Journal of Robotic Surgery (2019) 13:163–166
https://doi.org/10.1007/s11701-018-0788-3

CASE REPORT

Robotic-assisted bladder diverticulectomy: point of technique to identify the diverticulum

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Received: 7 November 2017 / Accepted: 11 February 2018 / Published online: 16 February 2018

Abstract
We aim to outline our technique of performing a robotic-assisted bladder diverticulectomy at our institution and report our surgical outcomes. We report the cases of three robotic-assisted bladder diverticulectomies, performed at the Royal Surrey County Hospital during the period of January 2014 to December 2015. Patient was positioned in low dorsal lithotomy position. A 6Fr double-J stent was prophylactically inserted at the start of the procedure. Foley catheter was placed over guide wire into the diverticulum and balloon inflated on the diverticulum neck. We used a transperitoneal extravesical approach to mobilise the distended bladder diverticulum, dissected en bloc and transected at the diverticulum neck in all cases. The bladder was closed in two layers with absorbable sutures. The procedures were uneventful, without post-operative complications and minimal blood loss. The median length of stay was 3 days and all three patients reported a significant improvement in all symptoms with non-significant post-void residuals. Robotic-assisted bladder diverticulectomy is a safe and effective procedure that results in both symptom relief and minimal post-void residuals.

Keywords Bladder diverticulum · Robotics · Point of technique

Introduction

Bladder diverticula represent a herniation of the bladder mucosa that can be congenital but are more often secondary to bladder outflow obstruction (BOO). They are false diverticula as they don't have a muscular layer, being formed by mucosa and submucosa.

In the absence of symptoms or complications, treatment may not be necessary; however, in the majority of cases, the cause of BOO must be treated either medically or surgically. Decision on removing the diverticulum is made based on clinical assessment. Even after resolution of the obstruction, diverticula may cause incomplete emptying of the bladder and, consequently, infections, stones and even cancer [1].

The traditional approach for managing bladder diverticula has included open surgery, endoscopy and laparoscopy, but robotic-assisted methods [2, 3] are now being more commonly performed. The robotic approach provides clear advantages over open surgery and we aim to outline our technique of performing a robotic-assisted diverticulectomy at our institution and report our surgical outcomes.

Materials and methods

We report the cases of three robotic-assisted bladder diverticulectomies, performed at Royal Surrey County Hospital during the period of January 2014 to December 2015. Pre-operative investigations included routine blood tests, urinalysis, uroflowmetry, flexible cystoscopy and imaging including CT Urogram.

Patient A

A 60-year-old male presenting with severe lower urinary tract symptoms. He required manual supra pubic pressure in order to empty his bladder. Background of a transurethral resection of the prostate (TURP) 2 years prior to presentation. A CT Urogram demonstrated a 10 cm

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bladder diverticulum, which displaced the right distal ureter at the bladder base. He had a post-void residual (PVR) of 812 ml. Flexible cystoscopy showed the diverticulum to be supero lateral to the right ureteric orifice (UO). The patient then went on to have a robotic-assisted bladder diverticulectomy. Due to the close proximity of the diverticulum to the ureter a stent was placed and removed intra-operatively.

Patient B

An 83-year-old male, with a background of recurrent urosepsis requiring hospital admission. Background of localised prostate cancer and right inguinal hernia repair. Despite a recent TURP he still had a high PVR and required intermittent self-catheterisation. A CT renal demonstrated an 11.5 cm bladder diverticulum, which was close to the right ureteric orifice. The patient then went on to have a robotic-assisted bladder diverticulectomy. Due to the close proximity of the diverticulum to the UO and inflammation found intra-operatively, a right double J stent was placed and remained in situ for 6 weeks post-operatively.

Patient C

A 74-year-old male with poor flow, recurrent urinary tract infections and difficulty voiding, requiring intermittent self-catheterisation. Background of atrial fibrillation, previous myocardial infarction and prostate cancer; treated with brachytherapy. A CT Urogram demonstrated a 12-cm inflamed diverticulum, in close relation to the left UO. The patient then went on to have a robotic-assisted bladder diverticulectomy. A left ureteric stent was placed and removed intra-operatively due to the close relation of the diverticulum to the UO.

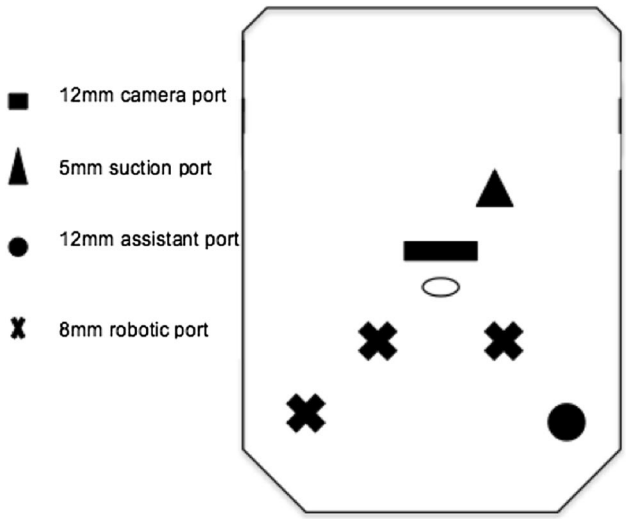
We describe the technique used for a robotic-assisted bladder diverticulectomy with concomitant cystoscopy and insertion of a Foley catheter into the diverticulum. Filling the diverticulum through the catheter enables easy identification of the diverticulum and its dissection.

Robotic-assisted bladder diverticulectomy technique

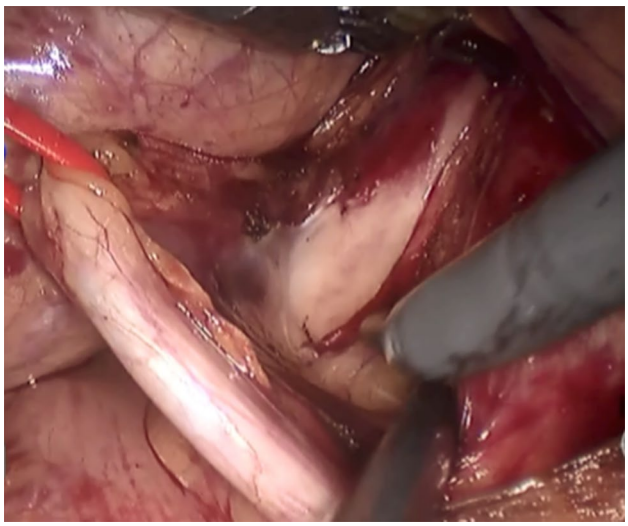
Step 1: Position—Patients placed in low dorsal lithotomy position. Patient prepped and draped.

Step 2: Rigid cystoscopy and ureteric stent insertion—If ureter in close proximity to diverticulum, rigid cystoscopy and insertion of double J ureteric stent performed.

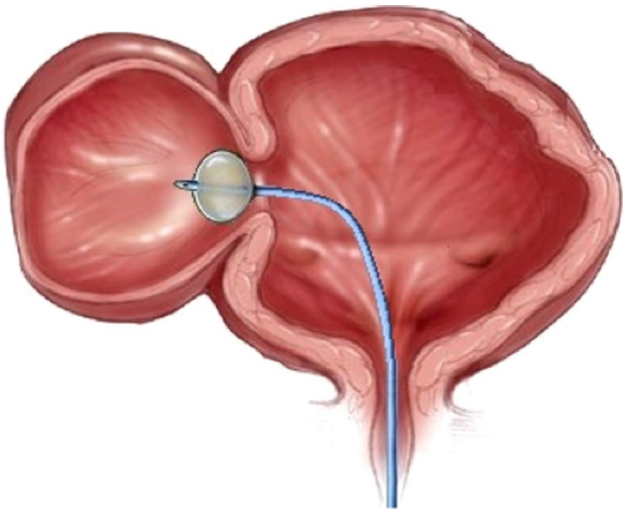
Step 3: Port position as per robotic-assisted laparoscopic prostatectomy (Fig. A).



Step 4: Identification of ureter—Stented ureter (inserted 6F double J stent) identified early and vessel loop applied to aid mobilisation (Fig. B).



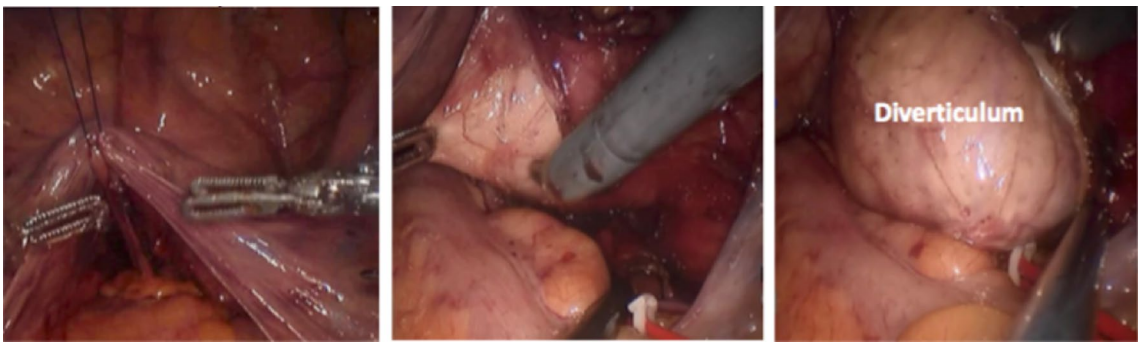
Step 5: Dissection of diverticulum—18F Foley Catheter placed over guide wire and placed in the diverticulum (Fig. C).



Balloon inflated in diverticula neck (up to 30 ml). Traction suture then applied to peritoneum and plane of dissection identified in order to expose bladder and diverticulum (Fig. D).

Results

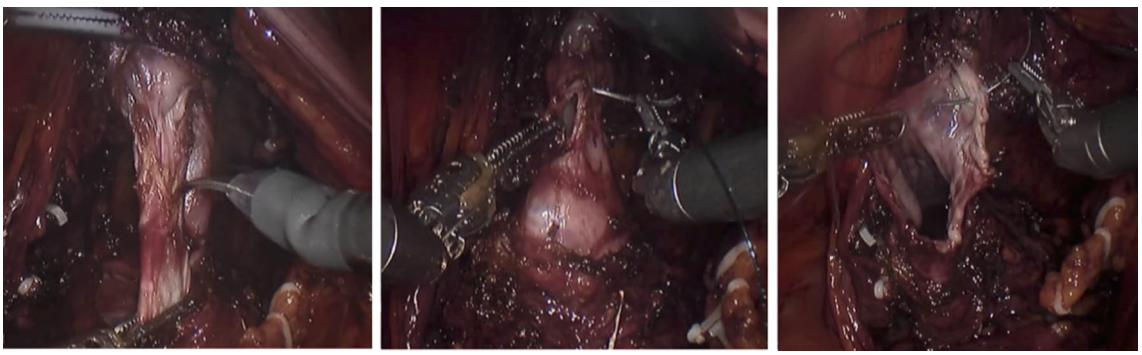
The mean age of patients in our series was 72 years, with a median length of hospital stay of 3 days. The catheter was removed successfully in patients A and C on day 3, post-operatively, with no significant PVR following catheter removal. The catheter in patient B was left in for 3 weeks due to significant mucosal inflammation. The ureteric stents were removed intra-operatively in cases A and C; however, due to the close relationship of the diverticulum to the right ureteric orifice, the stent was left in for 6 weeks in case B. A urethrocystogram was performed post-operatively prior to stent removable to exclude ongoing leak. There were no intra-operative or post-operative complications. All patients have been followed up regularly in the outpatient setting for a minimum of 14 months and have reported a significant improvement in all reported symptoms. Histopathology demonstrated features consistent with inflamed bladder diverticula; no evidence of CIS or malignancy.



Step 6: Closure of diverticulum neck—Dissection of diverticulum neck. Neck closure then commenced prior to completely transecting the diverticulum with 3/0 barbed V-Loc continuous suture (Fig. E). Second layer of sutures to complete.

Discussion

The technique of performing a bladder diverticulectomy has significantly transformed over time [2, 4], with minimally invasive techniques becoming more widespread. Various



methods using the da Vinci Robotic-assisted approach have been described since 2007 [2]. The three-dimensional vision, seven degrees of freedom and tremor elimination provided by the da Vinci Surgical System make this approach advantageous.

A multitude of laparoscopic techniques have been described in the literature, detailing various ways of identifying the bladder diverticulum [4, 5]. Established techniques suggest endoscopic placement of a urethral Foley catheter to achieve hydro distension of the bladder and diverticulum [2, 6]. Other techniques have used methylene blue dye [7] and transillumination [8]; where a flexible cystoscope is guided into and illuminates the diverticulum to aid recognition. However, the robotic technique we have described with a focus on ureteric stenting and bladder diverticula insufflation has never been described as a case series and has demonstrated good outcomes.

We have used a rigid cystoscope to insert a 16Fr Foley catheter over a guide wire and into the diverticula. The diverticula alone are then insufflated via the catheter with the balloon inflated at the diverticula neck. As a result the diverticula can be filled and emptied independently from the bladder unlike with previous catheter techniques [6]. Inserting the catheter and inflating the balloon in the diverticulum additionally aids both identification and dissection of the bladder neck.

Due to the vulnerability of the ureter to iatrogenic damage during bladder dissection, ureteric stenting at the start of the procedure was performed. This aids both ureter identification in conjunction with the vessel loop. Diverticula can often be in close proximity to the UO and sometimes require reimplantation [3].

Whilst this series has demonstrated that robotic-assisted diverticulectomies have good outcomes, this operation should only be considered in a select patient group. It is indicated in patients who remain symptomatic despite having treatment of their infravesical obstruction. In conclusion, robotic-assisted bladder diverticulectomy is a safe and effective procedure that results in both symptom relief and minimal post-void residuals.

Compliance with ethical standards

Conflict of interest Annelisse Ashton, Ricardo Soares, Venkata Ramana Murthy Kusuma, Dimitrios Moschonas, Matthew Perry and Krishna Patil declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent Written informed consent was obtained from all patients for publication of this case report/any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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