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CANCER-ASSOCIATED VOIDING DYSFUNCTION (S ELLIOTT AND J PARISER, SECTION EDITOR)

Rectourethral Fistula—Review of Current Practices, Developments, and Outcomes

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Abstract

Purpose of Review Rectourethral fistula (RUF) is an uncommon pathology associated with a significant deterioration in quality of life. It can result from a variety of etiologies and frequently occurs in medically complex patients. Due to the involvement of both the urinary and fecal systems, there are a number of treatment considerations. The literature surrounding management of this condition is quite varied due to these factors.

Recent Findings Recent literature on the field consists primarily of single institution case series, though there is a recently published multi-center cohort study with a relatively larger sample size. There is no clear surgical technique that appears to be superior. Transperineal repair is the most commonly described approach. In the properly selected patient, RUF repair results in success rates approaching 85–90%, though the definition of success is not standardized in the literature, and success rates are lower in patients post radiation or ablative therapy.

Summary This review highlights contemporary developments in the RUF literature, and provides an overview of important work-up and management considerations. Overall, there is no standardized protocol for management of RUF. Every case presents a unique challenge as a result of the RUF etiology, anatomical considerations, varying degrees of involvement of the genitourinary and gastrointestinal tracts, and patient comorbidities. Urologists must ultimately understand the disease process and utilize techniques that they feel most comfortable with.

Keywords Rectourethral fistula · Fistula · Iatrogenic fistula · Surgical repair · Rectourethral fistula management

Background

The most common cause of RUF in the USA is iatrogenic secondary to treatment for prostate cancer including radical prostatectomy, radiation therapy, or brachytherapy with estimates of RUF incidence in patients undergoing these procedures ranging from 0.1 to 3% [1, 2]. It is truly one of the most devastating complications with respect to patient quality of life. Other etiologies include urologic and colorectal malignancy, pelvic trauma, inflammatory bowel disease, and chronic infection. With increasing survival from primary prostatic malignancy (15-year relative survival rate > 90%), conserving a high quality of life post therapy must be considered [3]. Spontaneous closure only happens in a small minority of patients, and non-operative management is long, frustrating, and often unsuccessful [4, 5]. Due to the heterogeneity in etiology of RUF, clinical presentation, and comorbid conditions, there is a lack of consensus on ideal therapeutic modalities or surgical techniques [6, 7••]. Furthermore, the relative infrequency of these cases poses a challenge in performing high-quality prospective studies [8–12]. Ultimately, the treatment of RUF remains a multidisciplinary approach often utilizing extensive healthcare resources [11].

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Categories of Rectourethral Fistulas

Prior to the more widespread use of prostatectomy, rectal surgery, and radiation, the most common etiologies of RUF were inflammatory bowel disease (IBD), locally invasive malignancy, infections, diverticulitis, trauma, or complications from transurethral surgery [1, 13, 14]. Since then, iatrogenic causes have become the most common etiology. The management of RUF is guided by the categorization of the fistula as simple or complex. Simple RUF is usually comprised of small (< 1.5 cm) post-surgical fistulas. RUF that are large (> 1.5 cm) or have failed previous treatments, or those caused by radiotherapy/ablative therapy (XRT/AB) such as salvage cryotherapy or a combination of external beam radiation therapy and brachytherapy are considered complex [15]. The etiology of RUF is critical in determining a patient's chance of successful repair. Post-surgical fistulas are caused by radical prostatectomy (RP), rectal surgery, or trauma. XRT/AB RUF are caused by external beam radiation therapy (EBRT), brachytherapy, cryotherapy, or high-intensity-focused ultrasound (HIFU). The latter group is associated with poor tissue quality and healing. Recent efforts have been made to standardize the classification of RUF based on stage (size less than or greater than 1.5 cm), position (whether or not the urethral sphincter is involved), and grade (etiology) in hopes of formulating larger series of RUF patients that may lead to higher quality evidence to guide management [16••].

Simple Rectourethral Fistula

In 2010, Thomas et al reported the incidence of RUF after RP to be 0.53%, with increased risk associated with a perineal (1.04%; OR 3.06) versus a retropubic approach (0.34%) [17••, 18]. The incidence is further decreased to approximately 0.04% with robot-assisted laparoscopic prostatectomy [19•]. Studies comparing the characteristics of RUF have shown that post-surgical fistula tend to be smaller than XRT/AB fistulas with favorable surrounding tissue, making them more amenable to reconstruction [20]. Carefully selected post-surgical RUF has been shown to be correctable via minimally invasive techniques such as fibrin sealant or transanal repair [21, 22]. In a multi-institutional study with 210 patients who underwent surgical intervention for RUF, Harris et al. found 99% eventual resolution of RUF secondary to RP compared to 86.5% resolution in patients with XRT/AB [20]. If the injury is identified intraoperatively, then primary repair can be performed, and fecal diversion may be deferred. However, if identified in the early postoperative period, we feel that fecal diversion is usually warranted to minimize mixture of urine and stool, and to prevent perineal sepsis. While self-resolution of fistula is possible with early urine and fecal diversion, the chances are low if the fistula epithelializes, which happens around 6–8 weeks [5, 9, 17••].

Complex Rectourethral Fistula

A review of data from Surveillance, Epidemiology, and End Results (SEER) registries has shown the utilization of XRT/AB for cancer treatment has increased from 9.1% in 1973, to 26% in 2004, and 42% in 2012 [23]. Following XRT/AB, RUF formation usually occurs in a delayed fashion. Despite efforts to minimize scatter, these modalities lead to microvascular injury and subsequent damage to the mucosa. Over time, these areas form ulcers with poor recovery potential, which may ultimately lead to RUF formation [24]. Patients often present with rectal pain and occasionally bleeding [25]. RUF after XRT/AB is difficult to manage, and early urine and fecal diversion is recommended in all cases [26••, 27]. Involvement of a colorectal surgeon is imperative, and consideration should be given to preferentially performing a diverting loop colostomy over a loop ileostomy to decrease fluid loss [26••]. After diversion, the tissue should be allowed to heal for at least 4–6 months prior to undertaking any reconstructive efforts (Fig. 1) [26••]. Of note, XRT/AB may be favored in comorbid patients over surgery for their initial disease process, and these comorbidities, such as diabetes and cardiovascular disease, may further compromise their healing potential. Therefore, the risks and benefits of aggressive reconstructive efforts must be weighed prior to proceeding.

Workup

A detailed history and physical exam are critical. Patients should be assessed for signs and symptoms of RUF including passage of urine per rectum, pneumaturia, fecaluria, watery stool, incontinence, perineal pain/pressure, UTI, or rectal bleeding. Based on the findings of Thomas et al., the presence of fecaluria suggests a larger fistula that will generally not be amenable to conservative measures and is an indication for a diverting colostomy [17••]. Pertinent risk factors to review include any previous surgeries, radiation, salvage procedures, IBD, trauma, malignancy, diverticulitis, abscesses/infections, and results of any biopsies. If the initial presentation is concerning for a RUF, our preference is to perform a thorough examination under anesthesia in conjunction with colorectal surgery. At this time, a digital rectal exam (DRE) and proctoscopy should be performed, paying careful attention to the anterior rectal wall, the location of the RUF in proximity to the anal sphincter, the mobility of the rectum, and the quality of the surrounding tissue. If there is concern for significant damage to the anal sphincter, then permanent colostomy should be considered, as the patient may remain incontinent of stool even after repair. Anal manometry is a potential investigation to evaluate anal sphincter function [9, 14]. Cystoscopy is also performed to fully assess the involvement of the urinary system by the RUF [16••]. Cystoscopy may

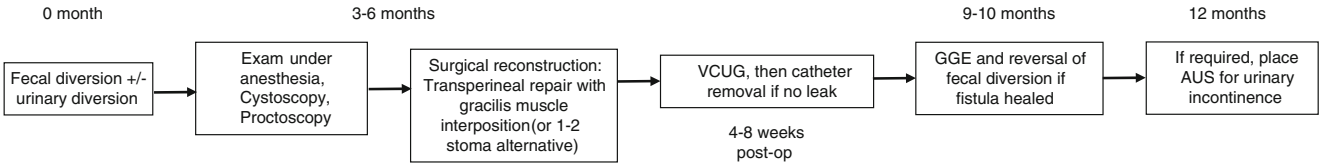

Fig. 1 A timeline of interventions in complex fistula cases based on reviewed literature and our experience

provide better visualization of fistulae that is not readily visible on imaging, and is useful in identifying concurrent pathology such as urethral stricture, bladder neck contracture, and cavitation. In a large multi-center series, the rate of bladder neck contracture or urethral stricture was 26% after ablative therapy and 14% after prostatectomy [20]. In addition, the bladder capacity should be assessed during cystoscopy to prepare for all reconstructive options [8]. Anterior rectal biopsy of a rectal ulcer after prostatic radiation has been associated with RUF formation and should thus be discouraged, especially after combined EBRT and BT [9, 15, 20, 27, 28].

Various imaging modalities may be utilized to fully characterize the RUF. A retrograde urethrogram (RUG) during cystoscopy can be useful to identify the location and size of the fistula. If the suspicion for a fistula is high, but it is not seen on RUG, then a cystogram may be necessary to look for suprasphincteric fistula. Depending on the modality of the injury, it is prudent to rule out ureteral injury during the evaluation. A CT scan with rectal contrast or barium enema can also be utilized to delineate anatomy of the fistula. MRI may be considered in select cases where patients present with recurrent septic episodes or have a complex fistula [8, 14, 29].

Management of Rectourethral Fistula

Management strategies range from non-operative interventions, to minimally invasive modalities, to complex open repairs with tissue interposition. While unofficial algorithms for management of RUF have been proposed, the ultimate decision for intervention must depend on six major factors: (1) presenting symptoms and associated severity, (2) the size of the fistula, (3) the extent of XRT/AB and associated tissue quality, (4) status of the urethra, (5) the presence of pelvic sepsis, (6) the health of the patient [10, 11, 26••]. Figure 1 provides a treatment algorithm, which will be discussed in further detail below.

Urinary and Fecal Diversion

If a rectal injury is identified intraoperatively, then a repair should be performed immediately with the assistance of a colorectal surgeon, and a decision was made as to whether to proceed with fecal diversion based on intraoperative findings. If a delayed injury is suspected, then one should proceed with the above described work-up. Once the diagnosis is confirmed, we recommend fecal diversion in most cases. Many times, urinary diversion using a suprapubic (SP) tube or a urethral catheter will also be performed; however, this is not always mandatory if there are minimal symptoms, no recurrent infections, or significant urinary leakage out the rectum. Of note, if a urethral catheter is in place, then it should be removed for a few weeks prior to final preoperative evaluation with a urethrogram or cystoscopy, so any concomitant urethral stricture can be identified. Ideally, these injuries are identified early before complete epithelialization of the fistulous tract (6–8 weeks) to maximize chances of healing with diversion alone. Incorporating a fully absorbable diet for 4 weeks may also help with spontaneous closure of the fistulous tract [11, 26••]. RUF identified after 12 weeks is unlikely to heal with conservative measures. Fecal diversion may be deferred in post-surgical cases to the time of repair as long as there is no refractory infection or other complications. Complex fistulas almost never heal with conservative measures and should all be considered for prompt diversion [30••]. Treatment algorithms are also dictated by the patient's ability to tolerate multiple surgical procedures, and older frail patients may be better suited for conservative measures.

In cases of perineal sepsis, immediate abscess drainage and diversion are indicated [12, 13]. In any situation, fecal diversion reduces induration of the tissue around the RUF and greatly aids surgical reconstruction. Figure 1 illustrates a rough timeline of interventions in complex fistula cases based on reviewed literature and our experience [11, 20, 26••]. We counsel all patients that the entire process may take up to 1 year to complete. After the initial fecal diversion, the fistula should be reevaluated at 3–4 months to determine if it is amenable to reconstruction. The evaluation includes a repeat physical exam (DRE), cystoscopy, endoscopy, and/or cystourethrogram. If the fistula is found to be healing or completely healed, extended conservative therapy or reversal of fecal diversion may be offered for a simple surgical fistula. However, our experience leads us to believe that complex fistulas have a significant risk of recurrence in this setting and warrant surgery. Persistent fistulas with minimal improvement should be considered for definitive surgery. In cases of the type of bowel diversion, colostomy is generally preferred over ileostomy to minimize dehydration [15, 17••, 29].

Reconstructive Surgery

Numerous surgical techniques have been described for the management of RUF, including endoscopic minimally

invasive approaches, transabdominal, transanal, transperineal, abdominoperineal, anterior and posterior transsphincteric, and transsacral. In fact, there are over 40 described techniques for RUF repair [8]. No single approach has proven superior to the others and we will focus our review on open techniques. In a 2013 meta-analysis, Herchenbleikner et al. determined that the rates of successful RUF closure were similar across techniques at around 90% [7••]. Clinicians managing RUFs should be aware of the various modalities available for management of this pathology.

Transperineal

The transperineal approach is the most commonly used technique for fistula repair and is our technique of choice. The surgery is performed by placing the patient in high lithotomy position. An inverted U-incision is made in the perineum, extending from just inside one ischial tuberosity to the other. The dissection proceeds in the plane dividing the thin muscular attachments between the anal sphincter and bulbospongiosus muscle, and then along the anterior surface of the rectum without violating the external urinary or anal sphincter. Once the fistula is encountered, it is transected, and the dissection between the rectum and the urethra, prostate, and posterior bladder is developed to near the peritoneal reflection. The rectum is mobilized to allow transverse closure when possible, and this is done in 2 layers. At this point, the urethral fistula is either closed primarily with 3-0 or 4-0 PDS suture, or a buccal mucosal graft is sewn into a fixed defect. An important factor that may alter the approach is the presence of a concomitant urethral stricture. This generally involves the bulbomembranous urethra or the vesicourethral anastomosis. Depending on the extent, one should be prepared to either perform an excision and primary anastomosis or buccal mucosal onlay graft with the distal segment covered by corpus spongiosum and the proximal portion with a gracilis muscle flap [31]. It is our practice to use a gracilis muscle flap in the majority of cases, as this provides well-vascularized tissue interposition between the urinary system and rectum that also fills the perineal cavity, and carries a relatively low morbidity. Dartos interposition flap has been used effectively in a small number of patients with simple post-surgical fistulas.

There are several advantages to the transperineal approach. First, it provides excellent exposure to both the urethra and the rectum through a single incision. Secondly, this approach provides familiar anatomy for many reconstructive surgeons who perform urethroplasty. Furthermore, a gracilis flap can be harvested without repositioning the patient, simply by adjusting the stirrups. Lastly, avoiding violation of the intraabdominal compartment allows the patients to resume a diet immediately after the procedure, and minimizes large fluid shifts allowing the procedure to be done safely in medically comorbid patients.

The utility of interposition with gracilis muscle flap has been evaluated in multiple studies. In a 2010 study with 35 patients who underwent perineal RUF repair with muscle interposition, Vanni et al. reported a 100% fistula closure rate in non-radiated patients with 97% stoma takedown [32•]. However, the success rate dropped to 84% in the XRT/AB group, with 31% of the patients ultimately requiring permanent fecal diversion. Subsequent studies have further evaluated whether interposition is necessary for fistula closure, and the data suggest that interposition is not always necessary in non-radiated patients; however, it may be considered [30••, 33]. In radiated patients, we recommend performing a gracilis flap, as the data supports higher a rate of RUF recurrence in this group [26••, 27, 34]. Figure 2 highlights key steps in a repair with gracilis flap interposition via a perineal approach.

Transanal (Parks/Latzko)

The transanal approach is best suited for small, distal fistulas which are readily accessible in a non-radiated field. The patient is placed in a prone jack-knife position, and a transanal incision is made to elevate an anterior rectal flap with the apex near the fistula. Subsequently, the fistula is excised and closed. The rectal muscularis advancement flap is then performed to cover the area, with additional multilayer closure. Success rates range from 75 to 100% with minimal morbidity [35]. Advantages of this approach include minimal morbidity and a lower risk of fecal incontinence versus a transsphincteric approach. Major limitations of this approach include limited mobility of the surrounding tissues and impaired access to the urethra, as well as an inability to perform graft interposition. It does not allow for concomitant repair of urethral pathology such as strictures or bladder neck contractures, and its use is not recommended for larger, more fibrotic RUFs.

Transsphincteric (York-Mason)

The York-Mason (prone trans-anosphincteric) approach requires posterior transection of the anal sphincter for improved exposure to the RUF. The patient is placed in a prone jack-knife position, and an incision is made in the midline from the tip of the coccyx to the anal verge. The subcutaneous tissue is dissected, and the anal-sphincter is divided sharply in layers with matching sutures to optimize alignment at the time of closure. After obtaining adequate exposure of the anterior rectal wall, the fistula is excised in a similar manner to the transanal repair, and an advancement flap or multilayer closure is performed. After the posterior rectal mucosa is closed, the anal sphincter is re-approximated. The sphincter closure is paramount to maintaining fecal continence, and it recommended that colorectal surgery be involved with this approach. Renschler et al. reported a 92% success rate in their experience with 24 patients over 30 years, with no fecal

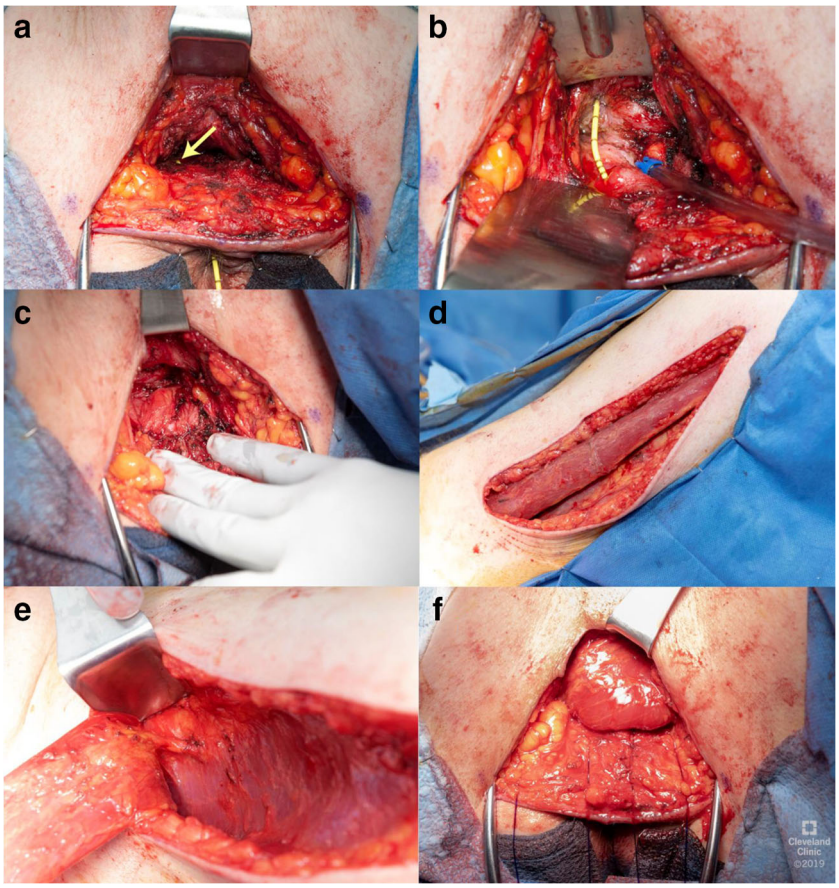

Fig. 2 Steps involved in the repair of a rectourethral fistula following irreversible electroporation for prostate cancer. **a** Perineal incision with an open-ended 5 French catheter through the fistula (arrow). **b** Division of fistula and separation of rectum from prostate. **c** Transverse closure of rectal defect following further mobilization of perirectal tissues. **d** Left gracilis muscle exposed. **e** Gracilis vascular pedicle. **f** Gracilis muscle rotated into the perineum as an interposition flap

incontinence or anal stenosis [36•]. A major shortcoming of this approach is the inability to perform tissue interposition and the unfamiliar anatomy for most urologists.

Transabdominal

This approach is ideal in patients who have proximal fistulas that are difficult to visualize from a perineal incision, or patients who are undergoing a concurrent salvage prostatectomy. Dissection is carried out from the cephalad direction until the fistula is identified, and similar surgical principles are applied. A major benefit to this approach is the ability to perform omental interposition, as opposed to a gracilis flap. In some cases, a combined abdominal and perineal approach may be required to adequately access the fistula tract and optimize repair. In this setting, we usually start with the perineal dissection and then lower the legs for the abdominal work. A downside to this approach is a more prolonged recovery time for patients.

Permanent diversion and complications

While there are numerous options for repair of RUF, it is critical to identify the severity of a patient's RUF along with their overall physical health, and their desire to undergo aggressive reconstructive measures before proceeding with surgery. For some patients, permanent diversion of either one or both of the urinary and colorectal systems is the best approach. For example, patients with a clear anal sphincter defect may be better served with permanent fecal diversion and closure of the urethral defect with or without proctectomy [26••]. Patients with a concomitant long segment urethral stricture may be better served by undergoing cystectomy, urinary diversion, and repair of the rectum. In these situations, the patient would end up with one long-term stoma. Finally, there will be a small number of patients with severely debilitating RUF with comorbidities and complex anatomy only amenable to heroic measures who are best suited for pelvic exenteration with permanent urinary and fecal diversion [2]. In our own unpublished data, we identified 103 patients who presented to our institution with a RUF over a 10-year period, 82 of whom ultimately underwent surgery. At a median 31 months of follow-up, 60% of patients were stoma-free, while 15% had permanent fecal diversion, 17% urinary diversion, and 9% required 2 stomas. We advise patients that until we have a chance to assess the fistula after 3–6 months of fecal diversion, with or without urinary diversion, it is difficult to predict if we will be able to reconstruct 1 system, 2 systems, or neither system.

Reconstruction is not without risk of complication. All patients should be counseled on the potential for urinary incontinence after reconstruction. Urinary incontinence rates have been estimated to be around 16% for RUF after prostatectomy and up to 35% after XRT/AB [20]. We routinely discuss with our patients the potential need for an AUS to manage persistent or new onset urinary incontinence. There is minimal long-term data on outcomes of AUS following RUF repair. Selph et al. reported their results from 6 non-transcorporal AUS implants in this setting, placed a median of 12 months after RUF repair. At 43.5 months of median follow-up, no patients required a revision or removal and all had improvements in their stress incontinence [37].

Our group had previously looked at fecal and urinary quality of life after transperineal repair with gracilis flap. Of the 13 patients in the study, 75% reported some degree of urinary incontinence. On the ICS Male Short-Form questionnaire, 50% had urgency, 42% had urge incontinence, and 58% had stress incontinence. Fecal outcomes were assessed with the Fecal Incontinence Quality of Life questionnaire—25% had some fecal incontinence although this was minor and manageable in most cases. When asked, patients uniformly did not want to resume fecal diversion for this problem. This study highlights the potential morbidity of reconstruction in a population that has often already suffered complications from their primary cancer treatment, and patients need to be counseled accordingly [31].

Conclusions

While there is no standardized algorithm for RUF management, it is best for providers to develop an individual treatment strategy that they feel most comfortable with. Fecal diversion should be considered in all cases and is critical for complex fistulas. The ability to reconstruct a patient cannot be fully assessed until at least 3–6 months after fecal diversion. Patients considering repair should be counseled about the long potential recovery and multiple procedures, and be willing to accept the risks of surgery. The majority of patients can undergo reconstruction of both their urinary and enteric system, and most of the remainder can have at least one intact system long-term thereby avoiding the need for double ostomies. Overall, RUF remains a complex pathology, and a multidisciplinary approach or referral to a center of excellence may lead to improved outcomes.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

Abbreviations RUF, Rectourethral fistula; RP, Radical prostatectomy; IBD, Inflammatory bowel disease; XRT/AB, Radiotherapy/ablative; DRE, Digital rectal exam; AUS, Artificial urethral sphincter; VCUG, Voiding cystourethrogram; GGE, Gastrografin enema

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