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ORIGINAL ARTICLE

Long-term outcome of low perianal fistulas treated by fistulotomy: a multicenter study

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Abstract
Purpose Fistulotomy is considered to be the golden standard for the treatment of low perianal fistula but might have more influence on continence status than believed. This study was performed to evaluate the healing rate after a fistulotomy and to show results for continence status.
Methods A retrospective database study was performed in one university medical center and its six affiliated hospitals. All patients treated with a fistulotomy for a low perianal fistula were identified. Healing and recurrence of the fistula were identified. Questionnaires on continence status and quality of life were mailed to all patients.
Results In total, 537 patients were identified. The primary etiology of the fistulas was cryptoglandular (66.5 %). Recurrence was seen in 88 patients (16.4 %) resulting in a primary healing rate of 83.6 %. After secondary treatment for the recurrence, another 40 patients healed. This resulted in a secondary healing rate of 90.3 %. The Kaplan-Meier analysis showed that at 5 years, the healing rate was 0.81 (95 % confidence interval (95 % CI) 0.71–0.85). The mean Vaizey score was 4.67 (SD 4.80). Major incontinence, defined as a Vaizey score of >6, was seen in 95 (28.0 %) patients. Only 26.3 % of the patients had a perfect continence status (Vaizey score 0). Quality of life was not different from the general population.
Conclusions Fistulotomy seems to be associated with a healing rate of 0.81 (95 % CI 0.71–0.85) after 5 years. However, major incontinence is still reported by 26.8 % of patients and only 26.3 % of patients had a perfect continence status.

Keywords Fistulotomy · Low perianal fistula · Continence status · Recurrence · Quality of life

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Introduction

Perianal fistulas (PF) remain a surgical treatment challenge in colorectal practice due to high recurrence rates and the risk of postoperative incontinence. Treatment of PF depends on the relation to the anal sphincter complex. Traditionally, the fistulas are classified according to Parks' classification (transsphincteric, intersphincteric, extrasphincteric, and suprasphincteric) [1]. However, treatment of a PF depends mostly on the amount of the sphincter complex that is

involved. Therefore, the classification in high and low fistulas has become more common. High perianal fistulas (HPF) are defined as involving the middle and/or upper third parts of the anal sphincter complex. Low perianal fistulas (LPF) are defined as involving the lower one third of the anal sphincter complex or not involving the sphincter muscles at all. The major disadvantage of surgical treatments for PF is the chance of anal sphincter dysfunction, like soiling, incontinence for gas, and liquid and/or solid stool.

At first, fistulotomy was the main surgical procedure for all PF. However, in HPF, this procedure results in a high risk of anal sphincter dysfunction [2]. Consequently, this led to the development of surgical techniques for HPF aimed at sparing anal sphincter function and improving recurrence rates [3–5]. Nowadays, new techniques are still being developed for HPF, since the ideal treatment has not been found yet [6–9].

For LPF, fistulotomy is still considered to be the golden standard of surgical treatment. Success rates have been reported as high as 80–100 % [10–12]. Unfortunately, incontinence rates after fistulotomy might be higher than we assume. This is indicated by several studies that report on incontinence, ranging from soiling to major incontinence, up to 41 % [13, 11, 14]. In contrast to treatments for HPF, development of new treatments for LPF has not been advancing as fast, although some newer techniques have been described [15, 16]. With the development of new techniques lagging behind for LPF and the risks of incontinence being real, we considered the evaluation of our results after fistulotomy appropriate. We therefore assessed healing rate, continence status, and quality of life after fistulotomy for LPF in our region.

Methods

We searched the databases and patient files of our university medical center and its six affiliated hospitals for patients with LPF between 2008 and 2013. A LPF was defined as a fistula traversing the lower one third of the anal sphincter complex or a superficial fistula not involving the striated sphincter complex.

The primary outcome of this study was closure rate after fistulotomy. The secondary outcomes were continence levels, quality of life, time to healing, and time to recurrence. Demographic data, disease etiology, type of fistula, fistula anatomy, and previous fistula surgery were all extracted from patient files. Fistula type was defined as a primary or a recurrent fistula. Both types of fistula were included. Prior fistula surgery was defined as any surgery regarding the fistula, including seton placement. Abscess drainage was excluded.

Closure of the fistula was defined as a visibly closed wound without external fistula openings and without discharge during manual compression. Recurring of these symptoms was defined as a recurrent fistula. If the fistula did not close within 3 months, it was defined as a persisting fistula. The time from operation to closure of the fistula was defined as time to healing. Time to recurrence was defined as the time from healing to the time that the patient file described recurring symptoms.

Information regarding fistula anatomy (location of internal and external openings, location of fistula tract, involvement of the sphincter complex, etc.) was obtained from additional imaging like magnetic resonance imaging (MRI) or from descriptions of the fistula tract in operative reports. MRI was generally only performed in case a HPF was suspected preoperatively.

To identify factors associated with a recurrence, patients with a recurrent LPF were compared to the primary healed patients using a Cox regression analysis. A p value<0.05 was considered statistically significant. Additionally, a Kaplan-Meier analysis was performed to compare cumulative proportions of patients with recurrence.

Long-term postoperative outcomes regarding incontinence rate and quality of life were obtained using two questionnaires. To assess the long-term postoperative continence status, we used the Vaizey questionnaire [17]. Quality of life was assessed using the Short Form Health Survey 36 (SF-36) [18].

Telephone interviews were used to evaluate the status of the fistula for patients not being in outpatient clinical follow-up anymore. Preoperative and postoperative interviews and examination were performed by the operating surgeons or by the resident surgeon involved with the operation. Either the operating surgeon or the resident surgeon involved with this study performed the telephone interviews. This study was performed according to national and local medical and ethical laws and guidelines. The local medical ethical committees approved this study.

Operative procedure

Patients were positioned in the lithotomy position under general or spinal anesthesia. First, a probe was inserted in the fistula tract, identifying the external and trying to identify the internal fistula openings. An anal retractor was only used if visibility was not good enough to examine the fistula and perform the procedure. The involved medical centers used different types of retractors. If a LPF was confirmed based on the amount of sphincter complex involved after probing the tract, a lay-open procedure of the tract was performed guided by the probe. The fistula track was curetted after the fistulotomy. If a HPF was suspected, the fistulotomy was not performed.

Results

Between January 2008 and June 2013, 537 patients were treated by fistulotomy for a LPF. Mean age at time of

operation was 45.5 years (range 5–97); 379 (70.6 %) patients were male. Median total follow-up was 38.9 months (6.0–74.8).

Of the 537 patients, 369 (68.7 %) had a primary fistula, 163 (30.4 %) had a recurrent fistula, and in 5 (0.9 %) patients, the type of fistula was unknown. Fistula anatomy according to Parks' classification is shown in Table 1.

Fistula etiology was cryptoglandular in 357 patients (66.5 %). Thirty-six patients (6.7 %) had a fistula related to Crohn's disease. For the remaining patients, the disease etiology could not be identified.

MRIs were made preoperatively in 266 patients (49.5 %). Of those 266 MRIs, 242 (91.0 %) confirmed the presence of a LPF. Fistula tract and sphincter involvement was also described in most of the operative reports.

A recurring fistula was seen in 88 (16.4 %) patients of whom 40 (7.4 %) had persisting fistulas. In four (0.7 %) patients, it was unclear if a recurrence occurred (Table 2). This resulted in a success rate of 83.6 %. The median healing time was 37 days (range 6–99). The median time until recurrence was 90 days (range 7–1085).

Recurrences were managed by conservative treatment in 12 (13.6 %) patients, with a seton in 16 (18.2 %) patients, a fistulotomy in 47 (53.4 %) patients, a seton + fistulotomy in 1 (1.2 %) patient, and a mucosal advancement flap in 4 (4.5 %). The method of treatment could not be identified in eight (9.1 %) patients. Results after surgery for recurrent LPF are displayed in Table 3.

After the secondary treatment, another 40 fistula remained closed, reaching a secondary healing rate of 90.3 %. The cumulative healing rate at 5 years is 0.81 (95 % confidence interval (95 % CI) 0.71–0.85), as can be seen in the Kaplan-Meier survival curve (Fig. 1).

No significant relation was found between gender, Crohn's disease, an unidentified internal opening or anterior location of the internal opening, and the development of a recurrence. However, a significant relation ($p<0.05$) for the development of a recurrence was found if it concerned a recurring fistula (Table 4).

Preoperatively, seven (1.3 %) patients had known incontinence problems. Five of these patients had complaints of soiling, one patient was incontinent for gas, and one patient was incontinent for solid stool.

Table 1 Distribution of fistula anatomy

Classification	Number	Percent
Transsphincteric	164	30.5
Intersphincteric	143	26.6
Superficial (subcutaneous)	211	39.4
Not classified	19	3.5

Table 2 Number and percentages of recurrence after fistulotomy

	Number	Recurrence	Secondary surgery	Healing after secondary surgery
Type of fistula				
Transsphincteric	164	30 (18.3)	21 (70.0)	5 (23.8)
Intersphincteric	143	18 (12.6)	13 (72.2)	10 (55.6)
Superficial (subcutaneous)	211	40 (19.0)	32 (80.0)	13 (40.6)
Not classified	19	3 (15.5)	2 (66.7)	2 (66.7)
Previous operations				
0	274	37 (13.5)	27 (73.0)	12 (44.4)
1	121	23 (19.0)	16 (69.6)	13 (81.3)
2	47	11 (23.4)	9 (81.8)	1 (9.1)
>2	29	5 (17.2)	4 (80.0)	1 (25.0)
Crohn's disease	36	12 (33.3)	7 (58.3)	1 (14.3)

Values are given as *n* (%)

The questionnaires were mailed to all 537 patients. After a month, we sent a second questionnaire and contacted the patients that did not respond after the first mailing. In total, 374 patients responded to our questionnaire, resulting in a response rate of 69.6 %. Thirty-four (6.3 %) patients replied that they were not willing to participate. This resulted in 63.3 % completion of the questionnaires. Two (0.4 %) patients turned out to be deceased.

We compared the results of our SF-36 survey to the validated values for the general population [19]. The results of our SF-36 survey are displayed in Fig. 2. Compared to the national values, no significant difference was found in quality of life (Table 5).

The mean Vaizey score was 4.67 (SD 4.80). Major incontinence, defined as a Vaizey score of >6 [3], was seen in 95 (28.0 %) patients. Incontinence levels and their relation to previous surgery are displayed in Tables 6 and 7. We did not find a difference in continence status between patients with and without a preoperative MRI. Data on the number of vaginal deliveries and nulliparous status were unfortunately

Table 3 Healing after secondary treatment

Type of treatment after recurrence	Number	Healing after secondary treatment
Conservative treatment	12	9 (75.0)
Seton	16	2 (12.5)
Seton + fistulotomy	1	0 (0.0)
Fistulotomy	47	28 (59.6)
Mucosal advancement flap	4	1 (25.0)
Unknown	8	Unknown

Values are given as *n* (%)

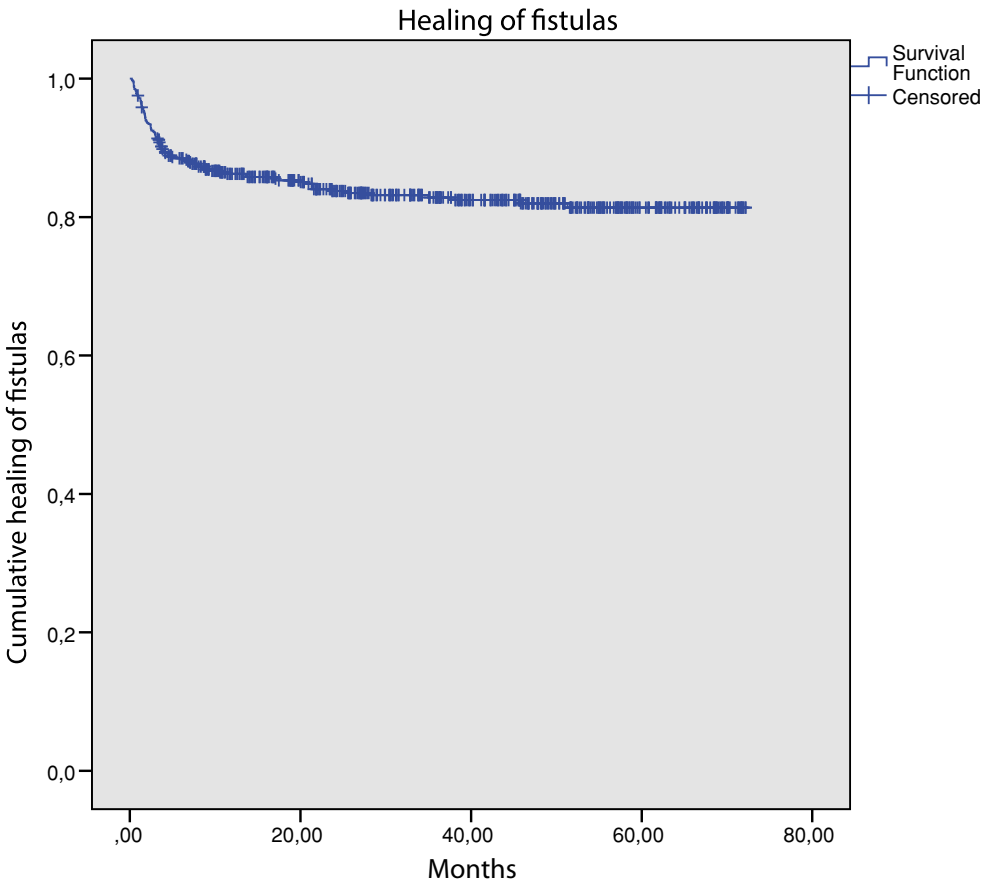

Fig. 1 Healing of fistulas. Remaining cases: 0 months, 533; 20 months, 338; 40 months, 207; 60 months, 72

not available, and its effect on postoperative continence status could therefore not be evaluated.

Discussion

This study on long-term results after fistulotomy for LPF demonstrates a primary healing rate of 83.6 % and a secondary healing rate of 90.3 %. This is consistent with other reports that have demonstrated a high healing rate (>90 %) [20]. Using a Kaplan-Meier analysis, we found a healing rate after 5 years of 0.81 (95 % CI 0.71–0.85).

The healing time after fistulotomy varied widely between several reports, ranging from a median of 3 up to 11.6 weeks [21, 20]. A maximum healing time of 12 weeks is regarded the standard for LPF [22, 21]. The 5-week healing time in our study is therefore similar to healing times in other studies.

Although we found a recurrence rate within the reported recurrence range, it cannot go unnoticed that our primary rate (16.4 %) was slightly higher than the average total recurrence rate of 10 % [23, 2, 20]. By analyzing center-specific data, we found the highest recurrence rate in our university medical

Table 4 Cox regression analysis for recurrence of fistula

Parameters	Hazard ratio	95 % CI	*p* value
Female	1.185	0.737–1.907	0.49
Recurrent fistula	2.170	1.427–3.300	<0.05
Crohn's disease	0.329	0.045–2.378	0.27
Unidentified internal opening	1.240	0.684–2.247	0.48
Anterior fistula location	0.547	0.162–1.852	0.33

A hazard ratio >1 shows increased frequency of recurrence

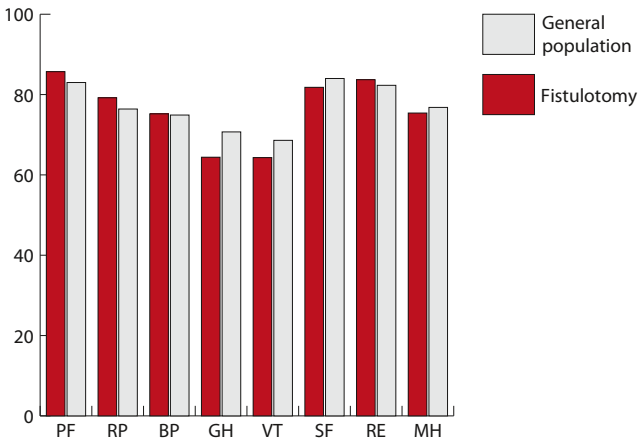

Fig. 2 Outcomes of the SF-36 questionnaire. *PF* physical function, *RP* role physical, *BP* bodily pain, *GH* general health, *VT* vitality, *SF* social functioning, *RE* role emotional, *MH* mental health

Table 5 SF-36 outcome: comparison of quality of life

Health score	Fistulotomy	General population	*p* value
Physical functioning	85.7 (21.1)	83.0 (22.8)	0.83
Role physical problems	79.2 (37.0)	76.4 (36.3)	0.90
Bodily pain	75.2 (24.3)	74.9 (23.4)	0.99
General health	64.4 (21.6)	70.7 (20.7)	0.61
Vitality	64.3 (20.3)	68.6 (19.3)	0.71
Social functioning	81.8 (21.5)	84.0 (22.4)	0.86
Role emotional problems	83.7 (32.1)	82.3 (32.9)	0.94
Mental health	75.4 (18.7)	76.8 (17.4)	0.90

Values as mean (SD)

center. The higher recurrence rate could be explained by the third line referral position for LPF. There might also be a difference in recurrence per surgeon. Furthermore, it cannot be discarded that the inclusion of patients with Crohn's disease might contribute to a higher recurrence rate, although these patients were only treated if the Crohn's disease was in remission. Similar effects are described in reports that also do not exclude Crohn's disease [10, 24].

Lack of identifying the internal opening [2], female gender, recurrent fistula surgery [24], and location off the midline [2] are reported to be factors associated with the development of a recurrence. In our series, the only significant factor associated with a recurrence was a recurring fistula. The reasons for our different findings are not clear.

Postoperative quality of life results were not significantly different from the general population. Furthermore, the long-term incontinence levels were low with a mean Vaizey score of 4.66 (SD 4.75). However, we did find major incontinence in 95 (28.0 %) patients [3].

Incontinence rates vary significantly between studies from 2.4 up to 64 % [24, 25], but most series report incontinence rates ranging between 30 and 40 % [23, 10, 11]. Similar to these reports, most incontinence problems consisted of soiling or flatus. Standardized incontinence scales are unfortunately rarely used in older studies. Reports that do use a standardized scale report average Vaizey scores of >6.5, which is higher than our series (4.66) [11]. Major incontinence is usually described as a Vaizey score >6 [3]. The Vaizey questionnaire consists of six questions scored 1 (mild incontinence) to 4 (severe incontinence) with a maximum score of 24. If a patient has only minor complaints, it may not affect daily functioning, although it may result in a score >6 on the questionnaire. Therefore, it is important to distinguish a very high Vaizey score from a Vaizey score of just >6 with only minor complaints.

Table 6 Incontinence levels

Vaizey score	Number (%)
0	89 (26.3)
1–6	155 (45.7)
>6	95 (28.0)

Table 7 Vaizey score related to previous surgery

Vaizey score	No operations	One operation	Two operations	> Two operations	Unknown
0	53 (32.2)	19 (24.6)	4 (11.1)	2 (10.5)	7 (16.7)
1–6	73 (44.2)	37 (48.1)	19 (52.8)	11 (57.9)	21 (50.0)
>6	39 (23.6)	21 (27.3)	13 (36.1)	6 (31.6)	14 (33.3)

Values given as *n* (%)

The reason for the high percentage of major incontinence in our study remains unclear; however, several possibilities come to mind. Even though no significant relation was found between the Vaizey score and the number of previous operations, it is likely that previously operated patients have a more damaged sphincter complex and a higher cumulative risk of postoperative incontinence. Secondly, if during the operation a HPF is suspected, even if the MRI contradicts, a fistulotomy is not performed and a seton is placed. This, however, does not exclude the possibility that some of the fistulotomies were performed in patients that had a HPF, making the risk of postoperative incontinence significantly higher. Besides, about half of the patients did not have a preoperative MRI and the surgeon had to rely on operative findings.

As previously described, we unfortunately miss the data on vaginal delivery status for our female patients. It is known that this can negatively affect sphincter function. Unfortunately, we cannot say if this influenced our postoperative results.

Another factor that has to be taken into account is the pre- and postoperative bowel function, specifically for the patients with CD, because irritable bowel with frequent diarrhea may also affect the continence status. However, the number of patients, both pre- and postoperatively, with these symptoms was limited to only a couple. The high level of postoperative continence issues can therefore not contribute to this.

Although we found a major incontinence in 28.0 % of the patients, quality of life was not significantly different from the general population. Long-term postfistulotomy quality of life is more likely affected by more recent life events instead of a limited surgical procedure years ago [26]. We performed a long-term quality of life survey to assess the current health status of our patients. However, after assessing the results, the usefulness of these quality of life results can be discussed. Either patients are satisfied with their quality of life regardless of their continence status or the quality of life questionnaire is not the right instrument to use.

A limitation of this study was the retrospective design. Due to this design, pre- versus postoperative comparison of secondary outcomes was not possible. Another limitation was the use of telephone interviews to assess long-term follow-up, which may have resulted in bias and maybe missed recurrences.

Fistulotomy is still considered to be the golden standard for the treatment of LPF. However, incontinence rates may be higher than we expected. The amount of sphincter involved by the fistula might be underestimated during operation. Therefore, we believe that it is important to lower the chance of anal sphincter dysfunction as much as possible. Patients should be optimized for the operation to lower the chance of a needed reoperation. Active Crohn's disease needs to be treated first. Besides, patients should be encouraged to stop smoking, since we know smoking influences wound healing [27], although contradictory results are found for the influence of smoking on the healing of PF [28, 11].

Preoperative imaging, either using MRI or (endoanal) ultrasound, of the fistula tract might be useful to determine the amount of sphincter muscle involved. This could be advantageous during preoperative planning. Because we know that the higher the internal fistula opening is located, and the more sphincter muscle is involved, the higher the risk of postoperative incontinence will be. In cases of a relatively high internal opening and large involvement of sphincter muscle, it could be better to change tactics and choose an operative technique that is developed for HPF. However, there is no data supporting this statement.

Fistulotomy seems to be a reasonably good treatment for LPF with a healing rate of 0.81 (95 % CI 0.71–0.85) after 5 years and a minimal effect on continence status (mean Vaizey score 4.67). However, major incontinence is still reported in 28.0 % of patients. Although this rate might be an overestimation on its influence in daily functioning, these levels of incontinence are disturbing for a small procedure regarded to be the golden standard for LPF. While many new techniques are being developed for HPF, the development of new LPF treatments is lagging behind when this could lower major incontinence levels.

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References

1. Parks AG, Gordon PH, Hardcastle JD (1976) A classification of fistula-in-ano. Br J Surg 63:1–12
2. Garcia-Aguilar J, Belmonte C, Wong WD, Goldberg SM, Madoff RD (1996) Anal fistula surgery. Factors associated with recurrence and incontinence. Dis Colon Rectum 39:723–729
3. Dubsky PC, Stift A, Friedl J, Teleky B, Herbst F (2008) Endorectal advancement flaps in the treatment of high anal fistula of cryptoglandular origin: full-thickness vs. mucosal-rectum flaps. Dis Colon Rectum 51:852–857. doi:10.1007/s10350-008-9242-3
4. Champagne BJ, O'Connor LM, Ferguson M, Orangio GR, Schertzer ME, Armstrong DN (2006) Efficacy of anal fistula plug in closure of cryptoglandular fistulas: long-term follow-up. Dis Colon Rectum 49:1817–1821. doi:10.1007/s10350-006-0755-3
5. Van Der Hagen SJ, Baeten CG, Soeters PB, Van Gemert WG (2011) Staged mucosal advancement flap versus staged fibrin sealant in the treatment of complex perianal fistulas. Gastroenterol Res Pract 2011:186350. doi:10.1155/2011/186350
6. Rojanasakul A, Pattanaarun J, Sahakitrungruang C, Tantiphlachiva K (2007) Total anal sphincter saving technique for fistula-in-ano; the ligation of intersphincteric fistula tract. J Med Assoc Thail 90:581–586
7. Gottgens KW, Vening W, Van Der Hagen SJ, Van Gemert WG, Smeets RR, Stassen LP, Baeten CG, Breukink SO (2014) Long-term results of mucosal advancement flap combined with platelet-rich plasma for high cryptoglandular perianal fistulas. Dis Colon Rectum 57:223–227. doi:10.1097/DCR.0000000000000023
8. Herreros MD, Garcia-Arranz M, Guadalajara H, De-La-Quintana P, Garcia-Olmo D (2012) Autologous expanded adipose-derived stem cells for the treatment of complex cryptoglandular perianal fistulas: a phase III randomized clinical trial (FATT 1: Fistula Advanced Therapy Trial 1) and long-term evaluation. Dis Colon Rectum 55:762–772. doi:10.1097/DCR.0b013e318255364a
9. Meinero P, Mori L (2011) Video-assisted anal fistula treatment (VAAFT): a novel sphincter-saving procedure for treating complex anal fistulas. Tech Coloproctology 15:417–422. doi:10.1007/s10151-011-0769-2
10. Van Der Hagen SJ, Baeten CG, Soeters PB, Van Gemert WG (2006) Long-term outcome following mucosal advancement flap for high perianal fistulas and fistulotomy for low perianal fistulas: recurrent perianal fistulas: failure of treatment or recurrent patient disease? Int J Colorectal Dis 21:784–790. doi:10.1007/s00384-005-0072-7
11. Van Koperen PJ, Wind J, Bemelman WA, Bakx R, Reitsma JB, Slors JF (2008) Long-term functional outcome and risk factors for recurrence after surgical treatment for low and high perianal fistulas of cryptoglandular origin. Dis Colon Rectum 51:1475–1481. doi:10.1007/s10350-008-9354-9
12. Cariati A (2013) Fistulotomy or seton in anal fistula: a decisional algorithm. Updat Surg 65:201–205. doi:10.1007/s13304-013-0216-1
13. Bokhari S, Lindsey I (2010) Incontinence following sphincter division for treatment of anal fistula. Colorectal Dis 12:e135–e139. doi:10.1111/j.1463-1318.2009.01872.x
14. Westerterp M, Volkers NA, Poolman RW, Van Tets WF (2003) Anal fistulotomy between Skylla and Charybdis. Colorectal Dis 5:549–551
15. Van Onkelen RS, Gosselink MP, Schouten WR (2012) Ligation of the intersphincteric fistula tract in low transsphincteric fistula: a new technique to avoid fistulotomy. Colorectal Dis. doi:10.1111/codi.12030
16. Mishra A, Shah S, Nar AS, Bawa A (2013) The role of fibrin glue in the treatment of high and low fistulas in ano. JCDR 7:876–879. doi:10.7860/JCDR/2013/5387.2964
17. Vaizey CJ, Carapeti E, Cahill JA, Kamm MA (1999) Prospective comparison of faecal incontinence grading systems. Gut 44:77–80
18. Ware JE Jr, Snow KK, Kosinski M, Gandek B (1993) SF-36 Health Survey manual and interpretation guide. New England Medical Centre, The Health Institute, Boston
19. Aaronson NK, Muller M, Cohen PD, Essink-Bot ML, Fekkes M, Sanderman R, Sprangers MA, Te Velde A, Verrips E (1998) Translation, validation, and norming of the Dutch language version of the SF-36 Health Survey in community and chronic disease populations. J Clin Epidemiol 51:1055–1068
20. Rosa G, Lolli P, Piccinelli D, Mazzola F, Bonomo S (2006) Fistula in ano: anatomoclinical aspects, surgical therapy and results in 844 patients. Tech Coloproctology 10:215–221. doi:10.1007/s10151-006-0282-1
21. Malouf AJ, Buchanan GN, Carapeti EA, Rao S, Guy RJ, Westcott E, Thomson JP, Cohen CR (2002) A prospective audit of fistula-in-ano at St. Mark's Hospital. Colorectal Dis 4:13–19
22. Vasilevsky CA, Gordon PH (1985) Results of treatment of fistula-in-ano. Dis Colon Rectum 28:225–231

23. Van Tets WF, Kuijpers HC (1994) Continence disorders after anal fistulotomy. Dis Colon Rectum 37:1194–1197
24. Hyman N, O'Brien S, Osler T (2009) Outcomes after fistulotomy: results of a prospective, multicenter regional study. Dis Colon Rectum 52:2022–2027. doi:10.1007/DCR.0b013e3181b72378
25. Sileri P, Cadeddu F, D'Ugo S, Franceschilli L, Del Vecchio Blanco G, De Luca E, Calabrese E, Capperucci SM, Fiaschetti V, Milito G, Gaspari AL (2011) Surgery for fistula-in-ano in a specialist colorectal unit: a critical appraisal. BMC Gastroenterol 11:120. doi:10.1186/1471-230X-11-120
26. Aaronson NK (1989) Quality of life assessment in clinical trials: methodologic issues. Control Clin Trials 10:195S–208S
27. Kinsella JB, Rassekh CH, Wassmuth ZD, Hokanson JA, Calhoun KH (1999) Smoking increases facial skin flap complications. Ann Otol Rhinol Laryngol 108:139–142
28. Zimmerman DD, Delemarre JB, Gosselink MP, Hop WC, Briel JW, Schouten WR (2003) Smoking affects the outcome of transanal mucosal advancement flap repair of trans-sphincteric fistulas. Br J Surg 90:351–354. doi:10.1002/bjs.4044