Technique of Extracorporeal Urinary Diversion

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14.1 Introduction

The purpose of this chapter is to provide a step-by-step approach to the different extracorporeal urinary diversions that may be performed in the setting of robotic-assisted laparoscopic radical cystectomy (RARC). Recent reports indicate comparable results to open surgery with regard to intermediate-term oncological outcomes and extent of pelvic lymph node dissection [1, 2]. However, operative times are one of the main obstacles that hinder widespread acceptance of RARC. Extracorporeal urinary diversion with RARC provides a method of reconstruction that mirrors that of open surgery with regard to operative times [3]. Complication rates and functional outcomes with extracorporeal urinary diversion also appear comparable to open series [4–6].

We will discuss in detail the extracorporeal techniques of a Studer orthotopic neobladder, Indiana pouch continent cutaneous urinary diversion, and ileal conduit urinary diversion. At our institution, we have performed more than 250 RARCs. All urinary diversions were performed extracorporeally and the majority were continent urinary diversions. We describe our technique that follows a common template, which can be applied to all types of urinary diversion.

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We first describe the technique of the Studer orthotopic neobladder. This is the most technically difficult of the three diversions because there are more maneuvers required to adapt it to robotic surgery, and because the robot needs to be re-docked. The Indiana pouch and ileal conduit techniques are simpler variations of the same basic template. The port site placement used for the cystectomy portion and referenced later in this chapter has been previously described [7].

14.2 Studer Orthotopic Neobladder

The extracorporeal Studer neobladder technique is best described in three stages: steps performed prior to undocking the robot, steps performed while the robot is undocked, and steps performed when the robot is re-docked.

14.2.1 Steps Performed Prior to Undocking the Robot

During the course of the radical cystectomy, there are a number of maneuvers that facilitate the creation of the neobladder. We typically divide our ureters early in the operation. The ureters are divided between extra large Weck Hem-o-lok® clips. The clips have a pre-tied 8-cm dyed or un-dyed suture to denote left and right. The clips are placed on the ureter through the right iliac 12-mm bedside assistant's port in a right to left

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orientation. This allows us to identify any twists in the ureter at the time of the uretero-ileal anastomosis. The ureteral sutures are placed aside, out of the operative field, during the completion of the cystectomy.

As the urethra is divided, we place a 9-in. 2-0 Vicryl™ (Ethicon, New Brunswick, NJ) suture at the 6 o'clock position of the urethra that will be used for the first stitch in the urethral anastomosis. The needle is set aside in the retropubic fat so that it can be easily found when the robot is re-docked for the anastomosis.

Once the cystectomy and lymph node dissection are complete, there are a small number of final steps performed prior to undocking the robot. The left ureter is brought under the sigmoid mesentery by guiding the attached suture with a laparoscopic grasper. An 8-cm silk stitch is placed in the terminal ileum to allow for quick identification through the small midline incision. A 16-Fr red Robinson catheter with an 8-cm silk suture pre-tied to the end is placed in the urethra. The catheter will later be sutured to the neobladder to serve as a handle for the assistant to bring the assembled neobladder down into the pelvis. The two ureteral sutures, the ileal suture, and the red Robinson suture are then placed into the assistant's laparoscopic grasper by the console surgeon. This allows for all four of the components to be readily available for the urinary diversion when the robot is undocked and the midline incision is opened.

14.2.2 Steps Performed After Undocking the Robot

The robot is undocked but kept sterile as it will be used for the urethral anastomosis. The gas is turned off and all port sites are kept in place with the exception of the midline port. We keep the patient in Trendelenburg position to keep the small bowel out of the way during the neobladder construction. The midline incision is extended inferiorly 6–8 cm, and the specimen is extracted using an Endo Catch™ II 15-mm specimen pouch (Covidien, Mansfield, MA). The use of the specimen bag serves to preserve the intact specimen and to also facilitate using a smaller incision. While the specimen can be removed through a generally smaller incision, 6 cm is approximately the smallest incision that allows us to place the constructed neobladder back into the abdomen.

The laparoscopic grasper holding the sutures on the ureters, ileum, and urethral catheter is brought out through the midline incision. The ureters are placed in their correct anatomic orientation, using both visual and manual evaluation to check for twisting or crisscrossing of the ureters.

The ileum is then brought out through the incision to create the ileal neobladder. For orthotopic diversions, we prefer a low-pressure ileal reservoir as described by Studer; however, this technique will also accommodate most other types of orthotopic diversion [8].

Prior to the construction of the reservoir, bowel continuity is restored by means of a stapled anastomosis and the mesenteric trap is closed.

We isolate a 60-cm segment of distal ileum beginning 15 cm proximal to the ileocecal valve. We prefer to discard a 5-cm segment of ileum proximally to afford us better mobility of the neobladder down to the urethra and farther from the bowel anastomosis (Fig. 14.1). The neobladder is constructed in the exact manner as would be done open.

Once the neobladder is complete, we estimate the most dependent portion where we think the urethra will be anastomosed. We place a dyed 0 Vicryl™ figure-of-eight suture at the estimated 6 o'clock portion of the neourethra that will be used as a handle by the console surgeon's fourth arm using a ProGrasp™ forceps (Fig. 14.2). An additional suture is placed in the same position and sutured to the red Robinson catheter that is in the urethra. This acts as an additional handle for the bedside assistant to help bring the neobladder down into the pelvis. An un-dyed Vicryl™ is placed at the 12 o'clock portion of the neourethra to give the console surgeon better orientation of the pouch and to provide an additional handle with which to manipulate the pouch.

The neobladder is then placed into the pelvis with only the afferent limb and bilateral ureters exposed at the midline incision (Fig. 14.3). An Adson-Beckman retractor is sometimes

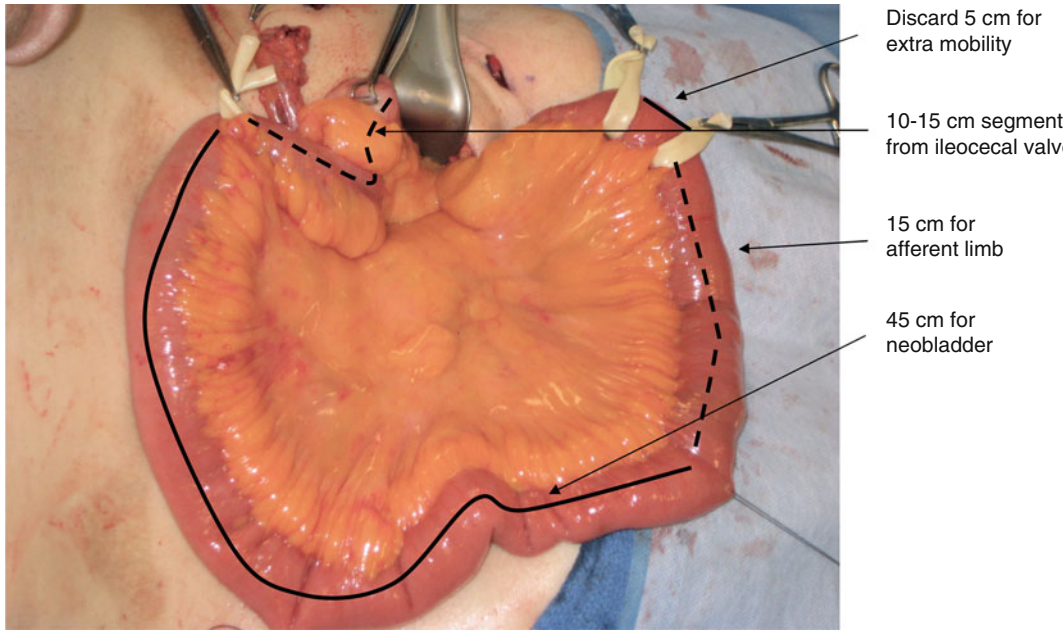

Fig. 14.1 The 6-cm incision provides excellent exposure of small bowel for neobladder reconstruction

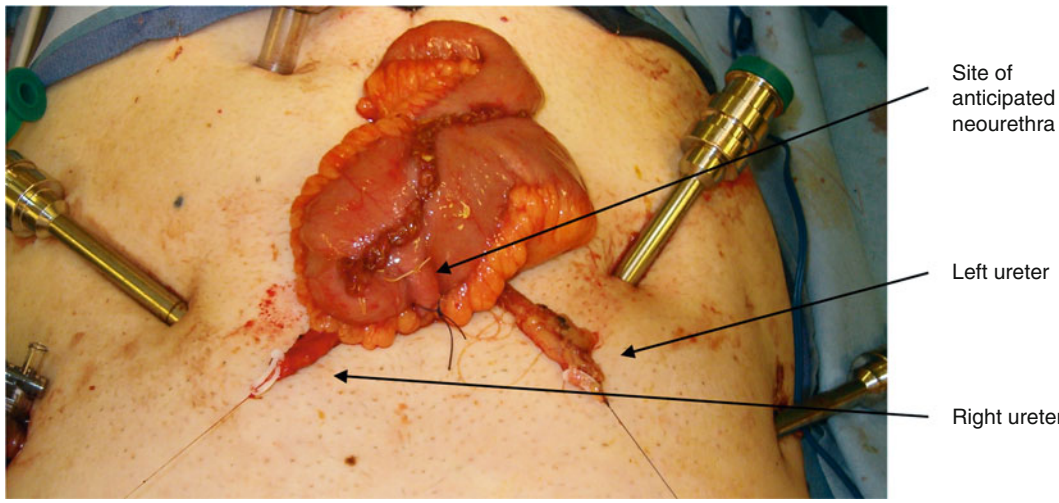

Fig. 14.2 The neobladder is completed with the 6 and 12 o'clock sutures placed at the site of the anticipated neourethra

used to improve exposure for the uretero-ileal anastomosis.

The ureters are once again inspected to ensure they are oriented in their correct anatomic positions. Each ureter is then spatulated and individually sewn in an end-to-side fashion with interrupted 4-0 Vicryl™ sutures. Each uretero-ileal anastomosis is stented with an 8-Fr feeding tube that is brought out through an opening in the afferent limb and beside the right paramedian robotic port. The feeding tubes are secured at the afferent limb with a 3-0 plain gut purse-string suture.

The midline incision is then closed to the level of the camera port site. We utilize four pre-placed interrupted size one polypropylene sutures at the

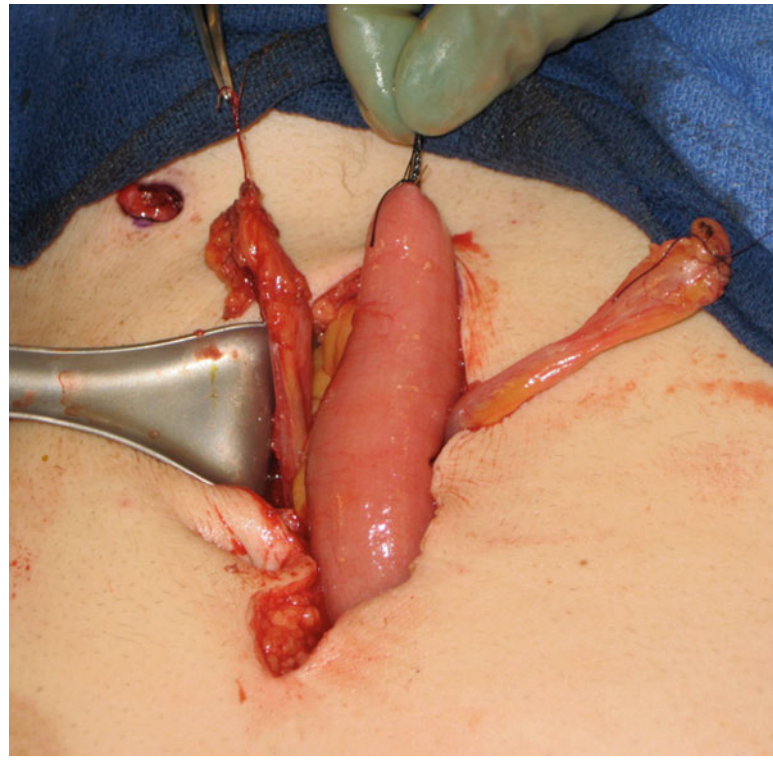

Fig. 14.3 The completed neobladder is placed back into the abdomen, leaving only the ureters and afferent limb exposed for the uretero-ileal anastomoses

superior aspect of the incision where the camera port is replaced. We are then able to tie down one or two of the interrupted sutures with the port in place to ensure an airtight seal for re-insufflation. The robot is then re-docked.

14.2.3 Steps Performed After Re-docking the Robot

The urethral anastomosis is performed robotically using either a 0° or 30° down lens. We first inspect the uretero-ileal anastomoses to ensure they are lying in their correct orientation.

The redundant sigmoid colon is moved out of the pelvis. The neobladder is then brought down into the pelvis by the console surgeon using the pre-placed 6 o'clock Vicryl™ handle and the fourth arm. The assistant can aid in the maneuver by placing gentle traction on the red Robinson catheter that is also attached to the 6 o'clock position of the neobladder.

Occasionally, the neobladder does not completely reach the urethra, creating tension at the anastomosis. Two maneuvers can be employed to decrease this tension. The first is simply perineal pressure. The second is to undock the robot, minimize the Trendelenburg, and re-dock the robot.

The site of the urethral anastomosis on the neobladder is opened using a robotic shears. This site is determined by choosing an area where the opening is well visualized and easy to work with.

Using the 2-0 Vicryl™ suture that was pre-placed at the 6 o'clock position of the urethra at the time of the urethral division, we begin the urethral anastomosis by re-approximating the urethral plate with 3–4 interrupted sutures. Additional 3-0 Vicryl™ sutures are placed at the 5 and 7 o'clock positions and run anteriorly to be tied at 12 o'clock. We typically use CT-3 needles for the urethral anastomosis, but RB-1 needles are sometimes used in very narrow pelvises.

The completed anastomosis is tested by irrigating the neobladder with 60–120 ml of normal saline. Any visible area of extravasation from either the neobladder or the anastomosis is reinforced with an additional 3-0 Vicryl™ suture.

A new two-way 18-Fr hematuria catheter is placed into the neobladder to gravity drainage.

A closed suction drain is placed through the left paramedian robotic port and placed over the urethral anastomosis and adjacent to our ureteroileal anastomoses. The drain and stents are secured with sutures. The robot is then undocked. The closure of the midline incision is completed with the pre-placed polypropylene sutures. The stents are cut 5 cm from the skin and placed to gravity drainage using a urostomy drainage bag, and the skin incisions are closed.

14.3 Indiana Pouch Continent Cutaneous Catheterizable Reservoir

With the Indiana pouch, minimal steps are required prior to undocking the robot. As with the neobladder, the ureteral sutures are secured with a laparoscopic grasper through the right iliac port.

We undock the robot but keep the abdomen insufflated with all ports in place. The Trendelenburg is decreased and the table tilted left as far as possible. Using our existing port placements, we use a conventional laparoscopic technique to mobilize the right colon and hepatic flexure.

The table is then leveled, the ports are removed, the midline camera incision is extended inferiorly 7–8 cm, and the specimen is removed. This incision is larger than the incision made for the neobladder because the pouch tends to be bigger and this also allows us better exposure for the ureterocolonic anastomoses. In obese patients, the size of this incision may need to be further increased to optimize exposure.

We isolate the 15 cm of proximal ileum along with 31 cm of right colon (Fig. 14.4). The avascular plane of Treves is divided to allow mobility to our stomal segment. Bowel continuity is then reestablished using a side-to-side ileal-colic-stapled bowel anastomosis. The mesenteric trap is then closed.

We perform a modified Indiana pouch as described by Ahlering et al., but this technique can be adapted to most continent catheterizable pouches [9]. We use a 24-Fr Malecot catheter as a suprapubic catheter that exits out the most superior aspect of the Indiana pouch and is brought out through the assistant's epigastric port site. The suprapubic tube is secured to the anterior abdominal wall in a Stamm fashion. The right paramedian robotic port site is then used as the stoma location, provided it is traversing the rectus abdominus. If the suprapubic port site is too high, it can distract and place tension on the ureteral anastomoses. In this situation, we use the right paramedian robotic port site for the suprapubic tube, and create a separate more inferior opening for the stoma.

The ureters are anastomosed to the Indiana pouch separately in an end-to-side fashion and stented with 8 French feeding tubes. The stents are secured at an opening in the Indiana pouch with a 3-0 plain gut suture and brought out through the right iliac port site. The stents are secured at the skin with a suture and placed to a urostomy gravity drainage bag. A closed suction drain is placed along the pouch and adjacent to our uretero-colonic anastomoses and brought out through the left paramedian robotic port site. The stoma is dressed with a petroleum dressing and not cannulated until the time of pouch training. The midline incision is then closed.

14.4 Ileal Conduit Urinary Diversion

Prior to undocking the robot, as with the neobladder, the ureteral and ileal sutures are secured on a laparoscopic grasper through the right iliac port. The ports are then removed and the midline camera port site is extended 4–5 cm. This incision can be smaller since it does not have to accommodate a pouch. The specimen is removed and the ureters and ileum are brought out through the incision and oriented.

We isolate our distal ileal segment in the conventional open fashion, discarding an additional 5-cm segment of ileum proximally to give us additional mobility of the afferent aspect of our conduit. Bowel continuity is reestablished with an ileal-ileal side-to-side stapled anastomosis.

Our uretero-ileal anastomoses are performed using a Bricker end-to-side spatulated

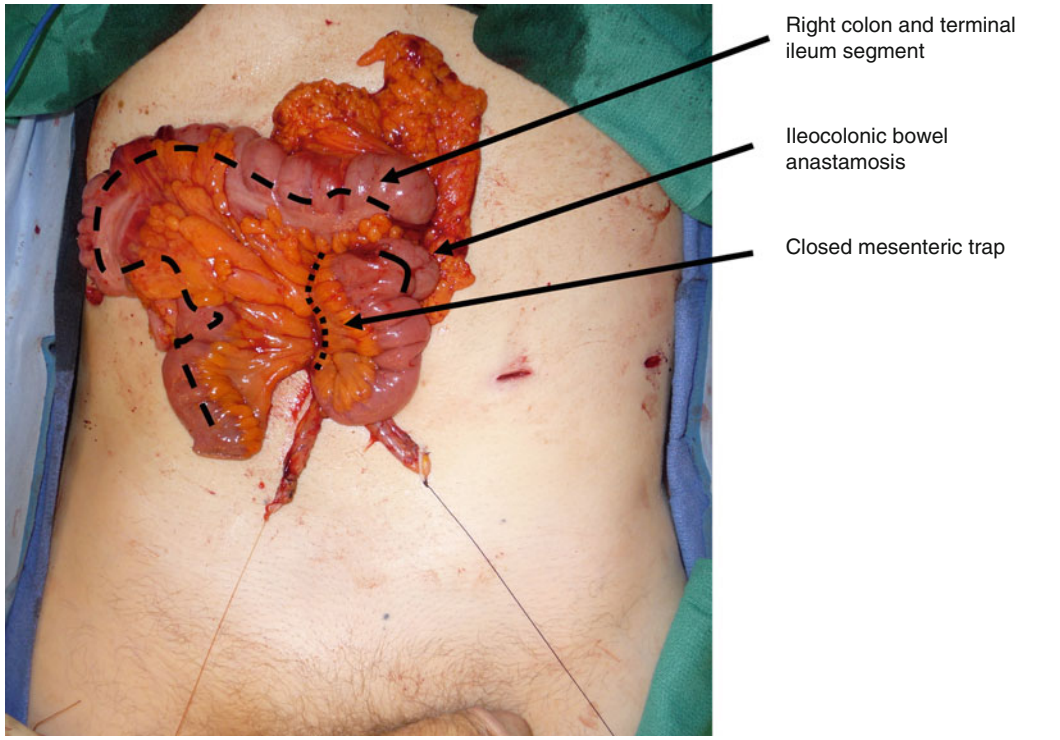

Fig. 14.4 An 8-cm midline incision allows excellent exposure of the right colon and terminal ileum for Indiana pouch construction. Here, the ileal-colic anastomosis is completed and the mesenteric trap closed

anastomosis bilaterally. We mature the stoma and place our closed suction drain into the pelvis and adjacent to our uretero-ileal anastomoses. Our stents are brought out through the stoma and secured with a suture. The midline incision is then closed.

14.5 Postoperative Care

Patients are placed on Alvimopan prior to the induction of anesthesia and continued on this postoperatively until first bowel movement. Nasogastric tubes are removed at the end of surgery or on the morning of postoperative day 1. Clear liquid diets are started with the resumption of flatus. Patients are discharged home when tolerating a regular diet. The closed suction drain is typically removed at the time of discharge if outputs stay at or below 200 ml/8 h.

For the continent diversions, a pouchogram is obtained at 3 weeks after surgery, and the urinary or suprapubic catheter and stents are removed if no extravasation is identified. A renal ultrasound is obtained 6 weeks after stent removal as a baseline evaluation of the upper tracts.

14.6 Advantages and Disadvantages of Extracorporeal Urinary Diversion

The key advantage of extracorporeal urinary diversion compared to the intracorporeal technique is the utilization of open suturing. This results in a shorter learning curve, operative times comparable to open procedures, less time under general anesthesia for the patient, and ultimately less cost. Other advantages include minimizing fecal contamination of the peritoneal cavity and minimizing surgeon fatigue.

The main disadvantage of the extracorporeal urinary diversion is the need for a larger incision

(typically ranging from 5 to 8 cm) which can lead to poorer cosmesis and theoretically a higher pain medication requirement. Another potential problem cited with the extracorporeal technique is impaired tissue orientation/positional distortion and the need for considerable mobilization of the ureters, both of which may contribute to ischemia and possible ureteral stricture. Other disadvantages include increased evaporative fluid loss and external bowel manipulation, both of which may contribute to ileus.

14.7 Complications and Outcomes

As the technique of RARC matures, we are seeing complication rates at least comparable to open surgery [1, 2, 4]. However, there is a paucity of data looking at functional outcomes with extracorporeal orthotopic and cutaneous continent urinary diversion in the RARC setting. We evaluated 44 patients undergoing an extracorporeal orthotopic Studer neobladder and found a 78 % daytime continence rate [5]. In our evaluation of 24 patients undergoing extracorporeal Indiana pouch urinary diversion, all 24 patients achieved complete continence [6]. While the data is still limited, it appears that both complications and functional outcomes with extracorporeal urinary diversion are comparable to open techniques.

Conclusion

The extracorporeal urinary diversion technique provides an effective and smooth transition from open radical cystectomy to the labor-intensive technique of RARC. We expect that with refinements in technology and surgical technique, complication rates and functional outcomes will continue to improve upon existing open surgical standards.

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