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Case Report

The Management of a Urinary Bladder Leak in a Patient with Radiation Cystitis ☆

Zubir S. Rentiya, MD, MSc^{a,b,*}, Deepa Francis, MD^c, Sandra Mary Francis, MD^c, Pugazhendhi Inban, MD^d, Rohan Raj, MD^e, Ogonnaya Akuma, MD^f, Chinaza Mercy Akuma, MD^g, Ronald Mauricio Blanco Montecino, MD^h, Manjeet Singh, MDⁱ, Kainat Makheja, MBBS^j, Om Parkash, MD^k, Santhosh J. Kottoor, MBBS^l

^a University of Virginia, Department of Radiation Oncology & Radiology, Charlottesville, VA, USA

^b MedStar Georgetown University Hospital, Department of Surgery, Washington, DC, USA

^c Windsor University School of Medicine, Department of Internal Medicine, Cayon, St. Kitts and Nevis

^d Government Medical College Omandurar, Chennai, India

^e Nalanda Medical College and Hospital, Department of Internal Medicine, Patna, India

^f Ebonyi State University, Department of Internal Medicine, Abakaliki, Nigeria

^g Nnamdi Azikiwe University, Department of Internal Medicine, Awka, Anambra state, Nigeria

^h Universidad de El Salvador, Department of Internal Medicine, San Salvador, El Salvador

ⁱ Liaquat National Medical College, Department of Internal Medicine, Karachi, Pakistan

^j Jinnah Sindh Medical University, Department of Internal Medicine, Karachi, Pakistan

^k Chandka Medical College, Department of Internal Medicine, Larkana, Pakistan

^l Mother Hospital Thrissur, Department of Internal Medicine, Kerala, India

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ABSTRACT

Urinary dysfunction following treatment for rectal adenocarcinoma is a common and complex complication. We present a case of a 69-year-old male who underwent laparoscopic-assisted left hemicolectomy and loop ileostomy after receiving chemotherapy and radiation therapy for rectal adenocarcinoma. Postoperatively, it was incidentally discovered the patient had urinary frequency and urgency. Cystoscopy revealed radiation changes to the bladder walls and a bladder leak was confirmed by cystogram. The patient underwent successful repair of the urinary bladder leak, with challenges posed by prior radiation therapy. Effective prevention and management strategies for urinary dysfunction require a comprehensive preoperative risk assessment, consideration of nerve-preserving surgical techniques, and prompt identification and repair of postoperative complications.

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* Corresponding author.

E-mail address: zrentiya@rirrc.net (Z.S. Rentiya).

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Introduction

Colorectal cancer (CRC) is the third-most common malignancy around the globe. Risk factors include age >50 years, physical inactivity, obesity, a diet with increased red meat, and decreased fiber, personal history of polyps or colorectal cancer, inflammatory bowel disease (IBD), and hereditary syndromes such as Lynch syndrome and familial adenomatous polyposis (FAP) [1]. Constituting around 30% of the annual incidence of colorectal cancers (CRCs), rectal cancers play a substantial role in the landscape of cancer cases in the United States. When considering the combined impact of both rectal and colorectal cancers, they emerge as the second leading cause of cancer-related deaths in the country [2]. It takes about 10 to 15 years for the rectal epithelium to transform into a dysplastic lesion and eventually into an invasive carcinoma. About 46,000 new cases of rectal cancer are diagnosed in the US annually and the majority of these are adenocarcinomas [3]. Primary rectal squamous cell carcinoma is extremely rare and is treated similarly to anal cancers with a combination of chemotherapy and radiation.

Many factors are considered while evaluating a rectal adenocarcinoma, such as its location in the rectum, the extent of the disease as to whether the neighboring structures are involved, the node status and whether venous invasion is present. A rigid sigmoidoscopy can help identify the distance of the lesion from the anal verge, while magnetic resonance imaging (MRI) or transrectal ultrasound can be used to determine the extent of the tumor and nodal involvement. The tumor, node, and metastasis (TNM) staging system of the American Joint Committee on Cancer (AJCC) is the most preferred system for staging and prognostication [4].

Pelvic radiation therapy is recommended for patients with rectal cancer as it has been shown to reduce regional recurrence by 20%-25% for stage II or III tumors. Combining radiation therapy with 5-fluorouracil (5-FU) based chemotherapy lowers recurrence and improves overall survival [5]. Open transabdominal resection of the tumor is the preferred surgical modality, but a laparoscopic approach is preferred in selected patients depending on the experience of the surgeon.

Urinary dysfunction is one of the complications that occur after treatment for rectal cancer [6]. The underlying mechanism for its development is not entirely clear. The factors associated with it include the impact of preoperative radiation therapy, age, sex, or even type of surgery. Some factors are modifiable while others are not. It is important to identify the exact cause of bladder dysfunction to provide effective therapy.

We present a case of a 69-year-old male with rectal cancer who had a prior normal colonoscopy. Symptoms included bleeding, loose stools, and a presence of a rectal mass. Imaging indicated tumor invasiveness (T3b). Treatment with chemotherapy and radiation yielded a limited response. Surgical options were discussed, and a laparoscopic-assisted left hemicolectomy with ileostomy was performed successfully. Postoperatively, it was incidentally found that patient had a urinary bladder leak. In this case report, we discuss the management approach for this common but complex complication.

Case presentation

We present a case of a 69-year-old male presented with a complex clinical picture suggestive of rectal cancer. He reported experiencing rectal bleeding over the past 7 months, initially attributing it to hemorrhoids. Additionally, he described loose stools, averaging 4 to 5 bowel movements per day. Notably, his last colonoscopy at the age of 50 showed no abnormalities, indicating a recent onset of symptoms. Upon physical examination, he appeared well-nourished with no significant abnormalities detected.

Further investigation commenced with a colonoscopy, revealing a concerning rectosigmoid mass. A tissue biopsy confirmed the presence of an ulcerated, well-differentiated adenocarcinoma. Subsequent imaging studies, including computed tomography (CT) of the abdomen and pelvis, demonstrated circumferential wall thickening of the sigmoid colon consistent with the primary malignancy. CT of the chest revealed no evidence of metastatic disease. MRI provided additional detail, showing a tumor extending from the mid-rectum to the sigmoid colon with invasion through the muscularis propria into the peri-sigmoid fat, indicative of T3b disease. Multiple regional nodes were also noted on imaging.

The patient was promptly initiated on a combination chemotherapy regimen consisting of folinic acid, 5-FU, and oxaliplatin (FOLFOX) along with concurrent radiation therapy. Despite aggressive treatment, the patient exhibited minimal response, as evidenced by imaging showing persistent circumferential mural thickening involving the mid and upper rectum. In addition, an MRI of the pelvis revealed an interval decrease in size of the circumferential tumor within the mid-rectum measuring 3.8 cm with persistent invasion through the muscularis propria into the right peri-sigmoid fat, compatible with a T3b disease as shown in Fig. 1. After integrating imaging and clinical features the preoperative diagnosis with the AJCC staging system for rectal adenocarcinoma was cT3bN0M0.

Subsequent restaging via flexible sigmoidoscopy identified a mass located approximately 10 cm from the anal verge, encompassing 50% of the rectal lumen. With the progression of the disease, surgical intervention became necessary. The patient underwent a laparoscopic-assisted left hemicolectomy and loop ileostomy formation. The surgery involved identifying and mobilizing the colon, skeletonizing the inferior mesenteric artery (IMA), and taking it with a robotic stapler, dissecting the rectum and performing a tension-free anastomosis, and creating the ileostomy. The resulting specimen was passed off and opened on a back table confirming that it contained the mass and that the margins were adequate, as shown in Fig. 2.

Following laparoscopic-assisted left hemicolectomy and loop ileostomy formation, the patient developed mild urinary frequency and urgency approximately 1-week postsurgery, suggesting potential surgical or radiation-related complications. Immediate evaluation included cystoscopy due to the patient's radiation therapy history, revealing bladder wall changes consistent with radiation effects and an associated bladder injury suspected to cause a urinary bladder



Fig. 1 – Pelvic magnetic resonance imaging (MRI) showing a circumferential tumor inside the mid-rectum in (A) coronal view and a computed tomography (CT) (B) axial view.

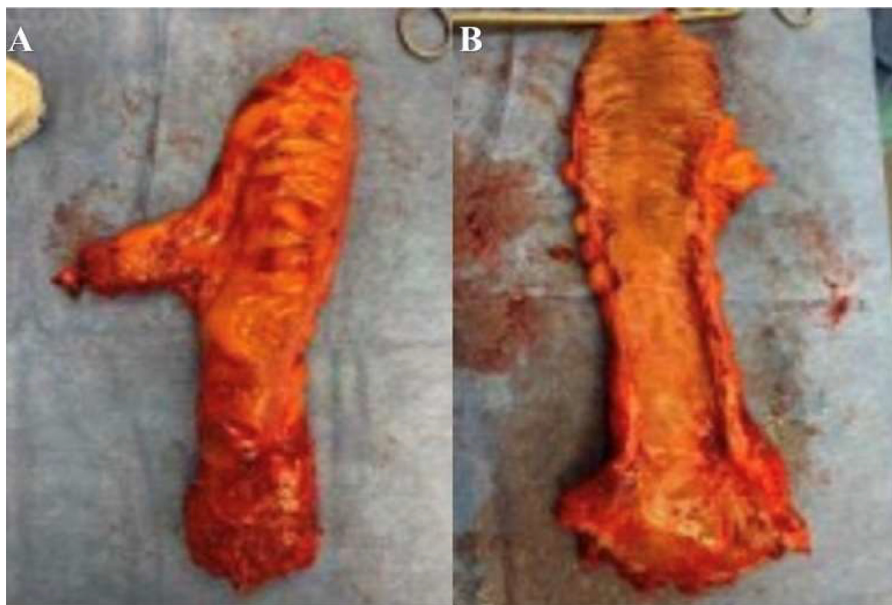


Fig. 2 – Rectal specimen removed from patient showing (A) anterior view and (B) open specimen.

leak. Subsequent cystogram confirmed the leak, as shown in Fig. 3, prompting prompt surgical intervention to mitigate risks.

The urinary bladder was repaired during the operation, the challenging dissection surrounding this location from earlier radiation was inevitable but was resolved by a suture. Despite the challenges posed by radiation and associated tissue alterations, successful repair was achieved. A foley catheter was maintained, and the ureteral stents were removed. He responded well to treatment, with gradual improvement in symptoms and overall clinical status. Follow-up imaging studies confirmed a partial response to treatment, indicating a positive trajectory in disease management. The patient was discharged with appropriate postoperative care instructions and scheduled follow-up appointments to monitor treatment response and address any potential complications.

Discussion

Urinary dysfunction after treatment for rectal cancer is common with a prevalence ranging from 6% to 77%. This huge gap is presumably due to differences in the type of dysfunction and time frame in which it develops. Regarding the type of dysfunction, urinary incontinence is by far the most common problem [5].

Radiation therapy and chemotherapy along with surgery are the mainstay of therapy in the treatment of rectal cancers. Urinary incontinence after rectal cancer treatment can either be a surgical complication or due to radiation therapy itself. It can present as urge, overflow, and/or stress incontinence. Urge incontinence usually results from a loss or damage of the sympathetic nerve supply, leading to decreased bladder

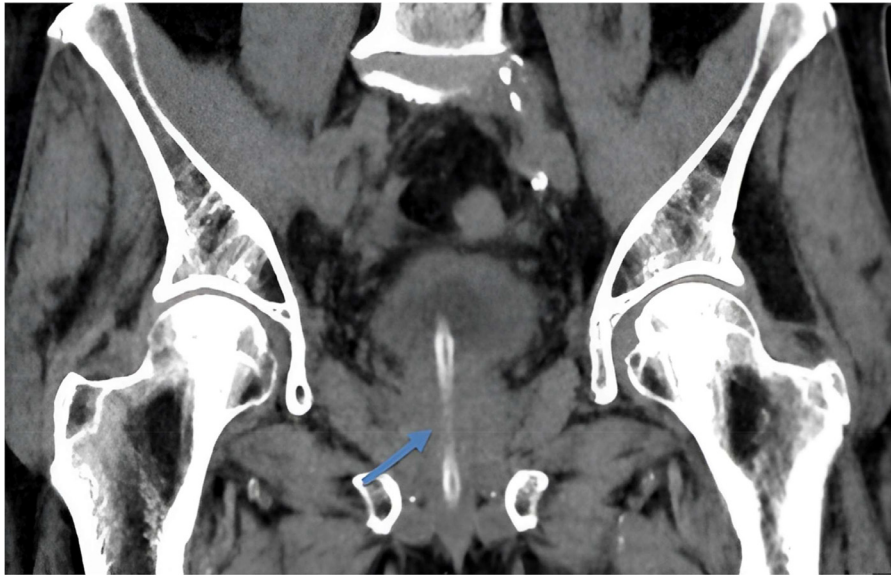


Fig. 3 – Cystogram demonstrating the presence of a urinary bladder leak (arrow).

capacity, while disruption of the sacral splanchnic nerves may result in overflow incontinence. Stress incontinence can result from injury to the supporting system of the bladder neck and urethra, which involves the pubourethral-vesical ligaments, the pubococcygeus muscle, and the surrounding connective tissue. Hence, selecting the most appropriate surgical option for a particular patient is often challenging.

Surgical options for rectal cancer include abdominoperineal resection (APR) and anterior resection (AR). APR, once preferred for higher-grade tumors, involves removing the distal colon, rectum, and anal sphincter complex. In contrast, AR, including high anterior resection (HAR) and low anterior resection (LAR), spares the anal sphincter complex, improving quality of life. Laparoscopic AR, with decreased morbidity and mortality, is now mainstream. HAR is for rectosigmoid junction and upper rectum tumors, while LAR is for mid-rectal tumors, with total mesorectal excision. LAR avoids permanent colostomy; a short-term ileostomy may be necessary post-radiation or chemotherapy, reversible later [7–10]. Bladder complications represent significant concerns in the surgical treatment of colorectal cancer, particularly in cases involving rectal cancer. The intricate relationship between the rectum and bladder increases the risk of inadvertent injury during procedures such as anterior resection (AR) or abdominoperineal resection (APR). Bladder injuries can lead to complications such as urinary leakage, urinary tract infections, or fistula formation. Additionally, postoperative complications may include urinary retention or dysfunction, with potential disruptions to nerve pathways or muscle function.

Adjuvant preoperative radiotherapy (RT) in patients with rectal cancer improves local control and survival but may increase the risk of postoperative morbidity and mortality. The major disadvantage of RT is the fact that it affects both cancer and healthy cells located in and around the tumor area. When RT is used to treat cancers in the lower abdomen and pelvis, its complication most often involves the urinary tract

due to its anatomic relations. The most frequent complications include hemorrhagic cystitis, urethral, and ureteral strictures, and less commonly bladder fibrosis and necrosis [11]. Few of its other adverse effects include venous thromboembolism, arterial disease, intestinal obstruction, fistulas and second cancers [12,13]. Complications related to RT can be divided into acute and late. Acute ones occur within days or weeks while late ones appear few months or years after irradiation.

In our patient, the tumor was located mostly in the mid-rectum, 10 cm away from the anal verge. He had received chemoradiation and a laparoscopic LAR of the tumor was done with a temporary ileostomy. His RT was 7 months prior, and chemotherapy was completed 2 months prior to the surgery. His urinary dysfunction identified during preoperative evaluation suggests that the bladder leak was a direct complication of the radiation therapy that the patient received. The radiation induced bladder injury was confirmed by cystoscopy, which resulted in the symptoms of urinary frequency and urgency later in the patient.

To evaluate the effect of radiotherapy and surgery on the urinary outcome, a study was conducted by Lange et al. in 2008. The study showed that radiotherapy contributes little to the urinary outcome and urinary dysfunction postrectal cancer treatment is rather a purely surgical complication [14]. While another study conducted in 2009 by PP Tekkis et al., involving 295 women showed that an age above 65, APR, prior radiotherapy and intra-abdominal sepsis were associated with a higher incidence of the sexual and urinary outcome in females [15].

RT appears to be directly responsible for the occurrence of urinary incontinence in this patient, which was promptly resolved with surgical repair of the bladder. When urinary complications occur after rectal cancer surgery, it is often due to damage to the autonomic nerves during the procedure and a backward displacement of the bladder especially when an APR

is used. These can be avoided by using an AR approach along with a laparoscopic total pelvic autonomic nerve preserving procedure [16]. A study conducted by Pollack J et al. compared the adverse effects of short-course preoperative radiotherapy in rectal cancer. It shows that urinary incontinence was more common in irradiated patients irrespective of whether they were operated on with AR or APR [17]. RT can cause fibrosis in the bladder, the urethral sphincters, and their innervation increasing the risk of urinary incontinence [18]. Therefore, the potential benefits of preoperative radiotherapy need to be balanced against the increased risk of such morbidity. When such a complication is identified appropriate measures must be taken to localize the lesion and repair the defect at the earliest to enable early recovery.

Conclusion

Urinary dysfunction is a complex issue following rectal cancer treatment, with challenges in post-treatment bladder leak complications. Surgical factors, tumor location, prior radiation therapy, and patient-specific variables contribute to the risk of urinary incontinence. Selecting the most appropriate intervention is challenging due to the complex interplay between nerve supply, pelvic anatomy, and surgical approaches. Preoperative risk assessment, nerve-preserving surgical techniques, and vigilant postoperative monitoring are essential for preventing, managing, and treating urinary complications. Early identification and management of post-treatment complications are crucial, especially in patients with prior radiation therapy. Personalized care and advances in surgical techniques can improve outcomes and quality of life for patients undergoing rectal cancer treatment.

Patient consent

Signed consent for a case report was obtained from the patient's legally authorized representative (LAR). The IRB approval was taken from Regency Hospital Ethics Committee.

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