

Robot-assisted laparoscopic transvesical diverticulectomy and simple prostatectomy

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Abstract Acquired bladder diverticula are often associated with bladder outlet obstruction (BOO). The increased voiding pressures required to overcome the BOO attenuate the detrusor and promote formation of diverticula. These patients may develop urinary tract infections, bladder stones, and incomplete bladder emptying. Effective treatment must address both the bladder diverticula and BOO. Reports of laparoscopic bladder diverticulectomy with concurrent transurethral resection of the prostate (TURP) procedure to provide relief of BOO [2–5]. However, this technique has failed to demonstrate widespread use due to the long operative times and technical demands of the laparoscopic approach. In addition, laparoscopic prostatectomy for glands larger than 75 g has been shown to be feasible, but again has not enjoyed widespread use [6, 7]. In contrast, robotic-assisted laparoscopic prostatectomy (RALP) for treatment of localized adenocarcinoma of the prostate has experienced widespread acceptance and use. This is largely due to the enhanced three-dimensional visualization provided by the robotic system and the ease of complex laparoscopic maneuvers such as intracorporeal suturing. Applying skills obtained from RALP, the authors demonstrate feasibility of robotic-assisted laparoscopic transvesical diverticulectomy with laparoscopic transvesical simple prostatectomy in a single surgical setting for treatment of benign prostatic hypertrophy (BPH) producing BOO.

Keywords Benign prostatic hyperplasia · Bladder diverticulectomy · Bladder diverticulum · Laparoscopy · Robot

Introduction

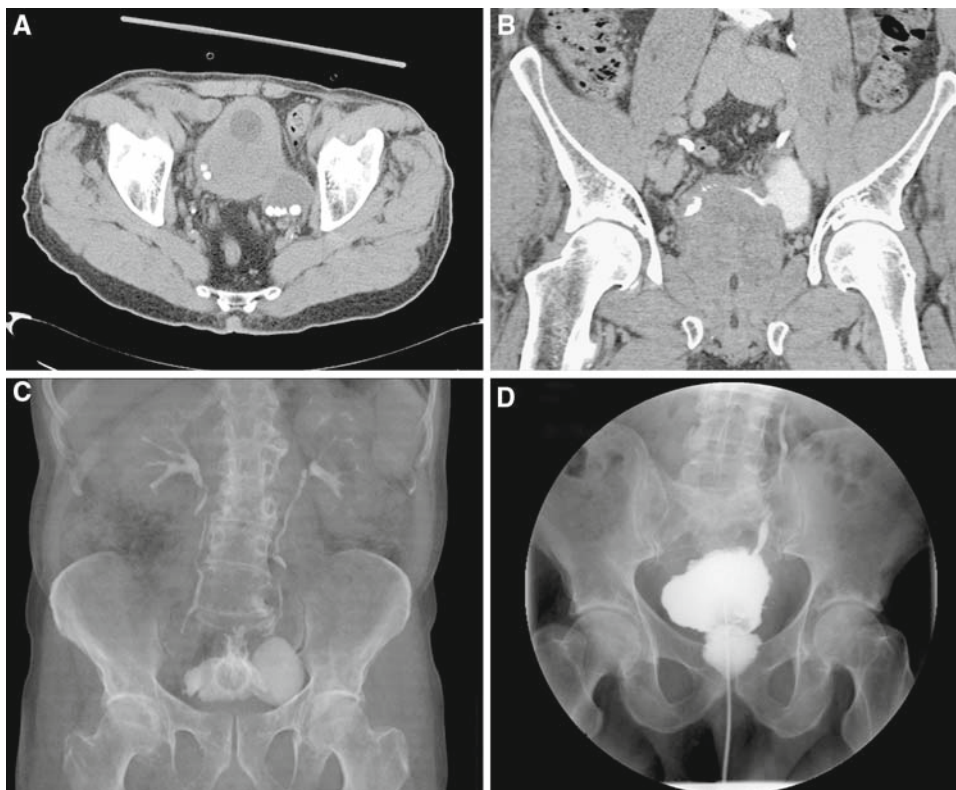
Acquired bladder diverticula due to bladder outlet obstruction (BOO) has traditionally been approached with an open surgical technique with a laparotomy extending from the

Case report

A 66-year-old man presented with right lower quadrant abdominal pain to an outside provider. Computed tomography (CT) scan of the abdomen and pelvis was obtained (Fig. 1), which revealed bilateral pyelocaliectasis, bladder distention, a 4-cm periureteral bladder diverticulum

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Fig. 1 Radiologic imaging. **a** Preoperative axial CT scan shows stones in the bladder and the diverticulum. **b** Preoperative coronal CT scan with contrast shows massive prostatic enlargement and the contrast-filled diverticulum. **c** Preoperative intravenous pyelogram shows the relationship of the diverticulum to the bladder and left ureter. **d** Postoperative cystogram obtained after 14 days shows a large prostatic fossa cavity at the site of adenoma enucleation and no evidence of contrast extravasation



containing numerous bladder stones, and an extremely large prostate gland with significant intravesical protrusion with an estimated volume of 230 cm³. A urethral catheter was placed with relief of symptoms. The patient was in an excellent state of health with no medical illnesses and requiring no medications. Physical examination revealed an extremely large prostate with no nodules or induration. Laboratory tests revealed a serum creatinine level of 1.0 mg/dL and a prostate-specific antigen (PSA) level elevated to 21 ng/dL. Urodynamic study revealed detrusor pressures exceeding 100 cm of water with postvoid residual of 450 mL, diagnostic of BOO. Cystoscopy revealed that the neck of the diverticulum was located 1 cm superior and lateral to the left ureteral orifice. Due to the elevated PSA, a 12-core prostate biopsy was performed and revealed benign tissue.

Surgical technique

The patient was placed in the steep Trendelenburg, lithotomy position and pneumoperitoneum was obtained via a Veress needle technique. Using the da Vinci-S four-arm surgical system (Intuitive Surgical, Inc., Sunnyvale, CA), a six-port approach was utilized (Fig. 2). Using a transperitoneal approach, the space of Retzius was developed as previously described by others [9]. A cystotomy was performed to provide transvesical access to the diverticulum and prostatic adenoma. A 2-0 polyglactin figure-of-eight suture was

placed on the prostatic adenoma and bladder wall to provide a handle for retraction in order to improve exposure of the diverticular neck. The bladder stones were then removed from the bladder and diverticulum and placed in a retrieval bag. A 5-French pediatric feeding tube was placed to improve identification of the ipsilateral ureter during the operative dissection. Using sharp dissection and electrocautery, the diverticular neck was circumscribed, giving access to the plane between the wall of the diverticulum and the surrounding tissues. A 2-0 polyglactin figure-of-eight suture was placed to aid in identification of the diverticular neck and to allow traction to be placed on the edges of the neck of the diverticulum with a robotic forceps. The neck and then the exterior walls of the diverticulum were carefully mobilized from the surrounding tissues and delivered into the bladder lumen in a fashion similar to the open technique [1]. With complete excision of the diverticulum, the defect was closed in two layers using interrupted figure-of-eight 2-0 polyglactin sutures for the detrusor and a running 3-0 poliglecaprone for the mucosa. Attention was then turned to prostatic adenomectomy. The cleavage plain formed by the adenoma was readily identified and developed. The previously placed traction suture was used to manipulate the adenoma and provide exposure to the leading edge of the adenomectomy dissection. Penetrating vessels were identified and controlled with electrocautery. Pneumoperitoneum also contributed to a relatively bloodless field, and visualization of the dissection was excellent.

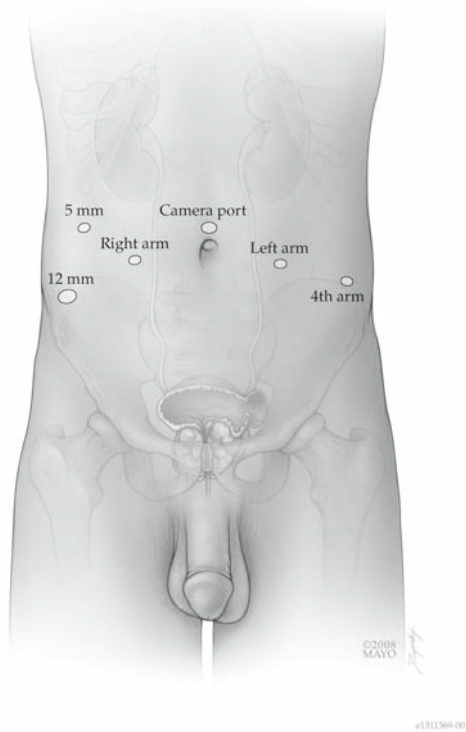


Fig. 2 Trocar placement in robotic diverticulectomy and simple prostatectomy

The natural cleavage plain clearly led to the prostatic urethral mucosa, which was incised sharply, delivering the bulky adenoma out of the prostatic fossa. Discrete bleeding points were controlled with electrocautery and a figure-of-eight suture was placed at the 6 o'clock position to advance the bladder mucosa into the prostatic fossa and supplement hemostasis. A 0 chromic purse-string suture was placed at the bladder neck to reduce its caliber to approximately 24 French in order to maintain the position of the urethral catheter within the bladder. The feeding tube previously placed in the ureter was removed and the bladder closed in a running, two-layer fashion with 2-0 polyglactin. A urethral catheter was placed and the bladder was distended to test the diverticular neck and the cystotomy closures. No leakage of fluid was noted at these suture lines. A pelvic drain was placed and the urethral catheter was placed on gravity drainage. Robotic-assisted laparoscopic transvesical diverticulectomy, stone removal, and suprapubic prostatectomy were performed in 300 min with a 200 mL estimated blood loss. The excised diverticulum was 6.3 cm in greatest dimension. Acute and chronic inflammation was evident microscopically in the wall of the diverticulum. The excised prostatic adenoma weighed 106 g and microscopic sections revealed BPH. Multiple (nine) stones ranging from 0.3 to 0.9 cm were removed. The adenoma is displayed in Fig. 3.

Postoperative course

Ketorolac was used for postoperative pain control and no narcotics were required. Two days after surgery, the patient was dismissed from the hospital. No postoperative complications were encountered. Hematuria was light throughout the postoperative period and the patient did not require continuous or manual bladder irrigations. Urethral catheter drainage was utilized for 14 days. Cystogram was obtained prior to catheter removal, showing no evidence of urinary extravasation and free reflux of urine into the left ureter and into the seminal vesicles (Fig. 1). Postvoid residual of 29 mL was noted at the completion of a formal voiding trial.

Discussion

An exponential growth in the use of laparoscopic procedures has been experienced in the field of urology in the last decade. Most remarkable is the expansion of the use of RALP. The learning curve is surmountable by many urologists, leading to the widespread use of this minimally invasive procedure [8, 10]. With many urologists routinely performing RALP, the surgical skills required to perform other complex urologic surgeries in the pelvis represent untapped potential. This concept is supported by the descriptions of robotic-assisted simple prostatectomy and robotic-assisted extravesical diverticulectomy in separate surgical settings [3, 11–13]. We report, to our knowledge, the first robotic-assisted transvesical diverticulectomy with concurrent transvesical simple prostatectomy. Previous to this report, even accomplished laparoscopists have recommended an open approach when a very large prostate gland with BOO is associated with a symptomatic bladder diverticulum [2]. However, with robotic-assisted laparoscopy, it is feasible to approach both the diverticula and the prostatic adenoma in a transvesical fashion in a single operative setting as we have demonstrated. Several centers have reported feasibility of TURP immediately followed by laparoscopic or robot-assisted laparoscopic extravesical or transvesical diverticulectomy [2–5]. These techniques typically utilize cystoscopic placement of a catheter or balloon in the diverticulum to preferentially inflate the diverticulum while decompressing the bladder, and ureteral stent placement to afford better visualization of the ipsilateral ureter [4, 14]. In contrast, robotic-assisted laparoscopic transvesical diverticulectomy does not require these cystoscopic maneuvers. Rather, laparoscopic transperitoneal cystotomy allowed direct visualization of the bladder diverticulum and placement of a 5-French pediatric feeding tube into the ipsilateral ureter for identification during dissection of the bladder diverticulum. Complex laparoscopic maneuvers such as

Fig. 3 Intraoperative photographs with a 30° lens viewing the posterior inferior bladder. **a** Anatomic relationship of the diverticular neck to the left ureteral orifice. **b** Stones noted in the diverticulum. **c** Diverticulum with dissection of fibrous bands. **d** Fully mobilized diverticulum. **e** Bladder closure at the site of diverticulectomy with the feeding tube intubating the left ureter. **f** Bladder closure at the site of diverticulectomy

without the feeding tube intubating the left ureter. **g** Excellent hemostasis during enucleation of the prostatic adenoma allowed transection of the prostatic urethra under direct vision. **h** Cystostomy closure. **i** Prostatic adenoma measuring approximately 3 inches and weighing 106 g

Conclusions

Transvesical diverticulectomy and simple prostatectomy are feasible in a single robotic-assisted laparoscopic surgical setting. The potential exists for widespread utilization of complex robotic-assisted laparoscopic pelvic surgeries due to the skills mastered by many urologists while performing RALP.

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