Continent cutaneous ileocecal cystoplasty in the treatment of refractory bladder neck contracture and urinary incontinence after prostate cancer treatment

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Introduction: *To assess the use, complications, and outcomes of continent cutaneous ileocecal cystoplasty (CCIC) for the management of refractory bladder neck contractures and/or urinary incontinence after prostate cancer therapy.*

Materials and methods: *An institutional review board approved database was reviewed for patients who underwent CCIC from January 1, 2003 to December 31, 2018. Preoperative, perioperative and postoperative factors were assessed, including complications and outcomes.*

Results: *Thirteen patients were identified. Indications for CCIC included refractory bladder neck contracture (n = 3), urinary incontinence (n = 5), or both (n = 5). Median age was 69. Median follow up was 78.1 months. Seventy-seven percent of patients (10/13) had a history of radiation. The median number of procedures between initial prostate treatment and augmentation was 3. Sixty-nine percent (9/13) of patients had a bladder neck closure along with augmentation (5 transabdominal and 4 transperineal). Median operative time was 375 minutes. Median blood loss was 175 mL. The overall complication rate was 69% (9/13), with 38% (5/13) occurring within 30 days. One patient (8%) required stomal revision. Thirty-three percent (3/9) of patients with bladder neck closure required revision due to perineal fistula. All had a history of radiation therapy. At last follow up all patients were satisfied with their urinary control. Eighty-five percent of patients (11/13) were fully continent via both urethra and stoma. One patient had urethral leakage with bladder spasms controlled with medication and one had mild stomal incontinence.*

Conclusions: *CCIC is an effective means of treating refractory bladder neck contractures and/or urinary incontinence. While morbidity rates are high, subjective patient satisfaction is high.*

Key Words: urinary bladder neck obstruction, urinary diversion, prostate cancer, radiotherapy, urinary reservoirs, continent

Introduction

Refractory bladder neck contractures (BNC) and refractory urinary incontinence after prostate surgery or radiation are rare but problematic complications. While the majority of the patients with BNC can be managed with dilations or incisions, with 50%-86% success,[1-3] refractory cases render the patient with a difficult decision: perform intermittent catheterization, live with an indwelling catheter, or resort to a complex operation in an attempt to restore patency. While recurrent BNC are vexing, perhaps a more difficult population is those that have failed multiple artificial urinary sphincters (AUS). With an AUS, urethral atrophy occurs at a rate of 3%-9%,[4-7] mechanical malfunction occurs up to 53%,[8] and infection or erosion occurs in up to 8% of cases.[7,9,10] These failures often require a salvage technique, either a double-cuff,[11] increased pressure in the regulating balloon,[12] downsizing the cuff,[13] or transcorporal placement.[14] Even with salvage techniques, there are still patients who fail treatment and must choose between incontinence, an indwelling catheter, or undergo some form of urinary diversion.

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The use of the continent cutaneous ileocecal cystoplasty (CCIC) was first reported for the treatment of neurogenic bladder with promising results.[15,16] Later reports of the use of a CCIC in the adult population also demonstrated excellent outcomes, both for neurogenic bladder and refractory urethral strictures.[17] Herein, the use of the CCIC is explored for the use for refractory BNC, refractory urinary incontinence, or both associated with prostate radiation or surgery. This procedure presents a consistently successful solution that can provide urinary continence for patients who would otherwise only have options conferring incontinence. Thus, we hypothesize satisfactory outcomes will be achieved despite the increased surgical complexity associated with this population.

Materials and methods

An institutional review board approved, prospectively collected database of patients treated for refractory urinary incontinence or BNC with a CCIC from January 1, 2003 through December 31, 2018 was reviewed. Data points collected included preoperative indications, prior procedures, preoperative creatinine, operative time, blood loss, early surgical complications, delayed postoperative complications, secondary surgery, imaging results, pre and postoperative serum creatinine levels, and overall outcome. Early complication was defined as those within 30 days and late complication was defined as those occurring after 30 days.

Surgical procedure

Procedural steps included isolation of 15 cm of the ascending colon and cecum along with 15 cm of the terminal ileum. The colocecal segment was detubularized, Figure 1 and reconfigured as a cup patch augmentation. If present, an appendectomy was performed. The continent catheterizable stoma was created by tapering the ileum over a 14Fr red rubber catheter using a gastrointestinal stapler, Figure 2, top left and top right panels, and augmenting the ileocecal valve with non-absorbable plication sutures, Figure 2, bottom right panel. The bladder was bi-valved in the sagittal plane from the bladder neck anteriorly to the trigone posteriorly. The bladder augmentation was performed with a two layer running closure using polyglactin suture, Figure 2, bottom left panel. The stoma was matured at the level of the right lower quadrant. A suprapubic catheter was placed to drain the bladder.

If a bladder neck closure was performed, it was either performed transabdominally, or in the presence of significant fibrosis prohibiting safe exposure of the bladder neck, a transperineal closure was performed

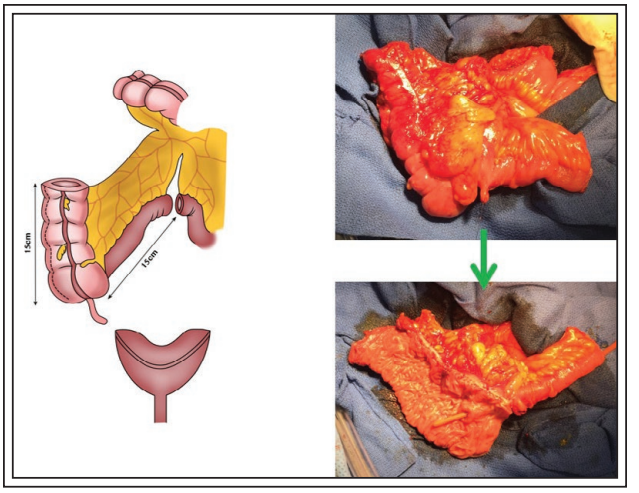

Figure 1. Isolate 15 cm of terminal ileum and 15 cm ascending colon. Bivalve bladder. Incise the antimesenteric border of the colonic section to the appendix and perform appendectomy.

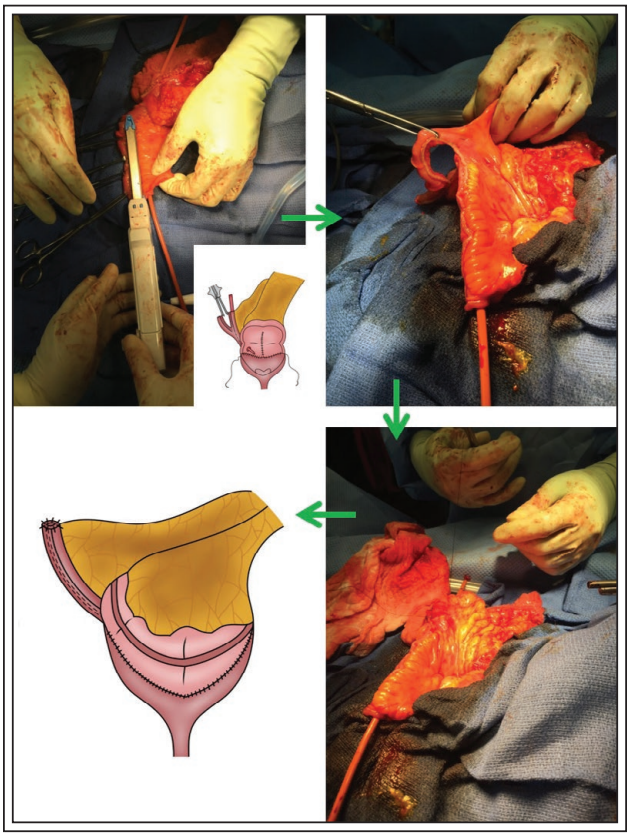

Figure 2. Taper the ileal limb over a 14 Fr Red Robinson. Plicate the junction of the ileum and cecum. Complete the posterior bladder augmentation, then the anterior augmentation.

Patient Age	Follow up (mo.)	Operative time (min)	EBL (mL)	Indication for CCIC	Bladder neck closure performed?	History of radiation ?	Number of procedure prior to CCIC	Early complications (Clavien-Dindo score)	Delayed complications	Recurrent UTIs?	Continent via stoma?
1 84	78.9	-	50	BNC after brachytherapy, urinary retention	No	Yes	3	None	Bladder stone	Yes, 1-2 per year	Yes
2 73	78.1	-	100	Incontinence and BNC after prostatectomy and salvage radiation	No	Yes	4	Internal hernia requiring reoperation (IIIB)	None	Yes, < 1 per year	Yes, but has mild urethral leakage with bladder spasm
3 65	129.9	-	75	BNC after combined radiation therapy, urinary retention	No	Yes	4	Gross hematuria requiring transfusion (II)	None	Yes, < 1 per year	Yes
4 75	122.6	-	100	Incontinence after prostatectomy	Yes, trans-perineal approach	No	4	None	None	Yes, 1-2 per year	Yes
5 75	49.2	270	75	Incontinence and BNC after radiation followed by salvage prostatectomy	Yes, transperineal approach	Yes	2	None	Perineal revision of bladder neck closure x2, bladder stones, stomal stenosis requiring revision	Yes, < 1 per year	Yes
6 56	109.4	431	300	Incontinence noted before salvage prostatectomy after cryotherapy	Yes, trans-abdominal approach without prostatectomy prophylactic given history of cryotherapy preoperative incontinence	No	0	None	Bilateral pulmonary embolism	None	Yes
7 68	110.8	270	200	BNC after open simple prostatectomy, urinary retention	Yes, trans-abdominal approach with prostatectomy	No	5	-Ileus requiring nasogastric decompression (I)	None	None	Yes
8 69	33.6	335	175	Incontinence after brachytherapy followed by salvage prostatectomy	Yes, transperineal approach	Yes	2	Transient post-operative hypoxia (I)	Revision of bladder neck closure x2 (2nd revision utilized gracilis flap)	None	Yes
9 69	78.9	328	150	Incontinence and BNC after EBRT followed by salvage prostatectomy	Yes, transperineal approach	Yes	3	None	Revision of bladder neck closure x2 (2nd revision utilized gracilis flap)	None	Yes
10 64	20.9	383	350	Incontinence, BNC, history of EBRT, transurethral incision of prostate, salvage prostatectomy, anastomosis breakdown, AUS, erosion of artificial urinary sphincter	Yes, trans-abdominal approach without prostatectomy	Yes	6	None	None	None	No
11 79	16.7	530	500	Recurrent BNC, incontinence, UTIs, and epididymitis; history of brachytherapy	Yes, trans-abdominal approach with prostatectomy	Yes	8	Reoperation for bleeding (IIIB)	Breakdown of anastomosis	None	Yes
12 60	2.5	375	200	Membranous and prostatic urethral strictures, incontinence, history of brachytherapy and photovaporization of prostate	No	Yes	3	None	None	None	Yes
13 71	3.0	420	350	Incontinence, recurrent bladder stones and UTIs, history of brachytherapy and TURP	Yes, trans-abdominal approach with prostatectomy	Yes	2	None	None	None	Yes
Median (IQR) 69 65-75	78.1 (20.9-109.4)	375 (328-420)	175 (100-300)	N/A	9/13 (69%)	10/13 (77%)	3 (2-4)	5/13 (38%)	6/13 (46%)	5/13 (38%)	12/13 (92%)

BNC = bladder neck contracture; EBL = estimated blood loss; IQR = interquartile range; UTI = urinary tract infections; AUS = artificial urinary sphincter; EBRT = external beam radiation therapy

Table 1. Patient information.

by isolating the proximal urethra and closing it off in three layers. Patients were hospitalized until pain was controlled and a regular diet was tolerated. Patients were instructed regarding routine bladder irrigation.

Follow up

Routine follow up began at 1 week for a wound check. A cystogram was performed at 3 weeks, and if normal, the suprapubic catheter was removed. At that time patients were taught intermittent stomal catheterization. The patient was then seen every 4 months for a year, then yearly thereafter. Yearly imaging and laboratory values were obtained. Subjective patient satisfaction and stomal continence was assessed at each visit.

Results

From January 1, 2003 until December 31, 2018, 13 patients underwent CCIC for refractory BNC (n = 3), urinary incontinence (n = 5), or both (n = 5). Patient age, follow up, operative time, indications, complications, and outcomes are noted in Table 1. The median age was 69 (IQR 65-75) and the median Charlson comorbidity index was 7 (IQR 5-9). The median follow up was 78.1 months (IQR 20.9-109.4). Ten of 13 (77%) patients had a history of radiation. The median number of procedures between initial prostate treatment and augmentation was 3 (IQR 2-4). Five patients had a prior history of artificial urinary sphincter placement. Four of these patients experienced an erosion of their artificial urinary sphincter and had the device explanted.

Sixty-nine percent of patients (9/13) had a bladder neck closure in addition to CCIC (5 via a transabdominal approach and 4 via a transperineal approach). Two of the patients who had transabdominal bladder neck closure had a history of salvage radical prostatectomy. For the other three patients, salvage prostatectomy was performed concurrently. All four patients undergoing transperineal bladder neck closure had a prior history of prostatectomy. Operative time was available for 9 patients; amongst these, the median operative time was 375 minutes (IQR 328-420). Median blood loss was 175 mL (IQR 100-300 mL).

Five of 13 patients (38%) had early complications. Delayed complications were seen in 6 patients (46%). The overall complication rate was 69% (9/13). Ninety-two percent of patients (12/13) were continent from the stoma. The patient with stomal incontinence reported that it was mild, requiring only a small gauze to control the leakage. One patient had urethral leakage from bladder spasms that was well-controlled with anticholinergic medications but was continent via the stoma. One patient (8%) required stomal revision for stenosis, while all other patients were able to catheterize their stomas without difficulty (92%). Thirty-eight percent of patients (5/13) have had intermittent urinary tract infections since surgery (no more than two times per year). Three of the 4 patients (75%) undergoing transperineal bladder neck closure required surgical revision due to perineal fistula. All 3 patients had a prior history of radiation therapy. In 2 patients the last revision was with a gracilis flap. One patient with a gracilis flap had prolonged leakage from a fistula, but this has resolved on last follow up. Two patients developed a bladder stone.

One patient had mild hydronephrosis with an elevation in serum creatinine from 1.1 mg/dL prior to surgery to 1.9 mg/dL after surgery. Another patient's serum creatinine level increased from 1.19 mg/dL before surgery to 1.36 mg/dL after surgery. He had no hydronephrosis on upper urinary tract imaging. All remaining patients had no hydronephrosis and had a postoperative serum creatinine level within reference range, except for one patient with a creatinine level of 1.38 mg/dL. He had pre-existing renal insufficiency and this was similar to his baseline preoperative creatinine level of 1.34 mg/dL. At last follow up, all patients reported that their urinary control was improved compared to prior to CCIC and that they were subjectively satisfied with their urinary control.

Discussion

This series demonstrates that CCIC consistently confers continent stomal catheterization for patients with otherwise very limited options. However, there are several caveats. First, transperineal bladder neck closure has a high revision rate in this series with 3 of 4 patients requiring revision, all 3 of whom had undergone prior radiation. Second, morbidity rates were high. A 38% (5/13) early complication rate was noted, and 69% of patients (9/13) experienced either an early or late complication. Therefore patient selection, informed consent, and shared decision making are of the utmost importance. We only offer this surgery to patients with adequate renal function and sufficient dexterity and mental capacity to self-catheterize. While this is naturally a more comorbid population, we discourage this surgery specifically in patients with poor performance status, short life expectancy, and/or cardiopulmonary comorbidities that would make a prolonged robot-assisted reconstructive surgery done in steep Trendelenburg position risky. Prior to proceeding with surgery, we make sure that patients have had ample time to consider less invasive options

such as suprapubic catheterization or, if the patient is incontinent and not in urinary retention, condom catheterization or use of an incontinence clamp.

While it may be possible to manage some of these patients by creating a catheterizable channel directly to the bladder without augmentation (i.e. ileovesicostomy or appendicovesicostomy), our preference is to augment the bladder for multiple reasons. First, most patients in our series had a prior history of radiation therapy or other risk factors for small bladder capacity, poor bladder compliance, and/or high storage pressures. Bladder augmentation is preferable in this setting. Second, CCIC provides a long segment of ileum with which to create a catheterizable channel of adequate length, which is especially useful in an adult population containing obese patients. Third, CCIC has the added benefit of including the ileocecal valve as a continence mechanism.

Bladder neck closure

The use of transperineal bladder neck closure is not well described in the male patient. Higuchi et al described a series of 6 patients with bladder neck closures.[18] In that series, only one patient had been treated for prostate cancer with radiation, and had a fistula form after closure.[18] Another study reports complete success in 4 patients with transperineal urethral ligation in the setting of neurogenic bladder.[19] Direct comparison with the present series is difficult given that the original procedures were instead for prostate cancer treatment in the present series. What can be learned, however, is that in the setting of radiation, failure is likely. Herein, gracilis flaps were utilized after primary failure with good success. However, our experience shows that a better approach may be to consider the use of a gracilis flap at the initial closure in previously radiated patients. We speculate that this may be because the gracilis muscle flap does not lie within the radiation field in these patients, whereas local spongiosal flaps, perineal fat flap and bulbospongiosal muscle flaps do.[20]

Transabdominal bladder neck closure likely is more reliable than transperineal closure. Pisters et al[21] reported successful bladder neck closure at the time of salvage prostatectomy in 12 of 13 patients. The ability to interpose an omental flap offers a reliable closure between the bladder neck and urethral stump. Similarly, Ulrich and Wessells[22] described a technique in which the prostatectomy is performed, and the bladder neck was incorporated into the augmentation. In five cases, no urethral fistulae were noted.[22] In the present series, 3 patients underwent simultaneous transabdominal bladder neck closure, prostatectomy, omental interposition, and CCIC. Two of these patients had prior brachytherapy as well as recurrent urinary tract infections and one had a prior simple prostatectomy. The other two patients who had transabdominal bladder neck closure had a history of salvage radical prostatectomy prior to CCIC. None of the patients undergoing transabdominal bladder neck closure developed perineal fistulae or required revision of their bladder neck closures.

We elected to perform transperineal bladder neck closures in 4 patients due to a history of prostatectomy, 3 of which were salvage radical prostatectomies performed after failed radiation treatment. It was felt that these patients were at increased risk for rectal injury during the posterior dissection if we attempted a transabdominal approach. As stated previously, all 3 of these patients who revision of their bladder neck closures for perineal fistulae.

Complications

The combination of prior surgery, radiation and multiple failed attempts at management make this a procedurally complex collection of patients, understandably increasing the risk for complications. In the present series, early complications were seen in 38% (5/13), which is comparable to a reported 52% (16/31) of CCIC patients by Redshaw et al.[17] Delayed complications were seen in 46% (6/13) in the present series, listed in Table 1. The rate of bladder stones in patients with neurogenic bladder treated with CCIC has been reported to be as high as 29%.[16] Herein, 15% (2/13) patients experienced bladder stones. Importantly, stomal stenosis is rare at 8% (1/13), similar to previous reports.[16,17] The rate of diarrhea following resection of the ileocecal valve is not well defined in the literature, but there were no long term gastrointestinal complications related to ileocecal valve resection encountered in our series.[16,20,23] Finally, there were no delayed bladder perforations reported.

Outcomes

Despite the high complication rates, all patients were satisfied at last follow up with their urinary control. One patient had urethral leakage, well managed with anticholinergics. Another patient had prolonged intermittent drainage from a persistent perineal fistula after two repairs of his bladder neck closure, including a gracilis flap interposition. The leakage was present for over a year, but this has since resolved. The vast majority of patients in this series were continent via their stoma (12/13, 92%). This is different than

previous reports of CCIC, but previous reports included patients with neurogenic bladder,[10,17] who are at higher risk for detrusor overactivity and decreased compliance. Perhaps the use of bladder augmentation in this series also ensures the bladder stores the urine at low pressure, thus improving the continence rate.

Limitations

Beyond the retrospective nature of the review, there are two primary limitations to this series. First, this is a relatively small patient cohort. This is a testament to the rarity of patients with contractures or incontinence refractory to traditional therapies. Second, the lack of standardized quality of life questionnaires limits our understanding and analysis of patient satisfaction with this approach. While no patient wants to catheterize himself to void, the alternative to an indwelling catheter versus total incontinence makes catheterization more desirable for many men. Despite these limitations, this is one of the largest single institution series of CCIC in this particularly complex patient population, and has, to our knowledge, the longest follow up time.

Conclusions

CCIC is a valuable tool for those with refractory bladder neck contractures, urinary incontinence, or both, and should be considered for patients with this rare but crippling problem. Given the high perineal fistula rate in radiated patients undergoing transperineal bladder neck closure, early use of a gracilis flap is recommended. Finally, despite the ultimate success of continent stomal catheterization, high complication rates can be expected. For this reason, patient selection, informed consent, and shared decision making are critical when considering use of CCIC. □

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