Short- and Long-Term Results of Hand-Sewn Coloanal Anastomosis Performed as a Salvage Procedure after Rectal Resection

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Citation

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Abstract

Background
The aim of this retrospective study is to show that pull-through anastomosis, as introduced by Parks, is the last possibility for sphincter sparing surgery in clinically difficult situations.

Methods
Fifty-nine hand-sewn coloanal anastomoses were performed in one university hospital when a stapling device could not be used. The indications for rectal surgery with consecutive coloanal anastomosis were rectal cancer (n=39), fistulae (n=10), and postoperative complications (n=10). A stapled anastomosis could not be performed due to complications including intraoperative complications, necessary second-look tumor resections, narrow or obese pelvis, or because of very deep tumor or lesion localization. Twenty-five patients underwent surgical procedures including 17 anterior resections and 24 intrapelvic radiations prior to the pull-through procedure.

Results
In-house mortality was 1.75%. Nine patients had to undergo relaparatomy with eight patients showing necrosis of the pulled through colon. The rates of anastomotic leakage, anastomotic stricture, and fistula were 37%, 20%, and 18%, respectively. Of the curatively treated patients, 25% developed tumor progression. Two rectovaginal fistulae became recurrent. In 35 patients, the protective colostomy was closeable. Anorectal continence was assessed by patient questionnaires based on the Kirwan classification as follows: (n=24): Grade III (38%), Grade IV (33%), and Grade V (29%).

Conclusions
Where a stapled anastomosis after rectal excision is impossible, patients' anorectal continence can be restored by performing a pull-through operation with hand-sewn coloanal anastomosis. However, the procedure carries a high postoperative complication rate and a poor functional outcome.

BACKGROUND

Rectal cancer is the predominant reason why permanent colostomies are performed. Due to its anatomy, the excision of the rectum and the sphincter apparatus can also become necessary when neighboring organs experience benign or malignant disease. Abdominoperineal extirpation was developed by the surgeon Ernest Miles in the early 20th century and is the traditionally accepted therapy of choice for patients with deep rectal cancer, especially in cases of malignant infiltration into the sphincter muscles, because it maintains a five centimeter distal resection margin. However, surgeons today are less concerned with maintaining this margin, and increasingly attempt to preserve patient continence using alternative approaches. One aim of local radiation therapy is to address the increased rate of local recurrence that is believed to accompany lower resection margins.

The first sphincter saving pull-through procedures were performed in the late 19th century and in 1972, Sir Alan Parks successfully developed a modified form of this technique that is still in use today [1]. The advancement of mechanical staplers in the 1970s made it possible to perform a reliable anastomosis that connected the colon to the anal canal, and made the transanal anastomosis with the double

stapling technique the most widely accepted treatment for low-grade rectal cancer. In the present study, the pull-through operation was not performed as an alternative to the stapled anastomosis, rather it was the last available option that could preserve the sphincter apparatus after rectal resection, and can therefore be considered to be a salvage procedure. The aim of the present study is to characterize the morbidity, the oncological results, and the functional results of this procedure in clinically difficult situations. The results section is followed by a discussion which takes into consideration the high rates of anastomotic dehiscence and incontinence after coloanal anastomosis (CAA).

METHODS

This work represents a retrospective single center experience comprising 57 (36 male and 21 female) patients who, in an 11-year period, underwent 59 transanal pull-through operations with consecutive hand-sewn coloanal anastomoses. The mean age of the patients was 59.9 years (range, 28 to 79 years). The underlying diseases of 53 patients were malignant. Forty-eight patients suffered from rectal cancer, two from prostate cancer, and three from uterine carcinoma. The benign underlying diseases included one endometriosis, one benign colitis, and one perineal rupture.

The abdominal phase of the operation did not differ substantially from the standardized procedure for a low anterior rectal resection. The mobilization of the rectum was performed, including total mesorectal excision in the cancer operations. After the dissection of the rectum, a retractor was inserted and the mucosa of the anal canal was stripped off from the dentate line to just above the levators. Two different retractors were used, the Park's retractor and the Scott's retractor. The descending colon was pulled down and usually sewn end-to-end with 12 to 16 interrupted sutures. In 58 cases, a diverting stoma was constructed, either as a transverse colostomy or as a loop ileostomy. Due to the heterogeneity of the indications and the high number of pretreated patients, not every step in the conducted operations was performed for all patients. To create a reservoir or enable continuity, modifications were performed as follows; a J-pouch was created for two patients; a coloplasty pouch was created for three patients; and an ileocecal interposition was performed for two patients. Of four patients that underwent a laparoscopic procedure, two had conversions to open procedures due to adhesions and deep tumor localization.

In this study, medical records and data obtained from the local tumor center were investigated. Presurgical functional assessment by clinical examination of the anorectal continence organ was documented in 32 patients. Postoperative functional assessment was performed for 33 patients, and of these, 21 were assessed by manometry (continuous pull-through technique). Sixteen of these manometrical examinations were performed prior to closure, two after closure, and three without closure of the diverting stoma. For analysis of the functional outcome, a questionnaire was developed, and sent to patients at least one and a half years after surgery. Seventeen of 21 sent questionnaires were suitable for analysis.

Statistical differences were determined by Student's t-test and Fisher's exact test. Local recurrence and survival were analyzed using the Kaplan-Meier method with comparisons between groups being made with the log-rank test. A p-value of less than 0.05 was considered to be significant. Statistical analyses were performed using SPSS, Version 12.0.

RESULTS

INDICATIONS FOR COLOANAL ANASTOMOSIS

This study summarizes the characteristics and outcome of 59 transanal pull-through operations with hand-sewn CAA. These 59 operations were subdivided into three primary groups representing the different indications to the operation (Table 1).

Figure 1

Table 1: Indication to rectal surgery and patients' characteristics

Group (n=59)	Indication to surgery	Prev. surgery (n=25)	RT/NRT (n=24/17)	Age	Sex (m=38/f=21)
I (39)	Rectal cancer	4 x LARR 3 x TALE 2 x Hysterectomy	15/15	60 (43-78)	29/10
II (10)	Fistulae	6 x LARR 4 x Hysterectomy 1 x Prostatectomy	5/1	54 (28-75)	1/9
III (10)	Various (postop.) complications	4 x LARR* 3 x HP after LARR 1 x Prostatectomy 1 x Sacral procedure	4/1	67 (58-79)	8/2

LARR= Low anterior resection of the rectum; TALE= Transanal local excision; HP=Hartmann's procedure; RT=previous radiation therapy; NRT= Neoadjuvant

radiation therapy of rectal cancer; *including 2 hand-sewn CAA; some patients underwent more than one surgical pretreatment

Group I comprises 39 patients with rectal cancer including 32 patients undergoing their first operation for tumor removal, and seven patients with rectal cancer and prior surgical procedures, among them four with recurrent disease. The second group (II; n=10) comprises patients with fistulae including eight with rectovaginal fistulae, one with rectovesical, and one with rectourethral fistula. The third (III; n=10) group includes patients with other indications to the operation after previous surgical treatment. Four patients showed colonic ischemia or anastomotic dehiscence. Three showed adhered rectal stumps after Hartmann's procedure. One showed postoperative rectal stenosis, one benign rectal stenosis, and one prostate carcinoma infiltrating into the rectum. In the first group, male patients (n=29; 74.4%) outnumbered female patients (n=10; 26.6%). The second group comprised mainly female patients.

In all the operations, a stapled anastomosis was deemed by the surgeon to be infeasible, so the hand-sewn anastomosis was considered as the last surgical option for preserving the sphincter apparatus. The reason for this decision was mostly a very low localization of the carcinoma or the lesion (n=37). In four operations, a stapler-anastomosis was tried in vain. Eight patients were described as having a narrow or obese pelvis which impaired the use of a stapler. In ten cases, a necessary second-look resection precluded the use of a stapler.

PRESURGICAL THERAPY

The patients in this study all had a high number of operations performed prior to CAA. Twenty-five patients went through surgical treatment of the pelvis during the run-up to the pull-through operation (Table 1). Seventeen patients underwent an anterior resection (15 stapled anastomoses). Three patients were pretreated by transanal wall excision for histopathological proof of carcinoma cells, which was the indication for CAA. Eight patients underwent surgery of the genitourinary system before CAA. Prior to the pull-through operation, 17 patients underwent radiation of the rectum; 15 of these were Group I patients that underwent neoadjuvant radiochemotherapy. Four of the six patients with rectovaginal fistulae underwent an additional conservative treatment and at least one unsuccessful surgical repair.

The operation lasted between 165 and 465 minutes with an average of 306 minutes. Eleven different surgeons performed the operations; however, the quantity per surgeon ranged from one to 17. The postoperative hospital stay averaged 22 days and varied from eight to 65 days. Patients from Group I with carcinomas had longer average hospitalization (23 days) than the ones with fistulae from Group III (14 days) because postoperative complications occurred less frequently in Group III.

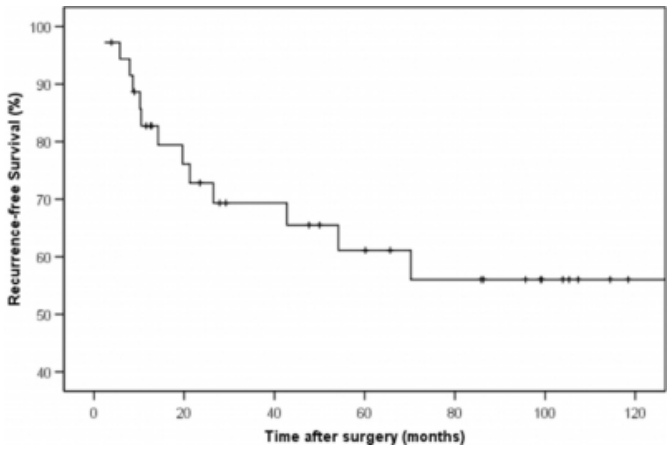
ONCOLOGICAL RESULTS

Histopathological staging of the tumor patients of Group I (without recurrences) in accordance to the Dukes classification was as follows: 4x i.s. carcinoma (11%), 10x Dukes A (29%; T1 or T2, no lymphatic spread), 9x Dukes B (26%; T3 or T4, no lymphatic spread), 7x Dukes C (20%; lymphatic spread), and 5x Dukes D (14%, metastatic spread). Thirty-eight of the 39 oncologic operations of Group I were R0 resections. The tumor differentiation was 1x Grade 1, 23x Grade 2, and 15x Grade 3. The localization of the tumor was determined either pre- or intra-operatively in 34 patients and was on average 4.4 cm (SD 1.5; range 1 to 9) above the anocutaneous line.

During the median follow-up period of 48 months (4 to 138 months), 37% of the tumor patients and eight of the 32 patients operated in curative intention (25%) exhibited tumor progression. Six of these 32 patients developed local recurrence, and two patients had progress of the disease without local recurrence. Tumor progression was diagnosed at an average of 55 months (10-127 months) after the abdominoperineal procedure. Two of the 4 patients with recurrent disease developed re-recurrences. Three patients received postoperative radiochemotherapy. The Kaplan-Meier survival curves show the recurrence-free survival of the curatively operated tumor patients (Figure 1) and the survival of all tumor patients of Group I subdivided by staging (Figure 2; p=0.0004, log-rank test). The three-year (n=20) and five-year (n=15) survival rates of the curatively operated patients were 85% and 80%, respectively.

Figure 2

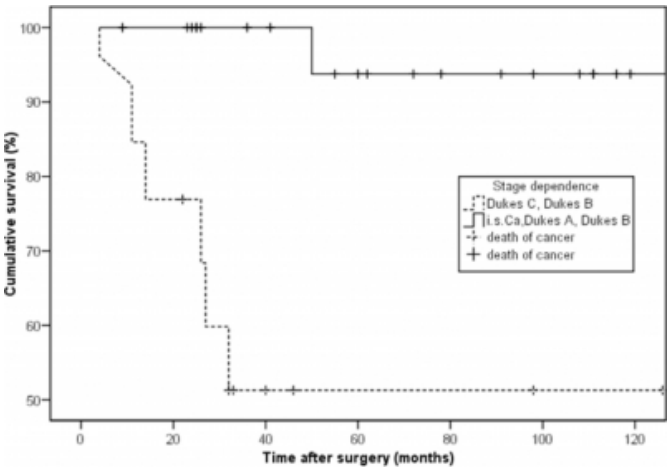
Figure 1: Recurrence-free survival curve of curatively operated patients



Kaplan-Meier recurrence-free survival analysis for patients with rectal cancer who underwent CAA (R0-resections).

Figure 3

Figure 2: Cumulative survival curve of all patients with rectal cancer



Kaplan-Meier curves illustrate the expected difference in survival rates between patients with low-grade tumors (i.s.Ca., Dukes A and B) and those with high-grade tumors (Dukes C and D). This was confirmed by log-rank testing(p=0.0004).

COMPLICATIONS AT THE ANASTOMOSIS

After 24 of the 59 operations, either a necrosis of the pulled-through colon or an insufficiency of the anastomosis occurred (40.7%). None of the patients with fistulae experienced anastomotic insufficiency or necrosis, whereas the rate of these complications in patients of with carcinomas was 51.3% (Table 2).

Figure 4

Table 2: Univariate analysis of risk factors for early anastomotic complications

Factor	Variable	Necrosis n (%)	p-value	Anastomotic insufficiency n (%)	p-value
Sex	Male	7/38 (18.4)	0.238	19/38 (50)	0.011*
	Female	1/21 (4.8)		3/21 (14.3)	
Cancer patient	Yes	7/39 (17.9)	0.245	18/38 (47.3)	0.048*
(Group I)	No	1/20 (5)		4/21 (19)	
Fistula patient	Yes	0/10 (0)	0.329	0/10 (0)	0.009*
(Group II)	No	8/49 (16.3)		22/49 (44.9)	
Prev. rectal	Yes	2/19 (10.5)	1	4/19 (21.1)	0.091
surgery	No	6/40 (15)		18/40 (45)	
Neoadjuvant	Yes	5/17 (29.4)	0.037*	11/17(64.7	0.008*
radiation	No	3/42 (7.1)		11/42(26.2)	
All patients		8/59 (13.6)		22 / 59 (37.3)	

*p<0.05, Fisher's exact test

Excluding patients with neoadjuvant radiation or previous deep anterior rectal resection, the rate of necrosis or anastomotic insufficiency in the 29 remaining patients (27.6%) was not significantly lower (p=0.064). Statistical analysis of possible factors contributing to these severe complications is shown in Table 2. In two of the eight necroses (detected on postoperative days 1, 3, 7, 8, 9, 16, 19) an intact anastomosis was described. In total, 22 anastomotic insufficiencies occurred. The anastomotic insufficiency rate was statistically significantly increased in tumor patients (p=0.027) and in male patients (p=0.011). Also, neoadjuvant radiotherapy was a risk factor for anastomotic leakage (p=0.008). Anastomotic stenoses were found in ten patients and were not statistically related to sex, history of previous surgery, prior radiation treatment, or anastomotic insufficiency. Two of the three postoperatively radiated patients had this complication.

In total, nine fistulae occurred during the postoperative time, among them two had recurrent rectovaginal fistulae and three developed new rectovaginal fistulae. All of them developed after anastomotic dehiscence. Three rectovesical fistulae appeared, whereas one was associated with an intraoperative bladder perforation. One rectorectal fistula occurred at the site of the anastomosis two years after surgery.

FURTHER COMPLICATIONS

One patient suffered from gastric bleeding on day nine after surgery and four suffered from temporary intestinal atony. Two male patients had transitory urinary retention. One patient with temporary ileal stoma developed a short bowel syndrome. Parastomal herniae occurred in four patients. One patient with colonic necrosis after surgery died 28 days later of related complications (30-day mortality: 1.75%).

FISTULAE PATIENTS

The eight female patients (aged 28-75 years) of Group II suffered from rectovaginal fistulae from one month to five years prior to the described procedure. Five of these fistulae developed after anterior rectal resection with stapled anastomosis, two after gynecological surgery, and one after third-degree laceration of the perineum. In total, three of these eight patients underwent radiation within the pelvic cavity before the pull-through operation, and two of them underwent radiation in addition to antecedent anterior resection. Two of these eight fistulae reoccurred, of which one was only radiologically detected and stayed clinically uneventful. The other recurrent fistula appeared two months after surgery and was successfully sutured. The rectourethral fistula recurred two months after surgery and had to be treated by gluing. The rectovesical fistula was also recurrent, but was cured after a newly performed ileal stoma and adjacent closure.

FUNCTIONAL OUTCOME

In 35 (63.6%) of the 54 patients whose data could be evaluated, a closure of the diverting stoma could be performed, on average, 17 weeks after surgery (Table 3).

Figure 5

Table 3: Closure of the protective stoma

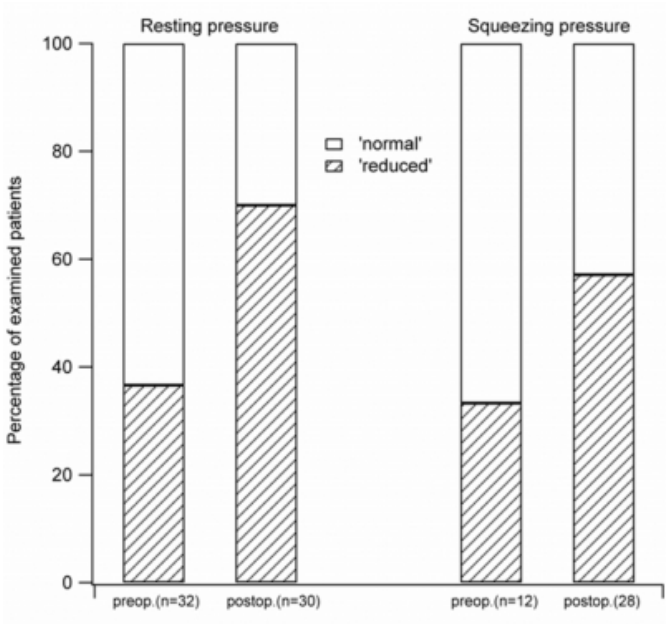
Colostomy	Reason for not closed colostomy	Patients n (%)
Closure		35 (63.6)
No closure	Colonic necrosis	6 (10.9)
	Rapid tumor progression	5 (9)
	Not tumor related death	2 (3.6)
	Incontinence	6 (10.9)
	Therapy-resistant fistula	1 (1.8)

The closure rates were significantly lower in patients with anastomotic leakage (36.4%, p=0.007) and in pre-irradiated patients (41.7%, p=0.032). In one patient with closure of the colostomy and weak functional results, and in one patient with rectorectal fistula, a permanent colostomy was again performed after previous closure.

During the preoperative procedure that comprised either a rectoscopy, or a colonoscopy, or both, the function of the continence organ (squeezing and/or resting pressure) was manually assessed in 32 patients (Figure 3). In total, six of the 11 patients with reduced presurgical function underwent intrapelvic surgery and five underwent radiotherapy before the pull-through operation.

Figure 6

Figure 3: Pre- and postoperative sphincter function



Summary of the clinical examinations on the pre- and postoperative resting and squeezing pressures including sub-threshold manometric values (50 mmH_20 for resting and 80 mmH_20 for squeezing pressures)

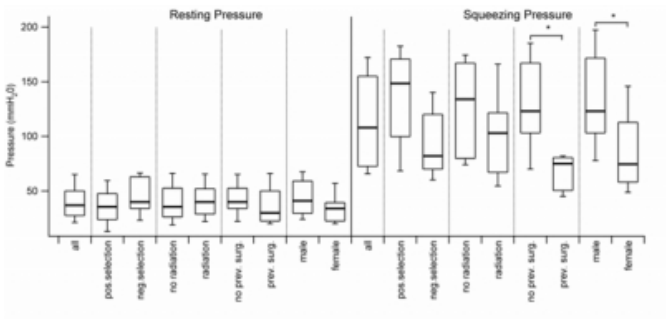
Assessment of the anorectal function in 33 patients obtained during clinical examination (including data from manometries) after the CAA could be evaluated. The resting pressures of 24 patients and the squeezing pressures of 15 patients were reduced.

Manometric data of 21 patients could be evaluated. Sixteen of these manometries were performed prior to closure of the colostomy (Figure 4). The maximum manometric resting pressures averaged 39.1 mmH_2O (0-68 mmH_2O; SD 17.5), and the maximum squeezing pressures averaged 115.6 mmH_2O (45-209 mmH_2O; SD 50). Twelve patients had a reduced resting pressure (threshold value of 50 mmH_2O),

and the squeezing pressure was reduced in six patients (threshold value of 80 mmH_2O). Significant relationships of female sex and previous rectal surgery to lower squeezing pressure values were found (p=0.013, p=0.006; Student's t-test). The previously mentioned positive selection group of patients without previous anterior resection and radiation had, on average, a higher but not significantly increased squeezing pressure in comparison to the negative selection group (140.1 mmH_2O, SD 44.9 vs. 100.1 mmH_2O, SD 44.4; p=0.056).

Figure 7

Figure 4: Manometric pressure values after CAA



Box plots of the manometrically assessed (n=21) postoperative resting and squeezing pressures divided into subgroups of patients. Positive selection of patients excludes irradiated patients and patients with previous anterior rectal resection. *p<0.05, Student's t-test.

Twenty-one questionnaires concerning the patients' anorectal function and quality of life were sent. At the time of the ascertainment, nine patients were dead, and 23 were living with colostomy. Eight patients were lost during follow-up. Seventeen of these 21 questionnaires could be evaluated (Table 4). The patients' functional outcomes were classified according to Kirwan (n=24)[2]. Grade I (full continence) and II (incontinence of gas) was not achieved by any patient. Grade III (incontinence of fluid stool) and Grade IV (incontinence of hard stool) were achieved by 37.5% and 33.4% of the patients, respectively. Grade V comprised the seven patients with permanent colostomy due to weak sphincter function.

Figure 8

Table 4: Analysis of the questionnaire for patients' anorectal continence

Questions	Yes (n / %)	No (n / %)
Inability to control solid feces	9 / 52.9	8 / 47.1
Inability to control loose feces	17 / 100	-/-
Inability to control flatus	17 / 100	-/-
Impaired flatus and feces discrimination	10 / 83.3	2 / 16.7
Stool frequency per day >4	14 / 87.5	2 / 12.5
Increase of stool frequency since surgery	14 / 82.4	3 / 17.6
More fluid stool since surgery	14/ 87.5	2 / 12.5
Regular use of facilities to prevent soiling of underwear	11 / 84.6	2 / 15.4
Decrease in quality of life since surgery	10 / 71.4	4 / 28.6
Gain in quality of life since closure of the colostomy	10 / 83.3	2 / 16.7

DISCUSSION

This discussion focuses specifically on the characteristics of the patients described in this study. It must be noted that the patients here differ from the patients in other studies characterizing CAA according to Parks. In this study, CAA was performed as the final option to preserve patients' anorectal continence, and thus as a salvage operation. It is widely accepted that a surgical technique that preserves anorectal continence is, from the oncological point of view, not worse than an abdominoperineal extirpation, and that a distal resection margin of 1-2 cm is sufficient [3,4]. The recurrence rate of 25% of the curatively operated patients is in accordance with other studies of this surgical procedure, where rates range from 0 to 30% [5,6,7,8,9,10]. The method of anastomosis (hand-sewn vs. stapled) does not seem to influence recurrence rates [11]. Although the length of the colon after precedent anterior resection is reduced, it is feasible to cure recurrent rectal cancer and prevent permanent colostomy by performing a CAA after prior deep anterior resection with stapled anastomosis. Problems concerning the anastomosis, mostly insufficiencies, present the most common and widely discussed complications in rectal surgery. The depth of the anastomosis and the aim of a tension-free anastomosis in the pull-through operation make high demands on the blood supply of the colon. Most likely, the blood supply suffers from the mobilization and the skeletonization of the mesocolon, which can lead to colonic necrosis. In general, as happened in six of the eight necroses described in this study, it is difficult to distinguish between colonic necrosis and anastomotic insufficiency because a hypoperfusion of the colon often leads to anastomotic problems. This difficulty in defining the colonic necrosis

could partially explain the high number of necroses seen here, while in the literature such cases occur not more than once or twice per study.

Suture insufficiency plays a key role in postoperative morbidity. The rate of this complication after CAA is generally reported to be lower than in the present study [5,6,7,8,12]. The rate of 37.3% in the present study seems to be exceptionally high, as only Köhler et al. have a comparable result of 48 % [10]. They attribute their high rate of insufficiencies to exact postoperative controls and detailed documentation, which also applies to the present study. The correlation of this complication and neoadjuvant radiation (most likely by causing obliterating endarteritis) was significant not only in the present study, but also in studies such as that by Minsky et al. which found that presurgical radiation did not increase insufficiency rates [12,13,14,15,16,17]. Stricture formation, a common problem at the site of the anastomosis, occurred in 20% of the patients in this study. This rate does not clearly differ from the rates after deep anterior resection, although not much data exists for comparison. In general, this complication is considered to be higher in stapled anastomosis [18,19]. The morbidity of the described anastomotic technique seems to be high, but many patients in this study were treated prior to CAA, and the patients with benign indications had a lower complication rate.

The salvage CAA described here was performed by 11 different surgeons, which suggests that not all surgeons were adept at this operation. It may be that a well performed hand-sewn anastomosis requires extensive experience and is therefore not always suitable as a salvage procedure. In many other studies with lower complication rates, the operation was performed by a single surgeon.

After deep anterior resection with stapled anastomosis, the rate of fistula formation was approximately 2% [14]. In addition to rectal and gynecological surgery, radiation and chemotherapy can typically lead to fistula formation [20,21]. Especially in recurrent fistulae, the pull-through operation with CAA became an established operation. The recurrence rate of 33.3% (including the clinically silent fistula) of this study lies in the range of other studies of this technique for treating rectovaginal fistulae [14,22,23].

Acceptable anorectal continence after rectal resection and hand-sewn anastomosis is widely described in the literature [5,8,24,25,26,27,28,29]. In most of these studies the majority of patient continence was described as low grade (Grade I or II according to Kirwan). The overall disillusioning results in this study in comparison to other studies have to be analyzed critically, as a uniform classification was not used in every study, and some patients in this study had reduced sphincter function caused by treatments prior to CAA. Generally, a hand-sewn suture facilitates nerve growth through the anastomosis, which is more likely to be impaired by stapled anastomosis, and can lead to better discrimination and a better recovery of the anal inhibitory reflex [30]. One characteristic of the technique applied in this study is the essential use of a retractor which can reduce the postoperative resting pressure [31]. In addition to the use of the retractor, intraoperative complications such as the failure of a stapled anastomosis, additional resection after incomplete tumor removal, or precedent deep anterior resection may further harm sphincter function [32,33]. Presurgical radiotherapy of the rectum or its neighboring organs further influences anorectal continence [12]. Patients with poor presurgical, manometrically determined resting pressure sometimes have better postoperative measurements than patients with initially good values. This makes it difficult to exclude patients with weak presurgical sphincter function from access to sphincter saving procedures [34]. The example of one patient described in this study who decided in favor of a permanent colostomy after weak postoperative anorectal continence points out that a well working colostomy, especially in combination with irrigation, can be more agreeable than poor anorectal function.

Pouch reconstruction seems to be an effective means of reducing stool frequency, as demonstrated by several studies. The construction of a coloplasty pouch that requires only a slightly longer colon seems more appropriate for the CAA and could reduce postoperative urge and stool frequency [25,35]. If the length of the colon is not sufficient for anastomosis to the anal canal, continuity can be reached by performing an ileocecal interposition, as was performed for two patients in the present study [36].

CONCLUSIONS

The present study reports the outcome of the treatment of very deep malignant and benign diseases by sphincter-sparing surgery, and thereby aims to improve patient quality of life by avoiding permanent colostomy [37]. The overall disillusioning functional outcome of the patients in this study is balanced by the patients' opinion that the closure of the diverting stoma improved their quality of life. The caveat

of this approach is that the patient context with regards to surgical or radiation treatment must be taken into consideration when considering CAA. However, given the low mortality and satisfying oncological results, the indication to the described salvage procedure seems justified in the hands of an experienced surgeon in patients with benign disease, despite the high rate of postoperative complications and the predictable continence problems.

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