Robot-Assisted Intracorporeal Ileal Conduit

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Introduction

Open radical cystectomy with pelvic lymph node dissection and urinary reconstruction is still considered as gold standard treatment in muscle-invasive bladder cancer [1–3]. Despite significant improvements in morbidity and mortality as well as in functional results in recent years, the procedure is associated with substantial early and late complications [4–6]. The adoption of minimally invasive surgery in attempt to reduce morbidity in radical cystectomy started with the first laparoscopic radical cystectomy in 1992 [7]. It was not until the introduction of robot-assisted surgery that larger series were presented [8–16]. When performing robot-assisted radical cystectomy (RARC), most centers perform the extirpative part (cystectomy and lymph node dissection) intracorporeally and the reconstruction of the urinary canal extracorporeally. In an attempt to further reduce morbidity and reduce hospital stay, some centers have developed techniques for intracorporeal urinary diversion [17, 18]. Potential additional benefits are less incisional pain, decreased bowel exposure and risk of wound rupture, preservation of blood flow in the distal ureters due to the intracorporeal anastomosis, and decreased risk of fluid imbalances.

Preparation

There are no specific preoperative preparations necessary other than those for robot-assisted radical cystectomy. The one change that may be employed is placement of the bedside assistant on the left side of the patient. This is particularly important for passing the endovascular stapler during the bowel work. The stoma site is marked preoperatively. As for every minimally invasive procedure, the patient is informed of the risk of conversion to open surgery. In our institutions we do not use any bowel preparation other than "nothing by mouth" the night before surgery. Of course, if there are extenuating circumstances such as a history of radiation, multiple previous surgeries, or a history of problems with constipation, a mechanical preparation can be employed. The patient is in 30° of Trendelenburg throughout the whole procedure. In rare cases, the amount of Trendelenburg may need to be decreased during if the bowel retracts too far proximally in the abdomen.

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Instruments and Equipment

Besides the standard robotic instruments for RARC, the Small Grasping Retractor (Intuitive Surgical, Sunnyvale, CA) is very helpful when performing the bowel work. The Cadière Forceps are an alternative but care should be taken not to injure the bowel since they have a higher closing pressure. A 15-mm laparoscopic port is used as the lateral left port allowing the large specimen retrieval bag to pass as well as for the stapling of the bowel. The third robotic metal port can easily be inserted through this port when the third robotic arm is used on the left side. Laparoscopic staplers are used for isolation of the ileal conduit and reestablishment of the bowel continuity. The cartridges should be for small bowel/vasculature. A pre-cut 15 cm or 20 cm suture will be used for measuring the bowel. Two 8 French baby-feeding tubes 55 cm long are used as ureteral stents. Alternatively, standard 90 cm single J urinary diversion stents can be used. They are fixed to the bowel mucosa at the level of the stomal end with absorbable suture. One extra 12 mm laparoscopic port and a laparoscopic Babcock grasper are used to catch the distal part of the conduit through the abdominal wall at the end of the procedure. For a list of instruments and supplies please refer to Table 11.1.

Table 11.1 List of instruments and supplies

Robotic	
	Cadière forceps
	Small grasping retractor
Additional	
	Pre-cut suture (15–20 cm) Endovascular stapler with vascular and small bowel loads—60 mm Laparoscopic babcock 4-0 absorbable monofilament suture 4-0 equivalent barbed suture (*optional*) Urinary diversion stents (Single J) or eight French feeding tubes

Surgical Technique: Step-by-Step

Preparation of the Left Ureter

The left ureter is tunneled under the sigmoid mesentery to the right side (Fig. 11.1). It is important to create a sufficient opening in the mesentery to avoid kinking of the ureter. The left and right ureter are then held together with an extra large Hem-o-Loc® clip (Weck Surgical Instruments, Teleflex Medical, Research Triangle Park, NC). This step makes it easier to find the ureters after the bowel work.

Bowel Identification and Anastomosis

Fifteen to twenty centimeters of the distal ileum are isolated, leaving at least 15 cm to the ileocecal valve. The bowel is divided using a 60-mm laparoscopic stapler with a cartridge for small bowel/vasculature (Fig. 11.2). By using a vascular load (red color) the small vessels of the mesentery are easily controlled along with division of the bowel segment. The assisting surgeon is performing the stapling through the 15-mm port from the left side of the patient. Care is taken to fire the stapler perpendicular to the bowel into the mesentery. In

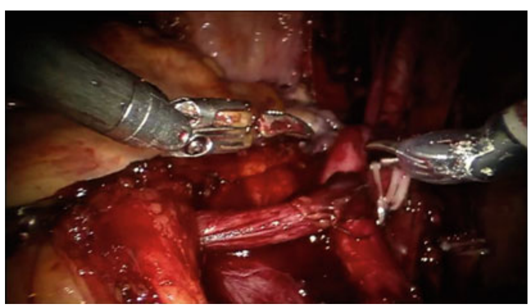

Fig. 11.1 Passing the left ureter through the window in the mesentery

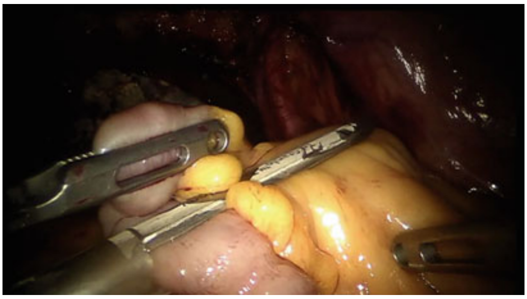

Fig. 11.2 Isolating the bowel segment

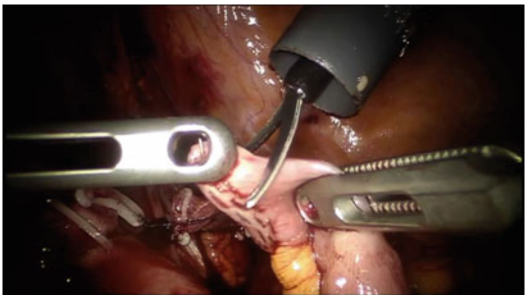

Fig. 11.3 Excising the antimesenteric corners of the staple line in preparation of passing the stapler

some cases, having tags on the bowel for retraction by the third robotic arm is helpful. It is important to achieve sufficient length at the distal incision in order not to have the bowel anastomosis too close to the stoma. The bowel continuity is restored using the same stapler with a small bowel load (blue color). The stapler is passed through the cut corners on the antimesenteric side of the staple lines of the distal and proximal ends of the ileum (Fig. 11.3). The anastomosis is performed in a "side-to-side" fashion with the antimesenteric part facing each other (Fig. 11.4). An additional transverse firing of the stapler is used to close the open ends of the ileal limbs—similar to what is done in open cases with an open gastrointestinal stapler. It is important to be gentle on the bowel serosa with all of the robotic instruments as inadvertent serosal tears can be encountered with tools such as the robotic needle drivers and robotic graspers.

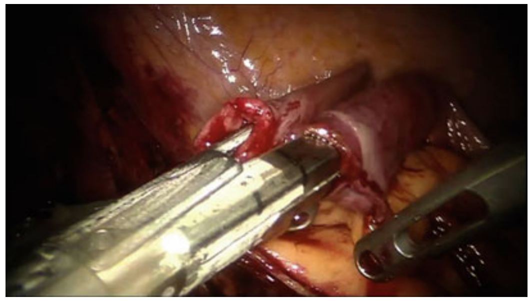

Fig. 11.4 Performing the side-to-side bowel anastomosis

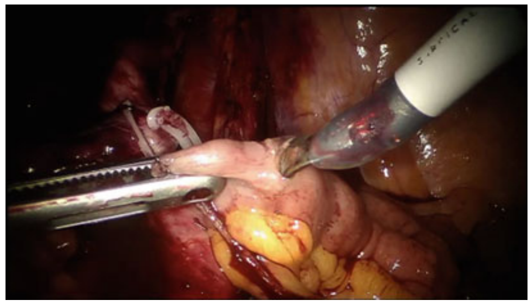

Fig. 11.5 Creating the enterotomy for the anticipated ureteroileal anastomosis

Ureteroileal Anastomosis

The distal staple line of the conduit is cut away and two separate openings in the proximal part, for the ureteral implantation, are created (Fig. 11.5). At our institution we prefer the separate Nesbit (Bricker) implantation but using the Wallace plate is also an option. The ureters are secured with the third arm and a ProGrasp™ and spatulated approximately 2 cm. The anastomosis between the ureters and the proximal part (butt end for Wallace) of the conduit is carried out using two 4-0 monofilament running sutures, one at each side of the ureter (Fig. 11.6). A slipknot is preferably used when first approximating the ureter and bowel. More recently, barbed sutures have become available. Some surgeons are using the 4-0 equivalents for the ureteroileal anastomoses. Ensuring a watertight anastomosis visually is important since it is difficult to "test" the anastomosis robotically as one would do open.

Before completing the ureteroenteric anastomosis, the baby-feeding tubes (or single J urinary diversion stents) are pushed up to the kidney pelvis and secured at the bowel mucosa with absorbable suture. Two baby-feeding catheters each 55 cm are inserted through the right assistant port and pulled through the ileal segment. The passage of the stents can be challenging and coordination between the assistant and the surgeon is key (Fig. 11.7a, b).

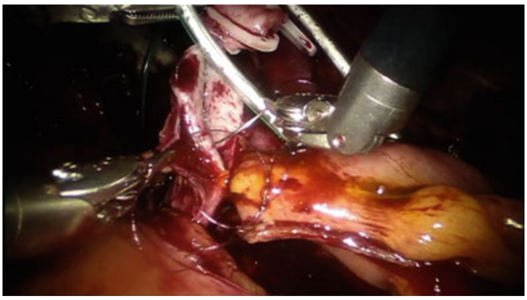

Fig. 11.6 Creating the ureteroenteric anastomosis

The surgeon must be careful to estimate the distance to advance the stents as haptic feedback is not available to know once the kidney is reached. In most cases, passing 20 cm (approximately four lines on marked stents) is sufficient.

Creation of the Stoma

The robot is then undocked with the ports still be in place. A drain is inserted through the second robotic port on the left side. The stoma is then constructed at its appropriately marked location. The skin and underlying fat are removed and the fascia is incised like a cross (cruciate incision). The muscle is separated and a 12-mm laparoscopic port is pushed through peritoneum still having pneumoperitoneum (Fig. 11.8a). A laparoscopic Babcock is used through the laparoscopic port to grab the distal part of the conduit and pull it through the abdominal wall (Fig. 11.8b).

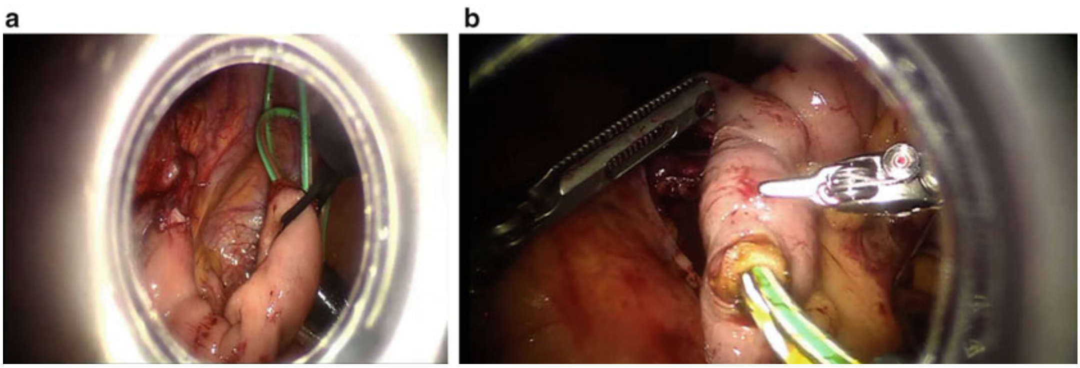

Fig. 11.7 (**a**) Passing the stents; (**b**) pulling through the stents

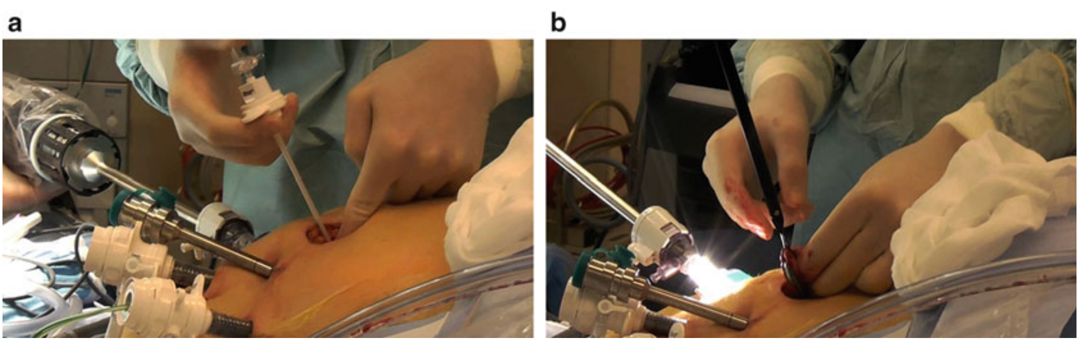

Fig. 11.8 (**a**) Creating the stoma site; (**b**) pulling the conduit through the stoma site with a laparoscopic babcock

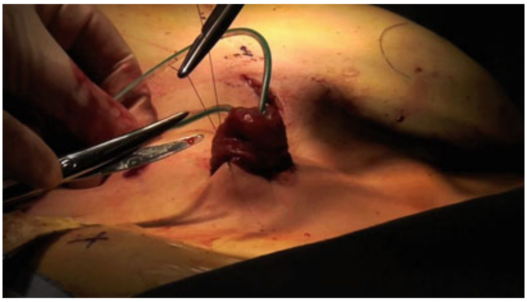

Fig. 11.9 Maturation of the stoma

The stoma is then everted and sutured to the skin (Fig. 11.9). Alternatively, the bowel can be passed to the stoma site through the infraumbilical extraction incision once the bladder is removed.

Results

Some authors have successfully completed total intracorporeal ileal conduit with a mean operative time of 11.5 h [19]. However, a more recent publication reports decreasing operative times [18]. In experienced hands, performing intracorporeal ileal conduits takes approximately 1.5–2 h in addition to the time required for the extirpative part of the procedure. Although results are short term in most reports, the overall consensus is that it is feasible and safe in the hands of surgeons experienced at robot-assisted radical cystectomy.

At our institution we intend to perform every cystectomy robotically with intracorporeal urinary diversion, both ileal conduit and ileal neobladder. Listed in Table 11.2 are unpublished results from our consecutive unselected series of intracorporeal ileal conduit.

Table 11.2 RARC with ileal conduit results (Herlev University Hospital Copenhagen, Denmark—unpublished)

N=69	
Female—18	
Male—51	
Age: 68 (47–81)	
Salvage procedures: 12 (after radiation and/or chemotherapy)	
EBL: 250 ml (50–3,700) no intracorporeal more than 700 ml (including cystectomy and lymph node dissection)	
Conversion to open sugery: 8 pts (11.6 %)	
OR-time: 287 min (155–517) (*skin to skin*)	
Complications according to the Clavien system [20]	
Clavien score	
0	28 pts
1	13 pts
2	10 pts
3a	5 pts
3b	12 pts
4	1 pts
5	0 pts

Conclusion

With time and increased experience, operative times, functional results, and complications will continue to improve. Selection of appropriate urinary diversion following robot-assisted radical cystectomy in the form of intracorporeal or extracorporeal approach needs further studies. At this point in time, intracorporeally performed urinary diversion may be recommended only in the hands of experienced surgeons at high-volume centers.

Editors' Commentary

Erik P. Castle and Raj S. Pruthi

As experience with RARC continues to spread throughout the urologic community, many surgeons who have mastered the cystectomy with extracorporeal diversion are transitioning to intracorporeal diversions. While there may be concern with the added time it may add, there are some significant benefits to an intracorporeal ileal conduit. One of the more important potential benefits is the decreased traction and tension on the ureters during the ureteroileal anastomosis. There have been some anecdotal reports among RARC surgeons during their early experience of ureteroileal strictures. This is likely due to traction and over mobilization of the ureters that is often a consequence early on in experience with extracorporeal diversion. By performing the anastomoses in the retroperitoneum, many feel that this decreases on the risk of stricture.

There are some key points to consider when starting with intracorporeal ileal conduit creation. Firstly, the assistant should be situated on the left side as this provides the best angle for stapling the ileum. Secondly, make the anticipated conduit segment at least 20 cm long as one can always cut back on a long conduit but one too short can pose problems during maturation of the stoma. Thirdly, the surgeon may want to undock the robot and take the patient 15–20° out of extreme Trendelenburg if the bowel is not dropping into the field of view adequately. Finally, passing the diversion stents may be a challenge and we have found that passing the assistant instrument from the anastomosis end to the stomal end to grasp the stent and pull through in order to pass up into the ureter seems to provide the best angle. One should also secure the stent to the stomal end after passing it in order to avoid it falling out when trying to develop the stoma.

References

1. Stein JP, Skinner DG. Radical cystectomy for invasive bladder cancer: long-term results of a standard procedure. World J Urol. 2006;24(3):296–304.
2. Stein JP. Improving outcomes with radical cystectomy for high-grade invasive bladder cancer. World J Urol. 2006;24(5):509–16.
3. Dhar NB, Klein EA, Reuther AM, Thalmann GN, Madersbacher S, Studer UE. Outcome after radical cystectomy with limited or extended pelvic lymph node dissection. J Urol. 2008;179(3):873–8. discussion 878.
4. Konety BR, Allareddy V, Herr H. Complications after radical cystectomy: analysis of population-based data. Urology. 2006;68(1):58–64.
5. Novotny V, Hakenberg OW, Wiessner D, et al. Perioperative complications of radical cystectomy in a contemporary series. Eur Urol. 2007;51(2):397–401. discussion 401–392.
6. Hautmann RE, Volkmer BG, Schumacher MC, Gschwend JE, Studer UE. Long-term results of standard procedures in urology: the ileal neobladder. World J Urol. 2006;24(3):305–14.
7. Parra RO, Andrus CH, Jones JP, Boullier JA. Laparoscopic cystectomy: initial report on a new treatment for the retained bladder. J Urol. 1992;148(4):1140–4.
8. Menon M, Hemal AK, Tewari A, et al. Nerve-sparing robot-assisted radical cystoprostatectomy and urinary diversion. BJU Int. 2003;92(3):232–6.
9. Guru KA, Kim HL, Piacente PM, Mohler JL. Robot-assisted radical cystectomy and pelvic lymph node dissection: initial experience at Roswell Park Cancer Institute. Urology. 2007;69(3):469–74.
10. Murphy DG, Challacombe BJ, Elhage O, et al. Robotic-assisted laparoscopic radical cystectomy with extracorporeal urinary diversion: initial experience. Eur Urol. 2008;54(3):570–80.
11. Wang GJ, Barocas DA, Raman JD, Scherr DS. Robotic vs open radical cystectomy: prospective comparison of perioperative outcomes and pathological measures of early oncological efficacy. BJU Int. 2008;101(1):89–93.
12. Hemal AK, Abol-Enein H, Tewari A, et al. Robotic radical cystectomy and urinary diversion in the management of bladder cancer. Urol Clin North Am. 2004;31(4):719–29. viii.
13. Palmer KJ, Shah K, Samavedi S, Coughlin G, Patel VR. Robot-assisted radical cystectomy. J Endourol. 2008;22(9):2073–7. discussion 2079.
14. Lowentritt BH, Castle EP, Woods M, Davis R, Thomas R. Robot-assisted radical cystectomy in women: technique and initial experience. J Endourol. 2008;22(4):709–12.
15. Khan MS, Shah SS, Hemel A, Rimington P, Dasgupta P. Robotic-assisted radical cystectomy. Int J Med Robot. 2008;4(3):197–201.
16. Pruthi RS, Smith A, Wallen EM. Evaluating the learning curve for robot-assisted laparoscopic radical cystectomy. J Endourol. 2008;22(11):2469–74.
17. Kang SG, Ko YH, Jang HA, et al. Initial experience of robot-assisted radical cystectomy with total intracorporeal urinary diversion: comparison with extracorporeal method. J Laparoendosc Adv Surg Tech A. 2012;22(5):456–62.
18. Jonsson MN, Adding LC, Hosseini A, et al. Robot-assisted radical cystectomy with intracorporeal urinary diversion in patients with transitional cell carcinoma of the bladder. Eur Urol. 2011;60(5):1066–73.
19. Balaji KC, Yohannes P, McBride CL, Oleynikov D, Hemstreet 3rd GP. Feasibility of robot-assisted totally intracorporeal laparoscopic ileal conduit urinary diversion: initial results of a single institutional pilot study. Urology. 2004;63(1):51–5.
20. Clavien PA, Barkun J, de Oliveira ML, et al. The Clavien-Dindo classification of surgical complications: five-year experience. Ann Surg. 2009;250(2):187–96.