

Surgery Illustrated – Surgical Atlas

Robot-assisted intracorporeal ileal conduit 'Marionette' technique

Khurshid A. Guru, Ahmed M. Mansour and John Nyquist*

Department of Urology, Roswell Park Cancer Institute, Buffalo, NY, and *Department of Pathology and Anatomical Sciences, State University of New York, Buffalo, NY, USA

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KEYWORDS

robot-assisted, ileal conduit, urinary diversion, bladder cancer, cystectomy.

PLANNING AND PREPARATION

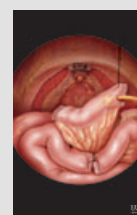
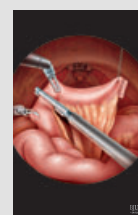
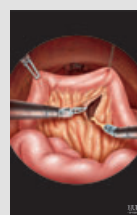
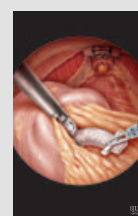
INDICATIONS

Robot-assisted ileal conduit urinary diversion after robot-assisted radical cystectomy (RARC) makes the procedure totally intracorporeal, and alleviates the need for making longer incisions for diversion. This may potentiate the merits of robot-assisted surgery for bladder cancer in terms of decreased postoperative pain, earlier return of bowel function and possible quicker recovery.

RARC has been performed in Roswell Park Cancer Institute since November 2005. After completion of 125 consecutive cases of RARC with extended pelvic lymph node dissection, the technique of robot-assisted intracorporeal ileal conduit was developed in April 2009. Since then, more than 50 consecutive cases have been performed successfully.

PREOPERATIVE PREPARATION

Patients are maintained on a clear liquid diet for 1 day before RARC, no mechanical or chemical bowel preparation is needed. Third-generation cephalosporin broad-spectrum antibiotic is administered before RARC.



**REQUIRED INSTRUMENTS
AND EQUIPMENT**

- One trocar (15 mm)
- Two trocars (12 mm)
- One trocar (5 mm)
- Three robotic arm trocars (8 mm)
- 5 mm laparoscopic long suction irrigator (45 mm)

- 5 mm laparoscopic scissors
- 5 mm laparoscopic locking Micro-France grasper
- 5 mm laparoscopic needle driver

ROBOTIC INSTRUMENTS

- Cardier grasper
- Electrocautery hook

- Suture cut needle driver
- Needle driver
- Precise bipolar
- Cobra grasper
- 45 and 60 mm Endo-GIA laparoscopic staplers

SURGICAL TECHNIQUE

Figure 1

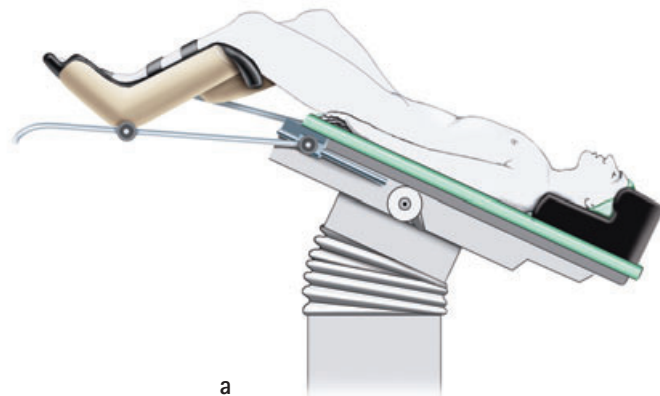
Patient positioning and port placement.

Figure 1a

After general anaesthesia is achieved, a nasogastric tube and a Foley catheter are inserted. The patient's arms are adducted and adequately padded; legs are placed in venodynes and separated with knees flexed to allow for docking of the robot. The patient is then placed in the steep Trendelenburg position.

Figure 1b

The pneumoperitoneum is created and a transperitoneal six-port approach similar to robot-assisted radical prostatectomy is used. However, the only difference in port positioning is to place ports proximal to facilitate the performance of the intracorporeal diversion. We also use a 15 mm port for the right assistant to facilitate the placement of a 15-mm specimen retrieval bag.



- 15 mm
- 12 mm
- × 5 mm
- 8 mm (robot)

b

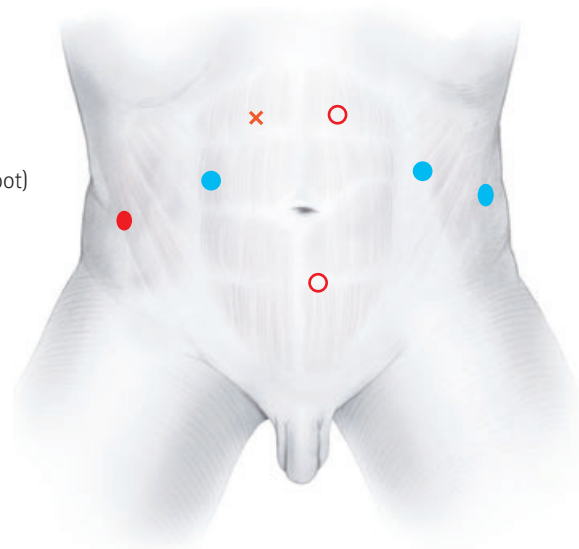


Figure 2

Isolation and transfer of the left ureter to the right side. The left ureter is delivered to the right side under the sigmoid mesocolon using a Micro-France grasper.

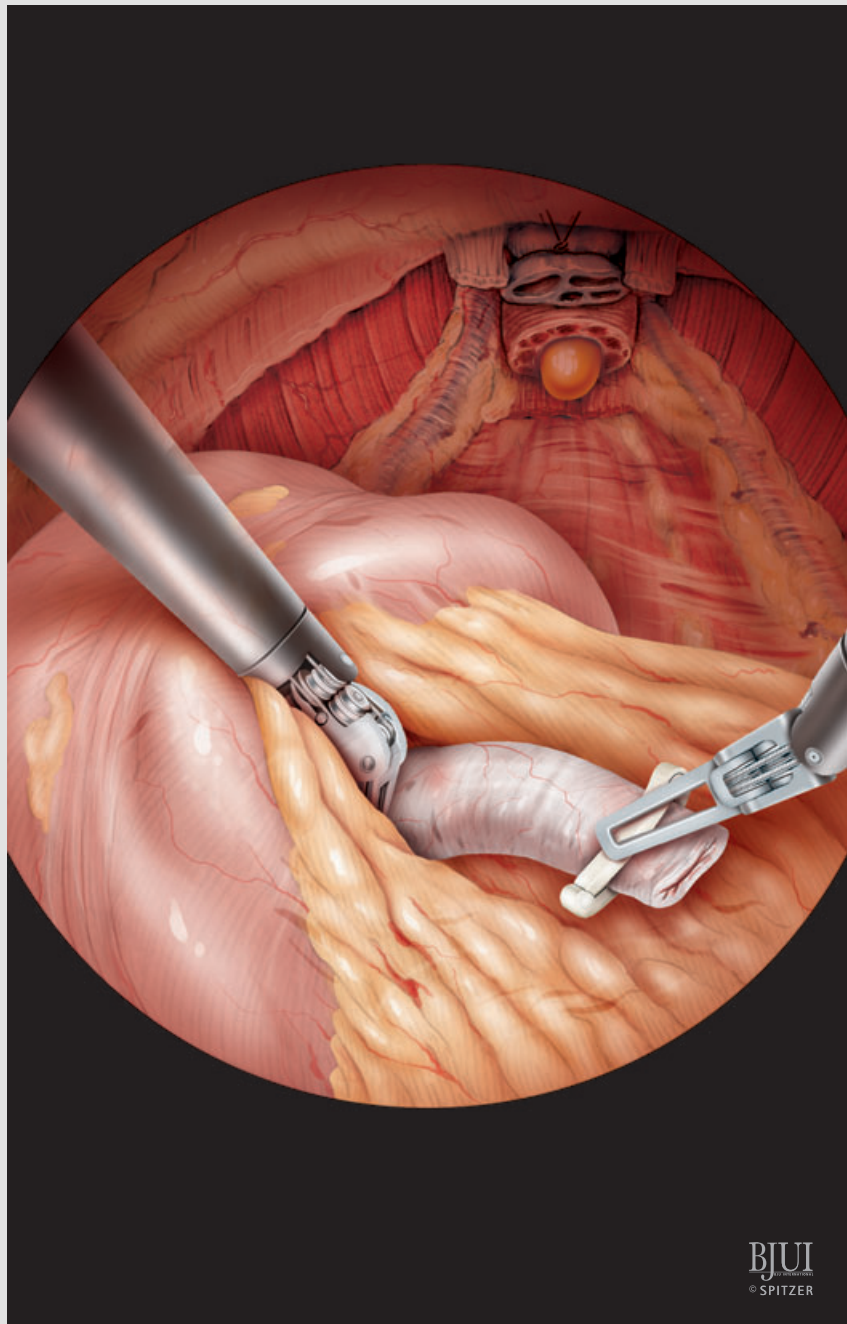


Figure 3

Creation of the 'Marionette' suture and isolation of bowel segment. Once the bowel is examined, a 12 cm segment of small bowel is identified ≈ 15 cm proximal to the ileocecal valve. A 152-cm 1-silk suture using a Keith needle is brought through the anterior abdominal wall at a location inferior to the marked stoma site to allow more space for the mobility of the robotic arms. The silk suture is passed full-thickness through the marked distal end of the future ileal conduit and then brought back through the anterior abdominal wall. This suture is controlled with an instrument and not tied to allow for raising and lowering of the conduit like a 'marionette' during the procedure.

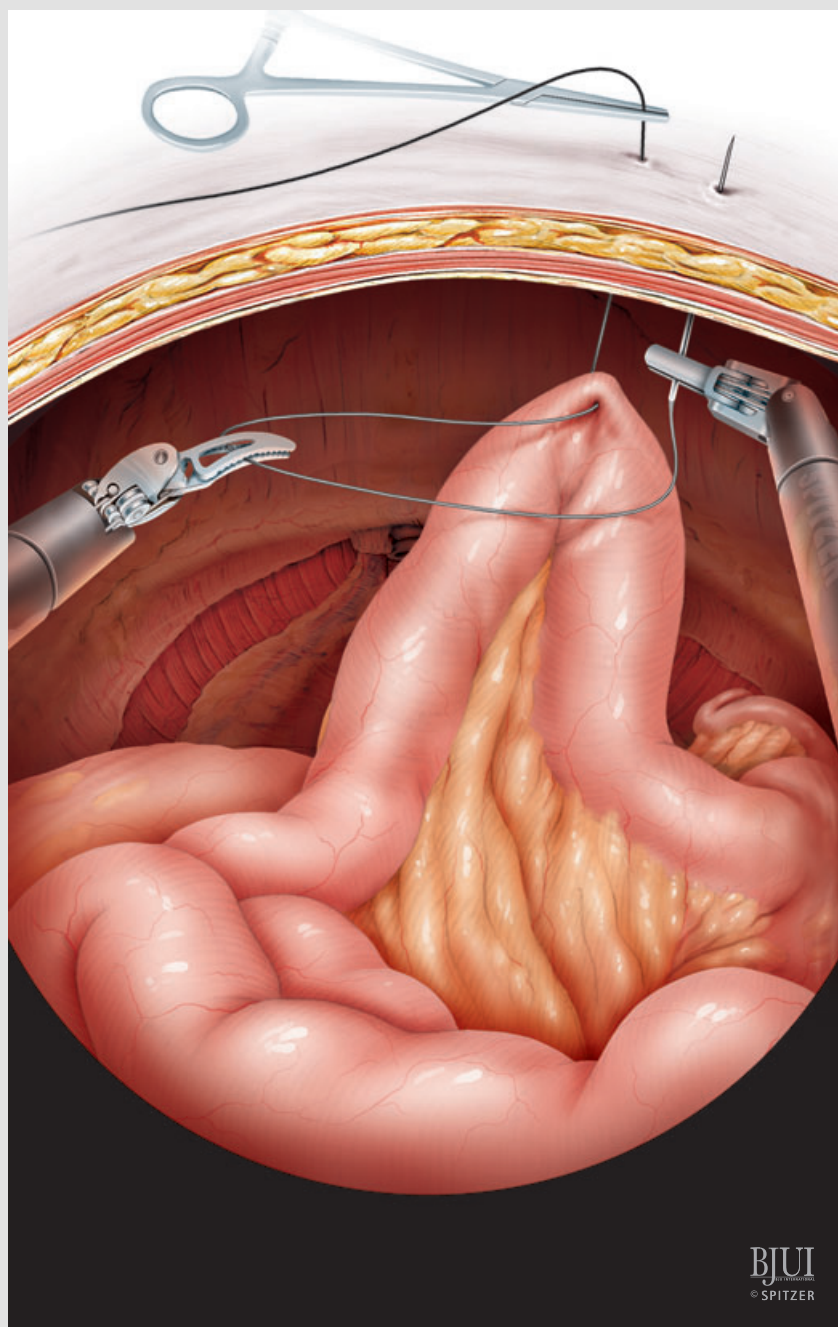
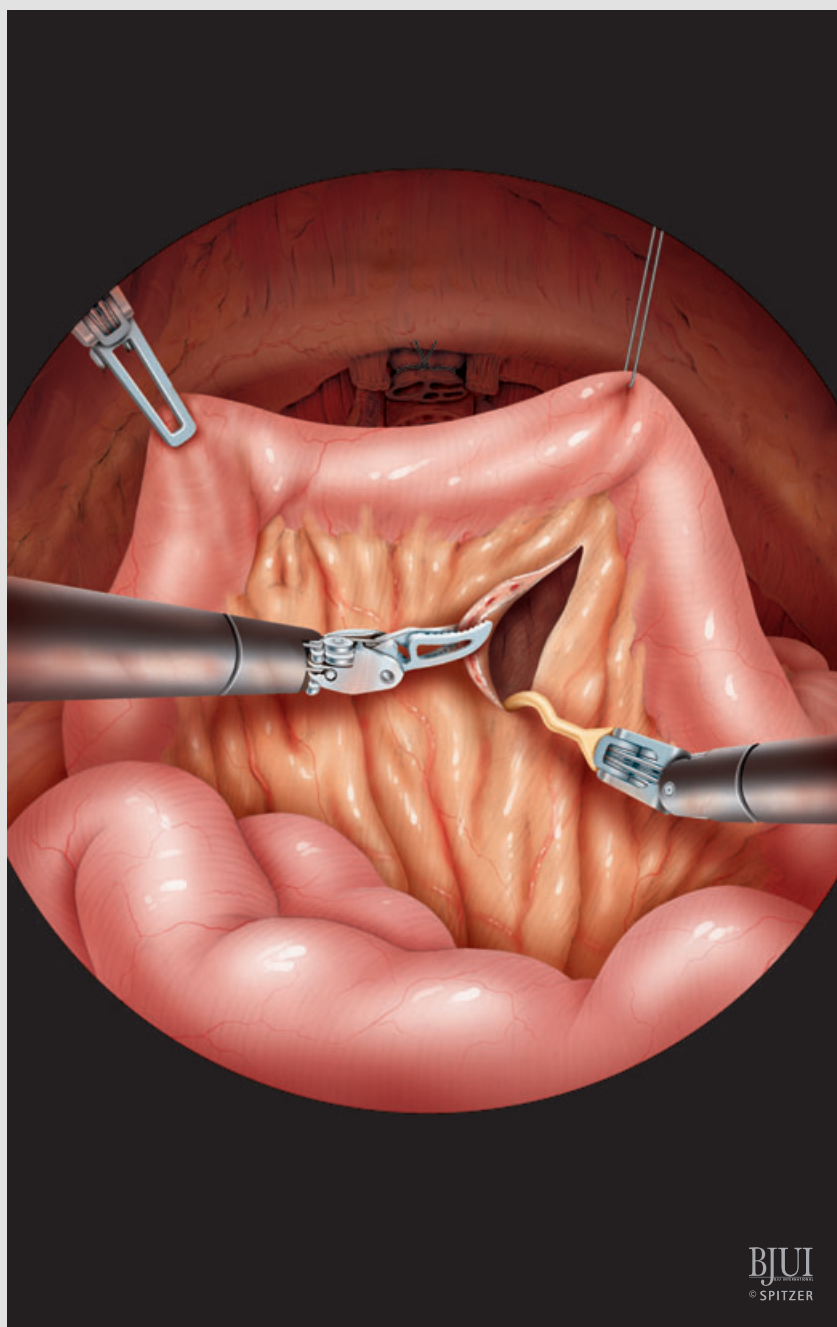


Figure 4

An ≈ 12 -cm segment of bowel is identified proximal to the 'marionette' suture (distal end of the conduit) and is held in place by the fourth-arm Cobra grasper. The hook cautery is used to incise the peritoneum of the bowel mesentery, after which the small mesenteric vessels are controlled using bipolar cautery or a stapler. The two mesenteric windows are created to isolate the ileal conduit.



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Figure 5

Once adequate vascularity to the ileal conduit is ensured, a 45-mm Endo-GIA stapler is introduced through the 15 mm right assistant-port to divide the bowel lumen on both sides of the conduit. The 'marionette' is manoeuvred appropriately during this step.

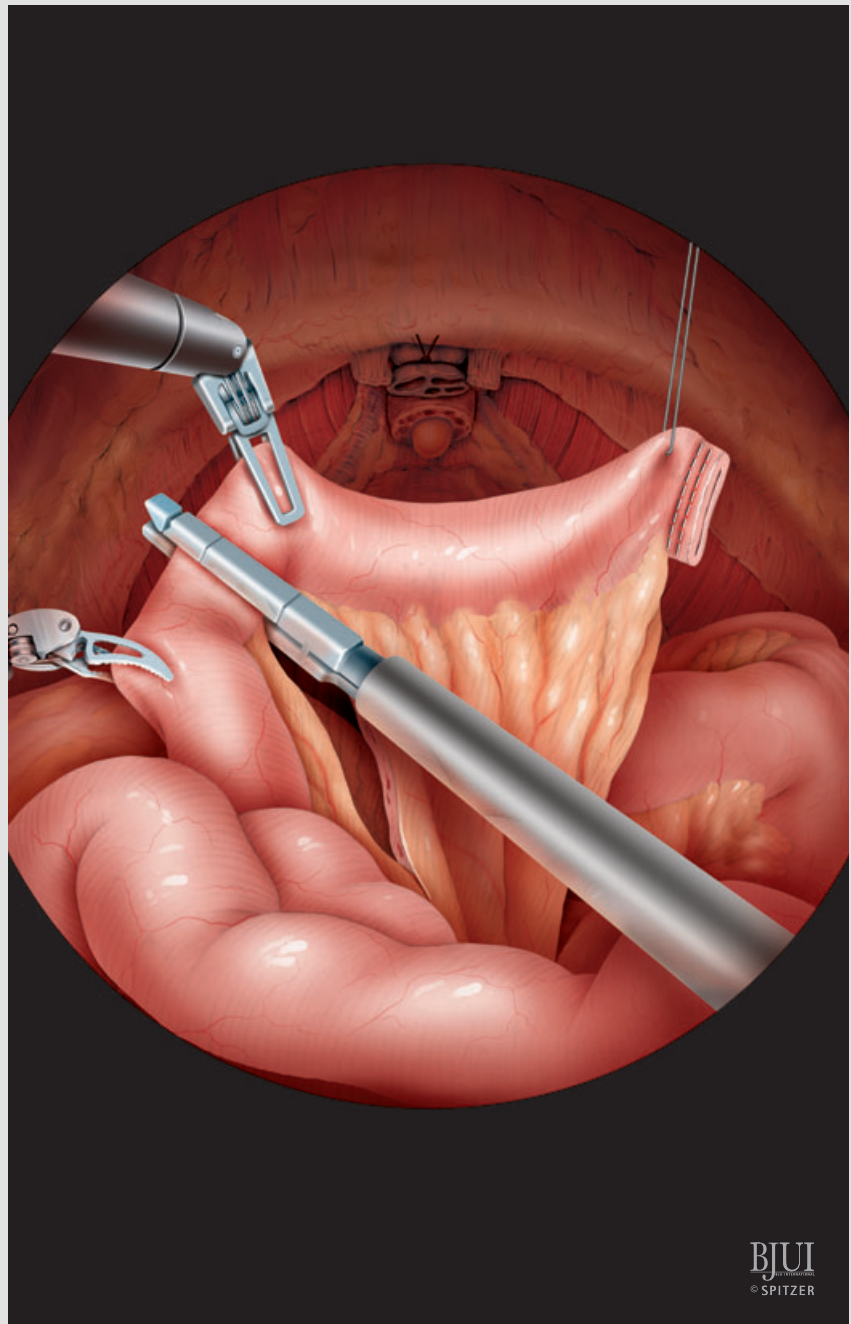
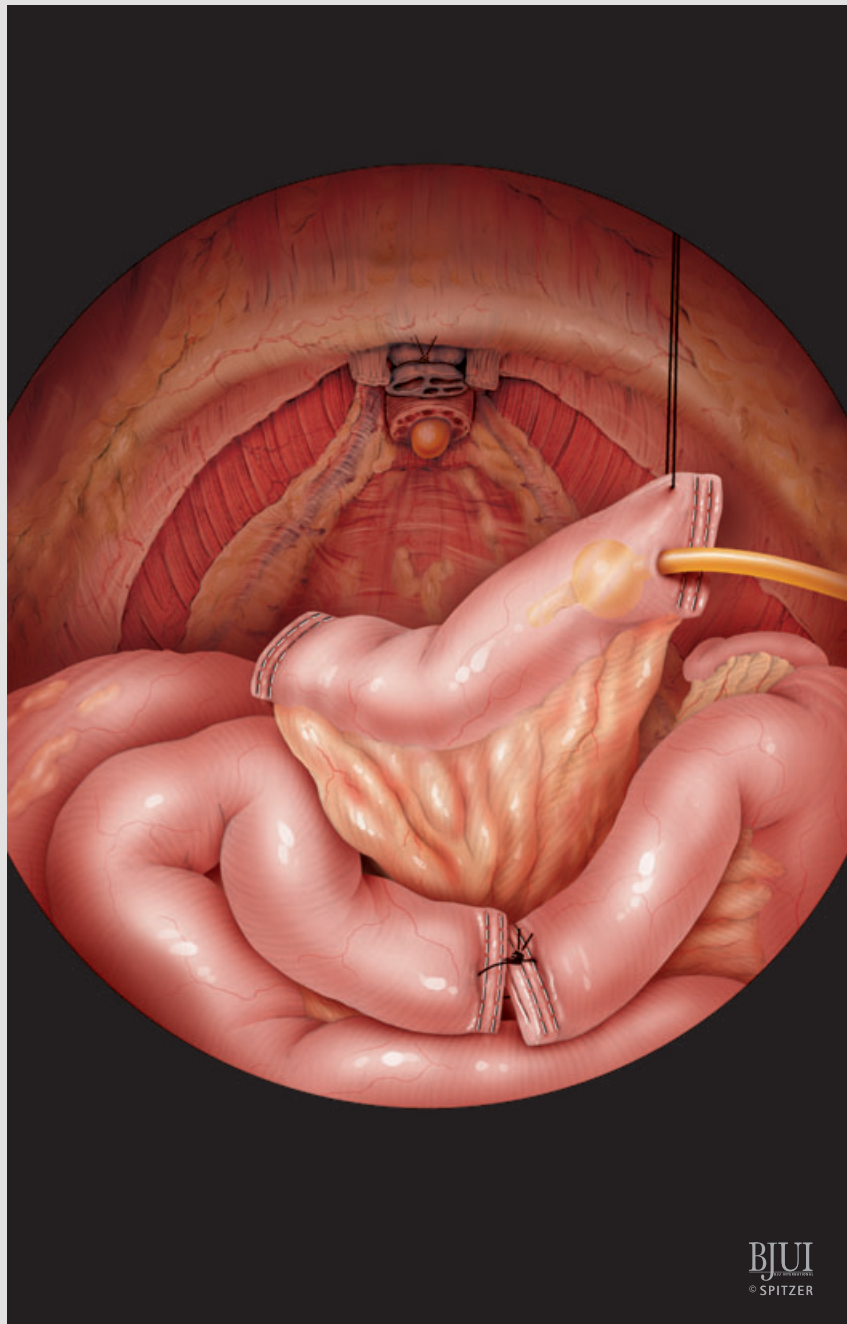


Figure 6

The bowel continuity is not re-established at this point, but completed towards the end of the procedure. A single zero silk suture is used to bring the two ends of small intestine together at this stage, maintaining proper orientation and preventing malrotation.



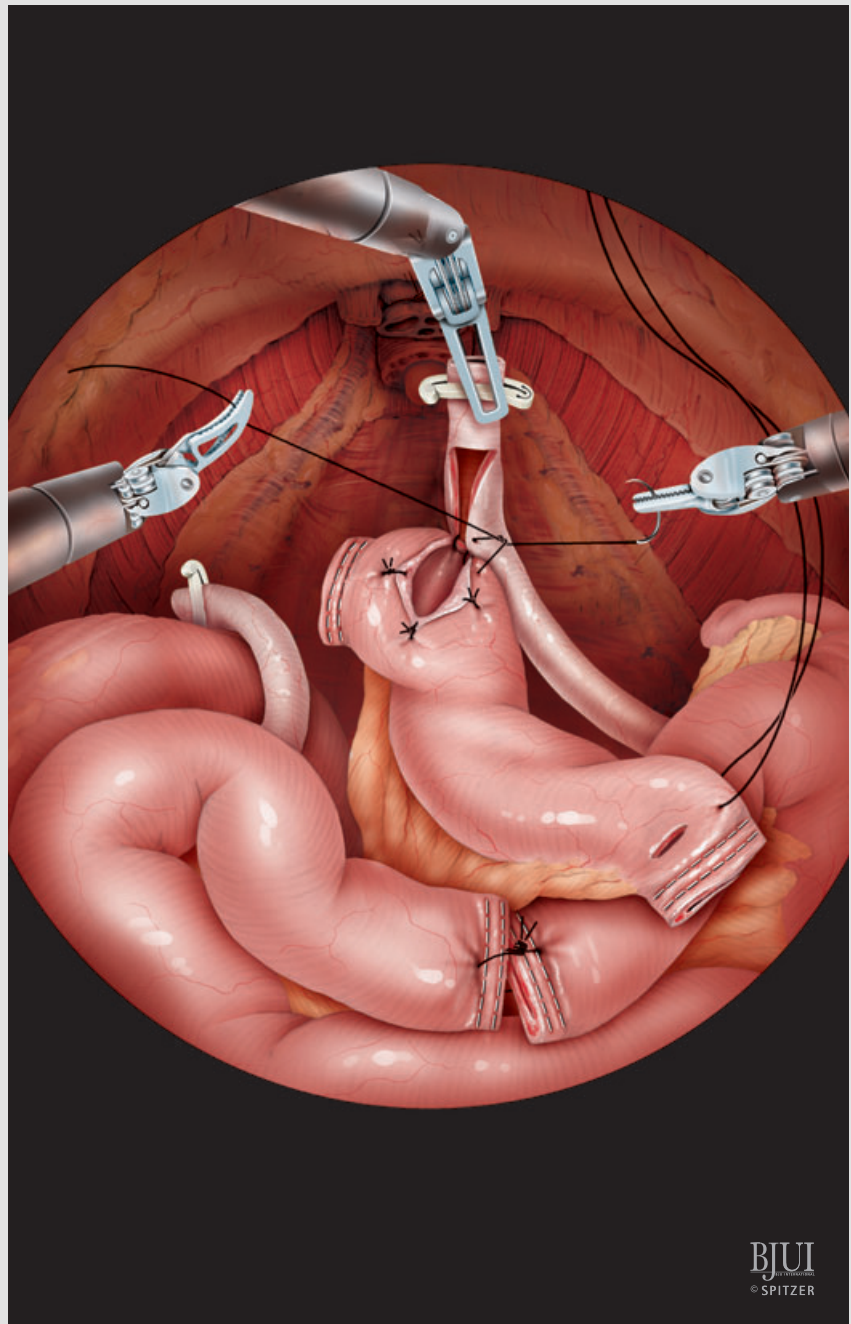
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BOWEL WASHOUT AND SET-UP FOR ANASTOMOSIS

An electrosurgical J-hook is used to create a small opening in the distal (stomal) portion of the conduit for irrigation of the bowel contents. The 'marionette' is lowered to easily place a Foley catheter into the conduit. A 22 F catheter is introduced through the 15-mm right assistant-port, and fed into the conduit through this enterotomy using a Cardier grasper in the right hand after lowering the 'marionette' suture. The catheter balloon is inflated with 5 mL of sterile water to prevent spillage while irrigating, the catheter is then used to irrigate the bowel segment. Once the irrigant is clear, the balloon is deflated and the catheter is removed.

Figure 7

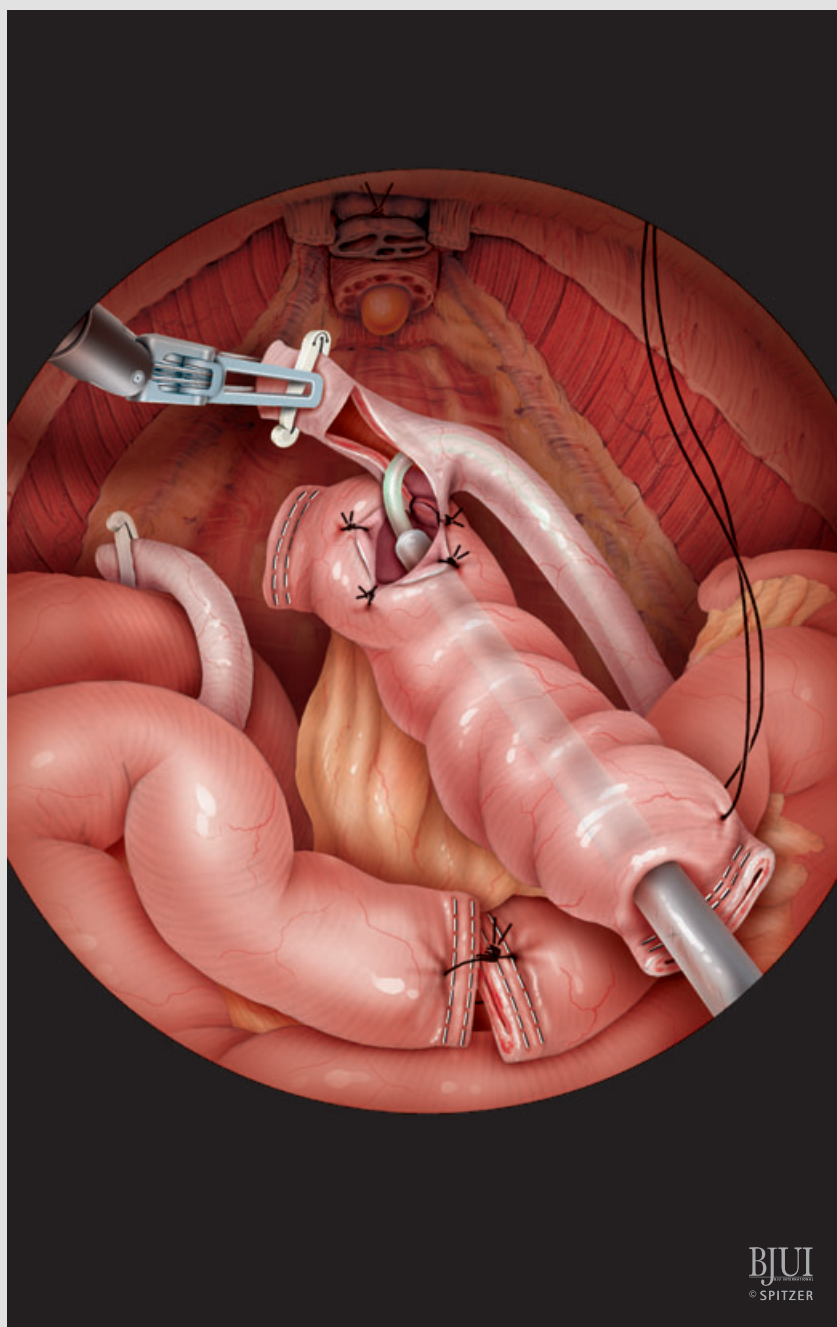
Uretero-ileal anastomosis. Minimal proximal dissection and gentle handling of the ureter is crucial during uretero-ileal anastomosis. The distal end of the ureter (Hem-o-lock clip) is held in position using the fourth robotic arm Cobra grasper. The robotic scissor is used to partially transect and spatulate the distal end of the ureter. Scissors or an electrocautery hook is used to make two enterotomies in the proximal conduit segment on two opposite sides. The edges of the enterotomies are everted using interrupted 3-0 polyglactin 910 sutures. For the interrupted simple uretero-ileal anastomosis 4-0 polyglactin 910 or polydioxanone is used.



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Figure 8

After half of the sutures have been placed, the ureteric stent is inserted. A metal laparoscopic suction tip is passed through the 15-mm assistant-side port, and the 'marionette' is lowered to align for easy passage through the conduit. The tip of the suction is gently guided through the entire conduit, starting at the previously made opening at the distal conduit for irrigation. A 90-cm, 8.5 F single-J ureteric stent with a guidewire is passed through the suction tip and fed into the ureteric opening while holding the metal suction tip in place using the left robotic arm. Once the single-J stent is positioned in the upper ureter, the suction tip is withdrawn while the robotic surgeon controls the stent with the guidewire. The guidewire is left in the stent to allow for easy identification of the stent inside the conduit.

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Figure 9

A 3-0 chromic catgut suture is used to suture the stent to the conduit, preventing accidental dislodgement and the guidewire is removed.

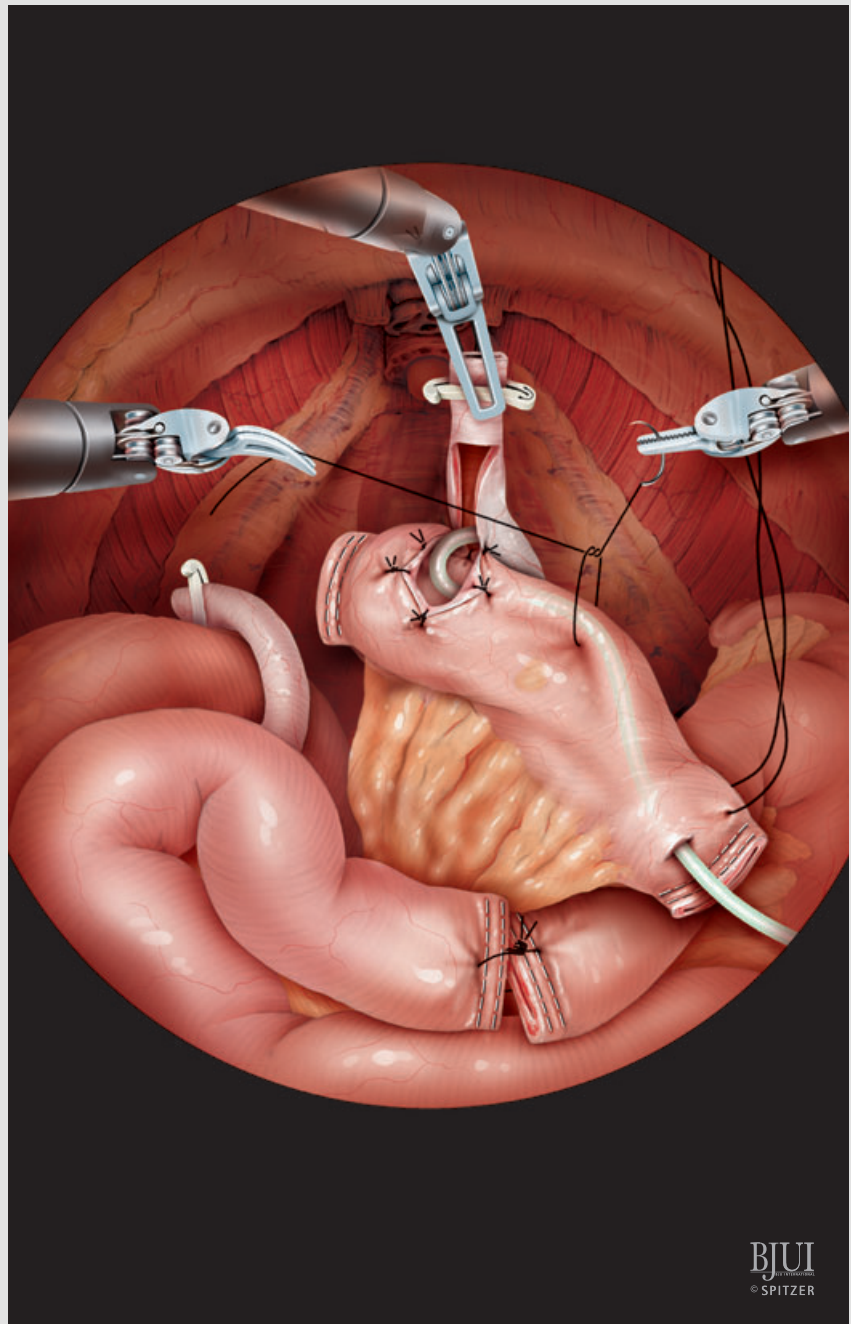
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Figure 10

The ureteroenteric anastomosis is then completed in an interrupted fashion. A similar series of steps are undertaken for the other ureter. The distal ends of the two stents are left in the 15-mm side port, the *ex vivo* portions of these stents should not be clamped or attached to any instrument to prevent accidental dislodgement during manoeuvring of the conduit. The 'marionette' can be raised and lowered as necessary, in combination with the manipulation using the fourth right robotic arm, to allow for optimal visibility and completion of the anastomosis.

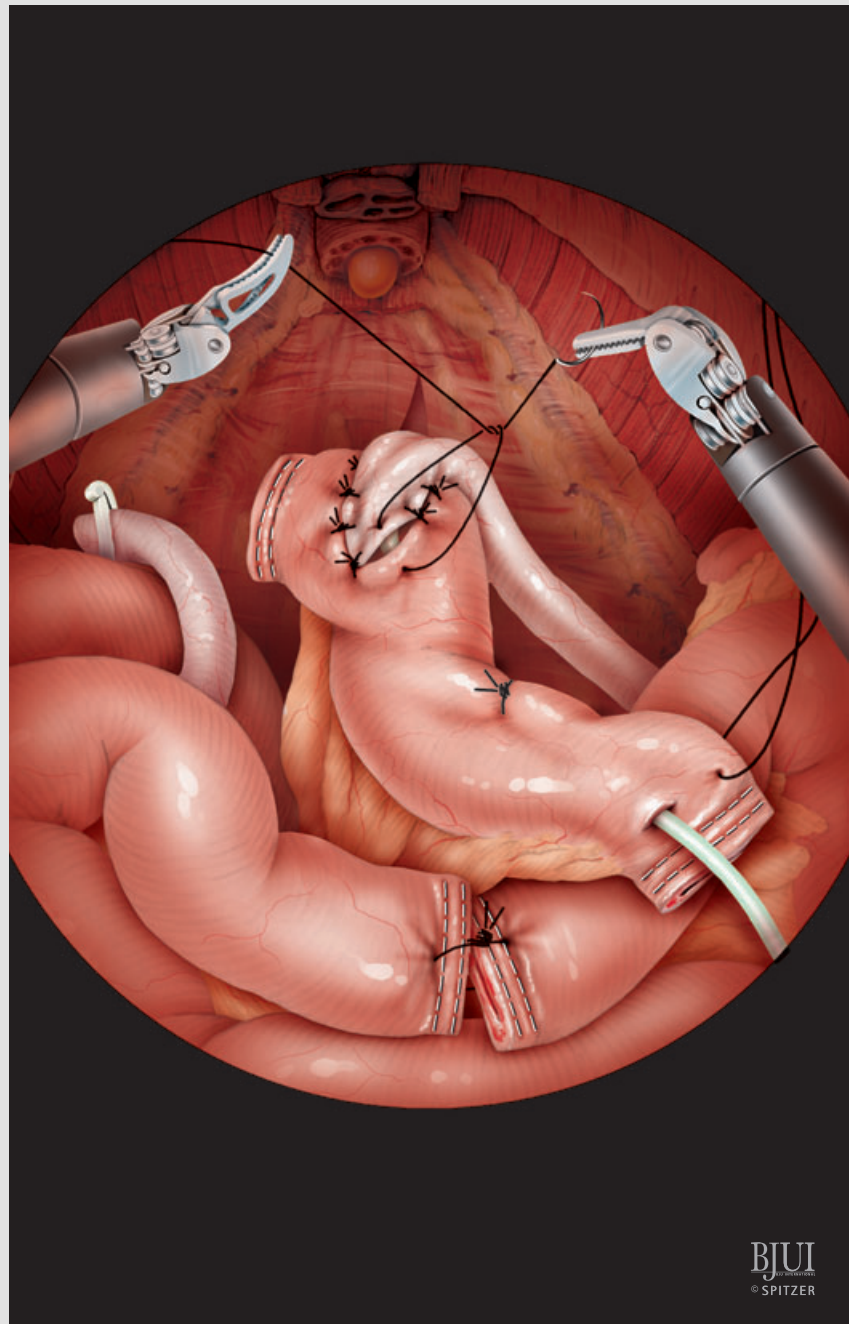
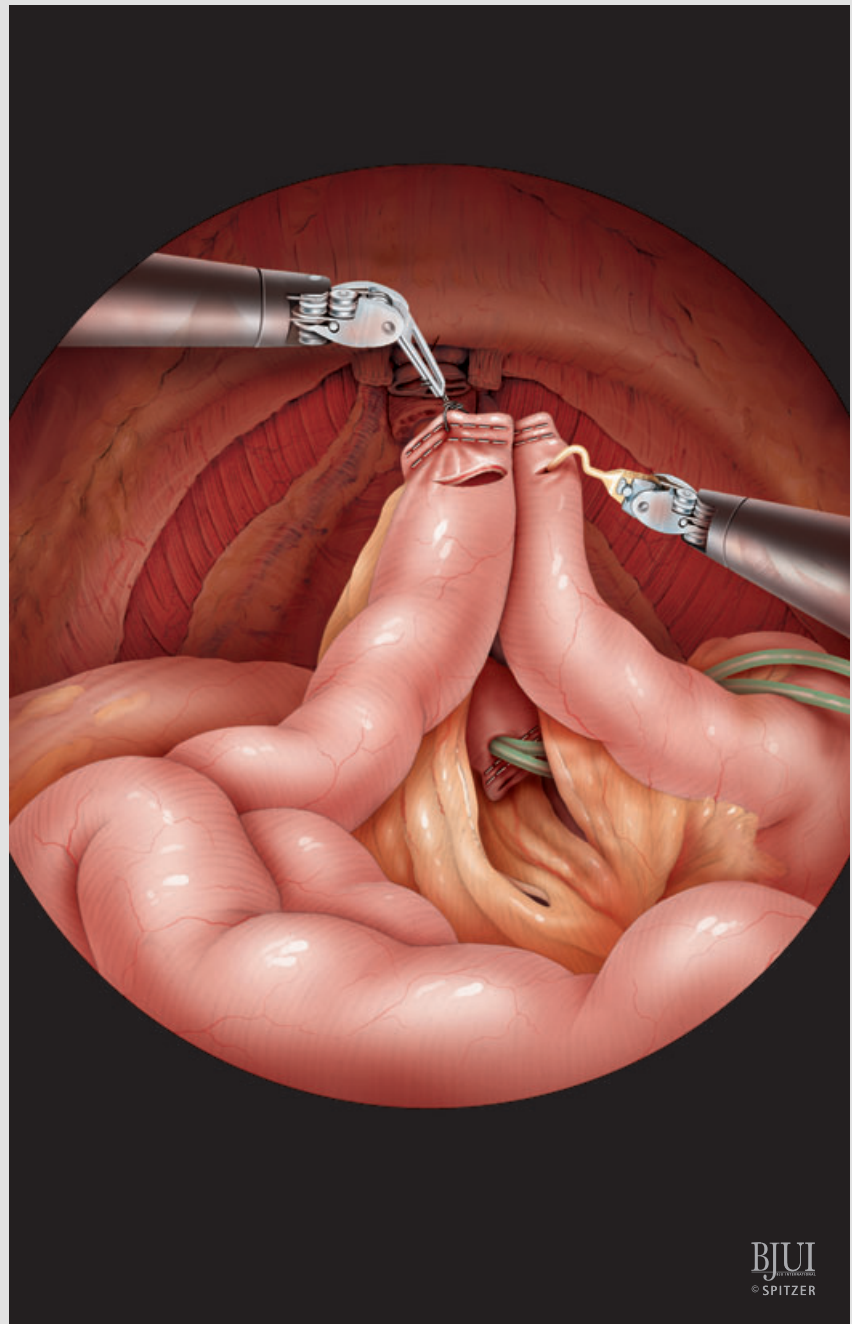


Figure 11

The fourth arm is used to hold the silk suture tagging the two stapled ends of the ileum, and is raised up to the anterior abdominal wall. This allows for proper orientation of the bowel and straightening the ileal segment, permitting the Endo-GIA stapler to be passed without tension. A small enterotomy is created on the anti-mesenteric side of each segment of bowel, close to the previously placed staple lines.



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Figure 12

A skin incision is made in the suprapubic region and a 12-mm port is placed. The silk suture tagging the two bowel ends is held by the fourth arm. A laparoscopic 60-mm Endo-GIA stapler is passed through the suprapubic port into the enterotomies. After ensuring that the anti-mesenteric sides of the bowel are properly opposed, the stapler is fired and bowel continuity is re-established.

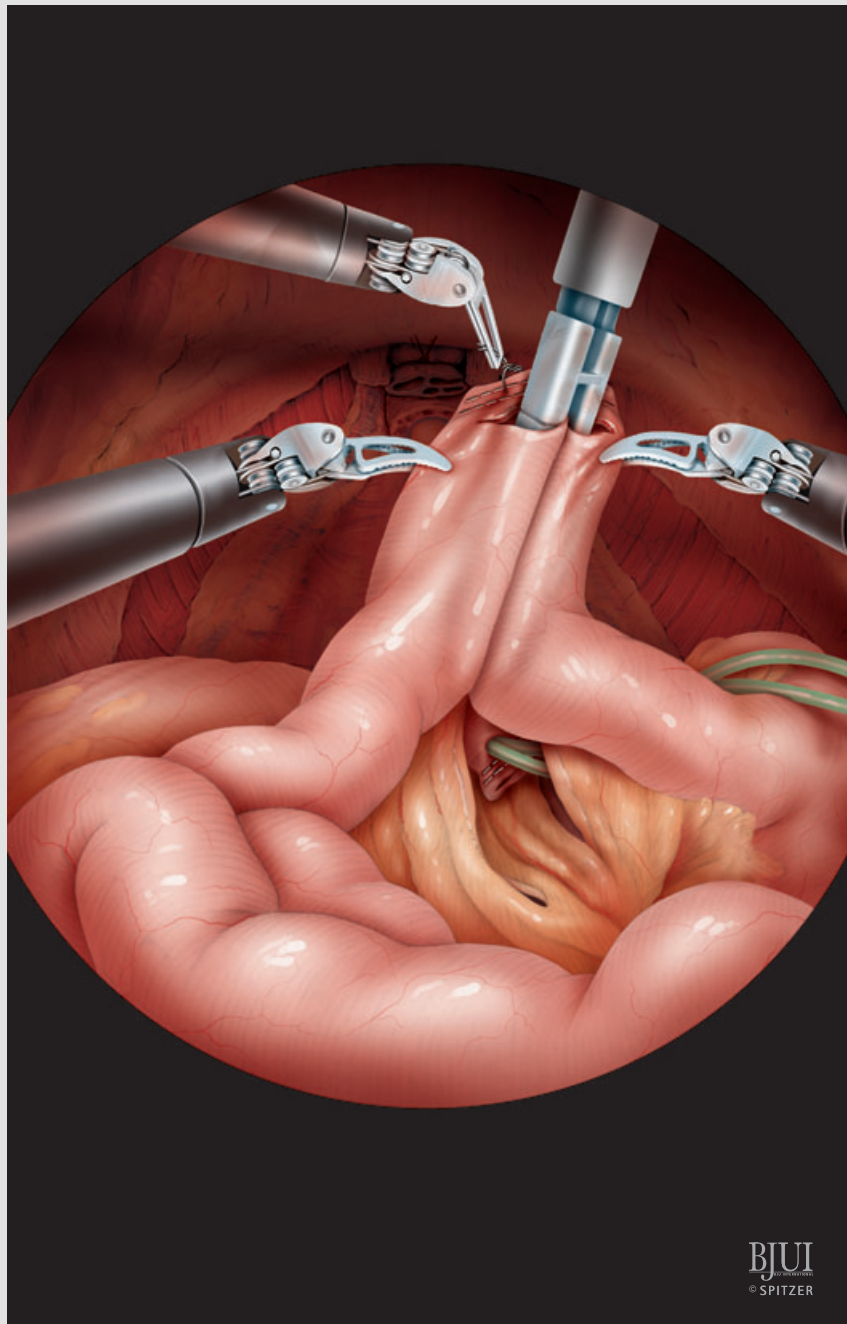


Figure 13

The two open bowel ends are held with the robotic arms and a second firing of the Endo-GIA stapler is performed transversely via the right assistant port. The peritoneal window can then be closed using 3-0 silk sutures, and reinforcement sutures can also be placed in the conduit. The 12-mm suprapubic port is used to remove the specimen through a Pfannenstiel incision. Specimen is removed via the vagina in female patients.

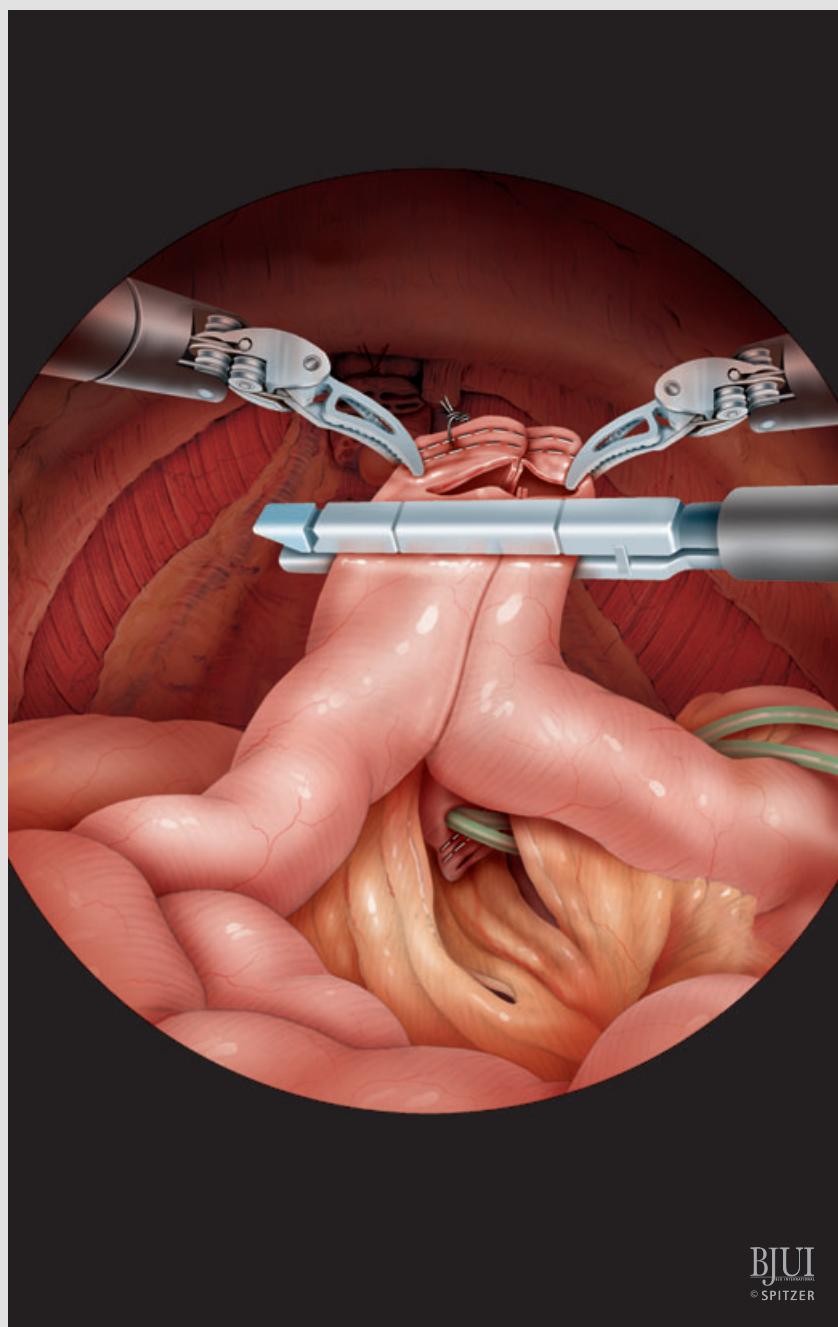
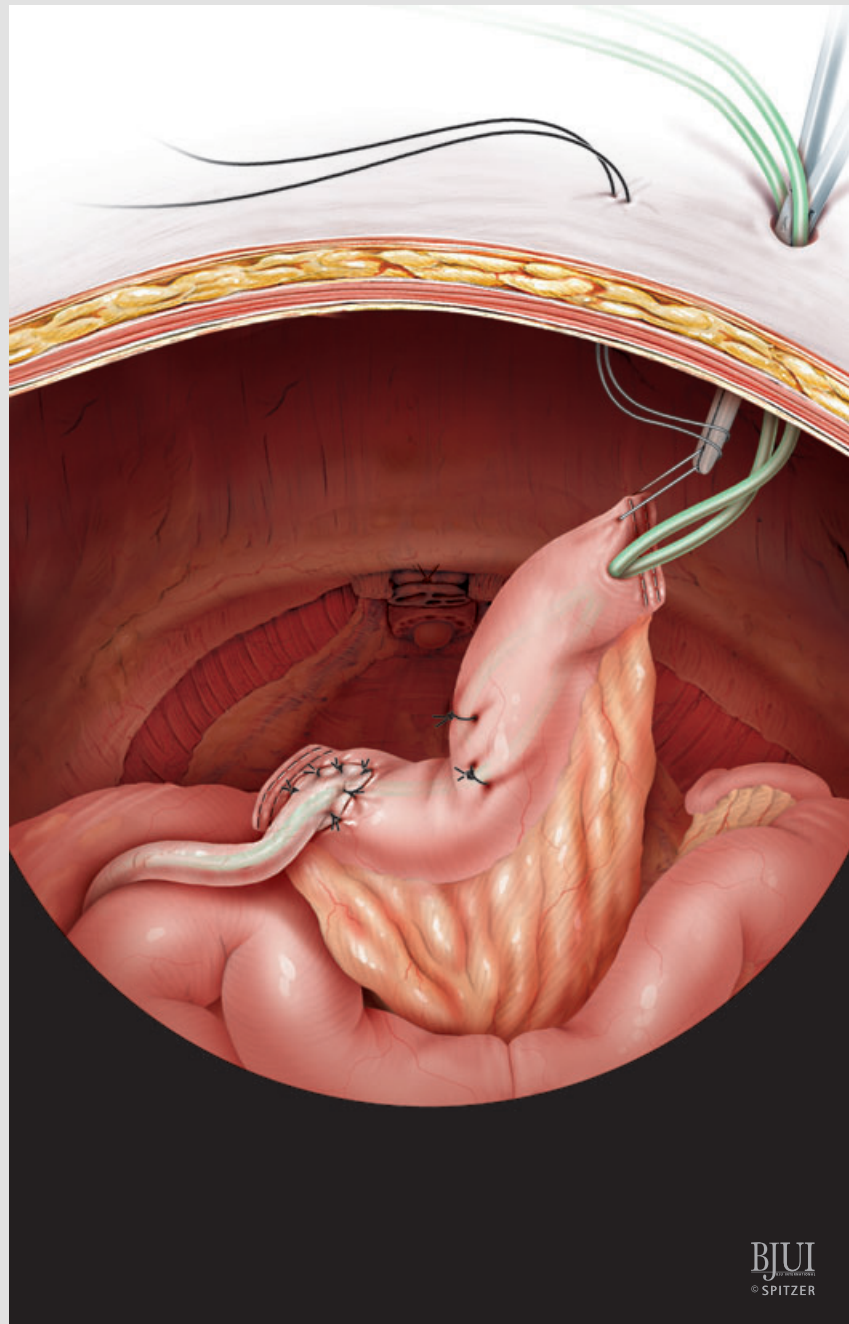
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Figure 14

Creation of the stoma. The marked stoma site is opened, and a cylinder of fat is removed. A cruciate incision is made in the anterior rectus fascia, and a hemostat clamp is passed into the peritoneum. The distal end of the conduit and the stents are extracted using the 'marionette' suture and the stoma is fashioned according to the surgeon's preferences.



POSTOPERATIVE CARE

Most patients can expect an average hospital stay of 5–6 days. Nasogastric decompression is usually maintained for 1–2 postoperative days. Ureteric stents are removed on fifth postoperative day.

Teaching and counselling by the stoma therapist should continue postoperatively. The patient or his/her caregivers should be competent in all aspects of stoma care before discharge. Oncological follow-up care is carried out according to National Comprehensive Cancer Network (NCCN) guidelines.

FROM SURGEON TO SURGEON:

Rationale for the 'Marionette' technique

Concept	Rationale
Marionette suture	Facilitates manoeuvrability of conduit.
Irrigation of conduit with 22 F catheter	Avoids internal soiling.
Bowel continuity established at the end	Avoids malrotation and difficulty with mobilization.
Creation and fixation of stoma is performed at the end	Permits flexibility with the 'marionette'.

Correspondence: Khurshid A. Guru, Department of Urologic Oncology, Roswell Park Cancer Institute, Elm and Carlton Streets, Buffalo, NY 14263, USA.
e-mail: khurshid.guru@roswellpark.org

Abbreviation: **RARC**, robot-assisted radical cystectomy.