Robotic intracorporeal orthotopic neobladder in the supine Trendelenburg position: a stepwise approach

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Robotic radical cystectomy with urinary diversion has become increasingly utilized for the surgical management of bladder cancer. Orthotopic neobladder reconstruction is still performed worldwide primarily via an extracorporeal approach because of the difficulty associated with robotic intracorporeal reconstruction. The objective of this article is to demonstrate a stepwise approach for robotic intracorporeal neobladder in a standardized manner that adheres to the principles of open surgery.

Key Words: robotic, intracorporeal, neobladder, supine, patient positioning, orthotopic, table motion

Introduction

Robotic radical cystectomy has become increasingly utilized for the management of bladder cancer. Estimated blood loss, transfusion rates, and hospital stay are significantly lower for patients undergoing robotic cystectomy compared to open radical cystectomy. There are no significant differences between robotic and open radical cystectomy with respect to oncologic control or major complication rates.[1] However, orthotopic neobladder reconstruction is still performed at many centers worldwide via an extracorporeal approach because of the increased difficulty and long operative time associated with robotic intracorporeal reconstruction.

Prolonged pelvic surgery, particularly radical cystectomy, may be associated with an increased incidence of lower extremity thromboembolic events or compartment syndrome.[2] Risk factors for these types of complications include length of time spent in lithotomy position and degree of limb elevation.[3] To reduce the potential risk of these complications, some surgeons have reported the use of split leg positioning for robotic cystectomy. However, split leg position may also be associated with a higher risk of femoral nerve neuropathies.[4]

After completing radical cystectomy and lymph node dissection, it is unnecessary to keep the patient in steep Trendelenburg position. Moreover, steep Trendelenburg position causes the small bowel to fall towards the diaphragm with gravity. Reducing Trendelenburg allows the ileum to fall towards the pelvis so that it can be easily handled for urinary diversion. In order to reduce the angle of Trendelenburg position for intracorporeal urinary diversion, robotic systems prior to the da Vinci Xi (Intuitive Surgical Inc., Sunnyvale, CA, USA) required undocking and redocking which is associated with increased operative time. This maneuver can be performed without undocking and redocking with the use of table motion and the da Vinci Xi system.

We utilize side docking with the boom rotation feature of the da Vinci Xi to perform radical cystectomy and urinary diversion in the supine Trendelenburg position.[3] We also use table motion to reduce the degree

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A video clip is available online at www.canjurol.com

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of Trendelenburg while performing intracorporeal neobladder reconstruction without undocking.[5]

One proposed cut off point for qualifying as a high volume center for radical cystectomy is approximately 20 cases/year.[6] Our hospital performs > 80 radical cystectomies/year and the majority of urinary diversions are performed intracorporeally with the robot. We perform all robotic radical cystectomies in the supine Trendelenburg position.

The objective of this article is to demonstrate a stepwise approach to robotic intracorporeal neobladder reconstruction in the supine Trendelenburg position with da Vinci Xi table motion and to present early results of 10 patients who have undergone robotic intracorporeal neobladder reconstruction using this standardized technique.

Materials and methods

Patient selection

Patients undergoing robotic cystectomy with orthotopic intracorporeal neobladder reconstruction typically have a diagnosis of ≥ cT2 bladder cancer or recurrent non-muscle invasive disease with or without a history of neoadjuvant chemotherapy. The choice of orthotopic neobladder reconstruction is dependent on oncologic and patient-specific factors. Relative contraindications for intracorporeal neobladder reconstruction include clinically significant renal impairment, inability to perform self-catheterization if required, lack of compliance for regular follow up, history of pelvic radiation, bowel disease, or history of prior bowel resection.[7]

Preoperative preparation

All patients undergo a comprehensive preoperative assessment. Patients who are on anticoagulants for a pre-existing medical condition typically stop taking these medications 5-7 days before surgery under the direction of the prescribing physician. Bridging anticoagulation with heparin or low molecular weight heparin is utilized when indicated. Patients who are on low dose (81 mg) aspirin for cardiac or vascular conditions are permitted to continue taking this medication.[8]

All patients are administered 5000 IU of unfractionated heparin subcutaneously before surgery. Patients are also administered Alvimopan 12 mg orally at least 30 minutes before the procedure. Preoperative IV antibiotics are administered per hospital protocol. We adhere to principles of enhanced recovery after surgery (ERAS) protocol for all patients undergoing robotic cystectomy with urinary diversion.[9]

Figure 1. Lower limb position.

Patient positioning

The patient is placed on a table motion enabled operating table.[5] After induction of general anesthesia, the patient's upper limbs are placed in an adducted position adjacent to the torso. For patients with higher BMI, it may be useful to leave the arm boards of the table in a completely adducted position to help provide additional arm support. Pressure points are padded with eggcrate sponge material and the arms are secured with minimal compressive pressure. Additional sponge material is also placed beneath the heels of the feet. The lower extremities are slightly abducted and a pillow is placed underneath the knees to provide support. At this point, both lower extremities are slightly abducted at the hips and flexed at knees. The legs are secured in position with straps, but without applying excessive pressure, see Figure 1. Slight abduction at the hip permits access for perineal pressure when needed (e.g. for suturing the dorsal

Figure 2. Supine Trendelenburg position.

venous complex and entero-urethral anastomosis). The lower limbs are placed in the same position for female patients and at the time of vaginal extraction of the bladder specimen, the lower limbs can be modified to a frog leg position if necessary. We utilize the Trendguard™ 450 hybrid system for securing the patient in order to prevent the shoulders and head from sliding during steep Trendelenburg position.[10,11] A patient in supine Trendelenburg position for robotic radical cystectomy is shown in Figure 2.

Port placement

Port placement is shown in Figure 3 and consists of 4 robotic trocars with 3 assistant ports (1 mm x 12 mm AirSeal port and 2 mm x 5 mm ports). The 5 mm subcostal assistant ports should not be in the same vertical line of any 8 mm robotic port in order to prevent collision between robotic arms and bedside assistant. Pneumoperitoneum can be set between 10-15 mm Hg.

Robot docking

The da Vinci Xi is docked from the right side of the patient. This position may still accommodate two bedside assistants (if needed) who can stand on each side of the patient.

Radical cystectomy

Robotic radical cystectomy with bilateral pelvic lymphadenectomy is performed in the standard manner.[12] Intraoperative frozen section of the urethra is used to determine suitability of orthotopic urinary diversion. Preservation of urethral length as well as the urinary sphincter is important for successful postoperative urinary continence outcomes. If the sigmoid colon is adherent to the pelvic side wall, it may be mobilized to allow for retraction during suturing of the entero-urethral anastomosis.

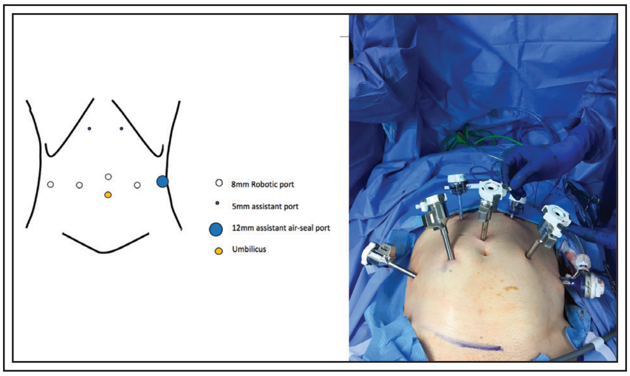

Figure 3. Port position.

Mobilization of the left ureter and uretero-ureteric side to side anastomosis

The left ureter is mobilized to the right side through the sigmoid mesocolon. Bilateral ureters are spatulated and we typically perform a uretero-ureteral side to side anastomosis with 4-0 polyglycolic suture on a RB1 needle.

Reducing Trendelenburg position with table motion

The da Vinci Xi is paired with a table motion enabled operating bed. During the initial phases of surgery and radical cystectomy, it is helpful to have Trendelenburg up to 30°. This allows the bowel to retract cranially and facilitates pelvic dissection. For neobladder construction, the Trendelenburg angle is reduced to between 5^0-20^0 depending on patient body habitus, mesenteric length, and mobility of bowel within the abdomen to provide for optimal visualization and handling during creation of the neobladder. At the time of urethroenteric anastomosis, Trendelenburg may be further reduced if needed to facilitate a tension free anastomosis. There is no need to undock any of the robotic arms while reducing the angle of Trendelenburg position using the da Vinci Xi and table motion. The changes in the degree of Trendelenburg can performed multiple times throughout the procedure if needed without undocking. In the surgery demonstrated in the video accompanying this article, we performed the radical cystectomy at Trendelenburg position angle of 30°. We reduced the Trendelenburg to 20° at time of construction of neobladder and we were able to complete the procedure at same angle without the need for further adjustment.

Isolation of the ileal segment and restoration of bowel continuity

A 60 cm ileal segment approximately 15 cm from the ileocolic junction is isolated. A Penrose drain marked at 5, 10, and 15 cm is used to measure the appropriate length of ileum, see Figure 4. A laparoscopic stapling

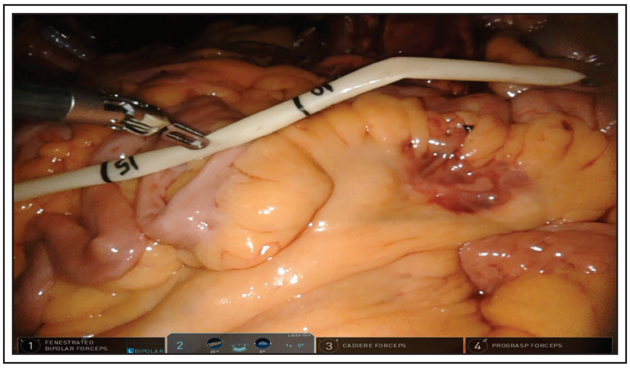

Figure 4. Use of Penrose drain for measuring length of ileum.

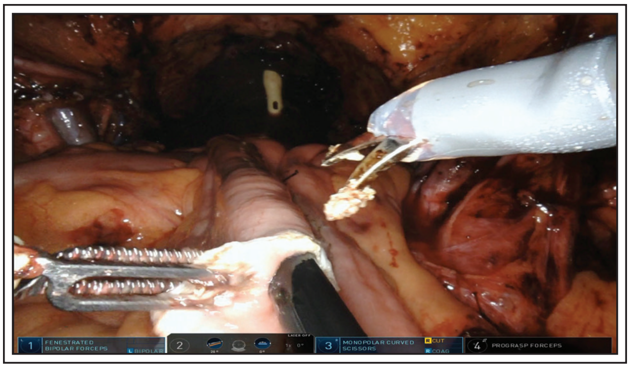

Figure 5. Use of atraumatic bowel grasper to assist with bowel detubularization.

device is used to facilitate creation of the entero-enteral anastomosis and restore bowel continuity. The distal end of the ileal segment may be tagged with suture to help maintain proper orientation. The proximal 15 cm of the isolated ileal segment is tagged and used for the afferent limb of the neobladder.

Detubularization

The distal 45 cm of ileum is aligned in a 'U' shaped configuration with interrupted 2-0 polyglycolic stay sutures. These stay sutures are cut long to facilitate bowel handling. The ileum is detubularized over a laparoscopic instrument (e.g. bowel grasper) that is passed through one of the 5 mm ports, see Figure 5.

Posterior plate construction

A single layer of continuous 3-0 barbed suture is used for approximation of the detubularized ileum to form the posterior plate of the neobladder. The previously placed interrupted stay sutures help not only for bowel handling, but also provide interval tie points for continuously running barbed sutures.

Folding of the neobladder

A clam shell configuration is achieved by approximating the distal and proximal ends of detubularized bowel with polyglycolic suture. This maneuver is an important step because it makes the neobladder shape spherical in order to provide maximal storage capacity and volume with the least surface area in accordance with principles of Laplace's law.

Anterior plate construction

The anterior plate is closed in a similar manner as the posterior plate using a single layer of continuous 3-0 barbed suture. Interrupted 2-0 polyglycolic stay sutures are placed to assist with bowel handling and provide interval tie points for the continuously running barbed suture. The distal most aspect of anterior plate is left open which will later be anastomosed to the urethra.

Ureteroenteric anastomosis

An end-to-side ureteroenteric anastomosis is performed with interrupted sutures with 4-0 Polyglycolic on a RB1 needle with the afferent limb of the neobladder over single J stents placed in both of the ureters. We typically exteriorize the single J stents through the afferent limb and bring them out via one of the robotic ports at the end of the procedure.

Enterourethral anastomosis

The enterourethral anastomosis is performed with a 3-0 double-armed barbed suture in a running manner, see Figure 6. The sigmoid colon may be retracted to facilitate mobilization of the neobladder into the pelvis in its final position for completion of the anastomosis. A 3-way silicone hematuria catheter is inserted per urethra. A Jackson Pratt drain is placed through one of the robotic ports.

Postoperative care and implementation of ERAS protocol

Patients are encouraged and supported for ambulation on the evening of surgery. Heparin 5000 IU subcutaneously (s.c.) is administered every 8 hours until discharge and Alvimopan 12 mg every 12 hours until discharge (for a maximum of 7 days). Neostigmine 0.5 mg s.c. may also be administered every 12 hours starting on postoperative day 1 until the patient has a bowel movement (or for a maximum of 6 doses whichever is earlier). Patients are started on a clear liquid diet on postoperative day 1. Diet is advanced to full liquids on postoperative day 2 and to a regular diet when passing flatus. Patients are discharged when they have passed flatus and/or have a bowel movement and are tolerating adequate oral intake. Follow up for the removal of

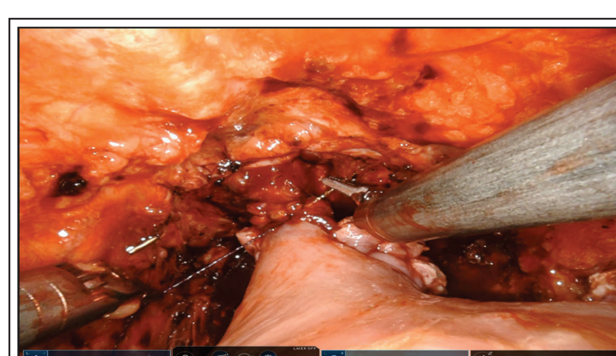

Figure 6. Completion of the enterourethral anastomosis.

the ureteral stents occurs approximately 2 weeks after surgery. The urethral catheter is typically removed 3 weeks after surgery without the need for a cystogram.

Results

Outcomes of 10 patients who underwent robotic radical cystectomy with intracorporeal neobladder reconstruction in the supine Trendelenburg position are summarized in Table 1. A total of 3 patients had Clavien–Dindo grade 2 complications. Two patients developed a urinary tract infection and another patient required blood transfusion on postoperative day 2. None of the patients had higher grades of complications. At 3 months of follow up, one patient required daily clean intermittent self-catheterization due to high post void residual volumes. A total of 3 patients were using one pad at night because of urinary incontinence and 2 patients were also using pads during the daytime.

TABLE 1. **Demographic information of patients undergoing robotic cystectomy with intracorporeal neobladder reconstruction (mean ± standard deviation)**

Number of patients	10
Male: Female	10:0
Body mass index	24.6 ± 4.5
Intraoperative blood loss (mL)	230 ± 86
Perioperative hemoglobin decrease (grams/dL)	1.8 ± 0.8
No. of patients needing intraoperative transfusion	0
No. of patients needing postoperative transfusion	1
Total console time: robotic radical cystectomy + intracorporeal neobladder (minutes)	504 ± 96
Console time for construction of intracorporeal neobladder (minutes)	340 ± 96
Hospital stay (days)	5 ± 1.3
No. of patients needing readmission within 90 days of surgery (n)	2 (both for UTI)
Post-void residual volume at 3 months (mL)	19 ± 31
Lymph node yield	17.7 ± 8.3
p0	1
pTa/T1/CIS	3
pT2	3
pT3	3
pT4	0
pN0	7
pN1	2
pN2	1

Conclusion

This article details a step-wise approach for robotic intracorporeal orthotopic neobladder reconstruction in the supine Trendelenburg position without redocking using the da Vinci Xi table motion feature. Modifications in patient positioning and robot docking minimize potential risk factors associated with lower limb lithotomy and split leg position that are commonly used for robotic urologic procedures. ☐

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