



Surgical management of acquired rectourethral fistula: a retrospective analysis of 52 consecutive patients

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Abstract

Background Acquired rectourethral fistula (RUF) is an uncommon complication mostly resulting from surgery or radiation. Standardization of the surgical management is lacking. The aim of this study was to report our experience with surgery for RUF.

Methods This was a retrospective study of a prospectively maintained clinical database. The surgical strategy was tailored to complexity of RUF, presence of sepsis, history of radiation and residual urinary/fecal functionality. Outcomes measured were RUF closure and permanent fecal/urinary diversion. Impact of radiotherapy was also assessed.

Results Between November 2002 and January 2019, 52 patients were identified (100% males). Median follow-up was 10.5 (0.5–16.8) years. Three patients had RUF closure after conservative management. The remaining 49 patients had a total of 76 procedures. The cumulative closure rate after the first, second and third attempt was 55.1%, 85.7% and 95.9%, respectively. Fistula closure together with preservation of the fecal and urinary function was achieved in 49%, 65.3% and 67.3% after the first, second and third repair, respectively. The overall success rate for transanal, transperineal, restorative transabdominal and non-restorative transabdominal procedures was 35.7%, 64.3%, 57.1% and 94.1%, respectively. A significantly higher rate of urinary/intestinal stomas was observed in the irradiated vs non-irradiated patients (84.2% vs 42.4%; $p=0.004$).

Conclusions Surgery ensured healing in 96% of the patients. Radiotherapy led to higher rate of permanent urinary/fecal diversion. Nearly all irradiated patients who had transabdominal repair end up with a definitive stoma. When transperineal repair with gracilis flap interposition was used, the rate of fistula closure approached 90%. A treatment algorithm is proposed.

Keywords Rectourethral fistula · Prostate cancer · Colorectal surgery · Radiotherapy

Introduction

Acquired rectourethral fistula (RUF) is a rare condition which nowadays mostly results from complications of multi-modal treatment (either surgery or radiotherapy) for prostate and rectal cancer [1]. Patients usually present with pneumaturia, fecaluria, urinary drainage from the rectum and

persistent urinary tract infections. Radiological evaluation (computed tomography [CT] scan and magnetic resonance imaging [MRI]) and diagnostic procedures (cystoscopy, rectoscopy and contrast studies) help to better define the anatomy of the fistula and to identify concomitant urinary or colorectal pathology [2].

Radiotherapy has been proven to be associated with more complex, poorly healing fistulas [3]. Especially in this setting, spontaneous healing is uncommon and surgery is needed. Over the years, several techniques have been proposed. Transanal, transphincteric, transperineal, transabdominal, or a combination have been reported with varying outcomes [4]. Surgical repair is notoriously challenging given the inflammatory process that distorts planes, making dissection difficult especially in irradiated patients. Permanent fecal or urinary diversion may be required in up to 40% of cases [5].

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Due to the rarity of the disease and the absence of high-quality studies, a standardized approach to the management of this condition is lacking. Furthermore, the optimal method of repair has still to be defined [2].

The aim of this study was to document a 12-year experience in the management of acquired RUF and to report surgical outcomes with regard to type of repair, number of surgical attempts and previous exposure to radiation therapy.

Materials and methods

After institutional review board approval, a single tertiary referral center retrospective study of a prospectively maintained clinical database was performed to identify all of the men with RUF who underwent elective surgical repair with the intent to close the fistula from March 2003 to November 2018. All fistulas were acquired, both iatrogenic and directly related to tumor growth in case of locally advanced pelvic cancer. Iatrogenic RUF developed as consequence of the treatment of the primary pelvic tumor (radiation and/or surgery) or following treatment for benign pathology after the cancer treatment.

Patients were excluded if they underwent emergent surgery, received diversion only as definitive repair, or had a fistula with a different etiology (ie, inflammatory bowel disease [IBD], traumatic, congenital).

RUF was defined as a communication between the urethra and the (neo)rectum. RUF was suspected based on a combination of preoperative symptoms (pneumaturia, fecaluria, rectal leakage of urine) and findings on radiological examinations such as retrograde urethrogram, voiding cystourethrogram, and/or cross-sectional imaging with either CT or MRI. A physical examination under anesthesia was routinely performed with additional cystoscopy and flexible/rigid rectosigmoidoscopy to assess the bladder and the rectum.

Age at time of diagnosis, etiology of the fistula, precipitating intervention, presenting symptoms, number and method of procedures and recurrences were recorded.

Patient characteristics included age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, previous pelvic surgery, and history of pelvic radiation. A multidisciplinary team approach combining expert urologists and colorectal surgeons was undertaken to streamline the process of care. Operations were performed by a colorectal and urologic team together.

At diagnosis, a urinary diversion by means of suprapubic or transurethral catheter placement was created in all patients. Additionally, a temporary derivative colostomy or ileostomy was performed in those patients suffering from fecaluria or experiencing sepsis and left in place for a minimum of 12 weeks (conservative management). When no

spontaneous healing was achieved, a surgical repair of the fistula was attempted.

Patients who failed conservative management were eligible to undergo definitive surgical repair. The surgical strategy was tailored to the anatomical complexity of fistula, presence of sepsis, history of pelvic radiation and residual urinary and fecal functionality. This was similar to a recently proposed algorithm [6]. Techniques included transanal layered closure or mucosal advancement flaps, transperineal repair with or without flap interposition (tunica dartos, tunica vaginalis, or gracilis muscle), transabdominal approach with either primary fistula repair or en bloc fistula removal with (one- or two-stage pull-through coloanal manual anastomosis with raphy of the urinary tract and omental interposition) or without restoration of the bowel and urinary tract continuity (abdominoperineal resection \pm cystoprostatectomy with ileal reservoir reconstruction). When a transperineal approach was performed, smaller (≤ 2 cm) urethral defects were closed primarily after adequate urethral mobilization. Larger defects were preferentially repaired by a tailored buccal mucosal graft.

Surgical interventions to restore bowel continuity (stoma closure) were not recorded as reoperations. The type and number of surgical procedures attempted to achieve successful fistula closure were recorded. Fistula closure was defined as complete resolution of symptoms supported by radiological or endoscopic studies especially in those patients considered for stoma closure. Follow-up was obtained by reviewing the most recent outpatient clinical records on the hospital's computer-based patient registry. Once healing was assessed, further follow-up (if needed) was scheduled according to the initial indication for surgery (i.e. prostate cancer).

Primary outcome was fistula closure according to type of operation and number of surgical attempts. Secondary outcome focused on the impact of prior radiotherapy on fistula closure and the need for permanent urinary and fecal diversion.

Statistical analysis

Descriptive statistics were performed using online statistics calculator with continuous variables reported as median (range) and categorical variables as n (%). Fishers exact tests (and their extension for tables of higher dimension) and Mann–Whitney U tests were used to compare nominal and continuous variables between two groups, respectively. P values < 0.05 were considered significant. An exact logistic regression was used to verify if there was still a relation between radiotherapy and an increased risk of definitive stoma, after correction for other significant differences between the two groups. All analyses have been performed

using SAS software, version 9.4 of the SAS System for Windows.

Results

Fifty-two male patients with acquired RUF were identified. Patient characteristics are reported in Table 1. Median age at time of diagnosis was 68 years (range 33–85 years). The most common presenting symptoms were fecaluria/pneumaturia (48.1%) and rectal leakage of urine (28.8%). Thirty fistulas (57.7%) were related to prostate cancer treatment and 14 (26.9%) to T4 rectosigmoid neoplasms.

Twenty-four (46.1%) RUF developed after laparoscopic, robotic or open prostatectomy. In 14 cases (58.3%), a rectal injury was identified intraoperatively and repaired. In five

patients, the RUF was consequence of repeated prostate biopsy, sclerotherapy for hemorrhoids and transurethral resection of the prostate (TURP). Among these, four out of five patients were previously exposed to pelvic radiation. Overall, 30 patients (57.7%) received radiotherapy in the form of both external beam radiotherapy (EBRT) (21 patients; 70%) or brachytherapy (9 patients; 30%).

Median follow-up was 10.5 years (range 0.5–16.8 years). Successful fistula closure was eventually achieved in 50 out of 52 patients (96.1%). In 35 patients (67.3%), the initial management consisted of temporary urinary diversion (transurethral or suprapubic catheter). Twenty patients additionally underwent fecal diversion. A total of three patients (5.8%) had spontaneous closure of the fistula without further surgical interventions.

The remaining 49 patients underwent a total of 76 procedures. Overall cumulative closure rates after the first, second and third attempts were 57.7%, 86.5% and 96.1%, respectively. As first attempt ($n=49$), a transanal approach was performed in 11 patients (22.4%), a transperineal approach with graciloplasty in 10 patients (20.4%), a restorative transabdominal approach in 11 (22.4%) and a non-restorative transabdominal approach in the remaining 7 patients. Fistula closure together with preservation of the fecal and urinary function was achieved in 46.1%, 61.5% and 63.5% after the first, second and third repair, respectively (Fig. 1).

Closure rate according to type of operation is reported in Table 2. The overall success rate for transanal, transperineal, restorative transabdominal and non-restorative transabdominal procedures was 35.7%, 64.3%, 57.1% and 94.1%, respectively. When a transperineal approach was preferred, the urethra was primary sutured (raphy) in nine patients. A buccal mucosal graft was used in the remaining five patients. Thirty-day morbidity both descriptive and classified according to Clavien–Dindo [7] in relation to each of the described approaches is reported in Tables 3 and 4. A total of 33 complications occurred in those 49 patients who underwent operations for fistula closure after failure of the conservative management (total number of surgical procedures $n=76$).

Patients with a previous history of pelvic radiation had an increased probability of having a definitive urinary/intestinal diversion. (Table 5) Other differences were found between patients who did and who did not receive radiotherapy (i.e. underlying pathology). However, in an exact logistic regression verifying the relation between radiotherapy and risk of definitive stoma after correction for these confounders, radiotherapy was still a significant risk factor ($p=0.0178$). A significantly higher rate of transabdominal operations was observed in the radiated group, 70% vs 36.4% ($p=0.024$).

Table 1 Patient demographics and characteristics

Patient characteristics	$n=52$
Age at diagnosis in years (range)	68 (33–85 years)
BMI Kg/m ² (range)	25 (17–36)
ASA class	
I	5 (9.6%)
II	36 (69.2%)
III	11 (21.2%)
Underlying pathology	
Prostate cancer	30 (57.7%)
Colorectal cancer	14 (26.9%)
Prostate cancer and colorectal cancer	6 (11.5%)
Other	2 (3.8%)
Precipitating intervention	
Laparoscopic/robotic prostatectomy	13 (25%)
Open radical prostatectomy	11 (21.5%)
Treatment hemorrhoids	3 (5.8%)
TURP/prostate biopsy	2 (3.8%)
Rectal/sigmoid resection	12 (23.1%)
Combined prostatectomy + rectal/sigmoid resection	5 (9.6%)
Other	3 (5.8%)
Radiation	
Overall	30 (57.7%)
EBRT	21 (70%)
Brachytherapy	9 (30%)
Presenting symptoms	
Fecaluria and/or pneumaturia	25 (48.1%)
Rectal urine leakage	15 (28.8%)
Urinary tract infections	6 (11.5%)
Imaging/endoscopic finding (asymptomatic)	2 (3.8%)
Other/unknown	4 (7.7%)

BMI Body mass index, *ASA* American Society of Anesthesiologist classification, *TURP* transurethral resection of the prostate, *EBRT* external beam radiotherapy

Fig. 1 Cumulative rectourethral fistula closure according to type of approached used and number of surgical attempts. *APR* Abdominoperineal resection

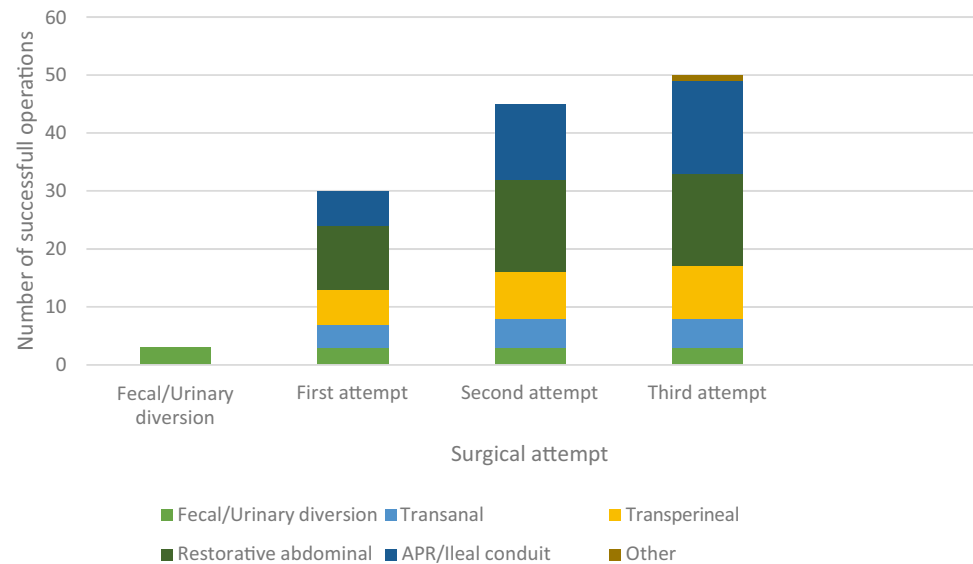


Table 2 Overview of all surgical procedures with overall healing rate

Type of surgery	1st surgery	2nd surgery	3rd surgery	Overall healing rate (%)
Transanal	4/11	1/3	–	5/14 (35.7%)
Transperineal	6/10	2/3	1/1	9/14 (64.3%)
Layered closure	0/1	–	–	0/1
Tunica vaginalis/dartos	0/3	–	–	0/3
Graciloplasty	6/6	2/3	1/1	9/10 (90%)
Transabdominal (restorative)	11/20	5/7	0/1	16/28 (57.1%)
Transabdominal (APR or ileal conduit)	6/7	7/7	3/3	16/17 (94.1%)
Other	0/1	0/1	1/1	1/3 (33.3%)

APR Abdominoperineal resection

Table 3 Thirty-day morbidity classified according to the Clavien–Dindo classification in relation to type of operation performed

Grade of complication n (%) [*]	Transanal	Transperineal	Transabdominal (restorative)	Transabdominal (APR or ileal conduit)	Other	Total
Grade I	–	–	2	2	–	4
Grade II	1	3	8	7	1	20
Grade IIIa	–	1	–	1	–	2
Grade IIIb	–	–	1	2	–	3
Grade IV	–	–	–	–	–	–
Total	1/14 (7.1%)	4/14 (28.6%)	11/28 (39.3%)	12/17 (70.6%)	1/3 33.3%)	29/76 (38.1%)

APR abdominoperineal resection

^{*}For each procedure only the highest scored complication (according to Dindo-Clavien) has been reported

Discussion

To our knowledge, this is one of the largest studies reporting on surgical management of acquired RUF. This study shows a cumulative fistula closure rate of 96%. Fistula

closure together with preservation of the fecal and urinary function was achieved in 63.5% of the cases. The only published meta-analysis on RUF including 416 patients in 26 studies, showed an overall healing rate of 88% with overall permanent fecal or urinary diversion rate slightly higher than 20% [8].

Table 4 Details of postoperative complications

Complication type <i>n</i> (%)	Total <i>N</i> = 33
Surgical site infection	8 (24.2%)
Urinary tract infection	9 (27.3%)
Postoperative ileus	4 (12.1%)
Pelvic abscess	2 (6.1%)
Postoperative hemorrhage	1 (3%)
Catheter sepsis	1 (3%)
Acute renal failure	3 (9.1%)
Transitory ischemic attack	1 (3%)
Atrial fibrillation	1 (3%)
Pneumonia	1 (3%)
Esophagitis	1 (3%)
Osteomyelitis	1 (3%)

More than half of the patients healed after a single operation. Furthermore, about half of patients whose initial operation failed could expect eventual fistula healing after a second attempt. However, the rate of definitive diversion increased progressively according to the number of surgeries, doubling between the first and the second one.

Conservative management was attempted in 35 patients. After 12 weeks, spontaneous healing was observed in three patients (5.8%): one without fecal diversion and two following fecal diversion. Previous studies have demonstrated that conservative management has a wide range of success rates, from 14 up to 100% [9, 10]. The low rate of spontaneous closure in our study probably reflects the higher frequency of complex fistulas, particularly when considering previous radiation treatments (57.7%). Furthermore, 25 patients (48%) reported pneumaturia or fecaluria as primary symptoms. Fecaluria is thought to be a poor prognostic sign as this would suggest a larger and more complex fistula at presentation [11]. Pelvic radiation has been proven to have a deep impact on the prognosis of RUF due to larger defects

with inflamed and poorly vascularized surrounding tissue [12]. Several series have demonstrated that patients who had irradiated RUF required significantly more complex operations and higher rates of permanent fecal or urinary diversion than non-irradiated patients [5, 8, 13]. This was confirmed in the present series. In the irradiated group, a significantly higher rate of urinary/intestinal stomas was observed, although fistula closure was achieved in nearly all patients. Despite these unfavorable premises, the preservation of fecal and urinary function was still possible in a consistently higher proportion (46%) of patients than previously reported by other groups (0–36%) which specifically considered complex irradiated fistulas [14–18].

Several procedures for RUF repair have been described in the literature [1, 2, 4]. The transanal approach is nowadays rarely used and adopted only for simple, non-irradiated, small size RUF. The main disadvantage is the confined space which makes maneuvers to adequately expose and repair the fistula more difficult. Fistula closure is achieved in a limited portion of cases, as described in this series. There is growing evidence that a transperineal approach with flap interposition guarantees the best results in terms of complex fistula healing, when functional preservation of bowel and urinary function is still an option [8]. Vanni et al. published the largest series of irradiated and non-irradiated RUF treated with interposition muscle flap via anterior perineal approach. All non-irradiated and 84% of irradiated fistulas were closed with one procedure [19]. In line with this, in this series, 9 out of 10 patients (4 irradiated) who underwent a transperineal repair with graciloplasty were able to reach a complete functional healing. Six patients (100%) healed after one attempt. Using the transabdominal approach, the rate of fistula closure was 71%, regardless of previous pelvic radiation. Restorative procedures were first attempted in the majority of the cases (74%). The indication for restorative abdominal procedures has been recently extended thanks to the popularization of transanal minimally invasive surgery

Table 5 Results of the univariate analysis for risk factors associated with the need for definitive urinary or fecal diversion

Variable	Urinary/fecal diversion – <i>n</i> = 33 (63.4%)	Urinary/fecal diversion + <i>n</i> = 19 (36.7%)	<i>P</i> -value*
Age at diagnosis in years, median, (range)	68 (33–85)	66 (53–74)	0.992
BMI Kg/m ² , median (range)	24.8 (20.5–35.8)	25 (17.7–30.7)	0.805
Underlying pathology, <i>n</i> (%)			0.072
Prostate	21/33 (63.4)	9/19 (47.3%)	
Colon/rectum	5/33 (15.1)	9/19 (47.3%)	
Prostate + colon/rectum	5/33 (15.1)	1/19 (5.2%)	
other	2/33 (6)	–	
Immediate RUF repair, <i>n</i> (%)	10/33 (30.3)	7/19 (36.8%)	0.761
Previous pelvic radiation, <i>n</i> (%)	14/33 (42.4)	16/19 (84.2%)	0.004

BMI Body mass index, *RUF* Rectourethral fistula

*All reported *p* values are two sided

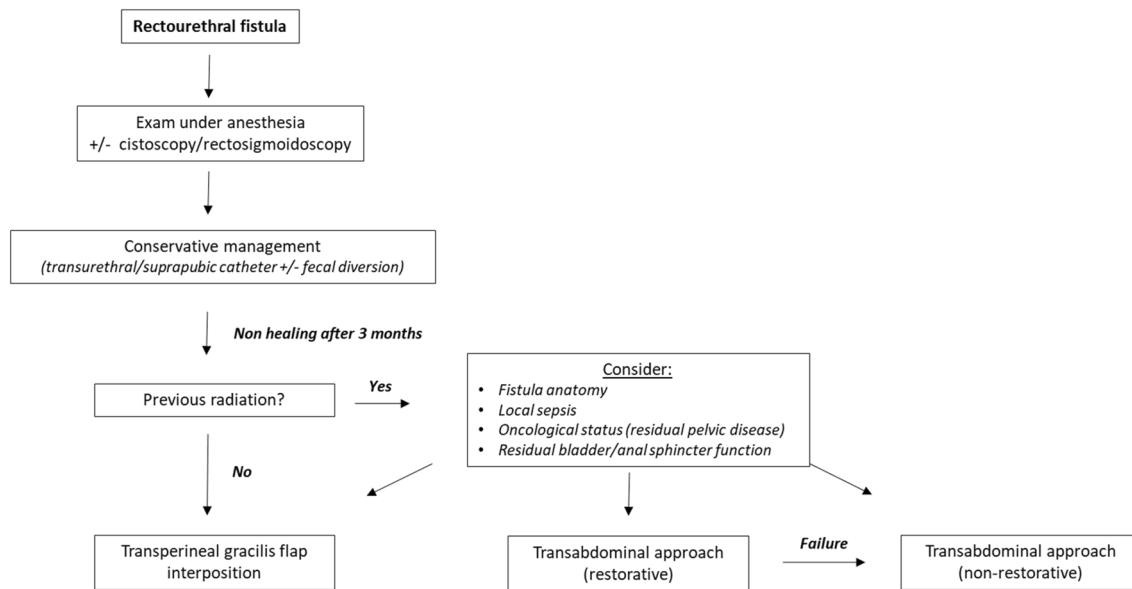


Fig. 2 A proposed treatment algorithm for patients with iatrogenic rectourethral fistula

(TAMIS) [20]. This improved the visualization and dissection of the narrow and inflamed pelvis as in the case of RUF. A delayed coloanal anastomosis as described in the Turnbull–Cutait technique allows the sealing of the colon conduit to the anal canal and helps to limit the anastomotic leak rate after ultralow rectal resections [21]. In our series, 5 out of 16 restorative abdominal procedures were performed using these two techniques, either alone or in combination. However, overall a restorative transabdominal approach was successful in only half of the patients after a single operation, illustrating the difficulty with repair in severely inflamed fields.

As already described in previous studies, definitive surgical RUF repair was approached predominantly abdominally in irradiated patients [13]. Furthermore, nearly all irradiated patients who underwent transabdominal repair end up with a definitive urinary or intestinal stoma. Based on these observations, a simplified treatment algorithm is proposed (Fig. 2).

A transanal approach should be reserved as the first surgical option for very carefully selected cases of simple, small, non-irradiated RUF. The preferred initial repair for larger, more complex RUF (both radiated and non-irradiated) is the transperineal with flap interposition. In our center, we usually perform a graciloplasty, according to our personal surgical experience, but in the literature, other sorts of interposition flaps (i.e. bulbocavernosus muscle) have been described with good results [22]. Transabdominal repairs usually entail greater omental and peritoneal flaps. However, as shown in the present study, patients treated with transabdominal repair techniques often end up with a permanent urinary

or fecal diversion. With this in mind, a transabdominal approach should be only considered as rescue surgery after failure of transperineal repairs or as a primary surgical step for those patients with complex RUF in need of extensive pelvic resections, or with non-functioning urinary/defecatory systems.

Despite reporting one of the largest series on RUF at a tertiary referral center, this study was limited by its retrospective nature, the heterogeneity of the study population and the relatively limited number of patients in relation to the wide variety of surgical options. The proposed treatment algorithm needs further validation.

Conclusions

Our results show that surgical treatment of RUF will ultimately lead to fistula closure in approximately 95% of the cases. A multidisciplinary approach is mandatory. Radiotherapy is associated with higher rate of permanent fecal and urinary diversion. RUF have a closure rate approaching 90% when a transperineal repair with gracilis flap interposition is used. Irradiated patients are predominantly treated by a transabdominal approach. Among them, rates of definitive urinary and fecal diversion are particularly high.

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Compliance with ethical standards

Conflict of interest The authors declare no conflict of interest.

Ethical approval The study was approved by the Ethics Committee of University Hospitals Leuven, Belgium.

Informed consent The patient's informed and written consent has indeed been sought and obtained.

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