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ORIGINAL ARTICLE

Robot-assisted bladder diverticulectomy sequentially followed by robot-assisted radical prostatectomy: a case series

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Abstract
We aimed to describe a case series of robot-assisted bladder diverticulectomy followed by radical prostatectomy for prostate cancer in a single surgical procedure. Three cases of robot-assisted bladder diverticulectomy and radical prostatectomy were completed between 2013 and 2016. Charts of the three cases were reviewed and analyzed for perioperative and postoperative outcomes. All patients presented with lower urinary tract symptoms, and bladder diverticulum or diverticula was revealed after further evaluation of the patients. In addition, elevated prostate-specific antigen levels were noted. All patients were diagnosed with prostate carcinoma on the basis of subsequent multiparametric MRI studies and biopsies. Three patients underwent da Vinci robot-assisted diverticulectomy followed by radical prostatectomy using a transperitoneal approach. All patients had Foley catheters removed postoperatively after negative cystogram, and no substantial complications were noted. Sequential robot-assisted bladder diverticulectomy—radical prostatectomy is an effective and safe procedure.

Keywords Bladder · Diverticulectomy · Diverticulum · Prostate cancer · Robot-assisted surgery

Introduction

A bladder diverticulum is a herniation of the urothelial mucosa through an area of weakness in the muscular wall of the bladder, and may be either congenital or acquired, with the latter being more common in the older population. Acquired bladder diverticula typically result from bladder outlet obstruction, neurogenic bladder, or prior bladder surgery. Surgical treatment is preferred in patients with bladder outlet obstruction, recurrent infections, or a diverticulum containing calculi or tumors [1]. If an acquired diverticulectomy is recommended, it should be performed in association with an outlet procedure, which can be achieved as a staged procedure or concurrently in the same operative session [2].

The first reported robot-assisted bladder diverticulectomy (RABD) combined with robot-assisted radical prostatectomy (RARP) for prostate cancer with prostate hypertrophy as the cause of bladder outlet obstruction was described in 2013 [3]. To the best of our knowledge, the present report is the first case series of RABD combined with RARP.

Methods

Three patients underwent RABD combined with RARP between November 2013 and September 2016. In the same period of time, 197 other patients underwent RARP in our hospital. Hospital review board approval was obtained for a retrospective review of the records. All patients were initially checked for symptomatic bladder outlet obstruction and large residual urine volume, and an elevated prostate-specific antigen level was noted in each patient during clinical evaluation. Findings of subsequent multiparametric MRI studies of the prostate revealed the presence of bladder diverticulum. Flexible cystoscopy was carried out to confirm the presence of the diverticulum and the proximity of the diverticular neck to the ureteral orifice. Transrectal ultrasound-guided 16-core needle biopsies were obtained, and each patient was diagnosed with adenocarcinoma on the basis of pathology reports. After consulting with each patient, RARP combined with RABD in the same setting was planned. All procedures were completed using the da Vinci S surgical system (Intuitive Surgical Inc., Sunnyvale,

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CA, USA). Preoperative patient characteristics are summarized in Table 1.

Patient 1

A 64-year-old man presented with lower urinary tract symptoms (LUTS).

He had a bladder diverticulum sized 112 × 76 × 55 mm on the right side, with urinary retention after the needle biopsy of the prostate. A Foley catheter was placed until the day of the operation. A double pigtail ureteral stent was placed during the RABD procedure.

Patient 2

A 66-year-old man presented with more than 8 years of LUTS. The MRI study showed extensive trabeculation of the bladder wall, together with a bladder diverticulum sized 47 × 45 × 27 mm on the right side. The needle biopsy findings of the prostate revealed a clinical stage of cT1cN0M0 and Gleason score of 3 + 3, which indicated prostate cancer.

Patient 3

A 67-year-old man presented with urinary frequency. Ultrasound findings revealed a large amount (680 ml) of residual urine, and MRI findings showed a large (105 × 81 × 45 mm) bladder diverticulum on the left side and a smaller diverticulum (30 × 24 × 18 mm) on the right side (Fig. 1). Subsequent flexible cystoscopy confirmed the presence of dual diverticula, and both orifices of the diverticula were noted just outside the ureteral orifices. Needle biopsy of the prostate showed two positive cores of cancer. After further evaluation, the patient was diagnosed with clinical stage of cT2aN0M0 and a Gleason score of 3 + 4, indicating intermediate-risk prostate cancer.

Operative technique

After consulting with the patients, RARP was planned in the same setting with RABD.

A transperitoneal approach similar to that used in standard RARP as described was used [4]. The fourth robotic arm (Endowrist ProGrasp Forceps, Intuitive Surgical, Inc.) was placed on the right side of the patient.

Fig. 1 MRI image of the patient #3

Regarding the third case, since the diverticular orifices were near the ureteral orifices, bilateral insertion of double pigtail stents with a rigid cystoscopy was carried out under fluoroscopic guidance prior to the robot-assisted procedure.

The patients were placed in the lithotomy and Trendelenburg positions, which are routinely used for RARP. We initiated a standard transperitoneal approach, and both medial umbilical ligaments were incised to drop the bladder and open the retropubic space. The lateral aspect of the bladder was carefully resected, and the surface of the diverticulum was identified. Occasional inflation of the bladder with normal saline through the Foley catheter aided in identifying the location and extent of the diverticulum. The fourth arm was used to manipulate the diverticulum to find the boundaries of the diverticulum and bladder wall. The diverticulum was transected at its neck, and the underlying ureteral orifice was confirmed to be intact.

Table 1 Preoperative patient characteristics

Patient #	Age	BMI (kg/m^2)	Side	Location	Dimensions (mm)	Prostate estimated vol (g)	Residual urine vol (ml)
1	64	23.9	Right	Posterolateral	112 × 76 × 55	50	350
2	66	26.2	Right	Lateral	47 × 45 × 27	63.9	187
3	67	24.7	Bilateral	Posterolateral	105 × 81 × 45	41.5	680
				Posterolateral	30 × 24 × 18		

Table 2 Operative details

Patient #	Total console time (min)	Diverticulectomy time (min)	Operating time (min)	Estimated blood loss (ml)	Prostate weight (g)
1	351	96	398	250	56
2	219	46	265	350	51
3	467	249	570	100	61

Regarding the first case, a double pigtail stent was inserted using robotic instruments through the opening of the bladder before closing it. The bladder opening was approximated using 3-0 Polysorb sutures (Medtronics, Minneapolis, MN, USA) by a two-layer continuous running technique. After confirming watertight closure of the bladder wall, standard RARP was performed. Regarding the third case, with prolonged pneumoperitoneum time in the Trendelenburg position, the patient was closely observed overnight postoperatively in an intensive care unit. Postoperative courses of all three patients were uneventful.

Results

Table 2 lists operative details and results in each case. There were no conversions to open surgery. RABD procedure increased significant amount of console time, especially for the patient #3, who had two diverticula. The pathology reports confirmed stage pT2 adenocarcinoma of the prostate with negative surgical margin. No malignancy was observed in all diverticular pathologies. Cystograms were scheduled 7 days postoperatively, and all patients had Foley catheters removed at that time. The ureteral stents were removed after 4 weeks.

Discussion

The first open bladder diverticulectomy was performed by Czerny et al., while the laparoscopic counterpart was initially reported by Parra et al. [2, 5]. The first series of RABD was reported by Myer and Wagner [6]. Several studies have shown that RABD is an effective and safe procedure, but the added expense of using the robotic system and its availability is a major concern [7].

Sequential procedures that combine bladder diverticulum excision with relief of bladder outlet obstruction because of the enlarged prostate are considered appropriate. In cases of benign prostatic hyperplasia, there are several choices of procedures, including transurethral resection of the prostate, holmium laser enucleation of the prostate, or photoselective vaporization. These procedures are combined on the same day or separated into a two-stage procedure [8]. A recent larger case study series recommended a staged bladder outlet surgery followed by RABD to avoid complications [9]. For patients scheduled to undergo RARP, carrying out RABD in the same setting as a single procedure is often the best choice for positive outcomes, and it also eliminates the issue of cost.

The first case report of RABD combined with RARP discussed the rationality and safety of the procedure [3]. In the present study, one-stage sequential RABD and RARP procedures appear to be safe and effective. The one challenge seems to be longer console and operative times. Especially for our third case with two diverticula, prolonged pneumoperitoneal time in the Trendelenburg position was of great concern. The patient was placed under intensive care overnight, and his subsequent clinical course was uneventful.

Conclusions

Sequential RABD–RARP is an effective and safe procedure. It is also cost effective. The only concern is longer console and operative times, which may necessitate additional postoperative care.

Compliance with ethical standards

Conflict of interest Ichiro Yoshimura, Hideaki Uchida, Akinori Nakayama, Katsuhiko Takatama, and Toshio Yoshida declare that they have no conflict of interest, including specific financial interests or relationships and affiliations relevant to the subject matter or materials discussed in the manuscript.

Informed consent All procedures were in accordance with the ethical standards of the response committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

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