Robotic Lower Urinary Tract Reconstruction

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KEYWORDS

- Robotic lower urinary tract reconstruction • Bladder neck contracture • Proximal urethral stricture
- Genitourinary fistula • Rectourethral fistula

KEY POINTS

- Robotic reconstruction for the lower urinary tract is novel and currently rare but is promising as a new technique to approach complicated repairs.
- Bladder neck contractures and vesicourethral anastomotic strictures have been successfully repaired robotically with good patency rates and improved rates of urinary incontinence versus traditional approaches.
- Robotic-assisted surgery versus traditional approaches enable better visualization and greater control of anastomotic sutures during proximal and posterior urethral stricture repair.
- Although reports and case series are promising more studies, and higher-level evidence are needed to conclusively support robotic reconstruction of the lower urinary tract.

INTRODUCTION

Reconstruction of the urinary tract was first described in 1851 with a ureterosigmoidostomy,[1] followed by the ileal conduit described by Bricker in the 1950s as the primary form of urinary diversion from the lower urinary tract (LUT).[2] Over the last several decades, there has been development of numerous novel techniques to facilitate the reconstruction of the LUT instead of urinary diversion. The advent of laparoscopy and subsequent robotic techniques have allowed even further innovation to allow complex LUT issues to be managed as orthotopically as possible with the addition of numerous benefits offered by laparoscopic techniques. Reconstructive urologists have increasingly adopted the robotic platform to address a wide variety of upper and LUT pathologies.

The LUT anatomy includes the bladder, bladder neck, prostate, urinary sphincter, and the urethra. Not all disease processes in this anatomic region require laparoscopic surgery to repair. This article instead focuses on the anatomy and disease processes in the LUT that are appropriate for robotic repair, including bladder neck contractures (BNCs), proximal urethral strictures, and genitourinary fistulas. Given the rare occurrence of these pathologies and the relatively new robotic techniques that have been described, most of the data presented are case series and reports that speak to the technical feasibility of the robotic approach rather than comparative effectiveness with traditional open techniques.

BLADDER NECK CONTRACTURES AND VESICOURETHRAL ANASTOMOTIC STRICTURES

BNCs and vesicourethral anastomotic strictures (VUAS) are well-known complications that occur after prostate procedures for both benign and malignant conditions. These 2 complications are discussed together given their similar locations and general approaches to successful reconstruction. Although the precise pathophysiology of BNC remains unclear, scar hypertrophy is considered to

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be the basis for recurrence due to a prolonged inflammatory phase and/or ischemia.[3] BNC has a reported incidence after transurethral resection of prostate between 0% and 9.6%,[4,5] although rates have varied between different techniques used to treat benign conditions such as outlet obstruction. After a radical prostatectomy, VUAS rates have historically been reported to be as high 16%[6–8]; however, the advent of robotic surgery and improved visualization enables better mucosal apposition and watertight anastomosis, and rates have decreased to 2.2%.[9]

Initial treatment of BNC is highly variable, ranging from a simple dilation to endoscopic procedures using cold knife, electrocautery, lasers, and loop resection. These procedures can also be augmented with the addition of a steroid or a cytotoxic agent such as mitomycin C. Treatment success has ranged from 58% to 89% after these techniques.[10–12] However, when conservative or endoscopic treatment fails, a more invasive option is considered. Open reconstruction of BNC has historically been performed in patients with highly recalcitrant BNC. Because of the rare nature of these procedures, most published series are limited by a small sample size and may vary significantly in techniques, ranging from abdominoperineal, perineal, and transpubic approaches.[13–15] Although the reported patency rates have been as high as 93.3%, dissection through the external urinary sphincter is associated with significant risk for urinary incontinence.[16]

Robotic reconstruction of BNC is becoming a more widely adopted technique that has been described as advantageous in regard to lower estimated blood loss, reduced postoperative pain, shorter hospitalization, and improved continence rates, as the dissection is above the level of the sphincter, and avoids the morbidity of a pubectomy described in open procedures. There is also the potential advantage of improved durability in placing a future artificial urinary sphincter due to the lack of prior perineal dissection.

Procedural Approach

The surgical principles for a successful anastomosis for urethral strictures are applicable to BNC repairs. A tension-free, watertight, mucosa to mucosa apposition, well-vascularized, and catheterized anastomosis using resorbable sutures is crucial.

The patient is placed in a steep Trendelenburg position, and the abdomen is entered using a similar approach to robotic prostatectomy. Port placement includes a supraumbilical midline camera port, a robotic port and assistant port on the right side, and 2 robotic ports on the left side (**Fig. 1**A).

Patients with a history of outlet deobstruction procedure

Patients who have had a transurethral procedure of the prostate or a simple prostatectomy can be approached anteriorly by developing the space of Retzius and dropping the bladder off the anterior surface of the abdominal wall. This dissection is carried inferiorly underneath the pubic symphysis to the junction between the prostate and bladder neck. Given most patients have undergone several transurethral procedures prior for recurrent BNC, there may be a dense desmoplastic reaction that may require careful dissection to separate the bladder and prostate from the anterior pelvis (**Fig. 1**B). After dissection of the desmoplastic reaction off of the bladder neck junction (**Fig. 1**C), a flexible cystoscope is passed retrograde through the urethra to identify the location and extent of BNC. Firefly technology can be used to help delineate the location of the contracture (**Fig. 1**D).

The bladder is then opened anteriorly just proximal to the bladder neck and continued distally to determine the proximal extent of the contracture (**Fig. 1**E). Using sharp dissection and electrocautery, the scar tissue is completely excised. The mucosal edges are then brought together to create a posterior plate using interrupted 4-0 Vicryl sutures (**Fig. 1**F). A Y-V plasty is then performed (**Fig. 1**G). The long arm of the Y is a longitudinal incision of the bladder neck scar on the anterior aspect. An inverted V incision is made on the anterior aspect of the bladder neck. A 16-Fr Foley catheter is brought through as the final catheter. The apex of the V bladder flap is then advanced to the distal aspect of the anterior longitudinal incision through the scar, which is then closed with a running V-loc suture. After anastomosis, a leak test is performed by flushing the catheter with saline (**Fig. 1**H).

Patients with a history of prostatectomy

The procedure is approached similarly to described earlier, although the dissection is usually more difficult due to the more distal location and severe adherence to the pubic symphysis. The bladder neck is approached anteriorly by developing the space of Retzius and dropping the bladder off the anterior surface of the abdominal wall. This dissection is carried inferiorly underneath the pubic symphysis to the area of the vesicourethral anastomosis, which is notably very distal. A flexible cystoscope is then passed through the urethra to identify the location and

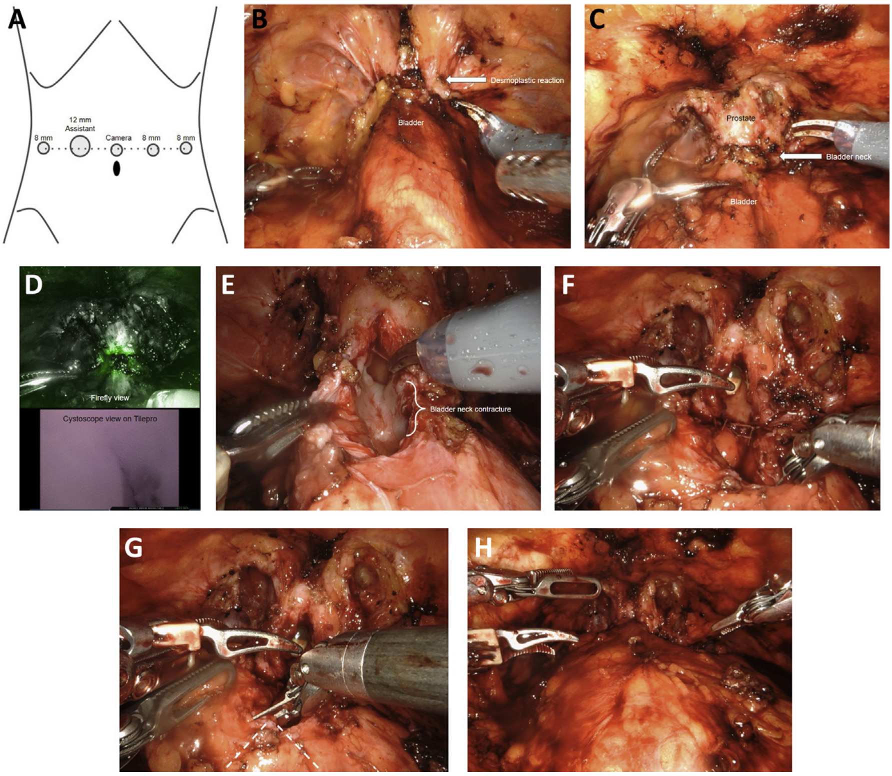

Fig. 1. (*A*) Robotic port placement for bladder neck reconstruction. (*B*) Desmoplastic reaction from prior transurethral procedures for bladder neck contractures. (*C*) Bladder neck junction after dissection of desmoplastic reaction. (*D*) Determination of location of bladder neck contracture using Firefly technology and TilePro. (*E*) Longitudinal incision from bladder through bladder neck contracture. (*F*) After excision of bladder neck contracture, the posterior plate is brought together with interrupted sutures. (*G*) A Y-V plasty performed to bring the anterior bladder wall distal to excised bladder neck contracture and into prostatic urethra. (*H*) A leak test with saline is performed to ensure watertight anastomosis.

extent of the anastomotic stricture. The bladder neck is completely freed from the pubic symphysis as well as 1 cm distal to where the scar tissue ends. The bladder is opened anteriorly just cephalad to VUAS and carried through the contracture. Using sharp dissection, the scar tissue is completely excised posteriorly and anteriorly. Healthy posterior bladder mucosa and urethra is mobilized to allow for a tension-free anastomosis. The anastomosis is performed similarly to a radical prostatectomy with running V-loc sutures. For a mild VUAS, a Y-V plasty approach may be used, although this would be the exception. The advantage to this approach is that it avoids the dissection of the posterior bladder neck and the potential of a rectal injury. If the repair seems tenuous for radiated VUAS, the authors strongly recommend placing an anterior omental flap to cover the anastomosis.

A suprapubic tube can be placed to maximize drainage, along with a pelvic drain. A Foley catheter is left in place for about 3 weeks depending on the degree of reconstruction. A voiding cystourethrogram or retrograde urethrogram can be performed at the time of catheter removal to ensure no leakage.

Outcomes

There are small case series that show the feasibility of a robotic approach to reconstructing the bladder neck. Kirshenbaum and colleagues[17] showed that 12 patients who have undergone robotic bladder neck reconstruction were assessed with a cystoscopy postoperatively with an average follow-up of 98 days. Eight of 11 patients had a wide-open, patent bladder neck, whereas 3 of 11 were deemed to have failure, with less than 17 Fr urethral strictures identified. One patient who did not have a cystoscopy had a uroflow rate of 24 mL/s with postvoid residual volume of 12 cc. Nine of 11 patients were continent. Overall, the success rate as defined by being able to pass a 17-Fr cystoscope or uroflow rate greater than

15 mL/s was 75%, with an incontinence rate of 18%.

Granieri and colleagues[18] showed the robotic reconstruction of BNC in 7 patients using Y-V plasty, which showed all cases successful with no evidence of recurrence after a median follow-up of 8 months. Two of 7 patients had persistent urinary incontinence. Musch and colleagues[19] showed a Y-V plasty performed on 12 patients, which was successful in 83.3% of patients after a follow-up of 23.3 months. One of 12 patients had documented stress urinary incontinence.

Overall, the success rate of a robotic reconstruction ranges from 75% to 100%, although the definition of success can vary. The ability to maintain a patent urethral channel, based on this small case series, is high. The rate of incontinence ranges from 8% to 28%, and this is a significant improvement from previous incontinence rates from open procedures that can range from 85% to 93%.[20]

Summary

BCNs/VUAS can be a very difficult issue to manage both from the patient and surgeon perspective. The recalcitrant nature of contractures through endoscopic approaches has necessitated novel techniques that attempt to reduce morbidity and complications. The robotic approach of bladder neck reconstruction is a viable surgical option for recalcitrant contractures, with good patency and minimal exacerbation of urinary incontinence. The robotic-assisted technique offers many advantages over the open technique for BNC/VUAS reconstruction: improved access to the deep and narrow retropubic space, fine and precise dissection and suturing, significant magnification, and improved ergonomics to perform the surgery. There is a growing body of literature to support the role of robotic-assisted reconstructive surgery for recurrent BNC/VUAS.

Clinics Care Points

- BNCs are a devastating complication of commonly performed procedures such as a prostatectomy or transurethral resection of the prostate and can be recalcitrant to endoscopic attempts to keep them open.
- Delineation of the contracture with a cystoscope intraoperatively is crucial to excising the scar tissue and performing a confident repair with mucosa to mucosa apposition.
- The surgical principles of a urethral anastomosis should be applied to BNC/VUAS repair: tension-free, watertight, well-vascularized, mucosa to mucosa apposition, and catheterized anastomosis.

PROXIMAL URETHRAL STRICTURE

The management of urethral stricture disease has varied considerably depending on location, length, and severity of the stricture. It can develop anywhere along the length of the male or female urethra and has been attributed to multiple causes including injury, infection, and iatrogenic instrumentation. The urethroplasty has long been considered as the gold standard for repair of urethral stricture,[21] and most of the anterior urethral strictures can be managed with an open technique with a transecting, nontransecting, onlay, or augmentation urethroplasty.

Proximal bulbar and posterior urethral injuries represent a different challenge in reconstructive urology. It is most commonly associated with pelvic fractures,[22] although it can also be found with radiation treatment. There exists a wide variety of techniques available for posterior injury management, a common principle being the excision of scar tissue and a spatulated end-to-end anastomosis of healthy mucosa.[23] However, given the anatomic complexity of these injuries, the exposure and visualization can be much more challenging than more distal urethral strictures. The location of the posterior urethral stricture can be difficult to access, as we are limited laterally by aspects of the pubic rami and by the pubic symphysis anteriorly. This has necessitated the development of ancillary maneuvers such as corporeal body separation, inferior pubectomy, and retrocrural urethral rerouting to bridge the gap between the prostatic urethral apex and bulbar urethra.[24] This long and narrow channel can also make it very difficult to place the proximal urethral sutures, and this can result in inadequate mucosal apposition. The robotic platform has been used extensively in urology to improve visualization, access to deep and narrow spaces, precise suturing, and ergonomics, and proximal urethral strictures is no exception.

Procedural Approach

The surgical principles of a urethral anastomosis are described earlier in the article. There are 2 described approaches to urethroplasty for proximal strictures. Depending on the location and distal extent of the stricture, a transabdominal versus perineal approach can be taken. A transabdominal approach can be considered when the urethral stricture is proximal to the membranous urethra, and the steps are described earlier in the article. The focus of this portion of the article will be the robotic perineal approach.

The steps of the procedure are similar to an open urethroplasty procedure, with highlighted improvement in visualization of proximal urethral mucosa and placement of reliable sutures due to the articulation of the needle driver arms in a relatively tight space. The patient is placed in a high lithotomy position and perineal dissection performed in standard urethroplasty fashion until the area of urethral stricture is encountered. The preferred urethroplasty approach is then performed, whether it is a primary anastomosis or a nontransecting technique. The robot is then brought in for suturing, angled in such a way that the camera arm is positioned facing toward the perineal incision. A total of 3 floating robotic arms are used, with 2 working arms using needle drivers and the middle arm using for the 0-degree camera lens (Fig. 2A).

For an excision and primary anastomosis, a spatulation is made dorsally on the proximal end and ventrally on the distal end. The distal end of the urethra is then tucked away from the field of view (Fig. 2B). A total of 12 full-thickness absorbable monofilament sutures are placed in a clockwise fashion circumferentially initially on the proximal urethra (Fig. 2C). Once these sutures are placed, the distal throw can be performed either open or with the robotic arms. It is important for the bedside assistant to keep the sutures organized and straightened throughout the case to avoid tangling issues. For a nontransecting urethroplasty, a dorsal longitudinal incision is made through the urethral stricture. A total of 7 sutures are placed starting with the middle stitch to bring the 2 apexes of the incision together. Three sutures are then placed on each side of the middle stitch and closed in a Heineke-Mikulicz fashion. It may be preferable to tie down each stitch, as they are thrown to help reduce future clash with the sutures and the robotic arms.

The Foley catheter is then placed before closure of the final suture and is standard care for urethroplasty. The catheter is left in place from 10 to 21 days. A cystoscopy and voiding cystourethrogram (VCUG) are performed postoperatively to rule out extravasation or anastomotic leak before catheter removal.

Outcomes

Use of the robotic approach for a proximal urethroplasty is rare. A case series[25] describes 10 patients with an average stricture length of 2.2 cm who underwent a robotic urethral reconstruction. The set-up time for the robotic portion of the case was 15 minutes and 30 to 45 minutes for suture placement. All patients had a VCUG before catheter removal, which showed no evidence of extravasation and had a 3- and 12-month

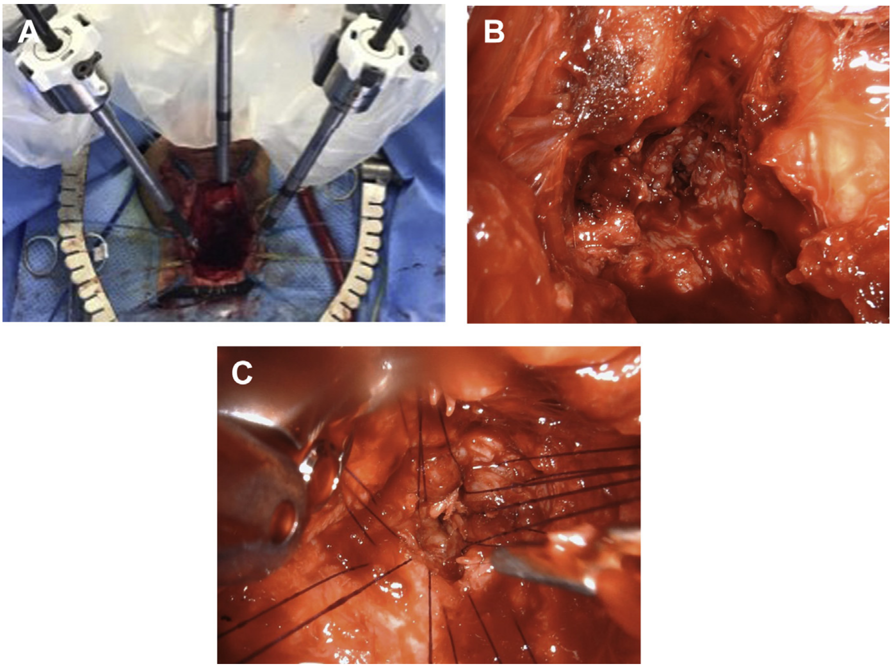

Fig. 2. (*A*) Robotic arm placement for repair of proximal urethral strictures. (*B*) Visualization of proximal urethra after excision of urethral stricture. (*C*) Placement of 12 proximal stitches.

cystoscopy follow-up. All patients were patent as demonstrated by the ability to easily pass a 17-Fr flexible cystoscope.

Summary

Proximal urethral strictures can be challenging to access, and its repair requires a deep perineal dissection for adequate visualization and suture placement. The robotic perineal approach can provide improved visualization and ergonomics needed for reliable suture placement to overcome the anatomic challenges inherent to this location. Operative times and outcomes are comparable to the standard open approach with improved surgeon comfort/ergonomics. Although proximal urethral strictures can be successfully managed with an open approach, the utility of robot-assisted surgery and all of its technical advantages can enhance the ability to perform the surgery.

Clinics Care Points

- Proximal urethral strictures can be difficult to access with the anatomic restraints afforded by the pubic rami and symphysis.
- The robotic perineal approach allows improved visualization with the magnified view to better visualize the proximal mucosa and greater control of the anastomosis with articulating arms of the needle driver in a deep, tight space.

LOWER URINARY TRACT FISTULA

LUT fistulas encompass a wide range of conditions that include vesicovaginal, rectourethral, colovesical, and other enterovesical fistulas. The cause of these fistulas vary significantly, but the overall impact they have on social life, mental and physical well-being, and sexual function can be debilitating. Robotic-assisted dissection and repair of urologic fistulas is a useful and highly successful approach that has significant benefit to the patient and the surgeon preforming the surgery.

Rectourethral Fistula

Rectourethral fistulas (RUF) represent a challenging problem; however, the incidence is fortunately rare. Most of the RUF are now a result of ablative therapy, mostly commonly radiation therapy for prostate cancer. Other less common causes are surgically induced RUF, medical conditions such as inflammatory bowel disease, diverticulitis, and perirectal abscesses,[26,27] and other pelvic cancer therapies. Patients with these fistulas encounter many debilitating symptoms including irritative voiding, recurrent cystitis, fecaluria, urine leakage per rectum, and significant pain (pelvic, perineal, and lower extremity).[28]

Both conservative and surgical approaches have been described in its management. It is rare for ablative fistula to resolve with simply urinary diversion, although this is often the first step preformed. In radiated patients it is found that hyperbaric oxygen therapy is a very useful tool to help alleviate many of the symptomatic complaints the patient experiences, in addition to overall improved healing if an operative approach is pursued.[29] All patients who have been radiated to have hyperbaric oxygen therapy before any surgical intervention if possible are encouraged.

There are numerous surgical techniques described such as the York-Mason,[30] anterior rectal wall advancement,[31] anterior transanal mucosal advancement flap,[32] and the Latzko technique.[33] Among these techniques is also a multitude of vascular interposition tissue flaps used, including the omentum, gracilis muscle, and peritoneum. Accepted success rates of the different surgical approaches by high-volume centers vary between 75% and 100%.[34] When done open, urologist tends to favor the perineal approach, as it allows for the range of various surgical techniques needed to close the fistula including an interposition muscle flap. The robotic approach to fistula repairs is still in the early phase of data collection and publication but offers some real advantages. The ability to access deep narrow spaces with precise dissection and suturing with increased magnification and comfort is a significant advantage over open fistula repair and closure.

Vesicovaginal Fistula

Vesicovaginal fistulas (VVF), a communication between the bladder and vagina, are a result of pelvic surgery, radiation, or gynecologic malignancies. They can also occur from obstructed labor or instrumental vaginal delivery in developing countries.[35] It results in a continuous involuntary loss of urine through the vagina that is socially distressing. A careful history, physical examination, and cystoscopy is essential to establish the size, number, and location of the fistula. A biopsy of the site is performed when malignancy is suspected.

VVFs can be managed conservatively with prolonged catheterization or even with a minimally invasive approach with a fibrin sealant and collagen as a plug after electrocoagulation[36]; however, only the small fistulas are likely to spontaneously close. There are 2 typical approaches to the repair, either transvaginal or transabdominal. The approach depends on characteristics of the fistula, along with surgeon preference. The authors focus on the transabdominal extravesical approach. Indications for transabdominal approach include involvement of the ureteral orifice, small capacity bladders requiring augmentation, vaginal stenosis, high VVF, redo VVF, involvement of the cervix or uterus, and ureterovaginal fistulas.[37]

Colovesical Fistula

Colovesical fistula is a communication between bowel and the bladder (**Fig. 3**A, B). Unlike VVFs or RUFs, colovesical fistulas are more likely due to colorectal conditions rather than from iatrogenic injury, most commonly due to diverticular disease or colon cancer.[37] The symptoms of CVFs are similar to RUFs, presenting with pneumaturia, fecaluria, and recurrent cystitis, and diagnosed with a combination of cystoscopy, computed tomography, or MRI. Given that the cause is typically a colorectal process, a colonoscopy or sigmoidoscopy is indicated, and a biopsy may be taken for suspected malignancy.[38]

Management for colovesical fistula is largely done by colorectal surgery, as the primary disease is managed first with a diversion or excision of affected bowel segment with primary anastomosis. A urologist is called on to help for more complex repair of the bladder for large openings or for augmentation of a small bladder. The importance of managing or removing the original bowel cause cannot be overemphasized for a success and permanent fistula closure.

Procedural Approach

Overall principles of a fistula repair remain unchanged with a robotic approach. It requires adequate exposure of the fistula, separation of the bladder or urethra from the vagina, colon, or rectum, trimming of the devascularized edges, a tension-free closure of the respective fistulous connections, interposition of a vascularized tissue, and adequate postoperative drainage. The repair approach for rectourethral, vesicovaginal, or colovesical fistula is similar and described later.

The patient is positioned in a dorsal lithotomy position, and the procedure is started first with cystoscopy. The C-arm fluoroscopy should also be available, should the fistula be difficult to visualize (**Fig. 3**C). Once the fistula is identified by

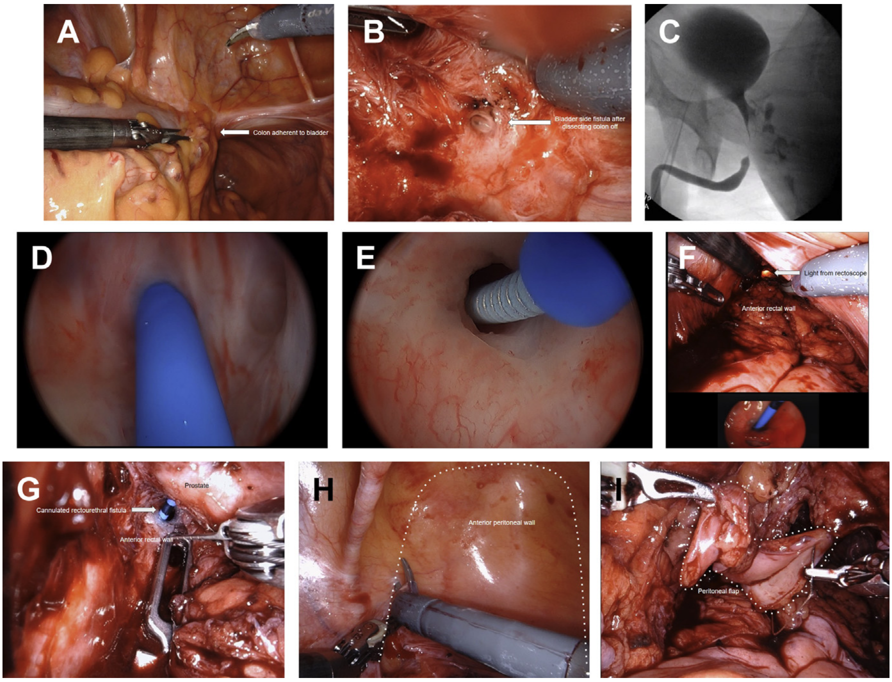

Fig. 3. (*A*) Colovesical fistula, with densely adherent colon to bladder. (*B*) Fistulous site seen after dissection of colon off of bladder, with saline irrigation confirming lumen of bladder. (*C*) Retrograde urethrogram with extravasation of contrast into rectum. (*D*) Cannulation of fistula from the urethral side with catheter. (*E*) Cannulation of fistula from rectal side. (*F*) Visualization of location of fistula with light from rectoscope. (*G*) Separation of rectal wall from prostatic urethra, confirmed with catheter visualization. (*H*) Peritoneal flap creation. (*I*) The flap is inverted and brought down into the deep pelvis to cover the urinary repair by securing it over and at least 1 cm distal to the prostatic urethral closure.

cystoscopy (**Fig. 3**D), it is cannulated with a wire and 5-Fr open-ended ureteral catheter and externalized through the vagina or anus (**Fig. 3**E). Should identification of the fistula be questionable or difficult to cannulate, contrast can be injected into an opening with a ureteral catheter and confirmed with fluoroscopy showing contrast or with methylene blue to directly visualize the fistula. Bilateral ureteral stents may also be placed at this time to be able to identify any potential injuries to the ureters that may occur in this case.

Once the fistula has been identified, the robot is then docked with the patient in low lithotomy Trendelenburg position. Ports are placed in similar fashion to a radical prostatectomy (see **Fig. 1**A). The posterior bladder is first mobilized. A flexible cystoscope is then placed through the urethra to assist with visualization of the level of the fistula, using the light visualized with near-infrared frequency technology. Light from a rectoscope can also be helpful to visualize the fistula (**Fig. 3**F). It is helpful to place a vaginal or rectal retractor to get some separation of the planes between the 2 fistulous sites. Once the dissection down to the fistula is performed with adequate exposure (**Fig. 3**G) the 2 systems are separated and dropped away from each other (ie, prostate from the rectum or the rectum from the bladder). The urethral or bladder wound is closed in a tension-free manner with interrupted absorbable sutures. The additional organ system (ie the vaginal, colon or rectal wound) is closed or resected and dropped away from the urinary tract closure. Ideally there are no overlapping suture lines.

Critical to a successful closure is the development of an interposition rotational flap placed between the 2 fistulous sites, including the peritoneum, gracilis muscle, and omentum. Robotically, the authors prefer to harvest a peritoneal inverted U flap (**Fig. 3**H). When possible, a 4-cm base width flap is harvested for adequate blood supply and the length measured to reach at least 1 cm distal to the fistula repair. The flap is then inverted into the inferior pelvis (**Fig. 3**I), creating an additional layer between the fistula repairs. For RUF, the gracilis muscle can be harvested and rotated from a perineal approach. Once the urinary side of the RUF is closed, the perineal dissection is performed with harvest of the gracilis muscle described earlier. The gracilis flap is placed between the rectal and the urethral closure.

A catheter is then left indwelling for about 2 to 4 weeks depending on the cause of the fistula. A retrograde urethrogram and/or voiding cystourethrogram can be performed after this period to check for patency and ensure no leakage of the repair.

Gracilis muscle harvest

The patient is placed in a lithotomy position with the thigh placed in minimal flexion, abduction, and external rotation at the hip. The muscle is marked on the inner thigh from the pubic tubercle to the medial condyle of the tibia. The skin is then incised, and after dividing through the subcutaneous fat and muscular fascia, the gracilis muscle is identified. The tendinous insertion near the tibia is divided and the muscle is separated. Small vessels supplying the muscle distally are then divided, while preserving the most proximal vascular supply. The vascular pedicle and nerve are identified 8 to 10 cm below the ischiopubic rami[27] and preserved. The muscle is then rotated 180° and tunneled beneath the subcutaneous tissue for interposition between the rectum and urethra.

Outcomes

Rectourethral fistula

The robotic approach to RUF is rare.[39–41] These are case reports with 1 or 2 patients, and more data are needed. One case report discusses a patient with a fistula secondary to a prostatectomy who had failed previous open repair. After the described robotic approach with a gracilis flap, a cystoscopy was performed 40 days postoperatively, showing no evidence of fistula recurrence. Another case report described 2 patients who had cryotherapy and salvage radiation as the cause of their fistula who underwent robotic repair using an omental flap placement. Both had no reported symptoms at 4 and 9 months, and the patency of the repair was confirmed with imaging studies. In the authors' own experience they have repaired several rectourethral fistulae using the robotic approach with no recurrences to date. It is especially valuable for a high bladder/trigone fistula to the rectum that is amenable to pelvic dissection and a peritoneal flap.

Vesicovaginal fistula

Robotic approach to VVF repair is well tolerated and effective. In several robotic VVF repair case series and case reports[42–47] in the posthysterectomy setting for 2- to 4-cm defects, operative times ranged from 110 to 240 minutes, length of stay from 2 to 5 days, and minimal blood loss. All reported successful outcomes defined subjectively as lack of leak symptoms or objectively with an imaging study.

SUMMARY

Fistulas involving the genitourinary tract are a challenging problem with many described methods for repair, although comparative effectiveness data are lacking to define a superior approach. Although there is early evidence for a robotic approach to repair, the technique has shown to be feasible, effective, and successful. A robotic approach to repair will continue to gain a larger presence in fistula repair surgery, as there are many advantages of the robotic approach over open fistula repair.

CLINICS CARE POINTS

- Genitourinary fistulas have a wide range of causes, and malignancy should always be ruled out as a cause.
- Careful preoperative workup and cannulation of the fistulas before the repair are critical to dissection of the correct plane between the fistulous connection.
- Interposition flaps are critical to success fistula closures and should be able to reach 1 to 2 cm beyond the fistula tract closure.

DISCLOSURE

The authors have nothing to disclose.

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