

# Necrotic mass after transurethral resection of a bladder tumor: novel management with robotic partial cystectomy

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**Abstract** A 76-year-old female with a history of high-grade transitional cell carcinoma (TCC) of the bladder presented with persistent nocturia and urge incontinence and was diagnosed with a necrotic bladder lesion. Cystoscopy revealed a 4 cm area of necrosis, ulceration, calcification, and fat. Transurethral biopsy confirmed the lesion to be benign, and two attempts to re-epithelialize the area of necrosis with cold scraping of exudate failed. Decision was then made to proceed with removal of necrotic lesion with bladder preservation. With the aid of concomitant cystoscopic visualization of the necrotic lesion, a robotic partial cystectomy with bladder reconstruction was performed. The patient tolerated the procedure, had an uneventful post-operative course, and remains asymptomatic and disease-free at last follow-up of 6 months. To our knowledge, this case represents the first report of a necrotic lesion as a complication of transurethral resection of a bladder tumor (TURBT) and the first description of a robotic partial cystectomy for the management of either benign or malignant bladder disease.

**Keywords** Robotic · Partial cystectomy ·  
Bladder necrosis

## Introduction

A 76-year-old female was diagnosed with a necrotic bladder lesion on surveillance cystoscopy for her history of bladder TCC. After failed conservative management, a robotic partial cystectomy was performed to excise this necrotic lesion and to reconstruct and preserve the remaining bladder.

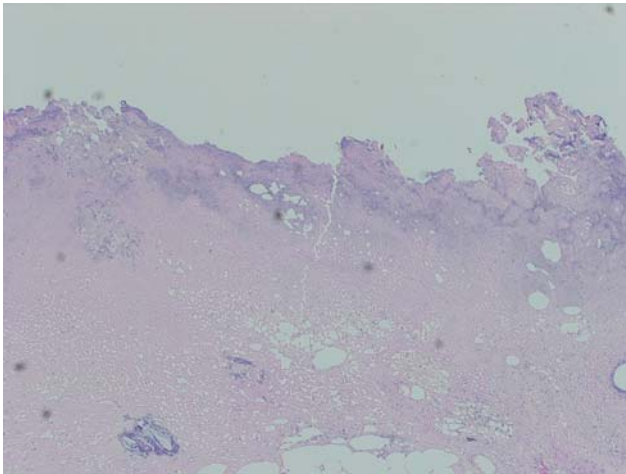
## Case report

A 76-year-old female initially presented with gross hematuria and was found on cystoscopy to have a 3-cm bladder mass involving the dome and posterior wall. Her medical history included emphysema, prior deep venous thrombosis, hyperlipidemia, and osteoporosis. Past surgical history was significant for bilateral hip replacements and spinal fusion. The patient underwent an uncomplicated transurethral resection of the bladder tumor (TURBT). Pathology revealed a high-grade TCC with invasion only into the lamina propria; however, only a small amount of muscularis propria was identified in the specimen. A repeat TURBT one month later revealed no residual carcinoma, with ample amount of muscularis propria in the sample. The patient was offered Bacillus Calmette–Guérin bladder instillation, but failed to receive treatment for unknown reasons. The patient returned six months later with urinary frequency, urgency, and dysuria, but no gross hematuria or urinary tract infection. A repeat cystoscopy revealed a necrotic-appearing bladder wall at the previous site of resection. This necrotic lesion was biopsied, and the patient was placed on antibiotics and anticholinergic medication for six weeks. Pathologic analysis revealed necrotic bladder wall, granulation tissue, and inflammation (Fig. 1). A follow-up

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**Fig. 1** Granulation tissue, inflammation, and necrosis of urothelium and fat

cystoscopy in two months demonstrated a persistently large, necrotic, and devitalized ulceration with exposed fat and fibrinous exudate. Repeat cold transurethral scraping with a resectoscope confirmed the benign necrosis, granulation tissue, and inflammation seen previously.

After discussing treatment options, which included continued observation with surveillance and partial or radical cystectomy, the decision was made to proceed with robotic partial cystectomy of the necrotic bladder wall.

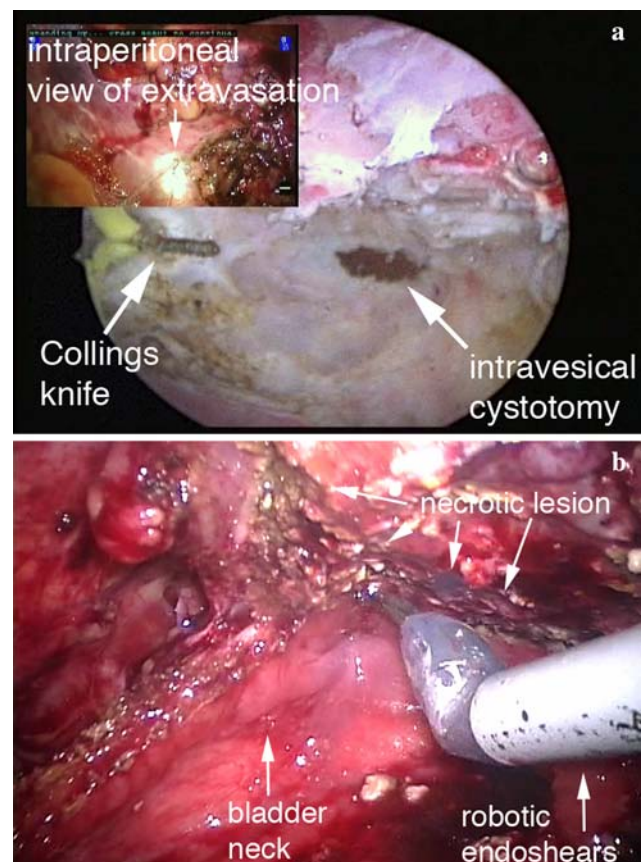
#### Robotic partial cystectomy technique

The patient is placed in a steep Trendelenberg position, the urethra is prepped into the field, and a carbon dioxide pneumoperitoneum is established with a Hassan cannula. Trocar placement is similar to that described for robotic prostatectomy: one periumbilical trocar, two lower quadrant 8 mm robotic trocars (each one slightly lateral to the mid-clavicular line), and two additional trocars, 10 and 12 mm, in the right lower quadrant [1]. The da Vinci Robot (Intuitive Surgical, Sunnyvale, CA, USA) is then docked to the patient, and the bladder filled with 250 cc of normal saline via a catheter.

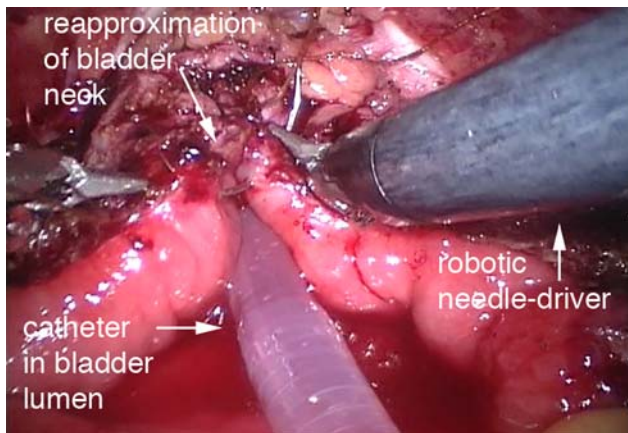
Any large or small bowel adhesions to the bladder are lysed, mobilized, and retracted superiorly. The bladder is then released from the side wall and surrounding structures to ensure all margins of necrosis are exposed extravasically. Next, the robot is undocked, and the side surgeon, using the three-dimensional laparoscope to view the bladder extravasically, uses a grasper to stabilize the bladder on traction. A resectoscope is placed transurethraly into the bladder to locate the necrotic lesion, and the remainder of the bladder is inspected to ensure there are no other suspicious lesions. The margins of the 4 cm necrotic bladder mass are demarcated cystoscopically with a Collings hot knife (Cook Medical,

Bloomington, IN, USA); in this case, a 1-cm margin from the anterior bladder neck was obtained. The Collings incision is deepened through the serosa circumferentially around the lesion, achieving full thickness. Again, these maneuvers are viewed in real time with the robotic laparoscope to confirm there is no inadvertent injury to surrounding structures or tissues (Fig 2). Once the cystotomy is made, allowing fluid to flow into the extraperitoneal space, the resectoscope is removed, a 20-french Foley catheter is passed into the bladder, and the robot is redocked to complete the bladder excision extravasically with the da Vinci system. To accomplish this, we prefer the Maryland bipolar forceps in the left hand, and the hot shears in the right (Intuitive Surgical, Sunnyvale, CA, USA) (Fig 2b). Thus, accurate identification and excision of the posterior margin is performed, allowing for easier excision of the remaining necrotic bladder wall, which is performed extravasically using robotic endoshears (Fig. 2b).

Once the necrotic bladder mass is completely excised, a running two-layer closure is performed, using 2-0 chromic suture for the internal layer and 2-0 vicryl suture for the seromuscular layer (Fig. 3). The anastomosis is tested with



**Fig. 2** **a** Transurethral cystotomy, allowing fluid into extraperitoneal space; (*inset*) view from intraperitoneal laparoscope. **b** Robotic excision of necrotic bladder lesion



**Fig. 3** Robotic closure of bladder defect

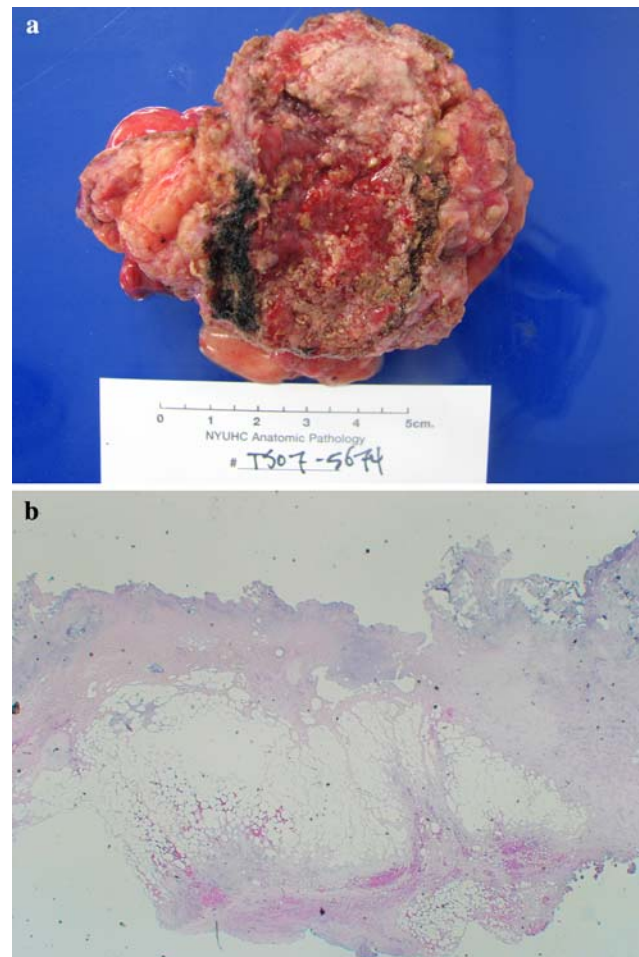
gentle irrigation through the catheter, and a self-suction bulb drain is placed extravasically.

The operative time was 252 min. The patient tolerated surgery without complication, progressed well post-operatively, and was discharged home on postoperative-day 3. Final pathologic examination of the specimen revealed necrosis with extensive dystrophic calcification, fibrosis, chronic inflammation, and eosinophilic infiltration, without residual carcinoma (Figs. 4a, b).

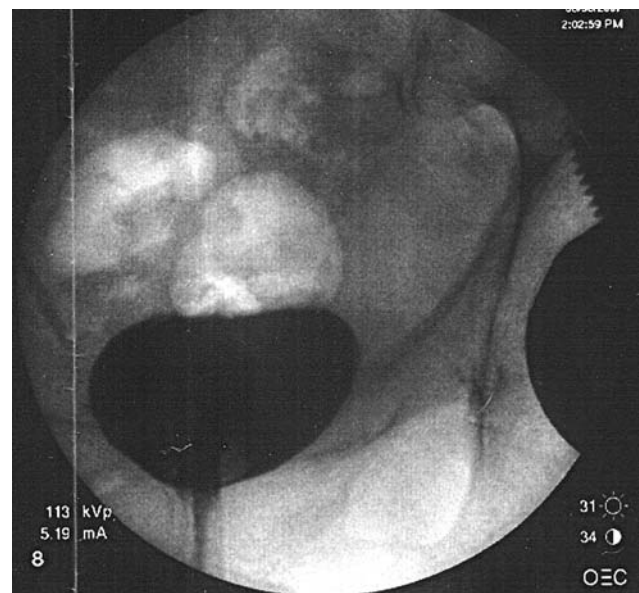
Post-operative cystogram at 3 weeks with 200 cc demonstrated no extravasation, and the Foley catheter was removed (Fig. 5). Aside from occasional nocturia, the patient reported doing well, denying hematuria or dysuria, and remains free of disease on last surveillance, 6 months after surgery.

## Discussion

Transurethral resection of bladder tumors is the treatment of choice for low-stage disease and is also utilized in the diagnostic evaluation of bladder tumors with higher stages. While TURBT is generally considered to have minimal morbidity, there are several well-recognized complications. The overall incidence of complications from TURBT has been reported to be anywhere from 5.1 to 43.3% [2–8]. The most common complication following TURBT is bleeding, with a reported incidence in the literature ranging from 2 to 13%, followed by bladder perforation with an incidence of 0.9–5% [2–8]. Hemorrhage requiring transfusion has been reported to occur between 2.3 and 13% of the time [2–4]. Other reported complications of TURBT include urinary tract infection (2–39%), medical complications, such as pulmonary embolism and myocardial infarction, reabsorption syndrome, urethral false passage creation, sepsis, ureteral orifice damage resulting in vesicoureteral reflux, tumor cell implantation following perforation, and intravesical



**Fig. 4** a Gross specimen. b Necrosis, dystrophic calcification, and chronic inflammation of partial cystectomy specimen



**Fig. 5** Cystogram without extravasation at 3 weeks post-operative



explosions [2–9]. Published 30-day mortality rates for TURBT are low, all less than 1.3% [2, 6].

To our knowledge, the complication of bladder wall necrosis following TURBT has not been previously reported in the literature. Bladder necrosis has previously been described after hydrodistension in patients with interstitial cystitis, following pelvic artery embolization, after bilateral internal iliac artery ligation during surgery for rectal cancer, and secondary to clean intermittent catheterization [10–13]. Other known causes include intravesical irrigation/instillation solutions, radiation, indwelling catheters, calculi, infection, prostatic electrocoagulation, carcinoma, urinary retention, trauma, thromboembolism, and diabetes [14]. Options available for the treatment of a benign necrotic bladder mass include hyperbaric oxygen treatment, repeat TURBT, radical cystectomy with enterocystoplasty, partial cystectomy, and observation [15, 16]. We chose to proceed with a robotic partial cystectomy for this benign lesion.

Partial cystectomy is employed to treat bladder cancer in selected patients and can also be utilized for benign entities such as bladder diverticula, cavernous hemangiomas, cystic hydatid disease, ulcerative interstitial cystitis, colovesical fistula, vesicovaginal fistula, and localized endometriosis of the bladder [17, 18]. Over the last decade, there have been many reports in the literature of minimally invasive surgical techniques to treat various bladder pathologies. Laparoscopic radical cystectomy, laparoscopic partial cystectomy, and robotic radical cystectomy have all been described [19–23].

In 2004, Mariano and Tefilli presented their initial experience of laparoscopic partial cystectomy and lymphadenectomy for TCC in six carefully selected patients [21]. Mean surgical time was 205 min, mean estimated blood loss 200 mL, there were no significant perioperative complications, and all surgical margins were free of tumor. At a mean follow up of 30 months (range 12–50), there was one patient who developed local and metastatic disease. Wadwa and associates performed laparoscopic partial cystectomy with bilateral pelvic lymphadenectomy for three patients with urachal adenocarcinoma, with a mean operative time of 180 min, and a mean estimated blood loss of 150 cc [24]. No patient developed local or distant recurrence at a mean follow-up of 6.5 months (range 4.5–9). Laparoscopic partial cystectomy has also been described for urachal cysts, vesical endometriosis, bladder pheochromocytoma, bladder leiomyoma, post-traumatic splenic pseudocyst, bladder schwannoma, and endometrioid adenocarcinoma [25–31].

Recently, Sener et al. [32] reported performing a combined transurethral and laparoscopic partial cystectomy with robot-assisted bladder repair for the treatment of a deeply infiltrating 4-cm bladder endometrioma. Patient

positioning and trocar placement were similar to those described in our case; however, we perform our exposure, extravesical excision, and reconstruction entirely robotically.

We have previously described the advantages of robotic surgery for reconstruction of the upper urinary tract [33]. Our growing experience with robotic reconstruction of lower urinary tract disease leads us to believe that the same advantages hold: increased instrument control, magnified, three-dimensional view, more working ports for the assistant, and increased surgeon comfort. This particular case involves a patient with a history of bladder TCC who developed a benign necrotic bladder lesion from TURBT. A robotic partial cystectomy was performed, based on the principles of open surgery, to excise the necrotic tissue and reconstruct the remaining healthy bladder. The patient will continue to receive appropriate surveillance for her history of bladder cancer. This communication represents the first report of a completely robotic partial cystectomy for either benign or malignant bladder disease, as well as the first report of bladder wall necrosis as a complication of TURBT.

## Conclusion

Robotic surgery continues to find new utility in urologic surgery. While the use of laparoscopy for the management of bladder cancer has been reported, robotic surgery in this arena has not been described, and awaits further evaluation. Prospective multi-institutional studies and outcome analyses with comparisons to the gold standard of open surgery as well as laparoscopy are warranted to determine the exact role of robotic surgery in partial cystectomy for either benign or malignant disease.

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