$) It was thought that the compression of the tissue and the circulatory problems in cutting seton applications may cause an increase in bleeding rates.

Fistulotomy and fistulectomy is the cutting of the fistula tract, starting from the perianal skin, including the sphincter fibers participating in the tract. However, since more than 30% of the external sphincter muscle mass is associated with the fistula tract in complex anal fistula, the surgical technique performed in these cases causes incontinence risk. Williams et al. stated that seton should only be used as the primary treatment in low transsphincteric fistula because of the high 12% of incontinence rate.(21) Fecal incontinence rates, which are the fearful dream of surgeons in fistula surgery, are reported at lower rates in patients with loose seton when compared to those with tight seton. Qiuxiong Yu et al. reported in their study that significantly lower incontinence scores in patients with loose seton when compared to the tight seton group.(20) Isbister et al. reported 36% gas, 8.5% liquid, 2.3% solid stool incontinence in patients who applied tight seton in their study.(22) Huseyin et al. reported that incontinence did not develop when an elastic band was used as a cutting seton in their study.(19) Transient gas incontinence was observed in 1 (0.8%) patient in the loose seton group. Sphincter functions were normal at the 6 months follow-up. Gas incontinence was observed in 4 cases (7.8%) and fluid incontinence in 1 case (1.5%) in group which is cutting seton was applied. We thought that this high rate was due to the gradual tight ligation of the cutting seton and damage to the external sphincter fibers during increased tension.

Raslan et al. used the cutting seton technique in their study and found the recovery rate to be 90.2%.(6) Menteş et al. found the recovery rates to be 45% in 1 month and 100% in 3 months.(23) This rate changes between 64-100% in other studies.(24,25) Recurrences were found in 21 (11%) patients in the postoperative period. Fifteen (11.9%) of these

patients were in the loose seton group, and 6 (9.3%) were in the incisive seton group. There was no statistically significant difference between groups in terms of recurrences rates. ($p<0,397$) The total recovery time was generally 63.4 (21-122) days. It was 73 (34-122) days in loose seton group and 44,4 (21-93) days in cutting seton group. There was a significant difference between the groups in terms of recovery time.($p<0,00$)

Qiuxiang et al. evaluated the severity of postoperative pain in highly complex fistulas. They found as 3.3 in decompression(cutting the inner mouth and internal sphincter) and loose seton group and 4.2 in the cutting seton group.(20) Lihua Z et al. conducted a study with the loose- cutting combined seton set and they found the VAS score as 0 in 21 patients and 1 in only 1 patient.(13) In our study, the mean VAS score was found to be 0.71 (0-3) in all patients, while this rate was 0.59 (0-3) in the loose seton group and 4.23 (2-7) in the cutting seton group. The statistic was significantly in favor of group 1.($p<0,00$) The results in our study was consistent with the literature.

Sphincter-preserving techniques have been described in parallel with the advancement of technology due to the risks of recurrence and incontinence in Seton applications. Although techniques such as intersphincteric fistula ligation (LIFT), anal fistula plug, video-assisted anal fistula treatment (VAAFT), fibrin glue and laser closure of the fistula tract (FiLAC) have been used recently in anal fistula treatment that preserves sphincter functions, it has been determined that the risk of recurrence is very high in the long term.(26,27,28)

The tract is closed from the inner mouth and ligation is performed in the intersphincteric area in these methods. Emile et al. showed the presence of extra, false and blind-ending weak tracts near or around the main tract as the reason for the high recurrence rate after these procedures. Kurihara and Zhang described that most complex fistulas are associated with secondary tracts in the posterior deep space. There are different results that are reported in terms of success rates, recurrence and complications despite all of these different methods which is described before. (29,30,31)

There are some limitations of this study. These may be its retrospective nature, the non-randomization of cases and also, every patient could not be performed endoanal ultrasonography and MRI preoperatively.

Although there is a trend toward an increase in the rate of the use of minimally invasive surgical methods with sphincter-sparing techniques, recurrence rates are common in the long term because complete drainage cannot be achieved. This leads surgeons to

still use the traditional seton method. We think that new modifications of Seton drainage methods will be the most used method in the treatment of this disease. We think that studies with long-term results on these methods will shed light on anal fistula surgery in the future.

References

1. Włodarczyk M, Włodarczyk J, Sobolewska-Włodarczyk A, Trzeciński R, Dziki Ł, Fichna J. Current concepts in the pathogenesis of cryptoglandular perianal fistula. *J Int Med Res.* 2021 Feb;49(2):300060520986669.
2. Westerterp M, Volkers NA, Poolman RW, van Tets WF. Anal fistulotomy between Skyla and Charybdis. *Colorectal Dis* 2003; 5: 549-551 [PMID: 14617238]
3. Whiteford MH, Kilkenny J, Hyman N, Buie WD, Cohen J, Orsay C, Dunn G, Perry WB, Ellis CN, Rakinic J, Gregorcyk S, Shellito P, Nelson R, Tjandra JJ, Newstead G. Practice parameters for the treatment of perianal abscess and fistula-in-ano (revised). *Dis Colon Rectum* 2005; 48: 1337-1342 [PMID: 15933794]
4. Parks AG, Stitz RW. The treatment of high fistula-in-ano. *Dis Colon Rectum* 1976; 19: 487-499 [PMID: 964106]
5. McCourtney JS, Finlay IG. Setons in the surgical management of fistula in ano. *Br J Surg* 1995; 82: 448-452 [PMID: 7613885]
6. Raslan SM, Aladwani M, Alsanea N. Evaluation of the cutting seton as a method of treatment for perianal fistula. *Ann Saudi Med.* 2016 May-Jun;36(3):210-5.
7. Williamson A, Hoggart B. Pain: A review of three commonly used pain rating scales. *J. Clin. Nurs.* 2005;14(7):798-804.
8. Vaizey CJ, Carapeti E, Cahill JA, Kamm MA. Prospective comparison of faecal incontinence grading systems. *Gut.* 1999;44(1):77-80.
9. Malik AI, Nelson RL. Surgical management of anal fistulae: a systematic review. *Colorectal Dis.* 2008 Jun;10(5):420-30.
10. Jafarzadeh J, Najibpoor N, Salmasi A. A comparative study on the effectiveness of rectal advancement flap and seton placement surgeries in patients with anal fistula on the rate of recurrence, incontinence and infection. *J Family Med Prim Care.* 2019 Nov 15;8(11):3591-3594.
11. P. J. Lunniss, P. J. Jenkins, G. M. Besser, L. A. Perry, R. K. S. Phillips, Gender differences in incidence of idiopathic fistula-in-ano are not explained by circulating sex hormones, *International Journal of Colorectal Disease* February 1995, Volume 10, Issue 1, pp 25-28
12. Devaraj B1, Khabassi S, Cosman BC. Recent smoking is a risk factor for anal abscess and fistula. *Dis Colon Rectum.* 2011 Jun;54(6):681-5.
13. Zheng L, Shi Y, Zhi C, Yu Q, Li X, Wu S, Zhang W, Liu Y, Huang Z. Loose combined cutting seton for patients with high intersphincteric fistula: a retrospective study. *Ann Transl Med.* 2020 Oct;8(19):1236.
14. Eitan A, Koliada M, Bickel A. The use of the loose seton technique as a definitive treatment for recurrent and persistent high trans-sphincteric anal fistulas: a long-term outcome. *J Gastrointest Surg* 2009; 13: 1116-1119 [PMID: 19238493]
15. Hammond TM, Knowles CH, Porrett T, Lunniss PJ. The Snug Seton: short and medium term results of slow fistulotomy for idiopathic anal fistulae. *Colorectal Dis* 2006; 8: 328-337 [PMID: 16630239]
16. Theerapol A, So BY, Ngoi SS. Routine use of setons for the treatment of anal fistulae. *Singapore Med J* 2002; 43: 305-307 [PMID: 12380728]
17. Williams JG, MacLeod CA, Rothenberger DA, Goldberg SM. Seton treatment of high anal fistulae. *Br J Surg* 1991; 78: 1159-1161 [PMID: 1958973]
18. Abdelnaby M, Emile S, El-Said M, Abdallah E, AbdelMawla A. Drained mucosal advancement flap versus rerouting Seton around the internal anal sphincter in treatment of high trans-sphincteric anal fistula: A randomized trial. *Int J Surg.* 2019 Dec;72:198-203.
19. Bektaşoğlu, Hüseyin Kazım, and Enver Kunduz. "Kompleks Anal Fistül Tedavisinde Elastik Seton Uygulaması: 44 Hastanın Analizi." *Turkish Journal of Colorectal Disease* 28.1 (2018): 18.
20. Yu Q, Zhi C, Jia L, Li H. Cutting seton versus decompression and drainage seton in the treatment of high complex anal fistula: a randomized controlled trial. *Sci Rep.* 2022 May 12;12(1):7838. doi: 10.1038/s41598-022-11712-9.
21. Williams JG, Farrands PA, Williams AB et al. The treatment of anal fistula: ACPGBI position statement. *Colorectal Dis* 2007;9:18-50
22. Isbister WH, Sanea NA. The cutting seton: an experience at King Faisal Specialist Hospital. *Dis Colon Rectum* 2001;44:722-727.
23. Menten BB1, Oktemer S, Tezcaner T, Azili C, Leventolu S, O?uz M, Elastic one-stage cutting seton for the treatment of high anal

- fistulas: preliminary results, *Tech Coloproctol.* 2004 Nov;8(3):159-62.
24. Hämäläinen KP, Sainio AP. Cutting seton for anal fistulas: high risk of minor control defects. *Dis Colon Rectum.* 1997 Dec 40(12):1443-6.
 25. Kamrava A, Collins JC. A decade of selective use of adjustable cutting seton combined with fistulotomy for anal fistula. *Am Surg.* 2011 Oct;77(10):1377-80
 26. Lin H, Jin Z, Zhu Y, Diao M, Hu W. Anal fistula plug vs rectal advancement flap for the treatment of complex cryptoglandular anal fistulas: A systematic review and meta-analysis of studies with long-term follow-up. *Colorectal Dis. Off. J. Assoc. Coloproctol. Great Br. Ireland.* 2019;21(5):502–515. doi: 10.1111/codi.14504.
 27. Emile SH, Elfeki H, Shalaby M, Sakr A. A Systematic review and meta-analysis of the efficacy and safety of video-assisted anal fistula treatment (VAAFT) *Surg. Endosc.* 2018;32(4):2084–2093.
 28. Emile SH, Khan SM, Adejumo A, Koroye O. Ligation of intersphincteric fistula tract (LIFT) in treatment of anal fistula: An updated systematic review, meta-analysis, and meta-regression of the predictors of failure. *Surgery.* 2020;167(2):484–492.
 29. Emile SH, Elfeki H, Thabet W, Sakr A, Magdy A, El-Hamed T, Omar W, Khafagy W. Predictive factors for recurrence of high transsphincteric anal fistula after placement of seton. *J. Surg. Res.* 2017;213:261–268.
 30. Kurihara H, Kanai T, Ishikawa T, Ozawa K, Kanatake Y, Kanai S, Hashiguchi Y. A new concept for the surgical anatomy of posterior deep complex fistulas: The posterior deep space and the septum of the ischiorectal fossa. *Dis. Colon Rectum.*2006;49(10 Suppl):S37–S44.
 31. Zhang H, Zhou ZY, Hu B, Liu DC, Peng H, Xie SK, Su D, Ren DL. Clinical significance of 2 deep posterior perianal spaces to complex cryptoglandular fistulas. *Dis. Colon Rectum.* 2016;59(8):766–774.