Robotic-Assisted Radical Cystectomy with Modified Hybrid Ileal Neobladder and Unilateral Nerve-Sparing in the Private Medical System. Case Report

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ABSTRACT

Introduction and Objectives. To describe our robotic-assisted laparoscopic radical cystectomy technique and modified hybrid ileal orthotopic neobladder (modified Studer) to treat muscle-invasive bladder cancer.

Materials and Methods. We describe our surgical technique for performing a robotic-assisted laparoscopic radical cystectomy with modified hybrid ileal neobladder and unilateral nerve-sparing using the DaVinci X Robotic Surgical System.

Results. The operation could be performed without any complications utilizing the DaVinci System. The operative time was 410 min. The intraoperative blood loss was 150 ml. The reservoir's oncologic and functional results were excellent.

Conclusions. A hybrid approach combining the advantages of extracorporeal urinary diversion and intracorporeal urinary diversion is efficient. The modified Studer neobladder technique using a hybrid approach is safe and feasible. This technique provides promising perioperative functional results. More data and long-term follow-up are expected in the future.

Keywords: DaVinci; hybrid approach, radical cystectomy; robotic, neobladder, nerve-sparing, functional outcomes

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Introduction and Objectives

For decades, radical cystectomy (RC), lymph node dissection , and urinary diversion, with or without neoadjuvant chemotherapy, have been the standard of care for patients with non-metastatic muscle-invasive bladder cancer (MIBC) and selected high-risk non-metastatic bladder cancer [1]. Following RC, ileal conduit remains the most common type of urinary diversion. However, orthotopic neobladder (NB) may improve the quality of life in suitable patients through the preservation of body image and normal micturition [2].

Technological advancements have contributed to the development of standardized mini-invasive procedures that now offer oncologic outcomes and complication rates comparable to open surgery. These procedures also have decreased transfusion rates, postoperative use of analgesics, and faster recovery of bowel function [3,4].

While robotic-assisted radical cystectomy (RARC) extirpative steps' quality mainly determines oncologic outcomes, functional outcomes are also determined by the reconstruction technique. Apart from patient and tumor status, the main obstacles to the increased use of orthotopic NBs are technical complexity and prolonged surgery. These disadvantages have driven many surgeons to adopt a hybrid method by performing the reconstructive steps following conversion to a mini-laparotomy (extracorporeal urinary diversion, ECUD) [5]. Recently, an increasing rate of intracorporeal urinary diversion (ICUD) has been reported with comparable perioperative results to ECUD when performed by experienced surgeons [6], with some advantages such as reduced risk of blood transfusion and gastrointestinal complications and shorter postoperative time of exhaust and oral intake [7].

Since 2011, when the lead surgeon performed the first RARC with orthotopic ileal NB [8], several changes in surgical technique, especially in reservoir configuration, have moved from an extracorporeal to an intracorporeal approach. In the last case, we performed a modified hybrid approach to combine the advantages and eliminate the disadvantages of these approaches. We report a case of robotic-assisted laparoscopic RC and unilateral nerve-sparing using the hybrid approach to perform an orthotopic ileal NB for the treatment of non-metastatic MIBC.

Materials and Methods

A 55-year-old male diagnosed with pT2G3 MIBC (the second transurethral resection of the bladder tumor was performed in July 2024) was admitted to our department for RC in October 2024.

The preoperative imaging abdomino-pelvine MRI revealed left hydronephrosis grade II, a tumor on the left vesical wall, and no lymph nodes or metastasis (Fig 1 and Fig 2).

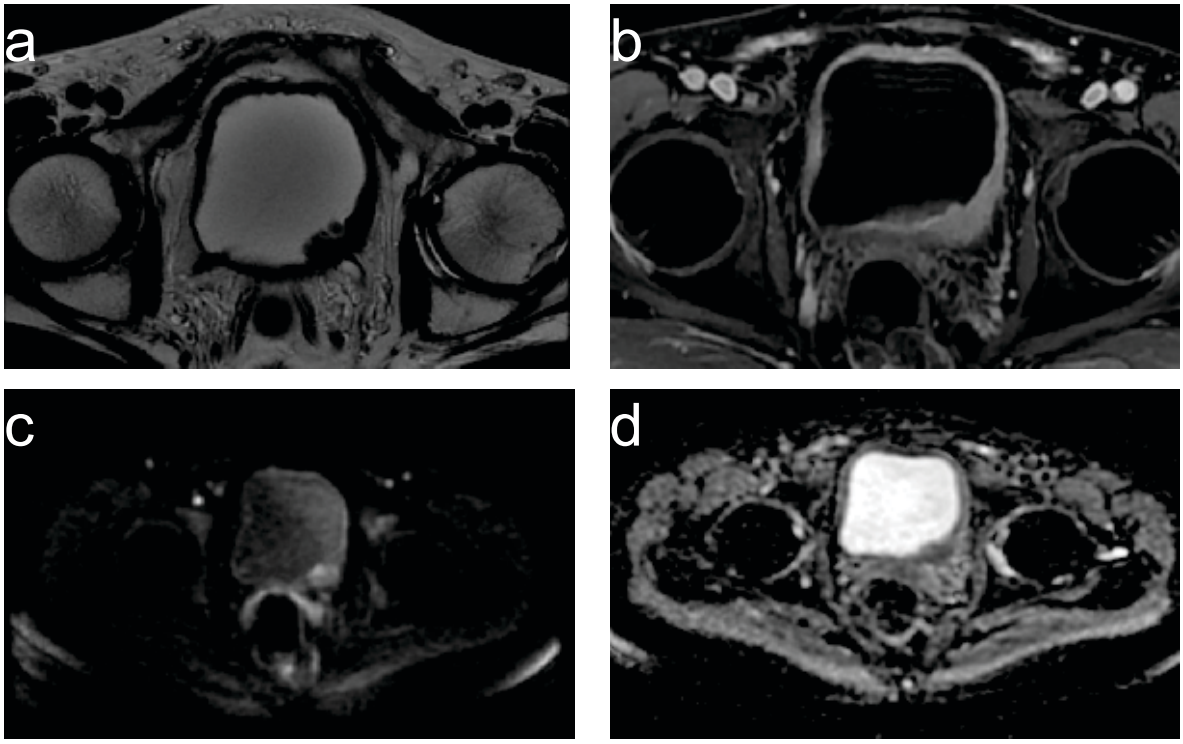


Fig 1. a.axial T2 weighted, b.contrast enhanced axial T1 weighted image, c. axial DWI b value 800 d. axial ADC – infiltrative tumoral lesion on the posterior left side of the bladder wall encasing the left ureter meatum with extension in the adjacent fat tissue

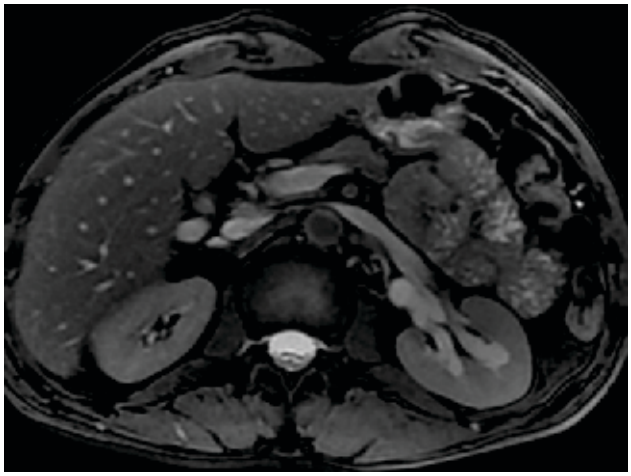


Fig 2. Axial FIESTA showing mild left-side hydronephrosis

After discussing the case in the tumor board, presenting the therapeutic options to the patient, and after obtaining informed consent, we decided to perform RARC with orthotopic ileal NB.

The patient had only clear liquids 24 hours before surgery. After general anesthesia, the patient is placed in a lithotomy position with the operating table in maximum Trendelemburg position. Compression stockings are applied to reduce the risk of deep vein thrombosis, the patient's arms are restrained at the sides, and a body warmer is placed over the thorax to prevent hypothermia. Antibiotic prophylaxis with broad-spectrum antibiotics is given at induction and ongoing postoperatively. Low molecular weight heparin was given in the early postoperative period and continued for 4 weeks postoperatively.

The procedure was performed using the Da Vinci X Robotic Surgical System (Intuitive Surgical, Sunnyvale, CA, USA). The instruments used were: monopolar curved scisors, fenestrated bipolar forceps, prograsp forceps, large needle driver, and tip-up fenestrated grasper. For trocar placement, we used the Karolinska configuration [], which means that the optical trocar 2-3 cm incision is made approximately 5 cm cephalad to the umbilicus. After obtaining pneumoperitoneum, the working trocars were placed laterally to the umbilicus under visual control at a distance of 8-9 cm: on the left side two 8 mm trocars for the robotic arms, on the right side one 8 mm trocar for the robotic monopolar scissors and the 12 mm AirSeal trocar. Another 5 mm trocar was placed 5 cm cephalad between the optic and the right robotic arm and is typically used for aspiration.

RC and extended pelvic lymph node dissection were performed first. The parietal peritoneum was incised along the white line of Toldt and the right/left colon was reflected medially, exposing the psoas and iliac vessels. The ureters were identified at the common iliac bifurcation and dissected distally to the ureterovesical junction with ligation and division of the obliterated umbilical artery and superior vesical pedicle. The ureters were dissected cephalad to the level of the aortic bifurcation, taking care to preserve periureteral tissue. The ureters were divided between two Hem-o-lock clips. A 5 cm stay suture was placed on both proximal clips to facilitate identification and mobilization of the ureters during subsequent reconstruction. The distal margin of each ureter was sent for a frozen section and analyzed. Bilateral lymphadenectomy of the iliac and obturator fossa lymph nodes was performed. The lymphadenectomy specimens were bagged with an Endobag. The posterior peritoneal reflection between the bladder and rectum was incised and the prerectal space was carefully developed under Denonvillier's fascia posterior to the seminal vesicles toward the prostatic apex. The posterior and lateral pedicles were clipped and divided bilaterally.

An incision was made in the peritoneum along the anterior abdominal wall above the level of the bladder. The urachus and medial umbilical ligaments were incised. The space of Retzius was developed to the level of the endopelvic fascia. The prostate was defatted, and the superficial dorsal venous complex was coagulated with electrocautery and divided. The endopelvic fascia was sharply opened on the left side.

The plane between the prostatic capsule and prostatic fascia was developed and the nerve-sparing dissection plane was defined and extended, freeing the neurovascular bundle on the right side (Fig 3).

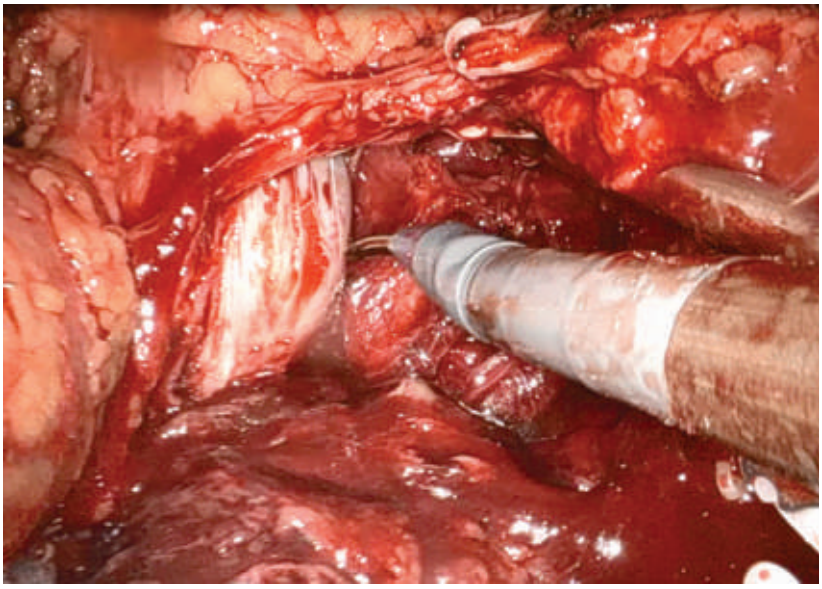


Fig 3. Right nerve-sparing

The dorsal vein complex was 2.0 V-lock suture. An occluding clip was placed on the urethra and the urethra sharply divided distally to prevent spillage. A urethral margin was sent to pathology for frozen-section evaluation. The bladder and prostate were placed in an Endobag. The left ureter is transposited on the right side through a window created under the sigmoid mesocolon.

After the cystectomy and lymphadenectomy are completed, the robot is undocked, the Trendelenburg position is decreased to 10-15°, the Alexis wound retractor is removed, and a 6-7 cm mini-laparotomy is made caudally extending the supraumbilical wound for the camera port to remove the endobags.

The ileal turning points for the NB were marked after extracorporeal manipulation. First, we marked a point 20 cm from the ileocecal region and then another point 45 cm from the previous one. Between these two points is the ileum selected for the NB. Then we placed a mark at 35 cm from the first mark and the 10 cm represents the afferent limb. Between these marks, we placed another mark representing the future location of the urethra-ileal anastomosis. Then we checked that the last mark reached the pelvic floor and that there was no misjudgment of the distance of the urethra for the urethra-ileal anastomosis. The continuity of the ileum is reestablished in a side-to-side fashion by using two 60 mm GIA staplers (Covidien, Medtronic, Tokyo, Japan). Approximately 35 cm of ileum was then detubularized, leaving 10 cm of the afferent limb. The posterior wall of the NB is closed in a double layer using 3.0 V-lock suture, without suturing the mucosa.

The pneumoperitoneum is obtained again and the robotic system is redocked in Trendelenburg position at 10-12°. A Rocco stitch is performed it allow a tension-free anastomosis. A circumferential urethra-ileal anastomosis is performed in a van Velthoven fashion using Stratafix 3.0. A 22 Foley catheter is placed under visualization before completing the anastomosis (Fig 4). The distal half of the anterior part of the NB is sutured. The proximal half of the anterior part is left open and later closed until the ureteral anastomosis is performed. Both ureters are spatuled for 2 cm. A running suture of the afferent limb and Wallace plate is performed using continuous 4.0 polydioxanone sutures (Fig 5). Each ureter is catheterized with a 6 Ch monoJ stent. Both catheters are exteriorized through the anterior wall of the reservoir, and sutured, and the distal ends are pulled through 2 additional incisions in the suprapubic area. The proximal half of the anterior

part of the NB is then closed. The NB was irrigated with 150 ml saline to ensure a watertight seal. A passive drainage tube was placed in the pelvis through the port site and the robot was undocked.

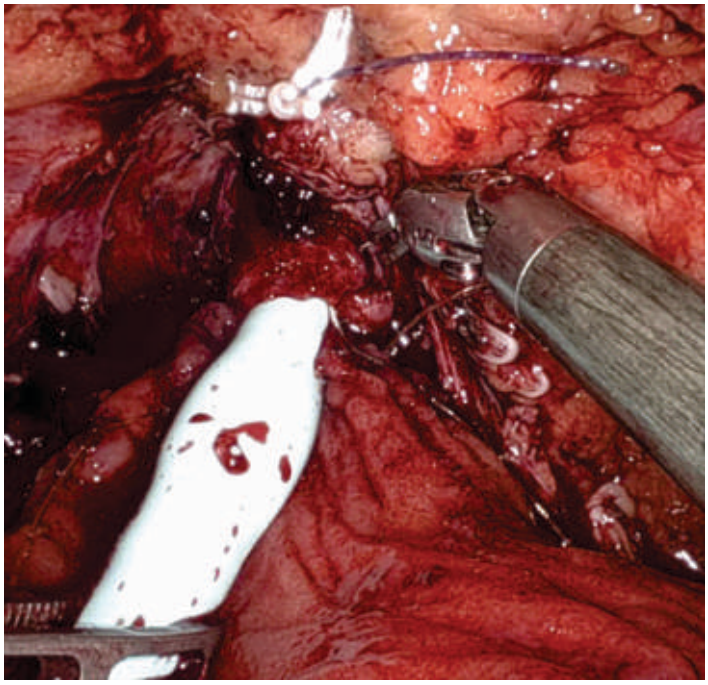


Fig 4. Urethra-ileal anastomosis performed in a van Velthoven fashion

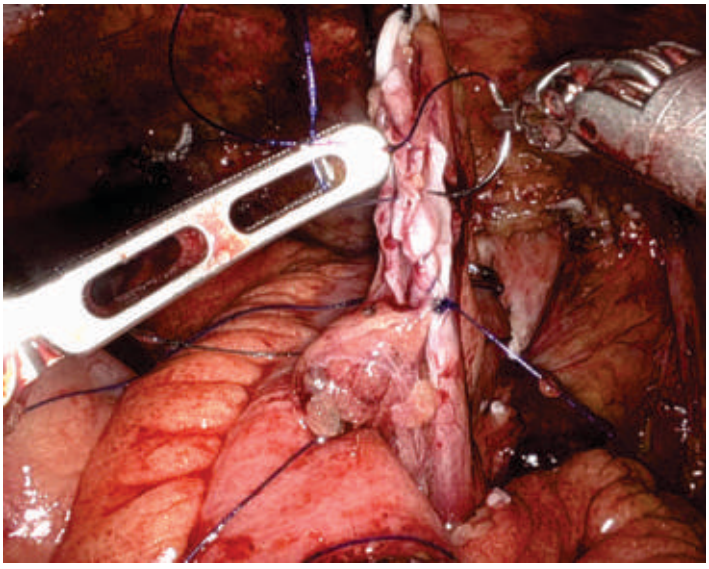


Fig 5. Wallace plate

We gave a clear liquid diet on postoperative day 1, and the diet advanced with the return of bowel function (which happened at 36 hours postoperatively). Then we started to irrigate the NB on the second postoperative day. There was no intra-abdominal urinary leakage and no postoperative ileus. The abdominal drain was removed when the output was < 100 ml.

Results

The procedure was completed without serious complications and no conversion to open surgery.

The operative time was 410 min. The intraoperative blood loss was 150 ml. The length of hospital stay was 14 days. Ureteral catheters were removed 3 weeks postoperatively, and bladder catheters were removed 4 weeks postoperatively.

The postoperative histopathological result revealed high-grade "Nested urothelial carcinoma" pT3aN1L1V0Pn1R0. Among the total of 20 lymph nodes collected, one showed positivity for urothelial carcinoma. The metastasis measured 11/6 mm (Fig 6 and 7).

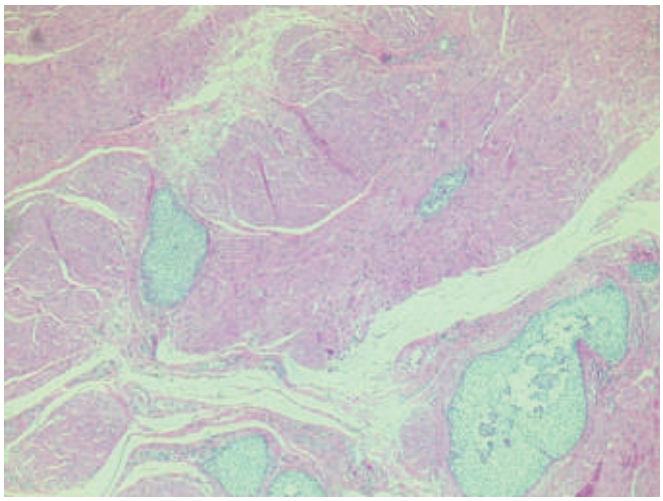


Fig 6. Urothelial carcinoma of the bladder revealing nested architecture and infiltration of the muscularis propria, hematoxylin-eosin stain, 100x

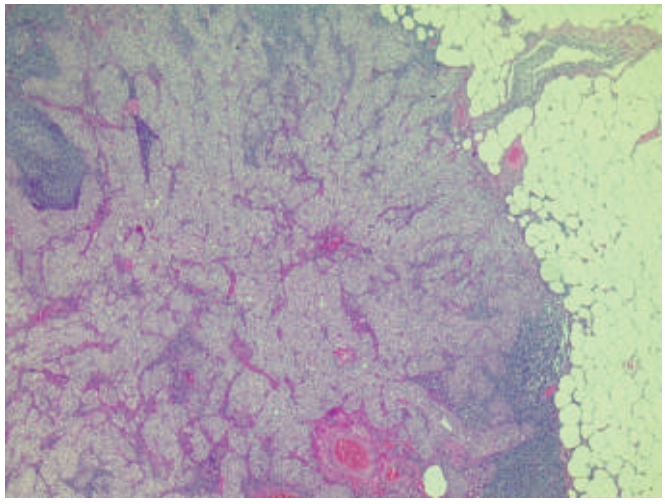


Fig 7. Lymph node containing urothelial metastasis, hematoxylin-eosin stain 100x

There were no readmissions for complications. At 3 months follow-up, the patient is doing well and has undergone adjuvant chemotherapy. The patient is continent daily and uses 1 pad at night. The urinary reservoir shows excellent function. We recommended postoperative erectile rehabilitation with PDE5I. Erectile function is present under PDE5I.

Discussions

RC is the surgical approach of choice for patients with MIBC and certain non-MIBC [1]. With the emergence of robotic surgery and increasing expertise, RARCs are likely to become the minimally invasive technique of choice []. Quality of life after RC is an important consideration in the choice of urinary diversion. An orthotopic continent diversion (NB) is preferable to an ileal conduit (traditional urinary diversion) for a better postoperative quality of life [10].

According to Laplace's law, a spherical bag has the highest capacity and the lowest pressure. Studer has demonstrated that folding the U-shaped ileum allows the NB to achieve low pressure and high capacity [10]. The Karolinska-modified Studer, USC-modified Studer, Hautmann, Pyramid, Y-pouch, and Vesica Ileale Padovana NB are common methods described for the reconstruction of the ICNB [5]. Most surgeons perform this procedure using the Karolinska-modified Studer approach. It results in high rates of daytime and nighttime continence [12].
Regarding functional outcomes, at 1 year, 75% of patients did not require pads during the day and <10% used more than one pad per day. Both the ICNB and ECNB groups achieved urodynamically demonstrated levels of adequate bladder capacity and compliance. Daytime continence was excellent. Nighttime continence was good in both groups. There was no significant difference in urodynamic parameters between the two groups. However, continence is achieved slightly earlier in the ICNB group, but ICNB does not appear to be superior to ECNB [13].
As a result of the inferior visualization of the urethra through the mini-laparotomy and the increased blood loss, it has been hypothesized that achieving excellent mucosal apposition is more challenging, which increases the risk of bladder neck contracture formation in ECNB compared to ICNB, after RARC [14].

According to Lombardo et al, 60 procedures of RARC with ICNB are sufficient in tertiary referral centers to achieve all outcomes defined by the Pasadena RARC Consensus [15]. Although there is growing interest in intracorporeal techniques for urinary diversion during cystectomy in the modern field, Faraj et al. report their concerns regarding the issues of steep learning curve and impact on resident training. Despite some theoretical advantages such as a lower ureteroenteric stenosis rate and the potential for longer operative times and complications, they advocate performing orthotopic NBs via an extracorporeal approach [16].

Mistretta et al. analyzed 101 patients who underwent RARC and orthotopic NB. 57 (56.4%) ICNB and 44 (43.6%) ECNB patients were identified. No statistically significant differences in complication rates (overall, early or late) were found when comparing ICNB and ECNB. Oncologic and functional outcomes also showed no statistically significant difference [17,18]. These results are supported by a recent meta-analysis comparing ICUD vs ECUD after RARC, with differences in blood loss and blood transfusion rate in favor of ICUD [19]. On the other hand, the International Robotic Cystectomy Consortium reported a higher rate of overall complications (not high-grade complications) and readmissions in the ICUD group compared to the ECUD group [20], leading to the recommendation that the ICNB should be performed in high-volume centers.

Gastrointestinal complications are associated with RC, ileus being the most common. Patients who underwent ICUD with RARC showed no difference in the incidence of gastrointestinal complications compared to those who underwent an open approach [21]. There was no difference in gastrointestinal complication rates between the two approaches in NB patients [22].

Postoperative complications such as acute kidney

injury and chronic kidney injury are important complications after RC. Wang et al. reported that pathological stage, ureteroenteric anastomotic strictures, and ECUD significantly affected long-term renal function. However, the type of urinary diversion (ileal conduit or orthotopic NB) did not affect renal function, and ICUD was superior regarding long-term renal injury rate [23].

The hybrid approach was used to perform the ileoileal anastomosis, the NB, and ureteral anastomosis extracorporeally, and the urethra-ileal anastomosis intracorporeally. The hybrid approach creates a NB by combining the advantages of extracorporeal and intracorporeal NBs through an infra umbilical midline incision. However, since an incision is always required to remove the specimen in men, the same incision can be used to manipulate the ileum extracorporeally.

Shimizu et al reported a series of 10 male patients who underwent RARC with NB simply by using a modified Vesica Ileale Padovana with a hybrid approach. They performed a side-to-side ileoileal anastomosis extracorporeally, then the NB posterior plate and intracorporeally the circumferential urethra-ileal anastomosis, side-to-middle anterior wall closure, and ureteral afferent limb anastomosis, emphasizing the advantages of the hybrid approach [24].

We used a hybrid approach for a modified Studer NB and we only performed the side-to-side ileoileal anastomosis and the posterior wall of the reservoir extracorporeally. The following steps of the procedure were performed intracorporeally. We combined the advantages of both procedures. Performing extracorporeally the ileoileal anastomosis and suturing the posterior plane gave us a shorter operative time, a watertight posterior plane suture, and less time with the patient in the Trendelenburg position. The advantages of ICNB include a reliable urethra-enteric anastomosis and no need for excessive dissection of the ureter, advantages that also apply to the hybrid approach. Reliable urethra-enteric anastomosis and no need for excessive ureteral dissection are the advantages of ICNB. These benefits also are valid for the hybrid approach. When UD is performed extracorporeally, the ureteral length is generally longer than when UD is performed intracorporeally, which may contribute to a higher rate of ureteroenteric stenosis [25]. Disadvantages include prolonged operative time and head-down time. Recent reports, however, show that the total operative time is similar to that of ECNB reconstruction [22].

Recently, Tyson et al. described a hybrid orthotopic NB using the single-port da Vinci SP robotic system and noted that the undocking and redocking time was more than offset by the time saved with extracorporeal suturing. Second, it mimics more open techniques. Third, the incision used in the SP method was needed for extraction anyway [26]

According to Cheng et al. [27], the nerve-sparing RC technique may contribute to the rate of continence and help patients achieve a relatively higher functional trifecta.

Regarding the robotic approach, the use of Bricker anastomosis and Wallace anastomosis for robot-assisted intracorporeal ileal conduit urinary diversion, there was no difference in postoperative renal function or the incidence of hydronephrosis between the two groups [28]. Only one robotic intracorporeal orthotopic NB during RC series includes both techniques. Based on surgeon preference, Bricker was performed in 46 patients and Wallace in 86. Bricker and Wallace were diagnosed with strictures in 2 and 3 patients, respectively. All strictures occurred within 3 months postoperatively [29]. The only published meta-analysis showed no superiority for either group with comparable stricture rates (Bricker: 2.9% vs. Wallace: 1.9%, p=0.57) [30].

Conclusions

A hybrid approach combining the advantages of ICUD and ECUD is efficient. The modified Studer NB technique using a hybrid approach is safe and feasible. This technique provides promising perioperative functional results. More data and long-term follow-up are expected in the future.

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