Robotic-assisted laparoscopic catheterizable bladder augment: a novel approach to treat recurrent bladder neck contracture following radical prostatectomy

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Introduction: *Bladder neck contractures (BNC) are an uncommon complication following radical prostatectomy. Occasionally, BNCs can be refractory to endoscopic approaches. We describe the effectiveness of a novel robotic-assisted laparoscopic catheterizable bladder augment in treating recalcitrant BNCs.*

Materials and methods: *Patients undergoing robotic-assisted radical prostatectomy (RALP) between 2004-2014 who developed a postoperative BNC were identified. We documented our experience with robotic-assisted laparoscopic catheterizable bladder augment for recalcitrant BNCs. Total operative time, robotic time, estimated surgical blood, length of hospital stay, serum creatinine, complications, and postoperative course/upper tract imaging were recorded.*

Results: *Thirty-six of 2002 RALP patients (1.8%) experienced a post-surgical BNC at 182 days post-surgery. Twenty-two (61.1%) underwent a single dilation and/or transurethral incision. Eleven (30.6%) required ≥ 1 procedure.*

Three patients (8.3%) had recalcitrant BNCs. One patient with normal bladder capacity elected open urethroplasty. The remaining two had reduced bladder capacity, detrusor over-activity and failed multiple incisions and self-catheterization. In one patient, the stricture was complete. The other patient experienced urethral leakage requiring bladder neck closure. In both patients, a robotic approach, utilizing an ileal-cecal segment as a catheterizable augment, was performed. At 16 and 89 months follow up, both are continent, with stable renal function and normal upper tracts.

Conclusion: *Robotic-assisted laparoscopic catheterizable bladder augment is a viable treatment for recurrent BNCs. This approach may be particularly well suited for patients with concurrent hyperreflexia or decreased bladder capacity.*

Key Words: bladder augment, bladder neck contracture, prostatectomy, stricture

Introduction

Reconnection of the bladder neck to the membranous urethra following the removal of the prostate is a normal component of radical prostatectomy (RP). If the anastomosis becomes narrow from scarring, bladder neck contracture (BNC) can occur, resulting in a reduction in urinary flow. Bladder neck contracture, bladder neck stenosis/stricture, anastomotic stenosis/stricture are synonymous terms and are a well-recognized complication of RP.[1,2]

Bladder neck contractures may negatively impact upon continence, and persistent BNC may further complicate the surgical management of post-prostatectomy incontinence.[3] In addition, treatment for recurrent and intractable BNC may, in itself, result in de novo incontinence. While open prostatectomy is well known to be associated with BNC formation, a lower incidence of BNC is associated with minimally invasive and robot-assisted laparoscopic procedures.[4-6]

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Reduced rates of BNC with laparoscopic approaches are attributed to reduced intraoperative blood loss, better visualization while carrying out the anastomosis, and the use of a continuous suturing technique that are facilitated by this technology.

The goals of all BNC treatment strategies are to relieve the obstruction, maintain continence, and avoid recurrence. Initial treatment is generally dilatation and/or incision. The optimal energy source (e.g. cold knife, holmium laser, TUR) and use of injections (e.g. triamcinolone, mitomycin C) are a matter of debate.[7-12]

In rare cases, RP-related BNC can be severe and refractory to endoscopic surgical approaches. Under these circumstances, strategies to avoid long term catheterization or urinary diversion include the combined placement of a UroLume stent and artificial urinary sphincter (AUS), or open surgery to reconstruct the bladder neck combined with AUS placement.[13-15]

Another option for refractory bladder neck contracture not often cited is a cutaneous appendicovesicostomy, originally described by Mitrofanoff.[16,17] The adoption of a purely laparoscopic or robot-assisted approach in this setting has been slow, given the relative paucity of relevant cases. However, the da Vinci robotic surgical system may be ideally suited to this clinical situation since it allows the efficient formation of a circumferential watertight appendicovesical anastomosis with reasonable operative times.[18,19]

Here we describe the effectiveness of a robotic-assisted laparoscopic catheterizable bladder augment in treating recalcitrant BNCs. This approach may be particularly well suited for patients with concurrent hyperreflexia or decreased bladder capacity.

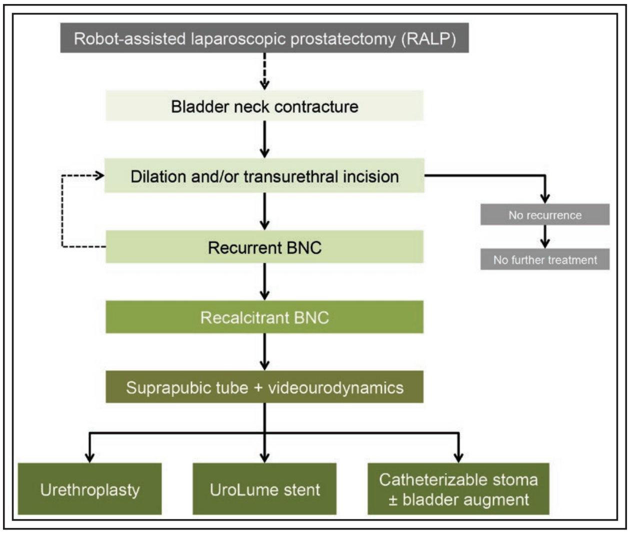

Figure 1. Treatment algorithm for RALP patients diagnosed with a post-surgical bladder neck contracture.

Materials and methods

The study design and protocol were reviewed and approved by the Hartford Hospital institutional review board (IRB). We undertook a retrospective review of patients who had undergone radical prostatectomy and subsequently developed recalcitrant bladder neck contractures. The treatment algorithm used at our clinical center for RALP patients diagnosed with a post-surgical bladder neck contracture is shown in Figure 1.

Patient information was maintained in a prospectively maintained IRB-approved prostate cancer database. Patients undergoing robotic-assisted laparoscopic prostatectomy (RALP) by a single surgeon between January 1, 2004 and December 31, 2014 were identified. From this cohort, patients who developed a postoperative bladder neck contracture were selected. Within this subgroup, we documented our experience with catheterizable bladder augment for recalcitrant bladder neck contracture. Data describing total operative time, robotic time, estimated surgical blood, length of hospital stay, serum creatinine, complications, and postoperative course/upper tract imaging were obtained from paper and electronic hospital and office records.

Preoperative evaluation and surgical technique

Patients who failed multiple incisions with subsequent self-catheterization had a suprapubic tube placed, and the stricture was allowed to mature. Video-urodynamics were performed, and patients were consulted on all treatment options.

Patients performed a mechanical bowel preparation the day before surgery. They received antibiotics and subcutaneous heparin on call to the operating room, and were placed in a modified dorsal lithotomy position with Venodynes. To avoid adhesions from prior surgery, a 5 mm incision was performed in the left midclavicular line below the costal margin. Pneumoperitoneum was introduced with a Veress needle, and a 5 mm visual trocar inserted under direct vision. A 12 mm camera port, three 8 mm robotic ports, and an 11 mm assistant port were placed at the same sites as for the original RALP, Figure 2a. The robot was docked between the legs. The bladder was then mobilized with bipolar Maryland forceps and monopolar scissors. In one case requiring bladder neck closure, the anastomosis was transected as distally as possible, and the bladder was closed in two layers with 2-0 Vicryl on an SH needle (Ethicon, USA). Peritoneal

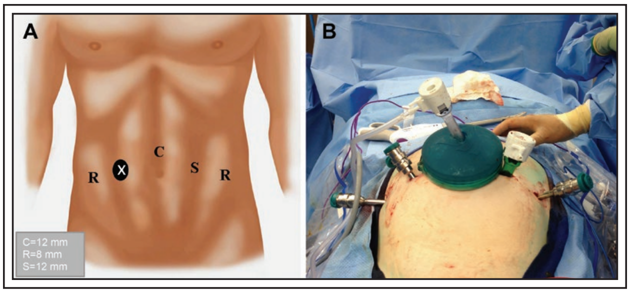

Figure 2. A) Robotic port placement for the procedure. An 8 mm port was converted to the stoma site ('X') (C = camera; R = robotic; S = suction/assistant ports). **B)** Camera port is extended for bowel harvest and gel port placed for remaining robotic portion of surgery.

and retroperitoneal attachments to the terminal ileum and cecum were mobilized, and the terminal ileum grasped with an atraumatic laparoscopic bowel grasper. The robot was undocked.

The 12 mm supraumbilical camera incision was extended to 5 cm, and the terminal ileum and cecum brought into the incision. The ileum was transected 10 cm from the ileal cecal valve with a 75 mm GIA stapler (Ethicon, USA), and the right colon was similarly transected at its midpoint with the ileal-cecal arcade vascularizing the segment. Bowel continuity was restored in a side-to-side fashion with 75 mm gastrointestinal anastomosis (GIA) and 90 cm transverse stapling devices (Ethicon, USA). The colon was opened anteriorly along the teniae, and the ileal cecal valve was reinforced with 2-0 Vicryl sutures. The catheterizable ileal segment was narrowed over a 16 F Foley catheter along the anti-mesenteric border with two fires of the GIA stapler.

The bowel segment was returned to the abdominal cavity, and a gel port (Applied Medical, CA, USA) was placed in the supraumbilical incision, Figure 2b. The camera port was placed through the gel, pneumoperitonem was re-established, and the robot was re-docked.

The bladder was opened longitudinally from the anterior bladder neck to the posterior floor. The colonic patch was sewn to the bladder with several 2-0 V-lock sutures. Two JP drains were placed through the lower lateral trocars. The robot was undocked. A circular incision was performed at the right peri-rectus port site and the catheterizable limb was brought through it laparoscopically. It was matured with interrupted 3-0 Vicryl sutures. The bladder was filled with normal saline via the suprapubic tube, and the limb catheterized several times. A 16 F Foley catheter was placed through the catheterizable limb.

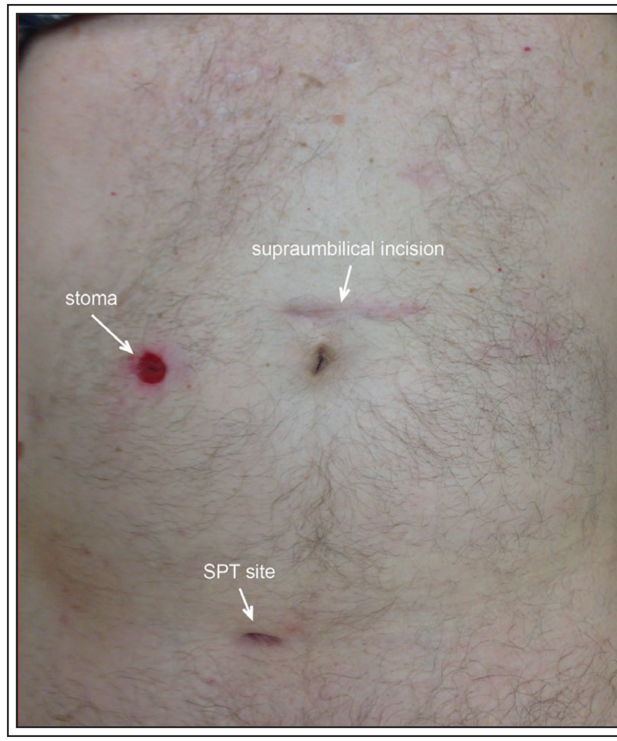

Figure 3. Incisions and stoma site at 1 year follow up after surgery. (SPT = suprapubic tube).

A cystogram was performed 10-14 days post-surgery. The 16 F Foley was removed, the suprapubic tube was plugged, and the patient started intermittent catheterization. To facilitate healing of the mature suprapubic tube site, the 16 F Foley was replaced and the suprapubic tube removed one week later. The Foley was then removed. Post-surgical serum chemistries were obtained at approximately 2 weeks, 6 weeks, 3 months, and then every 6 months for 2 years. Post-surgical renal ultrasonagraphy was performed at 3 months, 6 months, and then annually. The incisions and stoma site 1 year after surgery are shown in Figure 3.

Results

A total of 2002 patients underwent RALP by a single surgeon between January 1, 2004 and December 31, 2014. On average, 182 ± 37 RALP procedures were performed annually. During this period, a total of 36 cases of post-RALP bladder neck contractures (BNCs) were recorded that occurred at a median of 182 [interquartile range: 127-343] days post-RALP. The chronological frequency of post-RALP bladder neck contractures as a function of the number of RALP cases performed is shown in Figure 4. Over the entire

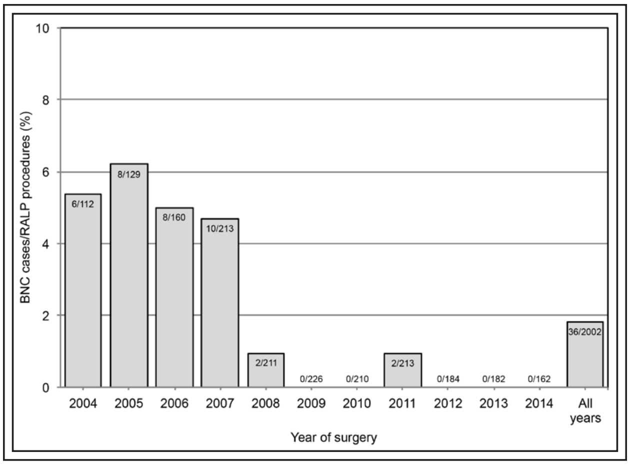

Figure 4. Chronological analysis of post-RALP bladder neck contractures as a function of annual RALP cases during 2004-2014.

study period, the overall incidence of post-RALP BNC was 1.8 %. A total of 22 (61.1%) patients underwent a single dilation and/or transurethral incision, while 11 (30.6%) patients required more than one procedure. Three patients (8.3%) had recalcitrant BNCs that failed repeated incisions and self-catheterizations. All had suprapubic tubes placed and underwent urodynamic studies. One of the patients had normal bladder activity and capacity and elected to undergo open urethroplasty. At 58 months post-surgery he is using one pad per day for mild incontinence. He declined any further treatment.

The remaining two study patients had markedly reduced bladder capacity and detrusor over-activity. Both underwent robotic-assisted laparoscopic catheterizable bladder augment as described. Patient A required a concomitant bladder neck closure, while patient B had a completely closed bladder neck. Patient demographics and operative outcomes for these two patients are summarized in Table 1. Both patients underwent a successful procedure without perioperative complications, are continent and have stable renal function with normal upper tracts by ultrasound. Patient B has had two hospitalizations for pyelonephritis over a 7 year period.

TABLE 1. **Demographic and postoperative clinical data**

	Patient A	**Patient B**
Age at time of bladder augment surgery (yrs)	63	62
Body mass index (kg/m^2)	25.1	32.6
Charlson comorbidity index	4	3
D'Amico risk category	high	low
Pre RALP radiation	yes	no
Post RALP radiation	no	no
ASA physical status score	3	2
Diagnostic PSA (ng/mL)	3.4	6.5
Gleason score		
Diagnostic	(4 + 4) 8	(3 + 3) 6
Pathologic	(4 + 4) 8	(3 + 4) 7
Operative time (min)		
Total	325	296
Robotic console	148	162
Laparoscopic	40	32
Estimated blood loss (mL)	50	50
Length of stay (days)	5	5
Follow up time (months)	16	89

Discussion

Bladder neck contracture is a recognized risk factor for patients undergoing RP, and is associated with significant post-surgical morbidity related to infection, urinary retention, incontinence and the requirement for additional invasive surgery. Typically, the incidence of BNC formation is 0.5%-17.5% when RP is performed using an open approach.[20,21] However, the rate of BNC is significantly reduced when either a laparoscopic or robotic-assisted approach is used.[4-6] We attribute the decreased rate of post-RALP BNC over time in our series, Figure 4 to the introduction of a running anastomosis, improved technique, and experience.

Several factors have been negatively associated with the formation of post-RP bladder neck contractures, including age, body mass index, preexisting renal disease smoking, ischemic heart disease, hypertension, diabetes, hematomas, the caliber of the reconstructed bladder neck and early urinary retention following catheter removal.[1-3] However, the creation of a tension-free, watertight anastomosis with good mucosal apposition and minimal devascularization of the bladder neck each contribute to minimizing the rate and severity of BNC formation.

There is common agreement that dilation and/or incision is the first line of therapy for BNC. However, there is no clear consensus regarding the treatment for recurrent BNC. Injections with agents such as triamcinolone and mitomycin C (MMC) have been utilized with the hope of decreasing the rate of BNC recurrence.[7-12] Vanni et al[7] reported an overall success rate of 89% in 18 patients after two procedures utilizing MMC. More recently, Redshaw et al[8] reported an overall success rate of 75% (41/55) after one or two procedures. Notably, four patients (7%) experienced serious MMC-related adverse events, with three requiring subsequent cystectomy. In this study, the authors felt the efficacy of intralesional MMC injection was similar to that reported for deep lateral incision alone, suggesting that surgical technique may be more relevant than adjuvant agents in establishing long term patency. In fact, our study supports this statement as we found that 11/14 (79%) patients with a BNC after their first incision were successfully treated with 2-3 incisions. MMC is not currently part of the treatment paradigm for treating BNCs at our clinical center, Figure 1.

Urolume urethral stent/artificial urinary sphincter or urethraplasty/artificial urinary sphincter are also viable options. In addition, Mitrofanoff cutaneous appendicovesicostomy is an effective means of providing a continent conduit for bladder catheterization for patients with normal bladder compliance. Skin level scarring is the most common complication at 10%.

A catheterizable bladder augment has several advantages and disadvantages compared to a Mitrofanoff procedure. The catheterized limb is less prone to stenosis, and the augment can address bladder hyperreflexia and reduced bladder capacity when present. However, mucus production, gastrointestinal issues from the removed bowel segment, electrolyte disturbances, and malabsorption could theoretically be problematic. Fortunately, neither of our patients have any such issues to date, but they do irrigate their augment daily.

Conclusions

The treatment of recalcitrant BNC can be vexing . Robotic-assisted laparoscopic catheterizable bladder augment appears to be a viable option for selected patients. ☐

References

1. King T, Almallah YZ. Post-radical-prostatectomy urinary incontinence: the management of concomitant bladder neck contracture. *Adv Urol* 2012;2012:295798.
2. Simhan J, Ramirez D, Hudak SJ, Morey AF. Bladder neck contracture. *Transl Androl Urol* 2014;3(2):214-220.
3. Parihar JS, Ha YS, Kim IY. Bladder neck contracture-incidence and management following contemporary robot assisted radical prostatectomy technique. *Prostate Int* 2014;2(1):12-18.
4. Kostakopoulos A, Argiropoulos V, Protogerou V et al. Vesicourethral anastomotic strictures after radical retropubic prostatectomy: the experience of a single institution. *Urol Int* 2004;72(1):17-20.
5. Breyer BN, Davis CB, Cowan JE, Kane CJ, Carroll PR. Incidence of bladder neck contracture after robot-assisted laparoscopic and open radical prostatectomy. *BJU Int* 2010;106(11):1734-1738.
6. Msezane LP, Reynolds WS, Gofrit ON et al. Bladder neck contracture after robot-assisted laparoscopic radical prostatectomy: evaluation of incidence and risk factors and impact on urinary function. *J Endourol* 2008;22(1):97-104.
7. Vanni AJ, Zinman LN, Buckley JC. Radial urethrotomy and intralesional mitomycin C for the management of recurrent bladder neck contractures. *J Urol* 2011;186(1):156-160.
8. Redshaw JD, Broghammer JA, Smith TG III et al. Intralesional injection of mitomycin C at transurethral incision of bladder neck contracture may offer limited benefit: TURNS Study Group. *J Urol* 2015;193(2):587-592.
9. Damico CF, Mebust WK, Valk WL, Foret JD. Triamcinolone: adjuvant therapy for vesical neck contractures. *J Urol* 1973;110(2):203-204.
10. Farah RN, DiLoreto RR, Cerny JC. Transurethral resection combined with steroid injection in treatment of recurrent vesical neck contractures. *Urology* 1979;13(4):395-397.
11. Eltahway E, Gur U, Virasoro R, Schlossberg SM, Jordan GH. Management of recurrent anastomotic stenosis following radical prostatectomy using holmium laser and steroid injection. *BJU Int* 2008;102(7);796-798.
12. Herrmann TR, Liatsikos EN, Nagele U, Traxer O, Merseburger AS; EAU Guidelines Panel on Lasers, Technologies. EAU guidelines on laser technologies. *Eur Urol* 2012;61(4):783-795.
13. Aaronson DS, Elliott SP, McAninch JW. Transcorporal artificial urinary sphincter placement for incontinence in high-risk patients after treatment of prostate cancer. *Urology* 2008;72(4):825-827.
14. Siegel J, Simhan J, Tausch TJ, Morey AF. Ureteral strictures and reconstruction in the cancer survivor. *Curr Opin Urol* 2014;24(4):421-426.
15. Morey AF, Watkin N, Shenfeld O, Eltahawy E, Giudice C. SIU/ICUD Consultation on Urethral Strictures: Anterior urethra-primary anastomosis. *Urology* 2014;83(3 Suppl):S23-S26.
16. Mitrofanoff P. Cystostomie continente trans-appendiculaire dans le traitment des vessies neurologiques. *Chir Pediatr* 1980;21:297-305.
17. Taneja SS. Complications of urologic surgery: prevention and management. 4th edition: Saunders; 2010.
18. Pedraza R, Weiser A, Franco I. Laparoscopic appendicovesicostomy (Mitrofanoff procedure) in a child using the da Vinci robotic system. *J Urol* 2004;171(4):1652-1653.
19. Nerli RB, Reddy M, Devraju S, Prabha V, Hiremath MB, Jali S. Laparoscopic mitrofanoff appendicovesicostomy: Our experience in children. *Indian J Urol* 2012;28(1):28-31.
20. Borboroglu PG, Sands JP, Roberts JL et al. Risk factors for vesicourethral anastomotic stricture after radical prostatectomy. *Urology* 2000;56(1):96-100.
21. Davidson PJ, van den Ouden D, Schroeder FH. Radical prostatectomy: prospective assessment of mortality and morbidity. *Eur Urol* 1996;29(2):168-173.