13 Robotic-Assisted Intracorporeal Urinary Diversion

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13.1 Introduction

The creation of the urinary diversion is a challenging surgical part after radical cystectomy and holds a special place in the development of urological practice. Following cystectomy, urine can either be diverted into an incontinent stoma, into a continent urinary reservoir catheterised by the patient or controlled by the anal sphincter, or into an orthotopic bladder substitute so that the patient voids per urethra.

During the last decade, urologists worldwide have witnessed a tremendous development of laparoscopic surgical treatment due to the development of robot-assisted surgery in many urological diseases. In parallel, the interest in expanding the role of robot-assisted radical cystectomy (RARC) for the management of urinary bladder cancer has risen during the last years and continues to grow. Robotic-assisted laparoscopic techniques have emerged allowing surgeons to more readily overcome the difficult learning curve and shorten operative times in minimally invasive abdominal and pelvic operations [1].

RARC has been grown steadily during the last years and has replaced LRC in centres where the robot is available. The neobladder can be formed intracorporeally [2–5], but operative time may be reduced if this is done extracorporeally through the same incision used to deliver the cystectomy specimen.

Most RARC surgeons advocate a combination of robotic-assisted laparoscopy and open surgery, performing the cystectomy and extended PLND with the robot, but due to technical difficulties and longer operative time [6–10] using an extracorporeal approach for the construction of the conduit or neobladder [6]. However, some centres including our own institution have developed techniques for RARC with a complete intracorporeal urinary diversion [2, 3].

Herein, we describe step by step the method used at the Karolinska Institutet for robot-assisted urinary diversion with ileal conduit and orthotopic neobladder by intracorporeal technique.

13.2 Patient Selection

The inclusion criteria for robotic-assisted continent or non-continent urinary diversion are the same as for open surgery. The selection process includes preoperative investigation to ensure fitness for surgery as well as specific counselling about robotic technology. Patients with decreased pulmonary compliance who cannot tolerate the Trendelenburg position are not candidates for the robot-assisted technique. Furthermore, if the patient has a history of previous extensive abdominal surgery, RARC may be contraindicated. Patients with bulky disease should be avoided.

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13.3 Preoperative Preparation

In patients scheduled for receiving an intracorporeal orthotopic neobladder, mechanical bowel preparation (osmotic laxative) may be used the day before surgery. A stoma site is also marked the day before surgery. Broad-spectrum intravenous antibiotics are administered at the start of the procedure.

13.4 Operative Setup

13.4.1 Patient Position

After induction of general endotracheal anaesthesia, a nasogastric tube and an 18-Ch Foley urinary catheter are inserted. The patient is placed in lithotomy position with arms adducted and padded. The legs are also abducted and slightly lowered on spreader bars. The table is placed in 25° Trendelenburg position during the RC and PLND. For the urinary diversion, the Trendelenburg position is decreased to 10–15°.

13.4.2 Equipment

The technique is challenging, requiring conventional laparoscopic infrastructure as well as an assistant skilled in conventional laparoscopy. Standard laparoscopic surgical equipment must be supplemented by some extra instruments (Ligasure® Covidien, surgical endoscopy clip applicators, laparoscopic Endo-Catch bags and laparoscopic stapler for intestinal stapling).

13.4.3 Trocar Configuration

Port placement is critical for successful robotic surgery. A six-port technique is used with the camera port placed 5 cm above the umbilicus in the midline. The camera port is placed by a small mini laparotomy as described by Hasson [11], and the other ports are placed in view of the camera. Pneumoperitoneum between 10 and 12 mmHg is desirable during the procedure, but during the port placement, a pressure of 18 mmHg can be helpful in creating additional tension on the abdominal wall. Two robotic ports are placed symmetrically and level with the umbilicus on the left and right side, lateral to the rectus sheath. A third robotic instrument port is placed just above and medial to the left anterior superior iliac spine through a 15-mm port, thereby enabling laparoscopic stapling by the assistant when the third robotic port is temporarily disconnected. Two assistant ports are placed, one on either side of the right robotic instrument port (Fig. 13.1).

13.4.4 Urinary Diversion

13.4.4.1 Orthotopic Neobladder

Anastomosis Between the Urethra and Ileum

After the cystectomy and the lymph node dissection are finished, the urinary diversion is performed. The first step is to perform an anastomosis between the ileum and the urethra. The 0° lens is used for this initial step. The ileum is sufficiently mobilised in order to reach down to the urethra. This is important for two reasons, first the anastomosis between the neobladder and urethra can be performed without tension, and second the neobladder will be placed correctly in the small pelvis during the whole procedure. This will help during construction of the neobladder by running suture. A 20-Ch opening (Fig. 13.2) is made in the antimesenteric site of ileum, using robotic scissors. The anastomosis is performed according to the Van Velthoven technique with a 16 cm 4-0 Quill™ suture, allowing for 10–12 stitches (Fig. 13.3). A needle driver and a Cadiere are used to establish the anastomosis.

Isolation of 50-cm Ileum

The orthotopic neobladder is fashioned from a 50-cm segment of terminal ileum. The intestine is isolated using laparoscopic Endo-GIA with a 60-mm intestinal stapler (Fig. 13.4). The stapler is inserted by the assisting surgeon, using the 15-mm port on the left side. The ileum is stapled 40 cm proximal to the urethral-ileal anastomosis.

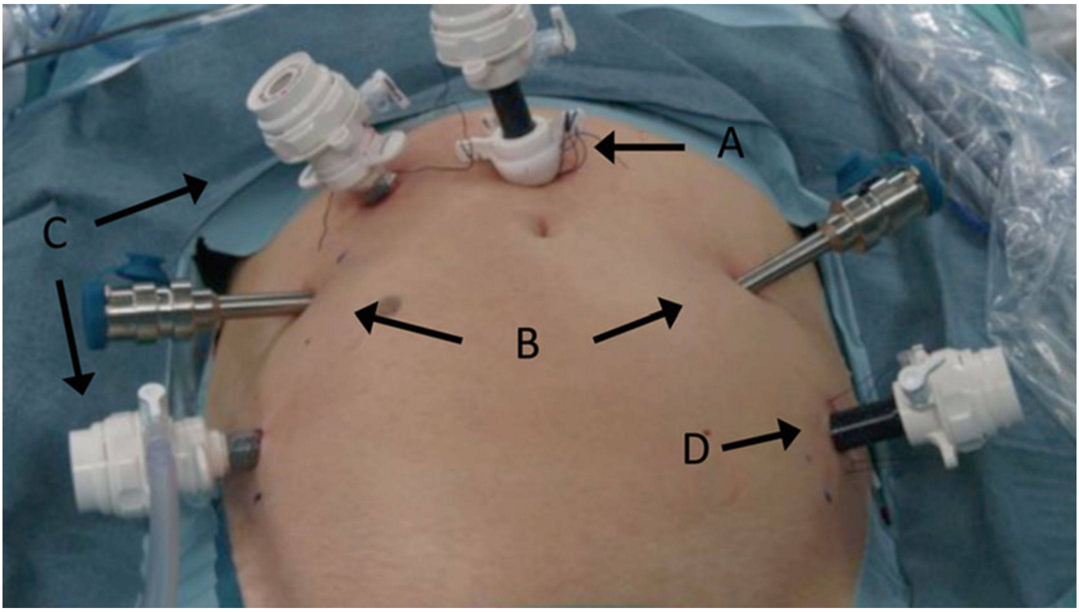


Fig. 13.1 Trocar placement for standard da Vinci system. (*A*) Camera trocar. (*B*) 8-mm trocar, right and left robot instrument. (*C*) 12-mm trocar, suction, bowel grasping, Ligasure. (*D*) 15-mm four robotic arm, specimen retrieval and stapling

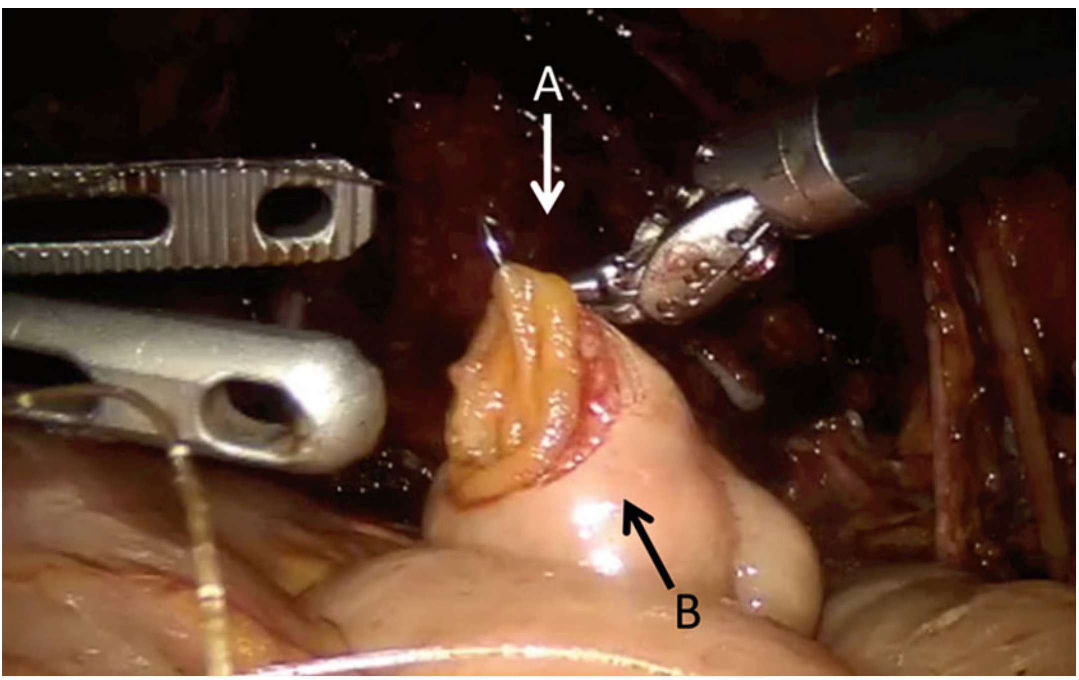


Fig. 13.2 An opening (*A*) in the ileum (*B*) is performed to allow the passing of a 20-Ch catheter

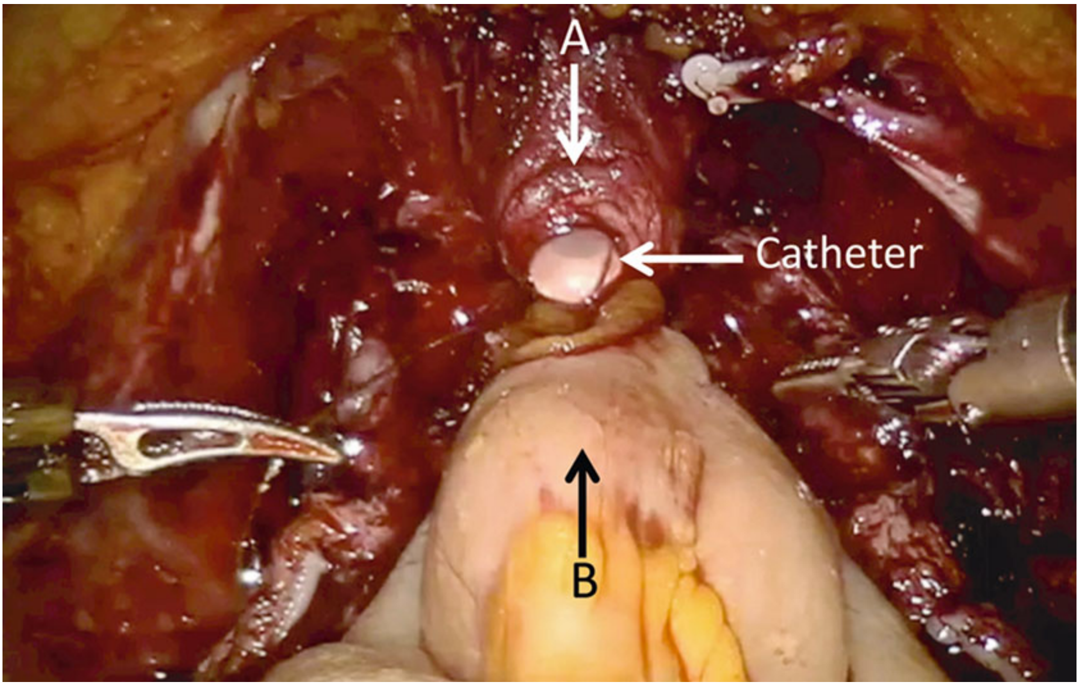
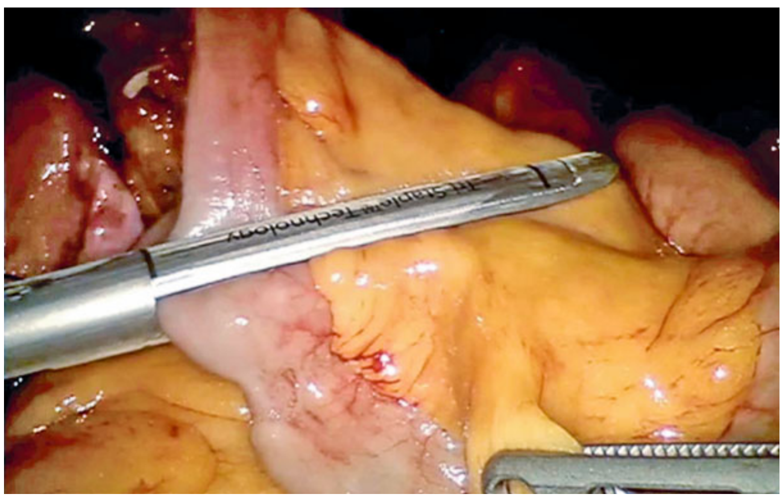


Fig. 13.3 Anastomosis between urethra (*A*) and ileum (*B*) using a 16-cm 4-0 Quill™ suture

Fig. 13.4 Stapling of the ileum, using Endo GIA 60 mm



The continuity of the small bowel is restored by using Endo-GIA with a 60-mm intestinal stapler, positioning the distal and proximal end of the ileum side to side with the antimesenterial parts facing each other (Fig. 13.5). An additional transverse firing of the Endo-GIA stapler is used to close the open ends of the ileal limbs (Fig. 13.6).

Detubularisation

The distal 40 cm of the isolated ileal segment is detubularised along its antimesenteric border

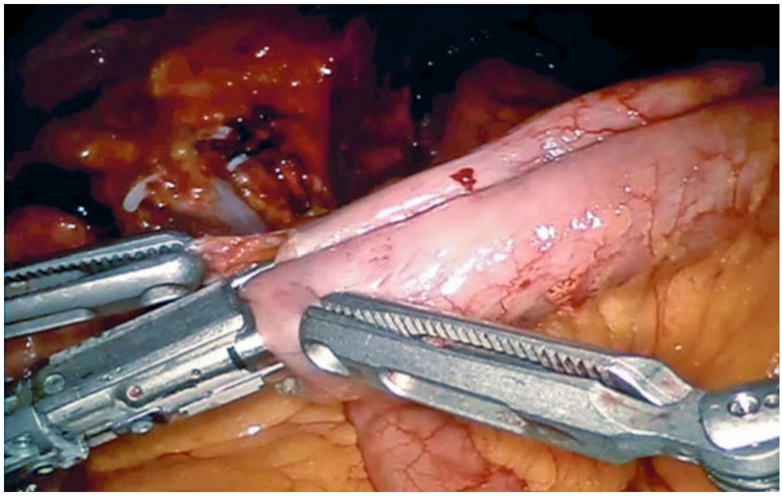


Fig. 13.5 Side to side anastomosis of the ileum by Endo GIA 60 mm

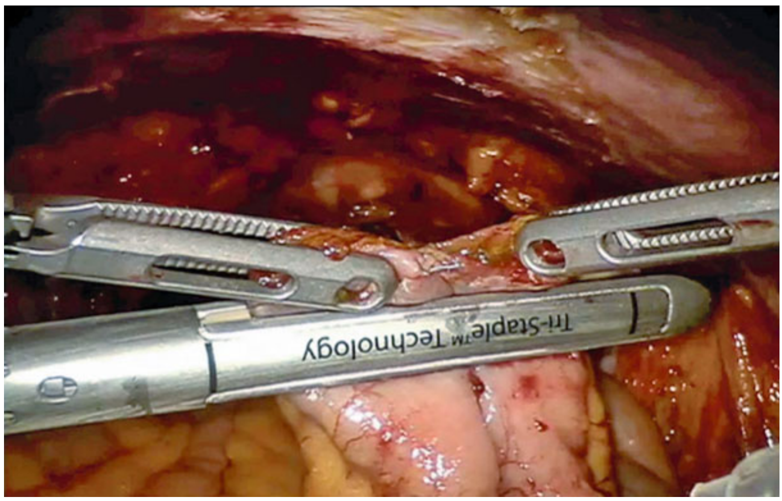


Fig. 13.6 Closing of the open end of the ileal limbs, using the Endo GIA stapler

with cold scissors (Fig. 13.7), leaving a 10-cm intact proximal isoperistaltic afferent limb. Care is taken not to interfere with the sutures used for the anastomosis to the urethra (Fig. 13.8).

Formation of Studer Neobladder

After detubularisation, the posterior part of the Studer reservoir is closed using multiple running sutures (15-cm 3-0 V-Loc™) in a seromuscular fashion, avoiding suturing the mucosa. After the posterior part is sutured, the distal half of the anterior part of the reservoir is sutured, using the same suture. The 0° or 30° lens can be used for this part of procedure. The proximal half of the anterior part of the reservoir is left open and is closed in the last part of the procedure.

Ureteric Entero-Anastomosis

The anastomosis between the ureters and the afferent limb is performed using the Wallace technique [11] using a 0° lens. A 3-0 Biosyn® stitch is placed at the distal end of each ureter. The left ureter is tunnelled under the sigmoid mesentery to the right side. The ureters are then incised and spatulated 2 cm (Fig. 13.9). The posterior walls

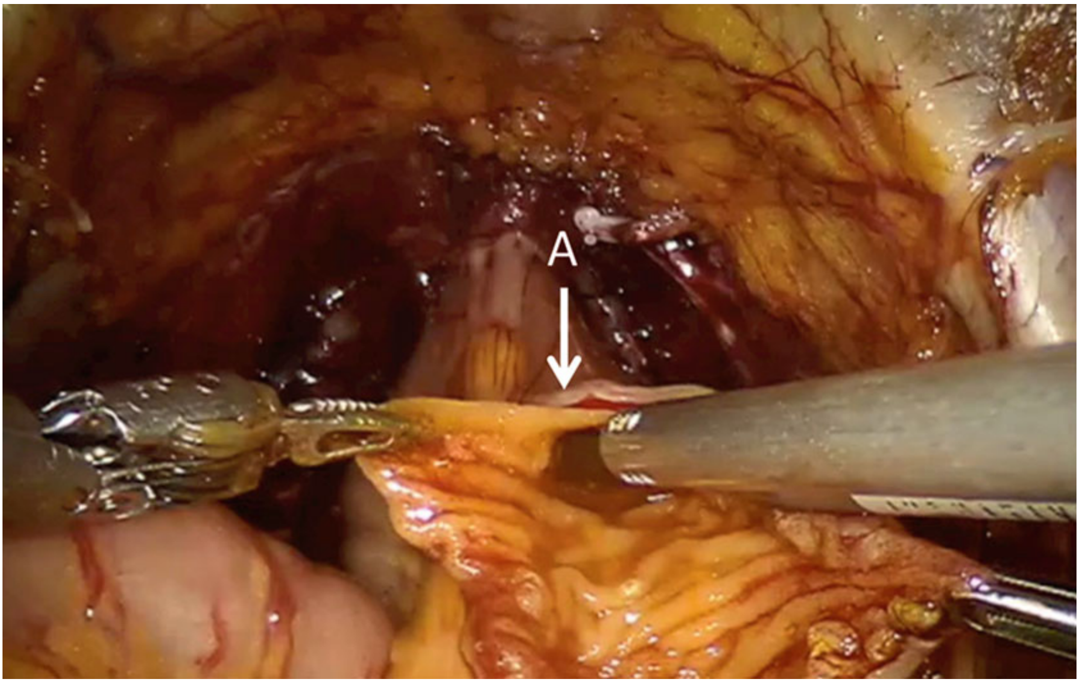


Fig. 13.7 Detubularisation of the ileum, antimesenterically (*A*) in order to create the neobladder

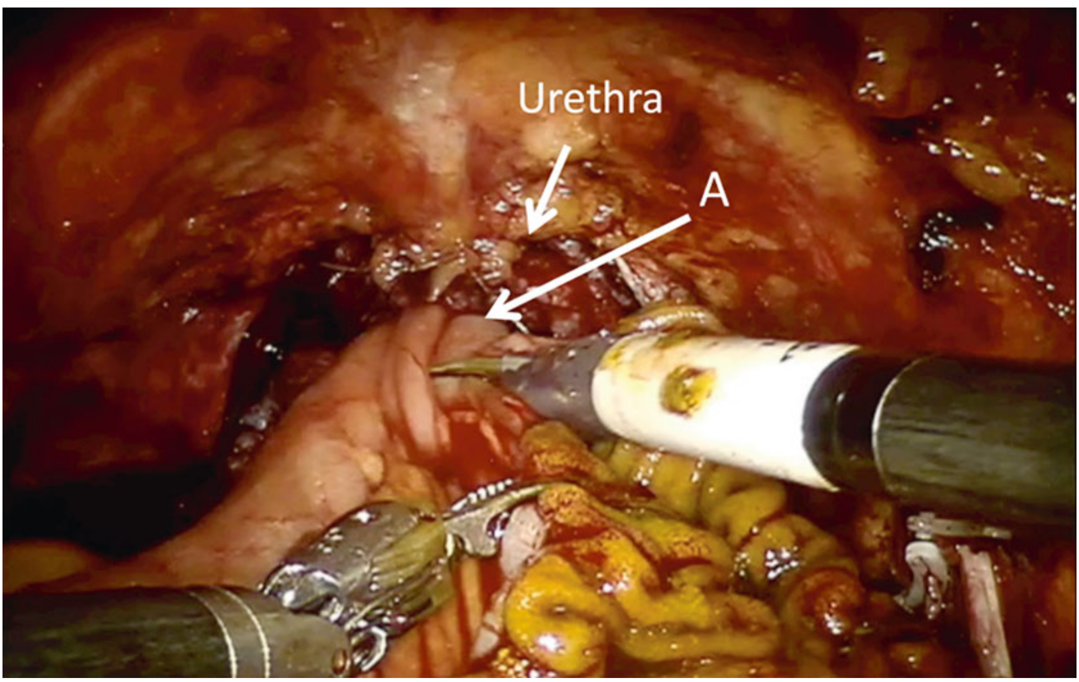


Fig. 13.8 Detubularisation, close to the ileourethral anastomosis (*A*), special care is taken not to interfere with the anastomotic suture

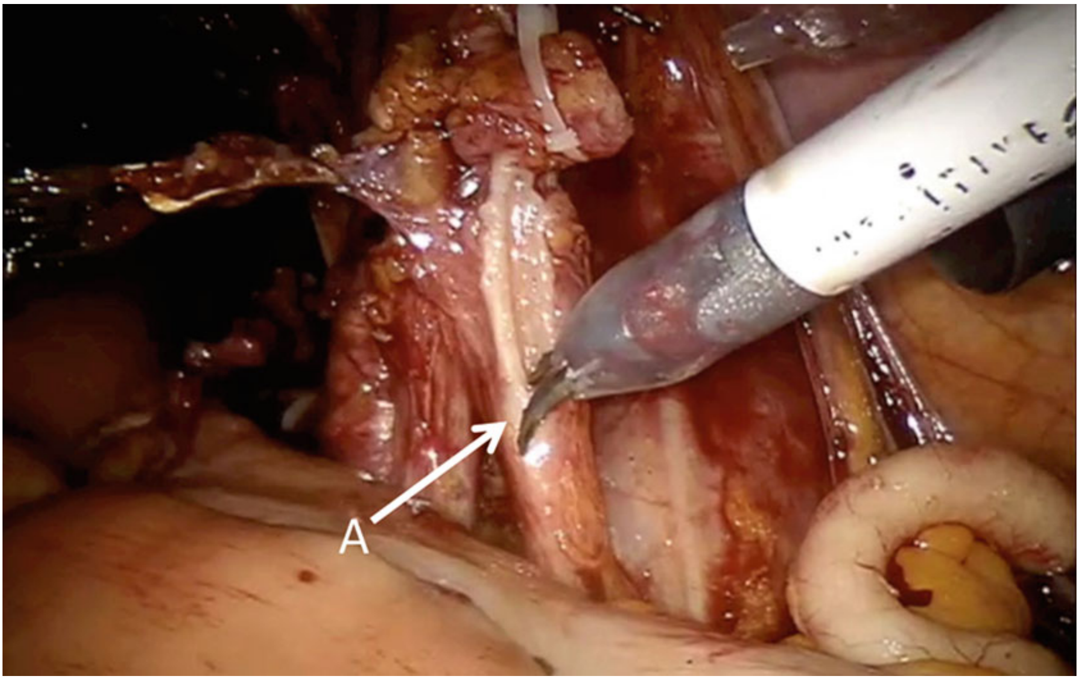


Fig. 13.9 Spatulation of the right ureter (*A*)

of the ureters are sutured side to side, using a 15-cm 4-0 V-Loc™ suture. Before the anastomosis between the ureters and the intestinal loop is performed, two Single-J 40-cm ureteric stents are introduced with Seldinger technique [12] through two separate 4-mm incisions at the lower part of the abdominal wall. The stents are pulled through the afferent limb (Fig. 13.10) and pushed up into the ureters on each side (Fig. 13.11). The ureters are then sutured to the afferent limb of the Studer pouch, using a 16-cm 4-0 Quill™ suture (Fig. 13.12). After the ureteric entero-anastomosis is completed, the stents are sutured and fixed to the skin.

Closure of the Studer Reservoir

The remaining part of the reservoir is then closed with a running 3-0 V-Loc™ suture, using a 0° lens. The balloon of the indwelling catheter is filled with 10 cc. The neobladder is then filled with 50 cc of saline to check for leakage (Fig. 13.13). If leakage is observed, extra sutures will have to be considered. A 21-Ch passive drainage is introduced and placed in the small pelvis.

13.4.4.2 Ileal Conduit, Intracorporeal Technique

Twenty centimetre of intestine is isolated from the terminal ileum, using an Endo-GIA with 60-mm intestinal staples. The continuity of the small bowel is restored as described above. The distal end of the conduit is fashioned as a stoma by the surgical assistant at the previously marked site on the abdominal wall. The left ureter is tunnelled under the sigmoid mesentery to the right side. The ureters are then incised and spatulated 2 cm. The Wallace technique is used here as described above. Single-J 40-cm ureteric stents are then introduced through the isolated ileal segment (ileal conduit). The stents are then pushed up into the ureters on each side and the ureteroenteric anastomosis is completed, using a two times 16-cm 4-0 Quill™ suture.

13.4.5 Special Considerations

13.4.5.1 Patient Position

Care should be taken to use a pneumatic leg compression system due to risk of decreased vascular

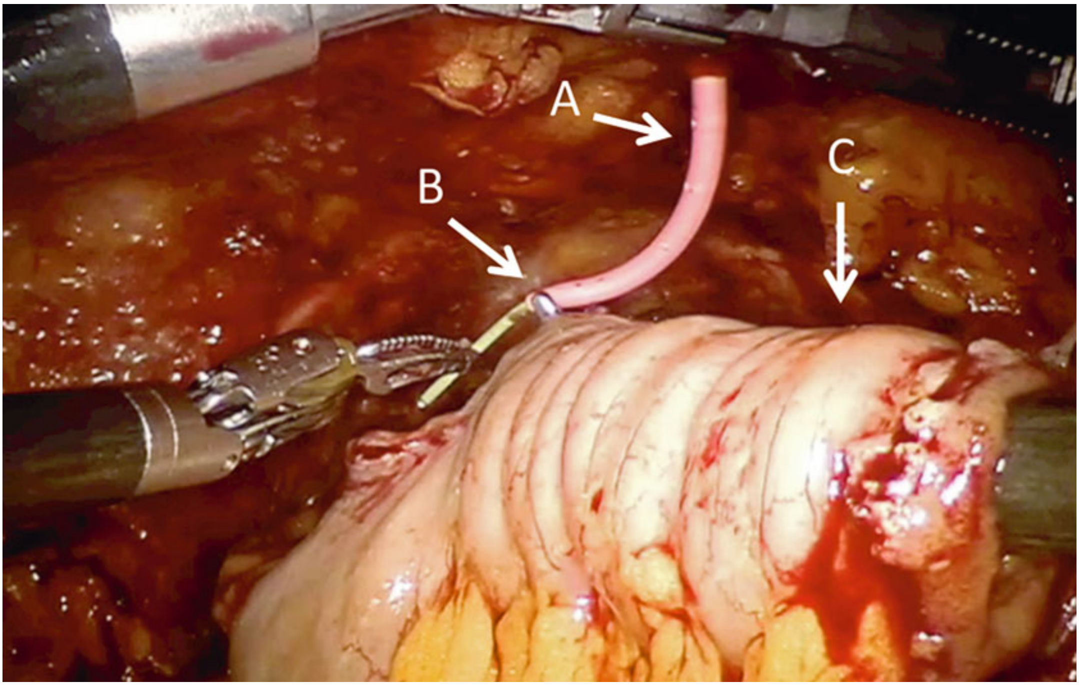


Fig. 13.10 Placement of a ureter stent (*A*) through a 3-mm port. The right robotic instrument (*B*) grasps the tip of the stent and inserts it upwards through the afferent limb (*C*) of Studer reservoir

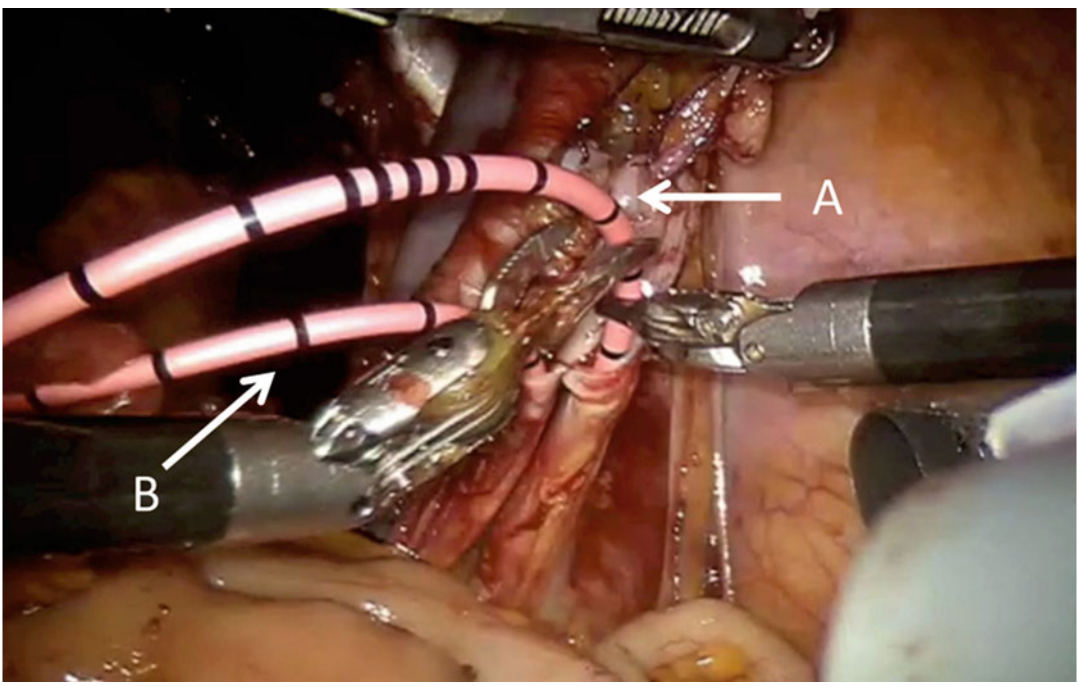


Fig. 13.11 Placement of a stent into the right ureter (*A*). The left ureter stent is already in place (*B*)

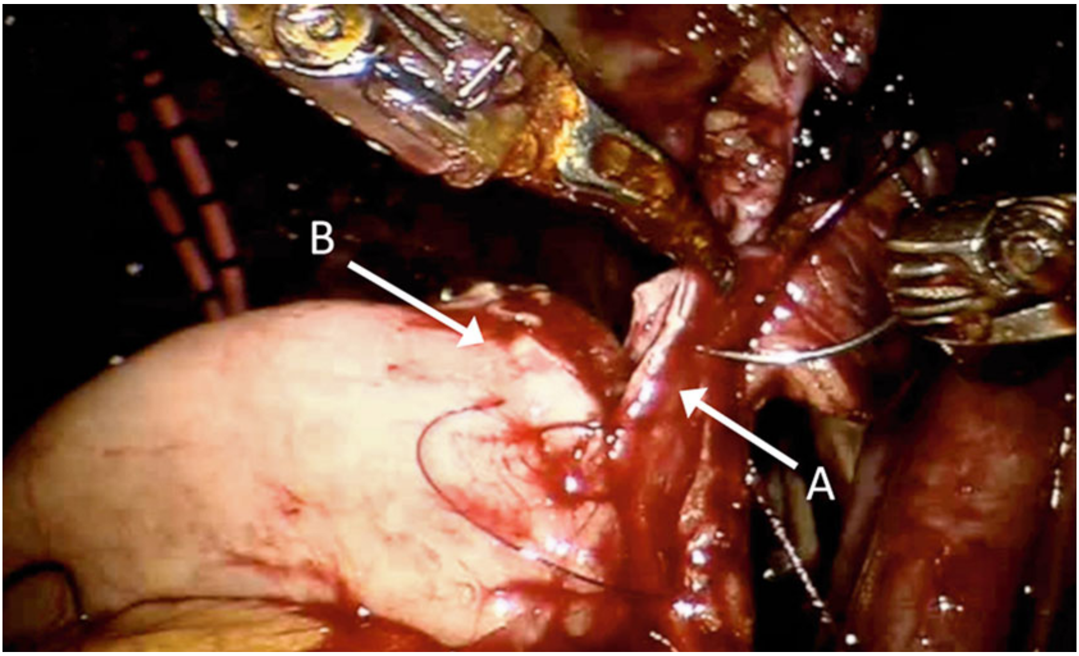


Fig. 13.12 Anastomosis between Wallace plate (*A*) and afferent limb (*B*) of the Studer reservoir, using a seromucosal suturing technique

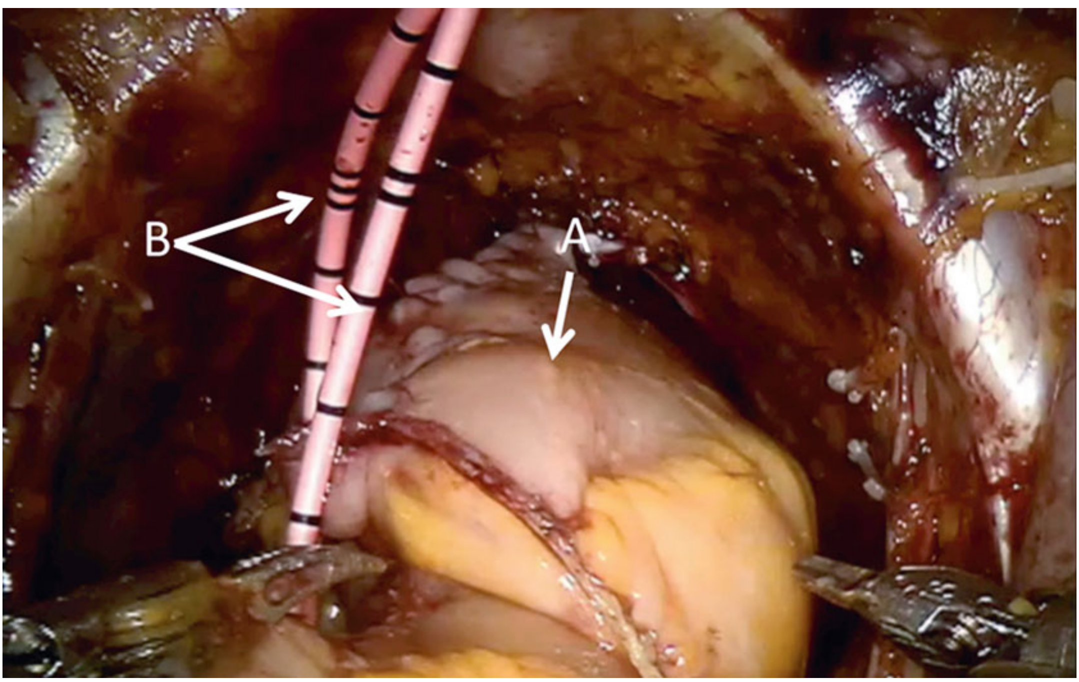


Fig. 13.13 After the neobladder (*A*) is completed, it is filled with 50-cc saline to check for leakage. The ureteric stents (*B*) are placed separately in the Studer reservoir

perfusion during the procedure. To avoid cardiovascular complications for the patient, anticoagulant treatment is started with low-molecular-weight heparin according to the patient's body weight, the evening before surgery and until the patient is fully mobilised. It is feasible to perform the urinary diversion with a 10–15° Trendelenburg, as a higher Trendelenburg inclination is to be avoided to minimise the risk for cardiopulmonary complications.

13.4.5.2 Port Position

It is always important to make sure the fourth arm port and the left robotic arm port are not in the same alignment to avoid clashing of the robotic arms.

13.4.5.3 Urethral-Neobladder Anastomosis

Making the anastomosis between the urethra and the ileum should be the first step in the formation of an intracorporeal orthotopic neobladder. This is a critical step because the anastomosis can be made without tension, and the neobladder will be placed correctly in the small pelvis during the whole procedure.

13.5 Steps to Avoid Complication

Shoulder pads should be avoided due to high risk for plexus damages. Care should be taken during the tunnelling of the left ureter behind the colon sigmoid to avoid damaging any vascular structures. It is important to check for leakage after the neobladder has been created. Extra suturing to secure a water-tight reservoir and anastomosis is fundamental to decreasing postoperative complications.

13.6 Discussion

With the introduction of the da Vinci® robotic system (Intuitive Surgical) in urological clinical practice, a large number of robot-assisted surgical procedures have been performed. Compared with the traditional laparoscopic technique, the hand-eye alignment and depth perception provided by the robotic system are advantageous and may eventually be superior to using open procedures, resulting in less surgical morbidity and a shorter learning curve. However, RARC with totally intracorporeal urinary diversion is still considered a technically challenging procedure [2, 3, 9]. Since the first report by Beecken et al. [2] in 2003 RARC, PLND and urinary diversion have been adopted by several institutions worldwide, and today >1,500 procedures have been reported to the IRCC.

It has been debated whether the intracorporeal technique for urinary reconstruction has any advantages over the extracorporeal technique. The intracorporeal technique allows the restoration of small bowel continuity and the construction of the neobladder performed without incision of the abdominal wall. In the female, the specimen may be taken out through an incision in the vaginal wall, and in the male, the specimen is extracted through a small incision at the end of the procedure. It has been argued that the intracorporeal approach should only be used if specimen retrieval may be performed without an additional incision. The intracorporeal reconstruction is less traumatic for the patient, but on the other hand, more technically demanding for the surgeon. Robotics makes an intracorporeal technique a more feasible procedure even though most centres prefer an extracorporeal approach for urinary diversion [6–8, 10]. One major advantage of performing the urinary diversion intracorporally is that performing the running suture of the anastomosis between the urethra and the ileum minimises the risk of urinary leakage. There is also less traction to the anastomosis between the reservoir and the urethra using an intracorporeal approach, as an appropriate ileal segment long enough to reach down to the urethra can be used [1].

The robotic system may positively influence functional results at RARC, especially if a nerve-sparing procedure is attempted. Furthermore, this system might facilitate suturing the anastomosis between the urethra and the reservoir, which in turn may improve urinary continence.

Conclusion

RARC with totally intracorporeal urinary diversion for patients with TCC of the bladder is technically feasible and reproducible with results comparable with those from ORC series and with acceptable complication rates, adequate lymph node yield and good functional results.

References

1. Schumacher MC, Jonsson MN, Wiklund NP (2009) Robotic cystectomy. Scand J Surg 98:1–17
2. Beecken WD, Wolfram M, Engl T et al (2003) Robotic-assisted laparoscopic radical cystectomy and intra-abdominal formation of an orthotopic ileal neobladder. Eur Urol 44:337–339
3. Sala LG, Matsunaga GS, Corica FA, Ornstein DK (2006) Robotassisted laparoscopic radical cystoprostatectomy and totally intracorporeal ileal neobladder. J Endourol 20:233–236
4. Balaji KC, Yohannes P, McBride CL, Oleynikov D, Hemstreet GP III (2004) Feasibility of robot-assisted totally intracorporeal laparoscopic ileal conduit urinary diversion: initial results of a single institutional pilot study. Urology 63:51–55
5. Hosseini A, Adding C, Nilsson A, Jonsson MN, Wiklund NP (2011) Robotic cystectomy: surgical technique. BJU Int 108(6 Pt 2):962–968
6. Murphy DG, Challacombe BJ, Elhage O et al (2008) Robotic-assisted laparoscopic radical cystectomy with extracorporeal urinary diversion: initial experience. Eur Urol 54:570–580
7. Wang GJ, Barocas DA, Raman JD, Scherr DS (2008) Robotic vs. open radical cystectomy: prospective comparison of perioperative outcomes and pathological measures of early oncological efficacy. BJU Int 101:89–93
8. Pruthi RS, Wallen EM (2007) Robotic assisted laparoscopic radical cystoprostatectomy: operative and pathological outcomes. J Urol 178:814–818
9. Keim JL, Theodorescu D (2006) Robot-assisted radical cystectomy in the management of bladder cancer. Scientific World Journal 6:2560–2565
10. Guru KA, Kim HL, Piacente PM, Mohler JL (2007) Robot-assisted radical cystectomy and pelvic lymph node dissection: initial experience at Roswell Park Cancer Institute. Urology 69:469–474
11. Hasson HM (1978) Open laparoscopy vs. closed laparoscopy: a comparison of complication rates. Adv Plan Parent 13:41–50
12. Bigongiari LR (1981) The Seldinger approach to percutaneous nephrostomy and ureteral stent placement. Urol Radiol 2:141–145