

Case Report

Corpus spongiosum flap: a unique technique in the management of urosymphyseal fistula

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Abstract: Urosymphyseal fistulas are a debilitating but treatable consequence of the combination of radiotherapy and endoscopic interventions in prostate cancer patients. Treatment includes fistula excision with a tissue flap to prevent communication of involved structures and provide structural and vascular support. We introduce a unique surgical approach of mobilizing and utilizing a corpus spongiosum flap in urosymphyseal fistula repair. A retrospective study identified two patients who underwent repair with a pedicled corpus spongiosum flap at our institution. The corpus spongiosum had adequate length and vascularization and limited the need for extra-pelvic muscle flaps, thus maintaining muscle integrity in the abdomen and thighs. Following extirpative surgery, both patients had durable fistula closure, decreased pelvic pain, and resolution of lower urinary tract symptoms and osteomyelitis. These cases highlight the potential of the corpus spongiosum to be a reasonable alternative interpositional flap in genitourinary reconstruction.

Keywords: Flap, surgical, cutaneous fistula, radiation induced abnormalities, diseases, urethral

Introduction

Urosymphyseal fistula is a condition involving an abnormal communication between the lower urinary tract and the pubic symphysis/rami. Although rare, these fistulas are a debilitating, but treatable consequence of radiotherapy combined with endoscopic interventions for obstructive processes such as radiation-induced strictures or bladder outlet obstruction in prostate cancer patients [1-6]. Vascular compromise and tissue injury during radiation cause poor healing and increase the risk of fistula development from the lower urinary tract to the pubic bone particularly following endoscopic procedures. Patients commonly present with chronic pelvic pain due to osteomyelitis and abscess formation, limited ambulation, voiding difficulties, and recurrent urinary tract infections [1-6]. Diagnosis is based on a combination of clinical presentation and imaging to confirm, locate, and characterize the fistula.

Due to chronic infection within the irradiated field, conservative management-analgesia,

antibiotics, urethral/suprapubic catheters-may have limited effectiveness whereas surgery may offer timely symptomatic relief, infection resolution, and improved function [1, 2, 4]. Surgical management commonly involves cystectomy with urinary diversion, pubic bone debridement or resection, and fistula excision with a tissue flap, which interposes the fistulized structures to prevent communication of involved structures and provide structural and vascular support to the healing tissue [1-6]. Ideal flap viability and selection depends on tissue anatomy, availability, location relative to the fistula, and morbidity associated with harvest [6-10]. Commonly, the gracilis muscle, rectus abdominis muscle, and omentum are utilized in genitourinary reconstruction. Since the urethra is transected during the cystectomy, the corpus spongiosum may offer a readily available tissue source in the repair of certain associated fistulas. This case report highlights a unique surgical approach in mobilizing and utilizing a pedicled corpus spongiosum flap in urosymphyseal fistula repair.

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Cases and management

Selection

With IRB approval, we identified patients who underwent urosymphyseal fistula repair with a corpus spongiosum flap between January 2018 to December 2020 at our institution. Patients were diagnosed based on clinical presentation and imaging, and evaluated by a multidisciplinary team involving reconstructive urology, orthopedic surgery, plastic surgery, and infectious disease specialists. Treatment usually involved cystectomy with ileal conduit urinary diversion, pubic bone debridement or resection, and interpositional tissue flap. The following demographic information and perioperative outcomes were assessed: age at surgery, medical comorbidities, prostate cancer stage and treatment, prior endoscopic interventions or catheterizations, precipitating cause, clinical presentation, diagnostic modality, pre-surgical management, bone culture results, hospitalization length, first 90-day complications, and time to relapse.

Technique

The patient is positioned in dorsal lithotomy and a urethral catheter is placed. During coordinated cystoprostatectomy with ileal conduit urinary diversion, a perineal incision is created, and dissection is performed down through the Colles' fascia to the bulbospongiosus muscle. A self-retaining retractor is placed, and the muscle is then incised sharply to expose the corpus spongiosum of the urethra, which is mobilized proximally and distally. The central tendon is transected for further mobilization with care taken to preserve the bulbar arteries. The fistula is then identified commonly extending from the posterior urethra to the pubic bone. The bone is exposed and debrided of necrotic, friable tissue. The distal bulbar urethra is transected, and the penile segment is oversewn with 2-0 PDS sutures (**Figure 1A**). A dorsal urethrotomy is created along the mobile bulbar segment (**Figure 1B**), and the urothelium is carefully denuded (**Figure 1C, 1D**), leaving behind just the corpus spongiosum (**Figure 1E**). The corpus spongiosum flap is secured circumferentially to the periosteum proximally with 2-0 PDS sutures to fill the defect and interpose the fistulous tract after the pubic bone has been

debrided or resected (**Figure 1F**). A drain is placed, and the wound is closed in multiple layers.

Case 1

A 69-year-old man who underwent salvage radiation therapy for positive margins following prostatectomy for prostate adenocarcinoma. He initially presented with worsening lower urinary tract symptoms and suprapubic pain in the setting of recurrent urinary tract infections. Prior cystoscopies revealed a bladder neck contracture with dystrophic calcifications and radiation cystitis. MRI demonstrated a fistulous connection arising from the dorsal urethra near the bulbomembranous junction and extending to the pubic symphysis with an enhancing fluid collection (**Figure 2**).

Despite initiation of broad-spectrum antibiotics, there was no significant improvement and poor quality of life which prompted extirpative surgery with a corpus spongiosum flap. He recovered well postoperatively without complications and was discharged on post-op day 6 with culture-sensitive antibiotics including intravenous micafungin and piperacillin-tazobactam. Approximately 10 months later, he developed new penile pain with urethral discharge which grew coagulase-negative staphylococcus and streptococcus viridians. An MRI was performed and concerning for a possible fistula recurrence as evidenced by a small fluid collection involving the pubic symphysis with extension to the right adductor muscle. However, subsequent retrograde urethrography did not demonstrate any extravasation and CT-guided fluid aspiration was unsuccessful. He improved with expectant management while on antimicrobials and repeat MRI 4 months later demonstrated significant improvement in the pelvic fluid. At 2 years follow-up he remains free of symptoms concerning for fistula recurrence.

Case 2

A 73-year-old man who underwent external beam radiation therapy for prostate adenocarcinoma and subsequent transurethral resection of a bladder tumor (benign pathology) complicated by a bulbar urethral stricture which was managed with intermittent self-catheterizations. He developed recurrent episodes of hematuria with clot retention over the course of

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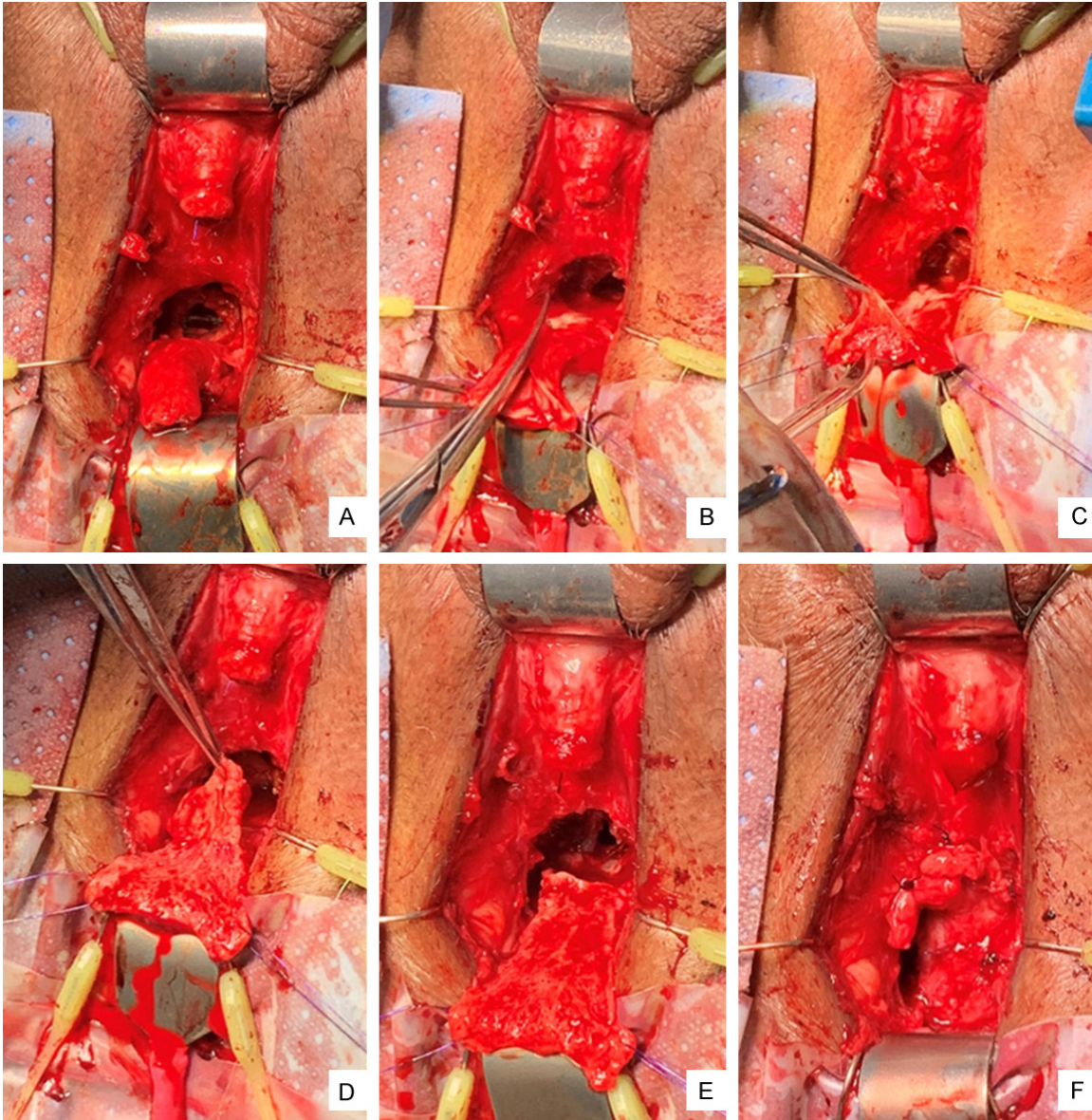


Figure 1. Intraoperative images of corpus spongiosum flap creation. After the bulbospongiosus muscle is incised to reveal the corpus spongiosum, (A) the distal bulbar urethra is transected, and the penile segment is oversewn. (B) A dorsal urethrotomy is created. (C, D) The urothelium is denuded, leaving behind a corpus spongiosum flap. (E, F) The flap is mobilized and secured to the periosteum to interpose the fistulous tract after pubic bone debridement or resection.

a year thought to be due to radiation cystitis and intermittent catheterization in the setting of dual antiplatelet therapy use for extensive coronary artery disease. He presented to the ER with a perineal abscess requiring incision and drainage.

Cystourethroscopy revealed a likely fistula extending from the proximal urethra to the pubic symphysis. Subsequent voiding cystoure-

throgram confirmed a large urethral leak, and he was initially managed with an indwelling catheter for 4 months. Approximately 6 months following catheter removal, he presented with suprapubic pain, difficult voiding, and drainage from an indurated left buttock. A CT scan confirmed a large urethrocutaneous fistula. Repeat imaging demonstrated a persistent tract from the posterior urethra to the perineum and left gluteal region, as well as bilateral inferior pubic

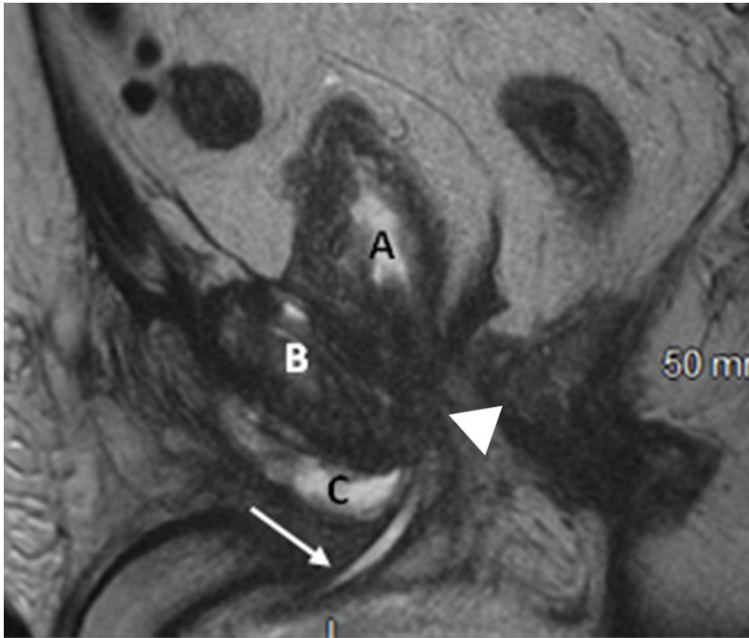


Figure 2. Sagittal T2-weighted MR image through the pelvis demonstrating the bladder (A), pubic bone (B), bulbomembranous urethra (arrowhead), and fistula with fluid collection (C) extending from the posterior urethra to the pubic bone. Note the anterior urethra (arrow).

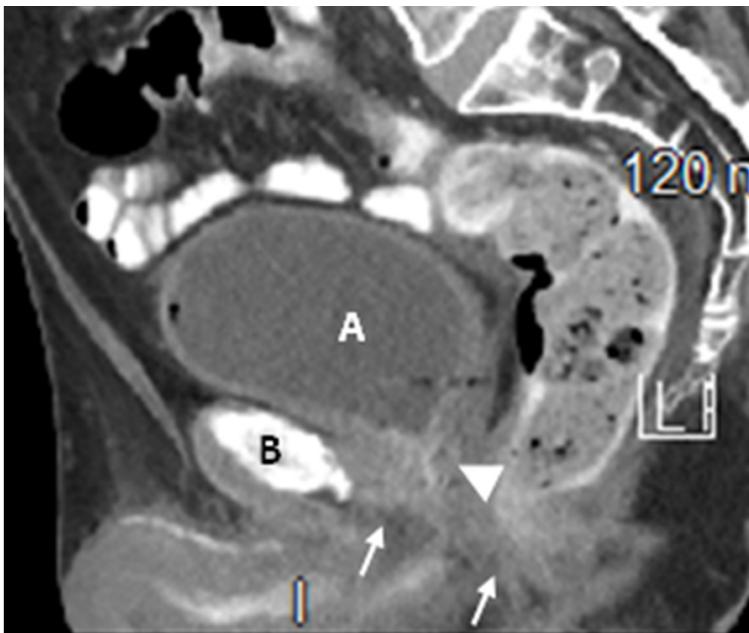


Figure 3. Sagittal CT image through the pelvis with oral and IV contrast shows the bladder (A) and inflammatory change in the vicinity of the posterior urethra (arrowhead) with fistulas (arrows) extending anteriorly towards the pubic bone (B) as well as posteriorly towards the perineum/gluteal region.

rami osteomyelitis which was refractory to antibiotic treatment (**Figure 3**).

neither had fistula recurrence. However, the lack of fistula recurrence, relief of symptoms,

Extirpative surgery was performed with combined omental and corpus spongiosum flaps. The postoperative course was prolonged and complicated by medical comorbidities including left brachial artery pseudoaneurysm and acute heart failure following onset of moderate-to-severe mitral regurgitation. He was discharged on post-op day 65 with culture-sensitive antibiotics including intravenous micafungin and ertapenem. Approximately 4.5 months later, he passed away after transitioning to hospice care due to progression of his medical comorbidities.

Discussion

This report introduces the corpus spongiosum as an alternative tissue flap in genitourinary reconstruction in cases where the urethra has been defunctionalized. The corpus spongiosum flap has the advantages of being mobile, well-vascularized, and easily accessible for harvest during surgery directly by the urologic surgeon using a single perineal incision. These advantages can also limit the need for additional incisions/procedures, the need for additional non-urologic surgeons, and the associated morbidity.

Both patients treated with the corpus spongiosum flap reported post-operative reduction in pelvic pain and resolution of infection and lower urinary tract symptoms postoperatively—patient #2 experienced a protracted hospital stay due primarily to his complex medical comorbidities. Although both experienced medical complications such as pyelonephritis,

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and resolution of osteomyelitis in both patients suggest that the corpus spongiosum has potential to serve as an excellent tissue alternative in comparison to more standard flap techniques.

The corpus spongiosum flap not only increases tissue flap choices but may also minimize post-operative complications associated with other common tissue flaps used in genitourinary reconstruction such as gracilis muscle, rectus abdominis muscle, and omentum [6-10]. Success of the gracilis muscle may be limited due to risk of ischemia when tunneling to the abdomen, necessitating a second repair for complete healing [8-10]. However, using both gracilis muscles can increase the risk of neuropathic pain, muscle weakness, and decreased function [8, 9]. The rectus abdominis muscle has a good dual blood supply and muscle bulk, but harvest may increase the risk of abdominal wall hernia (particularly if the anterior rectus sheath is not reapproximated correctly), infections, seromas, and difficulty re-siting stomas [7-9]. Lastly, the omental flap may be insufficient to reach areas deep in the pelvis without notable tension, especially in patients with prior abdominal surgeries [8-10], as seen with patient #2 who required a supplemental tissue source (i.e., corpus spongiosum).

In addition to introducing an alternative tissue flap, this report also underscores the importance of prompt diagnosis and management. Both patients experienced unrelenting chronic pelvic pain due to pubic osteomyelitis and abscesses, which resulted in multiple interventions and delays. The severity of this pain increases the risk of opioid dependence in patients with delayed diagnosis due to its refractory nature to conservative management, leading to higher and stronger pain medications [11]. Removal of the infected pelvic bone with cystectomy or cystoplasty and tissue flap interposition significantly decreased pain perception and long-term opioid use and also provided symptomatic relief [11, 12].

Thus, management of urosymphyseal fistula should focus on source control for symptomatic relief, and the corpus spongiosum represents another important tool to help achieve this goal. In addition, early detection with diagnostic imaging such as pelvic MRI/CT or voiding cystourethrogram, and subsequent manage-

ment with surgical extirpation and tissue interposition are vital to minimizing the debilitating consequences of urosymphyseal fistula. The interposition of healthy, vascularized tissue from the corpus spongiosum allows for separation of the pubic bone from the remaining lower urinary tract. This tissue flap is also able to prevent communication with involved structures and provide structural support as well as adequate oxygen and nutrient delivery for healing.

Use of the corpus spongiosum flap is limited by specific clinical circumstances in that appropriately-selected patients should be post-cystectomy with a defunctionalized urethra. In addition, the corpus spongiosum may not always be a viable option. The urethra may be variable in robustness (i.e., diminutive) or affected by inflammatory diseases and strictures, thereby limiting its utility. The length, tissue viability, and patient systemic conditions are important selection factors and should be considered when choosing a tissue flap.

Conclusion

Urosymphyseal fistulas are a debilitating yet treatable complication of prostate cancer treatments that require early detection and commonly surgical management. Repair with the use of interposition of tissue is critical in successful repair. The corpus spongiosum represents one such reasonable and effective alternative tissue source with situational utility. Further study is needed to determine outcomes following utilization of this flap.

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Disclosure of conflict of interest

None.

Abbreviations

CT, computed tomography; MRI, magnetic resonance imaging; TPN, total parenteral nutrition.

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