The conventional laparoscopic approach to intracorporeal urinary diversion has evolved since 1992 and its adoption was hindered by prolonged operative times, limitations of instrument maneuverability, and a steep learning curve (K.O., 1992; Sanchez de Badajoz et al., 1992; Potter et al., 2000). The compromise resulting from these difficulties led to hybrid procedures in which extirpation and lymph node dissection were performed by conventional laparoscopy and diversion was completed using a modified open approach (Haber et al., 2007).

The robot-assisted surgical approach for pelvic urologic oncology has existed since the mid-2000s (Menon et al., 2003; Guru et al., 2008), and the technique for robot-assisted radical cystectomy (RARC) with lymph node dissection has been established (Poch et al., 2013). Early oncologic outcomes after RARC and lymph node dissection are safe and efficacious (Hellenthal et al., 2010, 2011). Several perceived advantages of robot-assisted approaches for bladder cancer include less pain, minimal blood loss, and earlier return of bowel function, which ultimately help in a quicker return to previous quality of life (Challacombe et al., 2011). Despite smaller incisions and advances in extirpation, recovery has relied mainly on return of bowel function (Johar et al., 2013). More than 1700 cases of RARC have been registered in the International Robotic Cystectomy Consortium database (IRCC)—a quality assurance conglomerate of 58 surgeons at 33 institutions in 11 countries. Based on data published in 2013 from the IRCC, approximately 18% of procedures have been performed with the complete intracorporeal approach (Ahmed et al., 2014). Two commonly performed procedures with the complete intracorporeal approach include the ileal conduit and a modified Studer neobladder.

**KEY POINTS: INTRODUCTION**

- A steep learning curve, prolonged operative times, and limitations of instrument maneuverability have hindered progress in minimally invasive urinary diversion with conventional laparoscopy.
- Advantages of robot-assisted approaches for bladder cancer possibly include less pain, minimal blood loss, and earlier return of bowel function.
- Approximately 18% of RARCs have been performed with the complete intracorporeal approach.

**PREOPERATIVE CARE**

A clear-liquid diet 12 hours before surgery has become the standard: meanwhile, solid diet intake has been allowed up to 6 hours before surgery (Smith et al., 2011). Mechanical bowel preparation with oral antibiotics preoperatively is avoided. Bowel preparation can lead to electrolyte imbalance especially in elderly patients, and in some cases intracorporeal opening of bowel may lead to spillage of liquid content, which is annoying and can also become a source of infection. Several studies have shown no advantage to oral mechanical bowel preparation before surgery (Cerantola et al., 2013).

Intermittent pneumatic compression and leg stockings are recommended. To avoid significant cardiovascular complications (≥5%), anticoagulant treatment is recommended with low-molecular-weight heparin based on the body weight before and up to 4 weeks after surgery (Johar et al., 2013). Broad-spectrum intravenous antibiotics are preferably administered up to 1 hour before the start of the procedure.
KEY POINTS: PATIENT SELECTION AND PREOPERATIVE CARE

- Decreased pulmonary compliance is a contraindication for the minimally invasive approach.
- Absolute contraindications for the neobladder are same as for open surgery.
- Mechanical bowel preparation should be avoided.
- Anticoagulant treatment can help avoid significant cardiovascular complications (<5%).
- Preoperative broad-spectrum intravenous antibiotics are preferably given up to 1 hour before the start of the procedure.

PATIENT POSITION AND PORT PLACEMENT

After the induction of general endotracheal anesthesia, a nasogastric tube and a Foley urinary catheter are inserted. The patient is placed in lithotomy position with arms adducted and paddled. The legs are also abducted and slightly lowered on spreader bars or stirrups. The patient is positioned in a steep Trendelenburg position and the abdomen is insufflated with a Veress needle or the Hasson technique. A six-port transperitoneal approach is used and all the ports after the camera port are placed under direct vision and more cephalad. This positioning of the ports helps in small-bowel maneuvering during urinary diversion and extended lymph node dissection along the aortic bifurcation. In the six-port configuration, the camera port is placed just above and medial to the anterolateral to the rectus sheath. While performing the neo-bladder procedure, the third (right-assistant) and fourth (left-side) ports (12 to 15 mm) are placed just above and medial to the anterior superior iliac spines. The robotic arm could be used alternatively with an assistant instrument or by inserting an additional robotic arm inside the 15-mm laparoscopic port for stapling during neobladder creation. A 5-mm (12-mm for neobladder) port is placed between the camera and the right robotic arm port. An extra short 12-mm port is inserted in the suprapubic area for bowel reanastomosis while performing the marionette ileal conduit. This port helps in aligning the bowel during reanastomosis and can be extended and converted to a Pfannenstiel incision for specimen removal in male patients.

A 0-degree lens is used during this procedure. Occasionally it is advantageous to use a 30-degree down lens for a deep female pelvis during extended lymph node and vascular pedicle dissection. The use of a "technique of space" is important in completing extirpation of the bladder and adjacent organs; the division of the procedure into well-defined steps facilitates teaching and keeps the procedure focused. The four spaces of dissection are periureteral, lateral pelvic, anterior rectal, and retropubic space (Poch et al., 2013). Extended lymph node dissection is performed up to the aortic bifurcation, which helps with the crossing of the left ureter to the right side for the urinary diversion. After the bladder with adjacent organs and the lymph nodes are placed in the specimen bags and transferred to the pelvis, attention is directed toward the intracorporeal ileal urinary diversion. Before embarking on intracorporeal neobladder, the robotic arms are docked from the ports and the steep Trendelenburg position is reduced to 10 degrees to 15 degrees for ease of urethra-neobladder anastomosis. Tables 100-1 and 100-2 summarize the steps and instruments used in the creation of robot-assisted intracorporeal ileal conduit and neobladder, respectively.

CREATION OF ILEAL CONDUIT

Transfer of Left Ureter and Selection of Bowel

The left ureter is crossed underneath the sigmoid colon and over the great vessels to the right side. It is important to identify patients with duplication of ureters, so that they can be implanted separately or together, depending on the caliber of the ureter. If the length of the left ureter is short, the sigmoid is retracted with the fourth arm; occasionally a 30-degree down lens helps to identify and

<table>
<thead>
<tr>
<th>TABLE 100-1</th>
<th>Steps and Instruments Required for Intracorporeal Ileal Conduit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SURGICAL STEP</strong></td>
<td><strong>CAMERA</strong></td>
</tr>
<tr>
<td>Selection of bowel segment and placement of marionette stitch</td>
<td>0° or 30°</td>
</tr>
<tr>
<td>Isolation of bowel and creation of conduit</td>
<td>0°</td>
</tr>
<tr>
<td>Ureterointestinal anastomosis</td>
<td>0°</td>
</tr>
<tr>
<td>Restoration of bowel</td>
<td>0° or 30°</td>
</tr>
</tbody>
</table>

The marionette stitch manipulates the bowel segment to surgical instrument; not tying the marionette stitch allows free movement of the bowel segment during the creation of the conduit. The marionette stitch manipulates the bowel segment to free the proximal left ureter. A 12-cm long segment of ileum is identified (15 to 20 cm proximal to the ileocecal valve). Adequate bowel length on the ileocecal end of the bowel should be left in place to avoid kinking after the conduit is exteriorized and repositioned.

### TABLE 100-2 Steps and Instruments Required for Intracorporeal Neobladder Creation

<table>
<thead>
<tr>
<th>SURGICAL STEP</th>
<th>RIGHT ROBOTIC ARM</th>
<th>RIGHT BEDSIDE ASSISTANT</th>
<th>LEFT ROBOTIC ARM</th>
<th>FOURTH ROBOTIC ARM</th>
<th>SUTURE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neobladder-urethral anastomosis</td>
<td>0°</td>
<td>Scissor, needle driver</td>
<td>Needle driver</td>
<td>ProGrasp forceps</td>
<td>4-0 (Quill) 3-0 Monocryl RB1 (Ethicon)</td>
<td>3-0 V-Loc Foley catheter, thin caliber Penrose drain</td>
</tr>
<tr>
<td>Isolation of bowel</td>
<td>0°</td>
<td>Atraumatic Cadiere forceps</td>
<td>Laparoscopic: scissor and needle driver</td>
<td>Laparoscopic: scissor and needle driver</td>
<td>ProGrasp forceps</td>
<td>60-mm laparoscopic stapler (Echelon); Endo GIA (Ethicon)</td>
</tr>
<tr>
<td>Detubularization of bowel, Configuration of neobladder</td>
<td>0°</td>
<td>Scissor</td>
<td>Laparoscopic: scissor and needle driver</td>
<td>ProGrasp forceps</td>
<td>2-0 V-Loc, 3-0 V-Loc (Covidien)</td>
<td>Chest tube (24 Fr) (helps expose antimesenteric border)</td>
</tr>
<tr>
<td>Uretero-neobladder anastomosis</td>
<td>0° or 30°</td>
<td>Scissor, needle driver</td>
<td>Laparoscopic: scissor and needle driver</td>
<td>Needle driver</td>
<td>ProGrasp forceps</td>
<td>4-0 Vicryl 4-0 V-Loc 4-0 Quill 3-0 Biosyn</td>
</tr>
<tr>
<td>Closure of neobladder</td>
<td>0°</td>
<td>Needle driver</td>
<td>Laparoscopic: scissor and needle driver</td>
<td>Needle driver</td>
<td>3-0 V-Loc</td>
<td>Foley catheter; Jackson-Pratt drain</td>
</tr>
</tbody>
</table>

### KEY POINTS: PATIENT POSITION AND PORT PLACEMENT

- Intracorporeal diversion is performed with a six-port transperitoneal approach.
- All of the ports are placed more cephalad to help in the maneuvering of the bowel.
- For the neobladder, a 15-mm laparoscopic port can be used alternatively with an assistant instrument or by inserting an additional robotic arm.
- A 0-degree lens is used during intracorporeal urinary diversion.
- The "technique of spaces" is used for the extirpation of the bladder, which divides the entire procedure into well-defined steps to facilitate teaching and to keep the procedure focused.
- Before the intracorporeal neobladder creation, the robot should be undocked and the steep Trendelenburg position should be reduced to facilitate urethra-neobladder anastomosis.

### Figure 100-1

Keith needle used to transfer marionette stitch (placed into the stoma (distal) end of ileal conduit) out to the exterior for clamping.

### Adjust for the limitation of fixed ports and it enables mobilization of different areas of the conduit into the surgical field. The marionette stitch is especially helpful in patients with a limited distance between physical boundaries of the abdomen/pelvis and the true operative space. The marionette stitch can be placed further down in the pelvis to keep the operative field in range of optimal mechanical joint movements of the robotic instruments.

### Isolation of the Bowel Segment and Creation of the Ileal Conduit

The fourth arm is used to hold the proximal segment of the bowel at stretch opposite to the stoma end (held by the marionette stitch); meanwhile the hook cautery is used to incise the peritoneum of the bowel mesentery. It is important to keep the appropriate orientation of the bowel and to avoid mesenteric narrowing of the base of the conduit (which limits mesenteric blood supply). Another alternative is to use a vascular stapler across the mesentery, which makes this process quicker. After the two mesenteric windows are created...
Fourth arm holding and retracting bowel for vascular identification

Figure 100-2. Bowel segment with mesenteric windows and the marionette stitch.

Marionette suture separates distal

Figure 100-3. Proximal end of ileal conduit isolated using a laparoscopic stapler (note the distal [stomal] end can be seen as controlled with the marionette stitch).

Fourth arm holding and retracting bowel for vascular identification

Figure 100-4. Proximal opening for left ureteric anastomosis after isolation of the bowel segment for the ileal conduit.

(Distal (stomal) end with marionette suture

Distal end of ureter held by fourth arm

Logitudinal incision of ureter

Figure 100-5. Left distal (cut end) of ureter held with fourth robotic arm and spatulation performed by right robotic scissor. (Note that lowering of the marionette stitch allows the conduit to remain away from the surgical field.)

Interrupted ureteroileal anastomosis

Figure 100-6. Ureteroileal anastomosis performed with running sutures.

After the marionette is lowered, the ureter is implanted with minimal traction and stretching of the proximal end of the ileal conduit. After the efflux of clear urine is seen, the spatulation is performed for wide anastomosis with ease. The fourth arm is used to retract the cut end of the distal ureter, and spatulation of the proximal ureter is performed (Fig. 100-5). We prefer to implant the left ureter first for ease of anastomosis.

The two commonly used techniques of anastomosis include Bricker and Wallace. A Bricker anastomosis is a refluxing end-to-side anastomosis and is easy to perform while keeping the two renal units separate. Meanwhile the Wallace technique joins the ends of the two ureters in a Y fashion, anastomosing a single limb to the proximal portion of the ileal conduit (Rehman et al, 2011).

A few key issues should be remembered while performing this anastomosis. The position in which the anastomosis is carried out is not the final position in which the proximal end of the conduit will lie. The trick is to place the initial suture in the conduit opening first (outside in) and then into the angle of the incision in the ureter (inside out). The suture on the conduit side should be perpendicular to the proximal staple line of the conduit. This helps to align the ureter and avoids back-walling of the ureter. This initial suture sets the stage for a proper alignment and placement of the subsequent sutures. Interrupted sutures can also be run along both sides halfway up to the middle of the anastomosis, after which the stent is placed. Van Velthoven-type, double-armed, 4-0 Vicryl sutures approximately 5-cm long can also be used to suture the angle of the spatulation and can continue along both sides (Fig. 100-6). After completion of anastomosis of the posterior wall, the ureteral stent is introduced. A metal laparoscopic suction tube is passed into the distal conduit through the 15-mm right
assistant port. The metal laparoscopic suction tube is pushed gently across the conduit and positioned at the junction of the conduit and the ureteric anastomosis. The metal suction tip is held in place by the robotic needle driver to allow passage of a stent through it without damaging the anastomosis (Fig. 100-7). This maneuver helps to facilitate threading of the 90-cm, 8.5-Fr, single-J ureteral stent with a guidewire into the renal pelvis. The guidewire is kept in the stent until it is secured to the conduit using 3-0 chromic stitches to prevent accidental dislodgment of the stent. The guidewire is removed only after the suture is placed, as it is difficult to identify the stent because of a lack of tactile feedback. The distal end of the ureter is excised completely and sent for final histopathology. The ureteroileal anastomosis is then completed. The distal ends (external portion) of both ureteric stents are left draining through the 15-mm side port. The exterior portions of the stents should not be clamped to the drape, which avoids accidental dislodgment during in vivo manipulation of the ileal conduit.

After the left side is anastomosed, the marionette is manipulated to turn the conduit on the other side and the right ureteric anastomosis is performed in a similar fashion.

Restoration of the Bowel

The two cut ends of small bowel are held in place by a stay silk suture. We prefer to reanastomose the bowel after the two ureters are anastomosed. This helps ease conduit manipulation and helps tailor the bowel reanastomosis to avoid kinking or tension. A new suprapubic port is inserted for ease of alignment of bowel reanastomosis. A 60-mm Endo GIA stapler is inserted through the short 12-mm suprapubic port. An end-to-end anastomosis is performed after both ends of the bowel are aligned along their antimesenteric borders (Fig. 100-8). The open ends of the two anastomosed intestinal segments are stapled by firing an Endo GIA stapler horizontally via the right assistant port (Fig. 100-9). A secure stay suture is placed to reduce tension and to support the edge of the antimesenteric border. The mesentery window is closed using a 3-0 silk suture.

Prestoma Preparation

The robot is left docked and the instruments are removed. The surgeons scrub to create the stoma opening by making a cruciate incision in the anterior fascia and inserting the four stay sutures to anchor the conduit after it is externalized. After completion of four fascial sutures, the robotic arms are reinserted. The pelvis is examined for any bleeding, and strings of all specimen bags are removed via the suprapubic port. A vascular clamp is introduced via the stoma opening under direct vision into the abdominal cavity to remove the marionette suture and the free ends of the ureteric stents. A Jackson-Pratt drain is introduced via the right assistant port and the robot is dedocked after the robotic instruments have been removed. Finally the distal end of the conduit is brought out gently through the stoma site, assuring proper orientation after the pneumoperitoneum is lowered.

KEY POINTS: CREATION OF ILEAL CONDUIT

- To avoid kinking of the conduit when it is exteriorized and repositioned, adequate length of the bowel at the ileocolic junction should be retained.
- The marionette stitch is not tied to allow free movement of the bowel segment during the creation of the conduit.
- As the ileal conduit segment washout does not impact infection and causes more spillage, it has been abandoned.
- The ureteral stent guidewire is removed only after the tagging suture is placed, as the lack of tactile feedback makes it difficult to identify the stent.
- The exterior portions of the ureteral stents should not be clamped so as to avoid accidental dislodgment.
CREATION OF MODIFIED STUDER NEOBLADDER

The small bowel is assessed for its tension-free ease of approximation to the urethral stump with minimal traction. The significant difference between various approaches is the performance of early enterourethral anastomosis advocated by the Karolinska group. The alternate approach uses the fourth arm to hold traction at the future urethral anastomosis site in the small bowel and to perform anastomosis after the posterior plate of the neobladder is constructed.

Neobladder-Urethral Anastomosis

The ileum is sufficiently mobilized to perform a tension-free ileum-urethral anastomosis. Using robotic scissors, an opening is made at the most dependent, tension-free antimesenteric portion of the ileum. The anastomosis is performed by the Van Velthoven technique with a 4-0 Quill suture (Fig. 100-10). Some anecdotal experiences have suggested that the V-Loc suture (Covidien, Minneapolis, MN) should not be used because of the sharper and larger barbs that may traumatize the neobladder. In situations where it is difficult to approximate the bowel to the urethra easily, the neobladder is held in position between two customized Penrose drains rolled around the intestine (urethral end of the future neobladder). A silicone catheter is used to identify easily the urethral stump, similar to urethrovaginal anastomosis during robot-assisted radical prostatectomy.

Various maneuvers are advocated if it is difficult for the ileum to reach the urethra: reducing Trendelenburg positioning, using the Penrose drain for gentle stretching and traction, releasing and incising the peritoneum over the mesentry, stapling the medial/proximal portion of the mesentery (care is needed to avoid risking ischemia to the isolated bowel segment), and, finally, dissecting the ileum around the ileocecal region.

Isolation of Bowel

The orthotopic neobladder is tailored based on the Studer principles using a 40-cm segment of terminal ileum for the body of the neobladder and approximately 10 to 15 cm for the afferent limb. The intestine is isolated using a laparoscopic 60-mm bowel stapler. The bedside assistant can use the hybrid 15-mm port to insert the stapler for ease of alignment with the bowel. The ileum is stapled 40 cm proximal to the ureteroleal anastomosis. Integrity of small bowel is usually restored using staplers; however hand-sewn anastomosis has also been reported as safe. The stapler-based reanastomosis is performed based on a side-to-side method.

Detubularization of Bowel

The distal 40 cm of the isolated ileal segment is detubularized along the antimesenteric border with cold scissors or by inserting a 24-Fr chest tube for ease of identification of the most antimesenteric portion. A 10-cm proximal isoperistaltic afferent limb is left intact to anastomose the ureters.

Modified Studer Neobladder

The posterior part of the Studer neobladder is closed using absorbable running sutures (2-0 or 3-0 V-Loc). A 0-degree or 30-degree down lens can be used for this portion of the procedure (Fig. 100-11). After the posterior part is sutured, the distal half of the anterior part of the reservoir is also sutured in a similar fashion. The anterior part of the reservoir is not sutured completely and is closed toward the end of the procedure. The USC group advocates 90-degree counterclockwise rotation of the pouch at this stage.

Uretero-Neobladder Anastomosis

The Bricker anastomosis is performed between the ureters and the posterior plate of the Studer reservoir. Using a 4-0 Vicryl or a Quill suture (Fig. 100-12). Two single-J 40-cm ureteric stents are introduced before closing the ureters (Fig. 100-13). The stents are passed through the afferent limb and mobilized up to the ureters. The stents can be brought out via the midline just above the pubic symphysis or internalized by using double J stents.
Closure of the Neobladder

The remaining part of the reservoir is closed toward the completion of the neobladder. The balloon of the indwelling catheter is filled with 10 cc of water. The neobladder is checked for any anastomotic leakage. A Jackson-Pratt drain is placed in the pelvis away from the urethra-neobladder anastomosis.

KEY POINTS: CREATION OF MODIFIED STUDER NEobladder

- The significant difference among various approaches at neobladder formation is in initially performing the enterourethral anastomosis.
- The bowel can be mobilized to the urethra by holding the neobladder in position between two customized Penrose drains rolled around the intestine.
- Maneuvers to help the ileum reach the urethra include:
  - reducing Trendelenburg position.
  - using the Penrose drain to hold the ileum.
  - incising and releasing the peritoneum over the mesentery.
  - stapling the medial/proximal portion of the mesentery.
  - dissecting the ileum around the ileocecal region.
- Use of the hybrid 15-mm port by the bedside assistant can help ease alignment of the stapler with the bowel.
- The anterior part of the reservoir is closed toward the end of the procedure.

OUTCOMES

Intracorporeal urinary diversion attempts to minimize bowel manipulation and to reduce postoperative pain with minimal wound retraction and smaller incisions. The first published report of robot-assisted intracorporeal neobladder appeared in 2003 (Beecken et al., 2003). Several factors have facilitated performance of the procedure with an intracorporeal technique. First, RARC and the extended pelvic lymph node dissection technique have been standardized with oncologic results equivalent to standard open techniques (Raza et al., 2013). Second, the understanding of the robot-assisted surgical platform along with improving console-based surgical skills have allowed the robotic surgeons to optimize the use of this technology. The advantage of the EndoWrist technology in robot-assisted surgery allows surgeons to use the mechanical wrist for suturing and reconstructive purposes with minimal effort in comparison to conventional laparoscopy. This section addresses various key factors that define the acceptance of intracorporeal urinary diversion based on operative technique, learning curve, hospital stay, complications, functional outcomes, and comparison between intra- and extracorporeal outcomes.

OPENING TECHNIQUE

One of the major limitations of incorporating intracorporeal diversion has been prolonged operative time (Balaji et al., 2004; Hubert et al., 2006). Initial reports of operative times up to 450 minutes made this approach unacceptable, as the patient population is at risk because of age and comorbidity. More recent literature shows that overall operative times have been reduced (almost equivalent to the open approach), and the technique is standardized. Open conversion is rare, with only two technique-related reports (Table 100-3).

In one of the largest reported series of 100 consecutive robot-assisted intracorporeal ileal conduits, median overall operative time was 352 minutes with an estimated blood loss of 300 mL and no conversion (Azzouni et al., 2013). In a separate combined series of 36 intracorporeal neobladders and 9 ileal conduits, Jonsson and coworkers (2011) reported an acceptable median operative time (460 minutes for ileal conduits and 480 minutes for neobladders).
### TABLE 100-3 Comparisons of Operative Parameters for Robot-Assisted Intracorporeal Urinary Diversion

<table>
<thead>
<tr>
<th>SERIES (YEAR)</th>
<th>PATIENTS</th>
<th>DIVERSION</th>
<th>OVERALL OPERATIVE TIME (min)</th>
<th>DIVERSION TIME (min)</th>
<th>CONVERSION TO OPEN</th>
<th>INTRAOPERCATIVE DIFFICULTY/ COMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goh et al (2012)</td>
<td>15</td>
<td>Ileal conduit 7 Neobladder 8</td>
<td>450</td>
<td>NR</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Azzouni et al (2013)</td>
<td>100</td>
<td>Ileal conduit</td>
<td>352</td>
<td>123</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Canda et al (2012)</td>
<td>25</td>
<td>Ileal conduit 2 Neobladder 23</td>
<td>624</td>
<td>NR</td>
<td>1</td>
<td>Inability to anastomose</td>
</tr>
<tr>
<td>Pruthi et al (2010)</td>
<td>12</td>
<td>Ileal conduit 9 Neobladder 3</td>
<td>318</td>
<td>180</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tyritzis et al (2013)</td>
<td>70</td>
<td>Neobladder</td>
<td>420</td>
<td>NR</td>
<td>4</td>
<td>2 Cardiopulmonary compromise 2 Technical difficulty: prolonged difficulty operable time, inability to anastomosis</td>
</tr>
</tbody>
</table>

NR, not reported.

### COMPLICATIONS

It is difficult to attribute all reported complications to urinary diversion, as the patients also underwent radical cystectomy and a lymph node dissection, which can be morbid and responsible for a portion of reported complications. The possible attributed advantages in terms of reduced bowel manipulation, decreased insensible losses, and minimal need for analgesia can possibly help reduce the significant morbidity of this procedure.

Based on literature (only describing case series >10) overall early (30-day) and late (90-day) complications were up to 73% and 81%, respectively (Table 100-4). High-grade complications were observed in up to 37%, and sepsis was the most common cause of these complications. The reoperation rate at 30 days was as high as 17%; meanwhile the readmission rate ranged between 22% and 60%.

### HOSPITAL STAY

The literature does not show evidence of significant reduction in hospital stay except for the University of North Carolina series that showed a reduced average stay of 4.5 days (Pruthi et al, 2010). In the IRCC comparative study (Ahmed et al, 2014) median hospital stay was marginally longer with intracorporeal urinary diversion (9 days vs. 8 days, P = .086).

### FUNCTIONAL OUTCOMES

The most significant functional outcomes related to the neobladder are return of continence and sexual function. Canda and colleagues (2012) evaluated 23 patients who underwent intracorporeal Studer neobladder and found that 61% were fully continent and 22% experienced mild daytime incontinence. Erectile function was evaluated based on the International Index of Erectile Function scores with poor return of results attributed to limited follow-up and decreased libido. Goh and coworkers (2012) at 3-month follow-up had complete return of daytime continence in six patients and only one patient required conversion to a continent cutaneous pouch. Tyritzis and colleagues (2013) showed that 74% of men and 67% of women were continent (either no or one pad per day). A total of 81% of patients who underwent a nerve-sparing procedure were potent with or without oral medications at 12 months. A total of 67% of females also remained sexually active after surgery.

### INTRACORPOREAL VERSUS EXTRACORPOREAL DIVERSION

The IRCC compared outcomes (935 patients) between intracorporeal (167 patients, including 106 ileal conduits and 61 neobladders) and extracorporeal urinary diversion.
## Table 100.4
Comparisons of Clinical Outcomes following Robot-Assisted Intracorporeal Urinary Diversion

<table>
<thead>
<tr>
<th>Author/YEAR</th>
<th>TYPE/NUMBER</th>
<th>COMPLICATIONS (%) (30 DAYS, 90 DAYS)</th>
<th>HIGH-GRAD COMPLICATION (%)</th>
<th>REOPERATION (%) (30 DAYS)</th>
<th>READMISSION (%) (90 DAYS)</th>
<th>MORTALITY (%) (90 DAYS)</th>
<th>MORTALITY (%) (90 DAYS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azzouni et al (2013)</td>
<td>Ileal conduit 100 NR, 81</td>
<td>NR, 81 Infection 19 0 16 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goh et al (2012)</td>
<td>Ileal conduit (7)/Neobladder (8)</td>
<td>15 73, 13 Infection 13 0 60 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pruthi et al (2010)</td>
<td>Ileal conduit (9)/Neobladder (3)</td>
<td>12 42, 17 Infection 8 17 17 17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canda et al (2012)</td>
<td>Ileal conduit (2)/Neobladder (25)</td>
<td>25 52, 28 Infection 28 0 24 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyritzis et al (2013)</td>
<td>Neobladder 70 48, 51 Infection 37 4.5 NR 1.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ahmed et al (2014)</td>
<td>Ileal conduit (106)/Neobladder (61)</td>
<td>167 35, 41 Infection 18 12 12 1.6</td>
<td></td>
<td></td>
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NR, not reported.
FUTURE DIRECTION

After the safe inclusion of RARC and lymph node dissection in our armamentarium, urinary diversion is now being performed worldwide. The biggest technical challenges of pelvic reconstruction with conventional laparoscopy have been suturing and the ability to maneuver in narrow spaces. The depth of image with three-dimensional magnification and the ability of the EndoWrist to assist with intracorporeal suturing using the surgical robot have made intracorporeal urinary diversion possible in a safe and time-sensitive fashion.

Randomized controlled trials are ideal for safety and functional outcomes; they are meanwhile supplemented, however, with standardized registry-based outcomes. A permanent place for intracorporeal urinary diversion in urologic surgery will depend not only on optimal operative times but also on a reduction in morbidity and a quicker return of quality of life. These parameters have to be properly measured and must demonstrate improvement in comparison to the standards set with open urinary diversion.

REFERENCES

The complete reference list is available online at www.expertconsult.com.

SUGGESTED READINGS


REFERENCES