Robot-Assisted Laparoscopic Bladder Diverticulectomy and Ureteral Re-Implantation for a Diverticulum Containing High Grade Transitional Cell Carcinoma

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Key Words

Robotic-assisted laparoscopic bladder diverticulectomy •
Robotic surgery • Ureteral re-implantation •
Bladder diverticulum • Transitional cell carcinoma

Abstract

We present a case of an 84-year-old man presenting with painless visible hematuria. Further investigation revealed a primary G3pT1 transitional cell carcinoma confined to a bladder diverticulum. In view of bladder-sparing therapy, he underwent a robot-assisted laparoscopic bladder diverticulectomy with ureteral re-implantation. This report demonstrates a minimally invasive approach offering radical treatment without having to recur to partial or radical cystectomy. We discuss the operative steps, the significance of this case with a review of the literature, and the future potential this may represent for the treatment of tumor-containing bladder diverticula.

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Introduction

Bladder diverticula may be congenital or acquired. If acquired, they are most commonly secondary to bladder outlet obstruction, resulting in an increased intravesical pressure, causing a herniation of mucosa through the muscle layer of the bladder. Occasionally, these may contain malignant cells in situ. Surgical treatment is indicated in patients with bladder outlet obstruction, recurrent infections, or if a diverticulum contains calculi or tumors [1]. Bladder diverticula may be surgically resected via open, endoscopic, laparoscopic (extraperitoneal or intraperitoneal) and robotic-assisted techniques. Here we describe a robot-assisted laparoscopic bladder diverticulectomy (RALBD) with associated ureteral re-implantation for a high grade transitional cell carcinoma (TCC).

Case Report

The patient is an 84-year-old man who was referred to our services with a 6-month history of painless visible hematuria. He had undergone a transurethral resection of the prostate 14 years earlier.

Initial routine investigations for hematuria included a CT urogram (fig. 1) revealing a bladder diverticulum containing an area of possible high attenuation, with urine cytology showing no overt atypia. He proceeded to have an MRI pelvis (fig. 2) and rigid cystoscopy confirming the presence of a 6.5-cm diverticulum with narrow neck at the left posterolateral aspect of the bladder approximately 1 cm adjacent to the left ureteric orifice. Histology

Fig. 1. CT urogram confirming tumour within bladder diverticulum.

Fig. 2. MRI bladder confirming tumour within bladder diverticulum to be organ confirmed.

Fig. 3. Postoperative cystogram.

indicated a G3pT1 TCC tumor confined to the diverticulum. Treatment options were discussed, including active surveillance, radiotherapy with intravesical bacilli Calmette-Guérin, radical cystectomy with ileal conduit formation, or RALBD. He was very keen on the latter, and proceeded to have a RALBD with re-implantation of left ureter and right inguinal hernia repair.

The patient was admitted the day before surgery, and a single instillation of mitomycin C 40 mg was given intravesically a day prior to the operation. Cystoscopy was performed and a left double-J stent was inserted pre-procedure. With the legs in stirrups, the hip was flexed to 30 degrees and the bed was placed in Trendelenburg position. The robot was docked in between the legs. A 5-port approach was used as per conventional robotic prostatectomy. A flexible cystoscope was used to fill the bladder with saline under vision; to assist with robotic identification and dissection of

the diverticulum. The lateral wall of the bladder was dissected off the iliac vessels along with covering fat and nodal tissue. The neck of the diverticulum was identified both internally with cystoscope and externally with robotic arms; the neck was then closed with a staple device as the cystoscope withdrew from the diverticulum.

The diverticulum along with its lateral coverings and surrounding fat was placed in an EndoCatch bag. The staple line at the bladder was then excised and the defect closed with absorbable sutures. A leak test was performed with the cystoscope. As suspected, the neck of the diverticulum was at close proximity to the left ureteric orifice. The left ureter was therefore divided and re-implanted into the dome of the bladder with the help of a psoas hitch. An abdominal drain, urethral catheter and left double-J stent was left in-situ. Total operation time was 5:38 hours, including robotic right inguinal hernia repair.

CT urogram after 2 weeks showed no anastomotic leak and so the catheter was removed. Stent removal at 6 weeks via flexible cystoscopy was complicated by a tight urethral stricture. The patient thus proceeded to have a rigid cystoscopy and urethrotomy. Stent removal was then postponed as reactive changes were observed surrounding the re-implanted urethra, later confirmed histologically to be benign in nature. The stent was eventually removed 6 months post-operation (fig. 3).

Written informed consent was obtained from the patient for publication of this Case Report/any accompanying images.

Discussion

Whereas bladder diverticula are relatively common, they may undergo neoplastic changes in only 1–10% of cases, with carcinomas arising in diverticula accounting for 1.5% of all carcinomas arising in the bladder. The exact number however is difficult to establish as many

Table 1. Published cases of RALBD in adult patients

First author	Year	N	Indication	Surgery	Outcome	Dimension (cm)
Berger	2006	1	–	RALBD	–	–
Myer	2007	5	LUTS	RALBD	α -blocker + TURP	10.8
			LUTS despite TURP	RALBD	–	11
			LUTS despite TURP	RALBD	–	4.7
			LUTS 2° to Hutch diverticulum	RALBD + ureteral re-implantation	α -blocker + TURP	9.5
			LUTS	RALBD	α -blocker + 5 α reductase inhibitor	15.8
Rao	2007	3	–	RALBD	–	–
Tareen	2008	4	submucosal lesion	RAPC	histology: benign leiomyoma	–
			LUTS + hematuria	RALBD	–	–
			lesion post TURBT for high-grade TCC	RAPC	histology: benign necrotic fibromuscular stroma	–
			High grade TCC	RALBD	BCG	–
Macejko	2008	2	LUTS despite laser TURP	RALBD	–	–
			LUTS	RALBD	–	–
Mmeje	2008	1	LUTS despite TURP	RALBD + ureteral re-implantation	–	13 × 4 × 6
Magera	2008	1	LUTS	RALBD (intravesical) + laparoscopic transvesical simple prostatectomy	–	4
Childs	2009	1	–	RALBD (TV) + simple prostatectomy	–	–
Kural	2009	1	LUTS	RALBD + PVP	–	8 × 5 × 6
Moreno Sierra	2010	1	LUTS + recurrent UTIs	RALBD	TURP + PVP	–
Altunrende	2011	6	high grade TCC	RALBD + B/L PLND	–	2.1 × 0.97
			LUTS + right ureteral obstruction	RALBD + ureteral re-implantation	urosepsis at 3 weeks TUIP 2 months postoperatively	7.6 × 2.6
			LUTS + recurrent UTIs	RALBD	–	5.7 × 4.2
			recurrent UTIs	RALBD	–	4.9 × 2.8
			low grade non-invasive TCC	RALBD + bipolar TURP	–	4.7 × 2.5
			recurrent UTIs + neurogenic bladder	RALBD	persistent LUTS requiring LT catheter + PVP 3 months post-operatively	2.5 × 3
Moore	2012	5	retention despite TUMT + TURP	RALBD	–	2.5
			retention despite TUMT	RALBD	–	11
			recurrent UTIs	RALBD	–	2.5
			gross hematuria + LUTS	RALBD	–	5
			recurrent UTIs despite TURP	RALBD	–	7

LUTS = Lower urinary tract symptom; TURBT = transurethral resection of bladder tumor; TCC= transitional cell carcinoma; UTI = urinary tract infection; PLND = pelvic lymph node dissection; TURP = transurethral resection of the prostate; PVP = photoselective vaporization of the prostate; BCG = bacillus Calmette-Guérin; TUMT = transurethral microwave thermotherapy.

diverticula remain undiagnosed due to their asymptomatic nature. Whilst the majority tends to be TCCs, it seems that the different micro-environment may lead to an increased frequency of less-common bladder cancer subtypes including small cell carcinoma, squamous cell carcinoma, adenocarcinoma, and sarcomatoid carcinoma [2]. Another difficulty is the exact staging of these tumors as they consist of mucosa and serosa alone, and are deficient in muscularis propria. This suggests tumors

may progress earlier and more easily than in the rest of the bladder [3], which must be taken into account in the planning of their eventual resection and surveillance.

Diverticular tumors require thorough investigation to determine best treatment. In our case, a CT urogram, and further MRI helped to determine the exact location and dimension of the diverticulum and its relation to neighboring extravesical structures. Cystoscopy enabled direct visualization and biopsy of the diverticular sac, although

this may be limited if the diverticular neck is too narrow. It was also used to assess the relation of the diverticulum to the ureteric orifices, and to exclude further unusual growths in the rest of the bladder. Urine cytology and biopsy histology then contributed in staging the tumor. Caution must be taken however in dismissing a negative cytology result, as the sensitivity of this test may be significantly lessened if the tumor is confined to a diverticulum.

Bladder diverticula have traditionally been resected via open [4], endoscopic [5] and laparoscopic [6, 7] methods. More recently, robotic surgery has been an alternative option, with benefits in terms of ergonomics, an enhanced 3-D view, greater magnification, and better dexterity and precision when manipulating instruments. Robotic partial cystectomies [8] have been previously described. Since 2006, however, several reports have described RALBD in adult patients (table 1). RALBD has also been performed in children, but have not been included here due to their different etiology being mostly congenital in nature.

In the majority of cases, the diverticulum is secondary to bladder outlet obstruction. RALBD for malignant diverticular tumors has been described in 2 papers. Tareen et al. [9] in 2008 reported one such case for a high-grade TCC invading the lamina propria. This patient was subsequently found to have carcinoma in situ and so was started on bacilli Calmette-Guérin maintenance therapy. Altunrende et al. [10] in 2011 report 2 further cases. One patient had a high-grade urothelial carcinoma within the diverticulum with 2 further areas of carcinoma in situ in the remaining bladder. The patient underwent a RALBD with bilateral pelvic lymph node dissection and subsequent intravesical immunotherapy. Their other patient had a low-grade non-invasive TCC, and so had a RALBD and simultaneous bipolar transurethral resection of the prostate. In comparison, our patient has not had any recurrence after 1-year follow-up, and so has not required any further treatment beyond active surveillance.

If the diverticulum is in close proximity to the ureteral orifice, it may be necessary to proceed to a concomitant ureteral dissection and re-implantation. This has been described previously [10–12] but not yet in the setting of a RALBD for a tumor-containing diverticulum. In Myer et al. [12] 2007, a ureteral stent was kept in situ for 6 weeks before being removed post-cystogram confirming no extravasation. Renal and bladder ultrasound was then done at 3, 6 and 12 months. In contrast, Altunrende et al. [10] 2011 describe a case in which the ureter is terminating directly into the diverticulum, whereby they kept a

ureteral stent in place for 3 weeks. Sometimes however ureteral re-implantation may not be necessary – in Altunrende et al. [10] high-grade TCC, they proceeded to a combined intravesical and extravesical technique to obtain a wide margin and ensure preservation of the distal ureter. Thus proximity of the ureter to the diverticulum should not be a deterrent to resection via a robotic-associated technique.

From our experience, RALBD is a promising new surgical treatment for tumor-containing diverticula. Concomitant ureteral re-implantation and pelvic lymph node dissection are feasible if necessary. Nevertheless longer follow-up and a better understanding of the natural disease progression of diverticular tumors are needed to evaluate the risk of potential spread. The benefits of a bladder-sparing resection are clearly evident in this octogenarian.

Conflict of Interest

Sophie Elands, Andrea Tay, Nikhil Vasdev and James M Adshead declare that they have no conflict of interest. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Declaration of Helsinki 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

References

- 1 McLean P, Kelalis PP: Bladder diverticulum in the male. *Br J Urol* 1968;40:321–324.
- 2 Tamas EF, Stephenson AJ, Campbell SC, Montague DK, Trusty DC, Hansel DE: Histopathologic features and clinical outcomes in 71 cases of bladder diverticula. *Arch Pathol Lab Med* 2009;133:791–796.
- 3 Haecker A, Riedach G, Langbein S, Alken P, Michel SM: Diverticular carcinoma of the urinary bladder: diagnosis and treatment problems. *Med Princ Pract* 2005;14:121–124.
- 4 Young HH: The operative treatment of vesical diverticulum with report of four cases. *John Hopkins Hosp Rep* 1906;13:401–446.
- 5 Orandi A: Transurethral fulguration of bladder diverticulum: new procedure. *Urology* 1977;10:30–32.
- 6 Parra RO, Jones JP, Andrus CH, Hagood PG: Laparoscopic diverticulectomy: preliminary report of a new approach for the treatment of bladder diverticulum. *J Urol* 1992;148:869–871.
- 7 Nadler RB, Pearle MS, McDougall EM, Clayman RV: Laparoscopic extraperitoneal bladder diverticulectomy: initial experience. *Urology* 1995;45:524–527.
- 8 Allaparthi S, Ramanathan R, Balaji KC: Robotic partial cystectomy for bladder cancer: a single-institutional pilot study. *J Endourol* 2010;24:223–227.
- 9 Tareen BU, Mufarrij PW, Godoy G, Stifelman MD: Robot-assisted laparoscopic partial cystectomy and diverticulectomy: initial experience of four cases. *J Endourol* 2008;22:1497–1500.
- 10 Altunrende F, Autorino R, Patel NS, White MA, Khanna R, Laydner H, Yang B, Haber GP, Kaouk JH, Stein RJ: Robotic bladder diverticulectomy: technique and surgical outcomes. *Int J Urol* 2011;18:265–271.
- 11 Mmeje C, Michli E, Parra R: Robotic-assisted laparoscopic bladder diverticulectomy and concomitant ureteral re-implantation: initial clinical experience. *J Robot Surg* 2008;2:265–267.
- 12 Myer EG, Wagner JR: Robotic assisted laparoscopic bladder diverticulectomy. *J Urol* 2007;178:2406–2410.