Chapter

Robot-Assisted Radical Cystectomy with Intra-Corporeal Neo-Bladder

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Abstract

The purpose of this chapter is to provide a step-by-step description of the robot-assisted radical cystectomy with an intra-corporeal neo-bladder technique and a recent review of its outcomes. The procedure is also known as anterior pelvic exenteration or cysto-prostatectomy in the case of female or male respectively. Radical cystectomy (RC) is the gold standard treatment for muscle-invasive bladder cancer, but there are also several surgical indications for non-muscle-invasive bladder cancer. In the past years, minimally invasive surgery and the da Vinci system technology have played a major role in this procedure, with description of brand-new techniques and specific approaches for the creation of a continent urinary reservoir. The following chapter provides a detailed description of the robot-assisted radical cystectomy (RARC) with Y-shaped intra-corporeal bladder as well as a literary review of distinct perioperative, functional and oncological outcomes from the available RARC randomized controlled trials. Despite its high cost and complexity, the intra-corporeal technique has become widely popular around the world and is used more frequently each time. The described data in this chapter, demonstrates that morbidity can be reduced whilst simultaneously offer non-inferior oncological results and less intraoperative blood loss in contrast to the open RC approach.

Keywords: radical cystectomy, neo-bladder, urinary diversion, robotic surgery, bladder cancer

1. Introduction

The Radical Cystectomy with extended pelvic lymph node dissection has evolved dramatically with the emergence of new robotic technological advancements.

Bladder cancer is a broad-spectrum disease, from papillary urothelial non-invasive tumor to aggressive invasive lesions that require radical and multi-modal management [1]. Radical cystectomy (RC) has been the gold standard treatment for muscle-invasive bladder cancer [2, 3].

Historically, in the early 1800s, RC was performed with an open approach however the principles for the current technique were published in 1949 by Marshall and Withmore. Both authors listed some important disadvantages of this procedure such as its high impact on morbidity, overall survival rate and patient's quality of life [4, 5].

Over the years, this procedure has been redefined thanks to the increasing new technology developed around minimally invasive approaches (laparoscopy and robotic-assisted laparoscopy), that implies numerous advantages compared with standard procedures, including decreased blood lost, postoperative narcotic use, time to flatus, time to bowel movement and length of stay [2, 6–9].

Menon and his group developed the robotic-assisted technique and approach to the prostate at the beginning of the 2000s. Based on the rationale that radical prostatectomy could be performed with the robot-assisted approach, this principle was applied to multiple surgeries including radical cystectomy and urinary diversion [10–12].

Initial laparoscopic experience on radical cystectomy was described by two main groups, the first one leaded by Parra et al., who reported their initial experience in the department of Surgery of Saint Louis University School of Medicine in Missouri in 1992 and the second by Sanchez de Badajoz et al., who described several case reports of RC, lymph node dissection and laparoscopic urinary diversion in 1995 in the department of Surgery of the University of Malaga, Spain [4, 12, 13].

First reports of robotic-assisted radical cystectomy (RARC) were reported by Menon and colleagues in Egypt in 2003, where they concluded and published that this approach was both safe and feasible. Recent publications explore the potential to improve morbidity and oncological outcomes [4, 10, 14].

According to the National Inpatient Sample, RARC has gained popularity among urologic surgeons as the preferred minimally invasive approach for bladder malignancies and continues to evolve throughout time. Nowadays, highly experienced surgeons have adventured to perform intra-corporeal urinary diversion reconstruction and have compared general and oncological outcomes as well as health-related quality of life in a large number of patients [4–15].

2. Anatomical landmarks

The bladder is an extra-peritoneal muscular urine reservoir located behind the pubic symphysis in the pelvis. The male bladder consists of a distensible structure, formed at the level of the bladder neck by involuntary internal sphincter fibers. The standard surgical approach of the bladder is through a transperitoneal access. The cul-de-sac separates the rectum and the seminal vesicles from this deep pelvic area. The bladder neck is surrounded by the lateral ligaments and the arch of the pelvic fascia. The anterior portion of the bladder, is supported by the pubo-prostatic ligaments. In the female, the peritoneum lies anterior and superior to the vagina's wall on the Douglas space, anteriorly tendinous arch lateral and pubovesical ligaments.

The bladder is irrigated by the branches of the internal iliac artery:

- Antero-superior baldder: superior vesical artery
- Posterior-inferior bladder: Inferior vesical artery (vaginal artery in the females)

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The venous drainage coalesces in a venous plexus and prostatic venous plexus in the male and through the uterus vaginal plexus in the female, which ultimately drains into the internal iliac vein.

The lymphatic system has a supero-lateral drainage to the external iliac lymph nodes, the fundus and neck of the bladder drains to the internal iliac lymph nodes and the sacral lymph nodes [16].

The innervation is provided by presynaptic sympathetic fiber form T11-L2/3 and presynaptic parasympathetic fibers from S2-S4 and postsynaptic neurons in the wall of the bladder [16].

3. Surgical indications for cystectomy

The rationale of performing a cystectomy for malignancy is the outcome and implications of such minimally invasive surgery where continence, potency and sexual function, plus enhanced recovery programs, play a better role. Nowadays, the robotic technique has been further developed by several groups, with more technical variations and anatomical findings, having the sparing of structures as part of the actual benefits. The lymphadenectomy plays also a very important role and their oncological results are quite strong. The **Figure 1** below shows an algorithm of disease management [17, 18].

3.1 Immediate RC to patients with non-muscle-invasive tumors

- T1 tumors (high-risk progression)
- G3 (high grade) tumors.
- CIS.
- Multiple, recurrent and large (> 3 cm) TaG1G2/low-grade tumors.

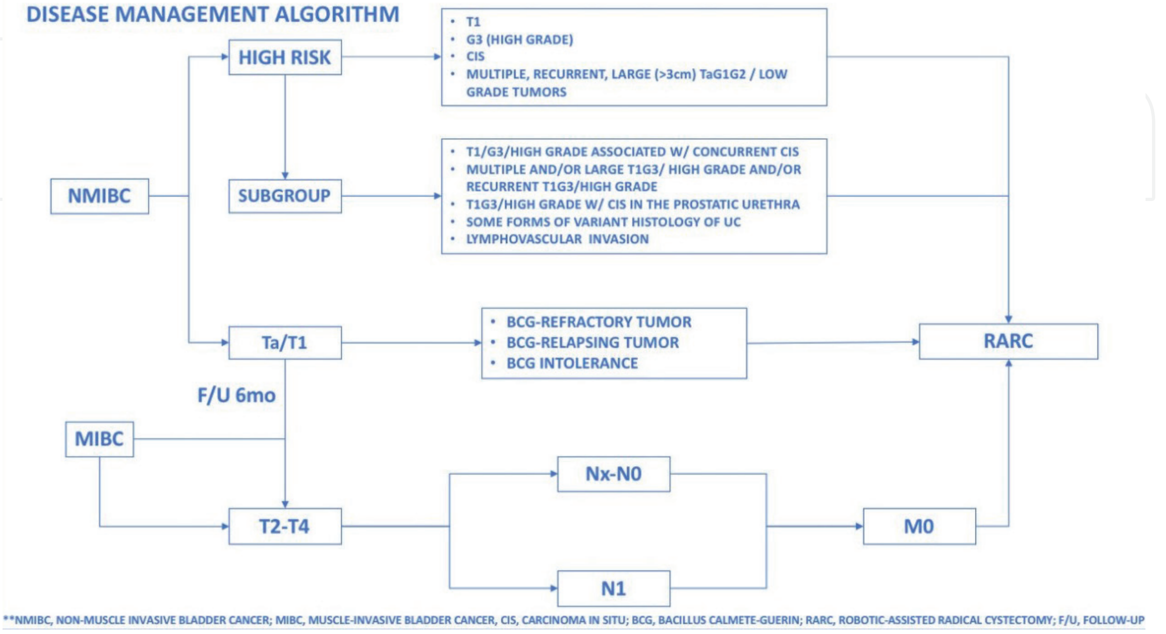

Figure 1.
Disease management algorithm.

Subgroup of highest-risk tumors:

- T1G3/high-grade associated with concurrent bladder CIS.
- Multiple and/or large T1G3/high grade and/or recurrent T1G3/high-grade.
- T1G3/high-grade with CIS in the prostatic urethra.
- Some forms of variant histology of UC.
- Lymphovascular invasion.

pTa: for refractory, relapsing or intolerance to BCG treatment.
pT1: multifocality, lamina propia invasion, recurrence after intravesical therapy, CIS.

3.2 RC to patients with muscle-invasive tumors

- pT2-T4.

4. Contraindications for urinary diversion

4.1 Absolute

- Renal function or hepatic function compromised (serum creatinine >2 mg/dl).
- Involvement of the distal urethra to the prostate or involvement of bladder neck.
- Presence of Metastatic disease.
- Physical disability (mental capability and hand dexterity).

4.2 Relative

- Advance age (>70y).
- Radiation to pelvis.
- Bowel disease
- Previous urinary incontinence or damaged rhabdosphincter [17, 18].

5. Surgical technique

5.1 Trocar placements

First robotic port is a 8-mm trocar for the camera, positioned in the midline 2 cm higher to the umbilicus. Robotic port for the scissors is placed in the lateral border of right rectus muscle. Second robotic port for the bipolar forceps in the left lateral border of rectus muscle and the third port for robotic grasp is placed as lateral about 3 fingerbreadths from the anterior-superior iliac spine. One more 5-mm port for suction, clip device and laparoscopic grasp, and a 15-mm port between the camera port and the right robotic one in a triangle position to avoid conflicts, these last port will be use for mechanical staplers. Patient is placed in a steep Trendelenburg position and the robotic system is docked [19].

5.2 Cystectomy and lymph node dissection

5.2.1 Female (anterior pelvic exenteration)

The technique starts with the section of the ovarian ligament following down this step will be also the start of the extended pelvic lymph node dissection reaching a better exposition of the ureter and later the bladder pedicles on the right side (**Figure 2**).

Once the lymph nodes are dissected medial to the ureter it can be visualized from the cross up over the iliac artery bifurcation, the ureter is perfectly identify and clip and transected then the lateral nodes are accomplished avoiding any injury of the hypogastric vessels and the obturator nerve preservation (**Figure 3**).

The common iliac artery bifurcation with-out the nodes shows the internal and external iliac arteries progressively dissected. The operative field view allows the identification of the bladder pedicles which are clipped or transected by ultrasonic device, the left ureter is clip and transected, lateral to this last one we follow the pedicle (**Figure 4**).

The same dissection is reproduced in the left side for the lymph node and the removed nodes are placed in an Endobag. It is then that both ureters are clipped and transected distally. In the case of uterus presence the pedicles are also clip by ultrasonic energy following the hypogastric artery to find the uterus branches. Because previously lymph node dissection and ureteral identification, uterus and vesical pedicles are easier to identify during exposition and dissection. Both pedicles are controlled and the lower plane of the bladder is follow by the anterior vaginal wall in assistance of a vaginal valve (**Figure 5**) [19, 20].

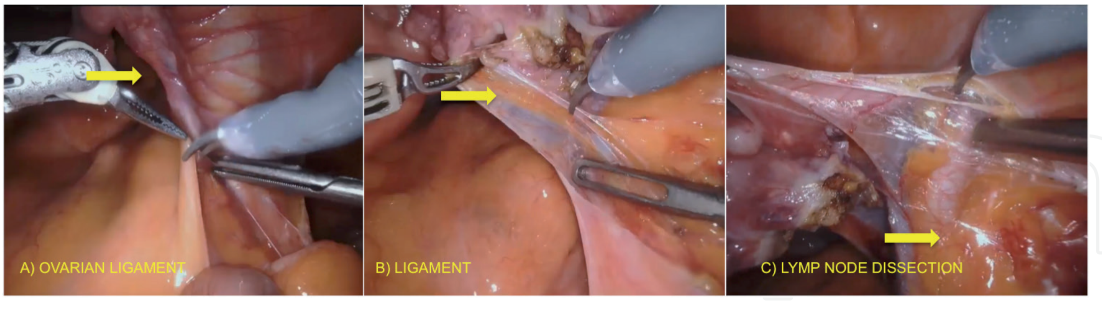

Figure 2.
Female ligament transection and lymph node.

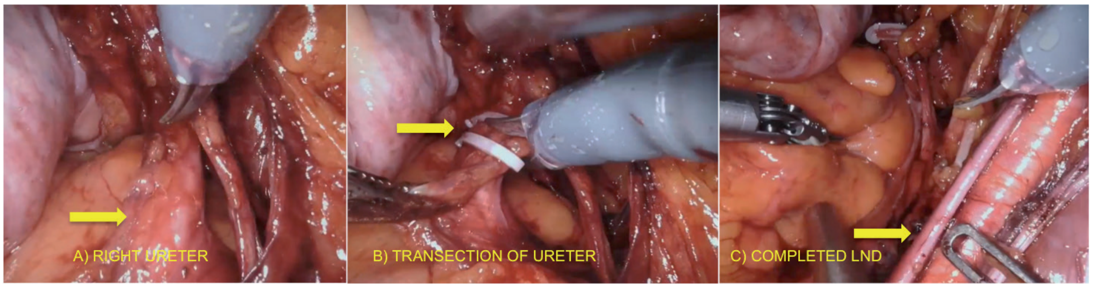

Figure 3.
Right ureter identification and lymphadenectomy.

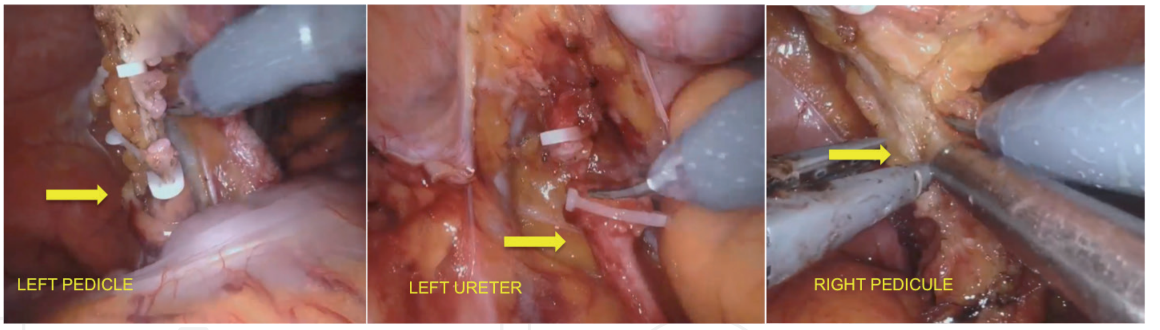

Figure 4.
Left ureter and pedicle identification.

Figure 5.
Anterior wall of the vaginal plane and anterior bladder.

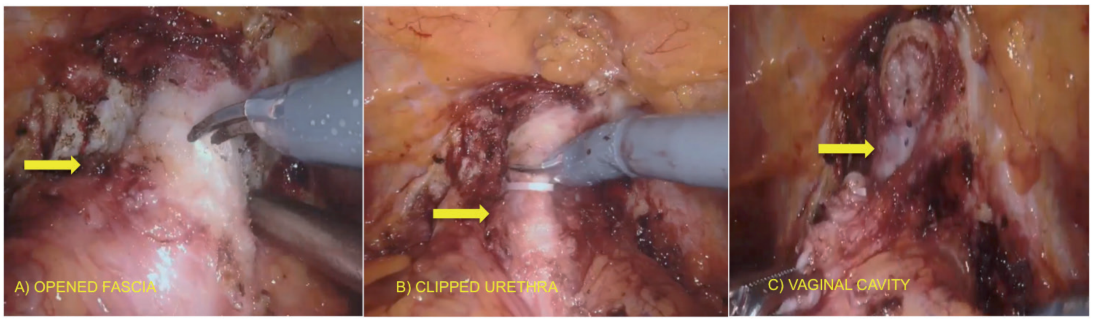

Figure 6.
Urethra dissection and vaginal cavity.

The dissection of the lateral surfaces of the bladder is extended, following the medial umbilical ligaments to the medial plane, the reflection of the endopelvic fascia is visualized and open it, the anterior urethra space is created and the urethra is clipped at the tip and transected safely, the specimen can be retrieval by the vaginal cavity (**Figure 6**) [21].

5.2.2 Male (cysto-prostatectomy)

When performing a lateral approach to the prostate the dissection of the lateral surface of the bladder starts on the right side, down dissection goes proximal to the prostatic pedicle following along the prostatic capsule and the seminal vesicle is identify [19]. The dissection starts lateral to the umbilical ligament, an incision is perform to the peritoneum until the finding of the ureter (**Figure 7**).

Following the ligament and medial will find the right ureter, while dissecting the perineotomy starts a little bit medial but not full open, just to continuo down and to expose the Vas Deferens and the Seminal Vesicle. The ureter is transected and clipped (**Figure 8**).

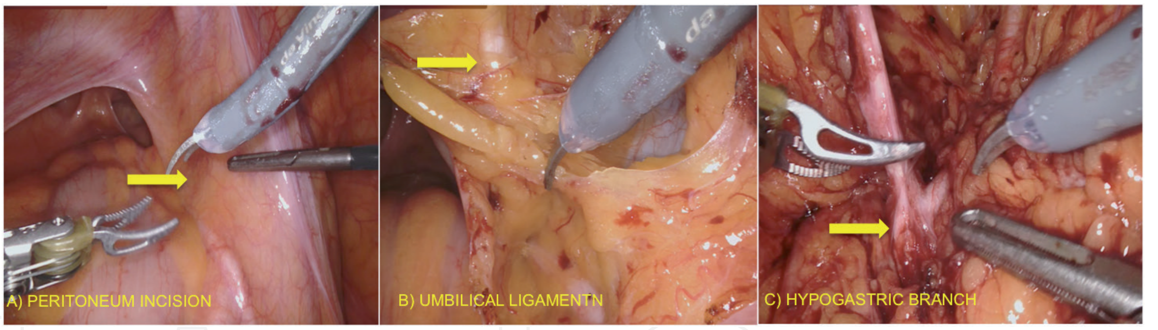

Figure 7.
Peritoneum incision and umbilical identification and transection.

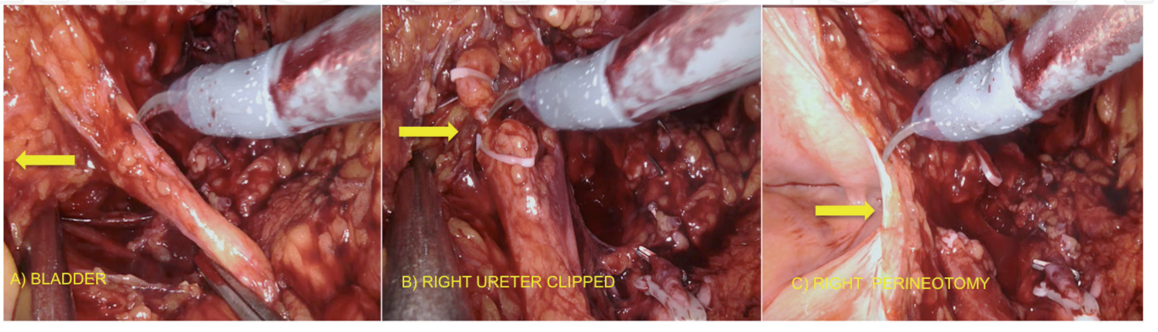

Figure 8.
Right ureter and half perineotomy.

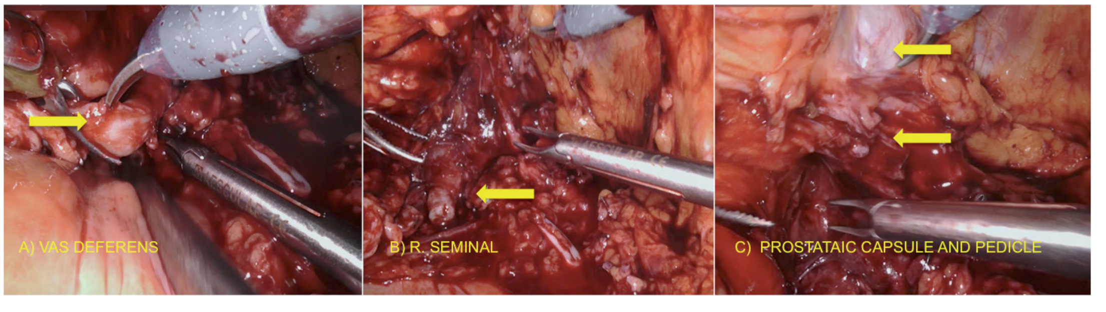

Figure 9.
Right lateral prostatic dissection.

The medial and ventral surfaces of the Seminal vesicle is transect, preserving the middle part and tip avoiding parasympathetic fibers damage in selected cases. The prostate vesicular angle is follow laterally to the apex [20–23] (**Figure 9**).

The same steps are replicated for the left side, starting with incision in the peritoneum lateral to the umbilical ligament, then ureter identification and transection. The lateral pedicles form bladder and prostate are identified and the seminal vesicle and vas are transected. The lateral face of the prostate is follow till the apex, and the Denonvillier's fascia is released (**Figure 10**).

Ligaments and endopelvic fascia are preserved, Santorini plexus is push up without any stich, the urethra is clip transected with the maximum length possible. The specimen is placed in an Endobag (**Figure 11**).

5.3 Neo-bladder creation

The creation of a Y-neobladder intra-corporeal technique following from the Clinique Saint-Augustin is described and showed step by step. The neobladder

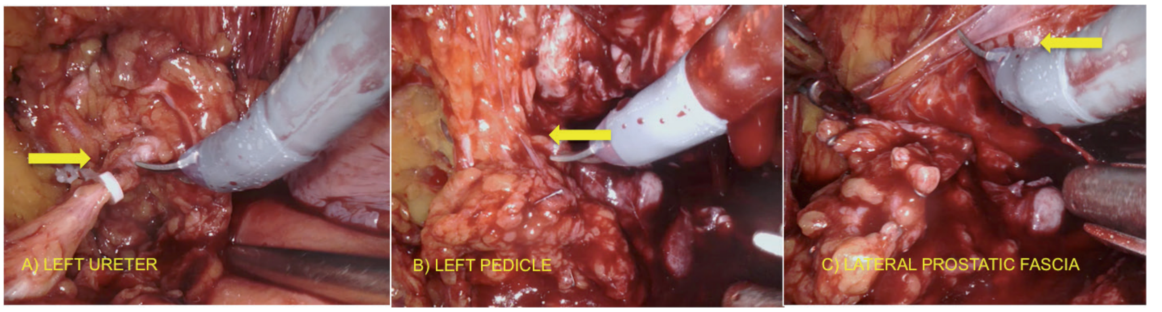

Figure 10.
Left side ureter and prostate fascia.

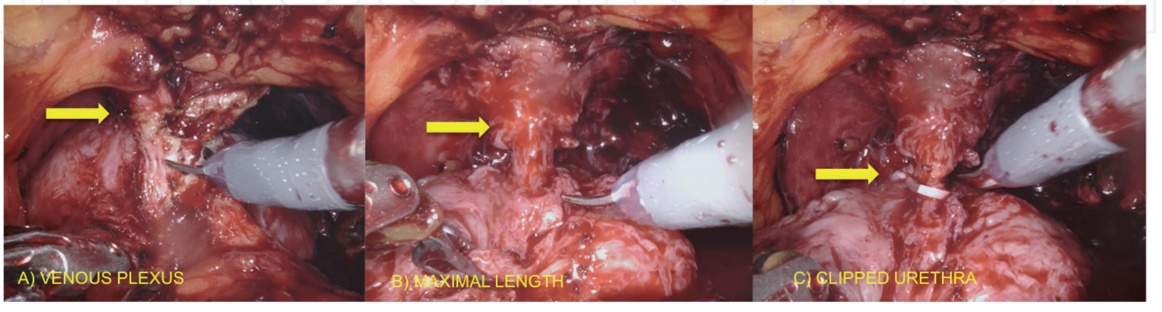

Figure 11.
Endopelvic fascia and ligaments preserved.

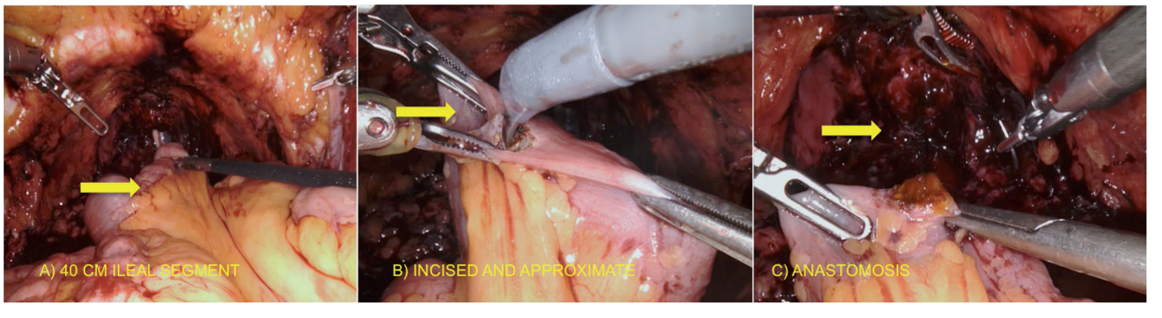

Figure 12.
Ileal segment and urethra-ileal anastomosis.

creation goes by selecting a 40 cm ileal segment form 15 to 20 cm proximal to the ileocecal valve. The segment is arranged in a modified Y shape [22]. The ileal segment is approximate to the urethra for an anastomosis (**Figure 12**).

The continuity of the bowel is achieved with a latero-lateral ileal anastomosis. Our group prefers to use a robotic Da Vinci system stapler, if not available, a laparoscopic stapler could be used trough the 15 mm assistant-trocar (**Figure 13**).

Detubularization of the bowel starts for the two ileal limbs in the antimesenteric border. Construction of the posterior plate is performed by suturing the medial edges of the detubularized limbs (**Figure 14**).

The proximal part of the posterior plate is folded anteriorly and suture for the creation of the anterior wall, the lateral windows are closed with running sutures (**Figure 15**) [22, 23].

The ureter is spatulated and implanted over the proximal end of both ileal limbs without antireflux technique independently with two plates running suture (**Figure 16**).

The neobladder is tested by the instillation of 500 cc of saline by the definitive catheter. A drain is place in the left side of the cavity and the specimen is extracted at the end of the procedure via a 5 cm midline incision [22, 23].

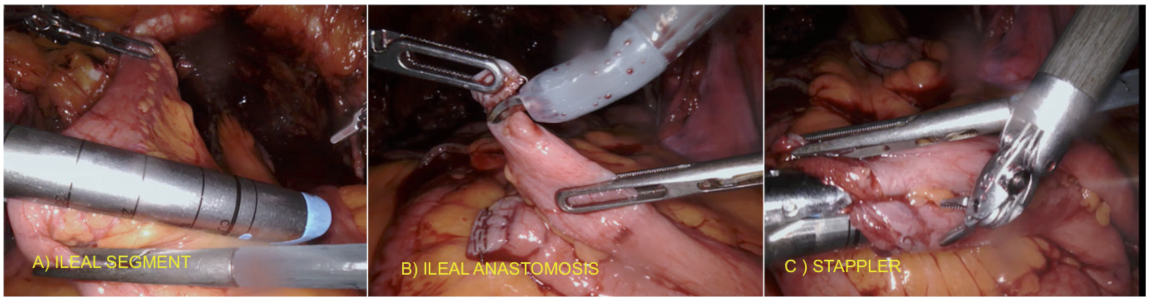

Figure 13.
Latero-lateral ileal anastomosis.

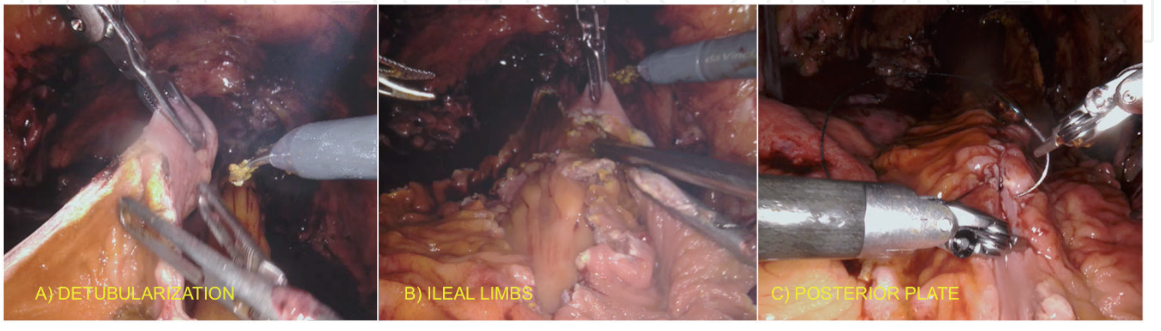

Figure 14.
Detubularization and posterior plate.

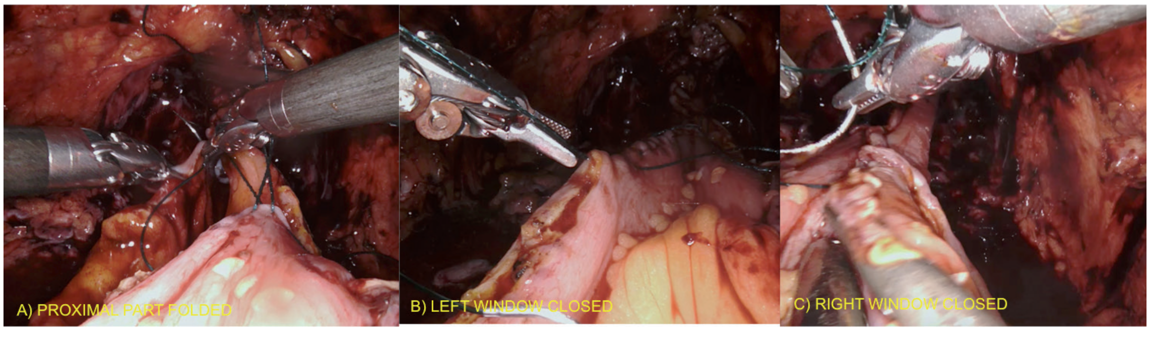

Figure 15.
Proximal part folded. Lateral close to create the neobladder.

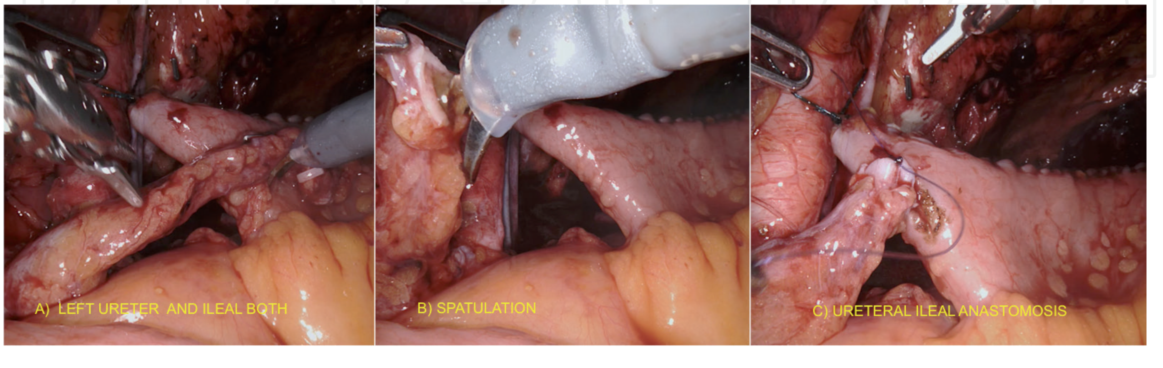

Figure 16.
Ureteral ileal anastomosis.

6. Others techniques for neo-bladder

Some other worldwide groups have developed shaping techniques, equally safe and effective, some of them are resume in the next lines.

The *Karolinska modified Studer "U"*a 55–60 cm ileum is isolated 25 cm proximal to the ileocecal valve. After antimesenteric incision and detubularization the posterior plate is created and its follow by an anterior closure using the initial 15 cm approximately. The rest of the segment is part of the chimney and in his lower side proximal to the pouch is kept open to stend the ureters later. The uretero-ileal anastomosis is perform in the free-top of the chimney once the Simple J ureteric stents were previously introduce [22, 23].

The *Padua Intracorporeal Neo-Bladder* starts with a segment of 42 cm portion of the ileum, detubularization of the distal part 8 cm is perform, follow by detubularization of the distal side 24 cm, the left horn is created with a stapler. The first 8 cm ileum segment is folded and sutured to the first 8 cm ileum segment, creating the posterior plate. To complete the anterior wall, the last 16 cm of the posterior plate are folded to configure it, both edges are suture together. The urethro-ileal anastomosis is performed and the uretero-ieal anastomosis is performed over the posterior wall [23].

The *modified Studer "U"* from University of Southern California, starts with the identification of the most mobile terminal ileum to reach the urethra. 11 cm towards the ileocecal valve for distal end of the pouch, 22 cm for apex of the posterior plate. 44 cm for proximal end of the pouch and beginning of the chimney. The distribution goes to bowel detubularization, creation of the posterior plate and rotation 90o counterclockwise. Urethto – ileal anastomosis and cross folding of the pouch is perform. The uretero ileal anastomosis is performed end-to-side [24].

The *Hautmann W*, a 50 cm of the ileum is isolated and divided into a right and left limb, then the ileum is detubularized and suture to create the posterior plate by and ascending and descending loop. Urethro-ileal anastomosis is performed by a tension-free Van Velthoven technique. The half of the anterior wall is closure and uretero ileal anastomosis is made on each chimney once the ureters were spatulated [22, 23].

The *Pyramid Pouch* starts with the selection of a 50 cm segment of the ileum > 15 cm proximal to the ileocecal valve. The utethral-ileal anastomosis is done at this point, following by the detubularization and formation of the posterior plate except the 2 cm uppermost portion as chimneys. 10 cm of the anterior plate are closure to accomplish the anterior wall. Uretero-ileal anastomosis an end-to-side is performed over the proximal end of both ileal limbs [22, 23].

7. Literature review

The benefits of robotic-assisted laparoscopic surgery rely mainly on the enhancement implied to the ergonomics of the surgeon and a reduction of the learning curve for some procedures. The down size is the lack of tactile feedback during the procedure and the associated costs. Specific improvements to robotic-assisted radical cystectomy are decreased intra-operative blood loss, reduced blood transfusion rates and a shorter length of hospital stay days. Due to the minimally invasive procedure, the surgical time have a tendency to increase in the robotic approach radical cystectomy.

Menon et al. was the first to describe a nerve-sparing robotic-assisted radical cysto-prostatectomy and extra-corporeal urinary diversion back in 2003 [10]. The completely intra-corporeal urinary diversion was reported by Gill et al. in the year 2000. The intra-corporeal urinary diversion was performed in a laparoscopic radical cystectomy and since then the technique found it's way to more recent robotic procedures [25]. The robotic-assisted radical cystectomy (RARC) continues to evolve and the first randomized controlled trial comparing it with open radical cystectomy (ORC) was published in 2009 [26]. The international literature includes multiple articles of technique and complications of RARC but a scarce number of randomized controlled trials comparing its oncologic outcomes and/or benefits with a different approach.

As previously mentioned, the first randomized controlled trial (RCT) to confirm the viability and oncologic safety of the RARC in comparison to ORC was published by Nix in 2009. Nix and his group found a median surgical time longer for RARC, lesser intra-operative blood loss, shorter time to bowel sounds and shorter hospital stay in comparison with ORC [26]. In contrast, controversial findings have been reported comparing RARC and ORC. A meta-analysis of the RCT's found no significant difference in peri-operative complications, length of hospital stay, time to flatus, lymph node yield and positive surgical margins [27]. A lower intra-operative blood loss and longer surgical time is a consistency among the studies.

Comparative findings (surgical, peri-operative complications and oncologic) between randomized controlled trials are described (**Table 1**).

7.1 Oncologic results and safety of the robotic-assisted approach

The Robot-assisted radical cystectomy versus open radical cystectomy trial (RAZOR) is a phase 3 non-inferiority study to compare the oncologic outcomes, complications, pelvic nodes burden, cost and morbidity [29]. At the beginning 350 patients were randomized but only 150 patients underwent RARC and 152 patients ORC after exclusions. The 2-year progression-free survival was 72.3% (95% CI 64.3–78.8) in the RARC group and 71.6% (95% CI 63.3–78.2) in the ORC group, these results demonstrated non-inferiority of robotic surgery VS open approach (difference 0.7%, 95% CI −9.6–10.9%, p non-inferiority=0.001). Local recurrences were similar in both groups (RARC 4%, ORC 3%). Twenty two percent and 23% had distant metastasis in RARC and ORC respectively and no port-site recurrences were reported [29]. Results from the International Robotic Cystectomy Consortium confirmed 16% in distant disease-recurrence, 11% local disease-recurrence, 1% peritoneal carcinomatosis and 0.4% port site recurrence [30].

In a RCT update from the Memorial Sloan Kettering Cancer Center, no statistical differences were reported in disease-recurrence (p=0.4), cancer-specific survival (p=0.4) and overall-survival (p=0.8) between RARC and ORC groups. The authors reported a median follow-up of 4.9 years [31].

In a recent meta-analysis, the disease-recurrence was analyzed in 458 patients with no difference between RARC and ORC (RR 0.94, 95% CI 0.69–1.29) [32]. In the same study, all included articles reported the rate of positive surgical margins (PSM) of 541 participants, it stated no difference between a robotic and open approach (RR 1.16, 95% CI 0.56–2.40) [32]. Tang et al. pooled data from 3 different RCTs and his collaborative group reported that both approaches have similar rate of PSM [33]. A Cochrane review found similar outcomes in the time-to-recurrence and PSM rates for both surgical approaches [34].

The CORAL trial update described similar five-year survival for open, robotic-assisted and laparoscopic radical cystectomy. The 5-year recurrence-free survival was 60%, 58% and 71%; 5-year cancer-specific survival was 64%, 68% and 69%; and 5-year overall survival was 55%, 61% and 61% for open, robotic-assisted and laparoscopic radical cystectomy, respectively [35].

7.2 Operative time

The RARC operative time has been reported to be the longer in comparison to the open approach, with a mean difference from 68.51–90 minutes [32, 36, 37]. Tang et al.

	Nix et al. [26] *n* **(%) OR mean (range)**		**Bochner et al. [28]** *n* **(%) OR median (range)**		**Parekh et al. [29]** *n* **(%) OR median (range)**	
	+RARC (21)	**ÇORC (20)**	**+RARC (60)**	**ÇORC (58)**	**+RARC (150)**	**ÇORC (152)**
Age, *years-old*	67.4 (33–81)	69.2 (51–80)	66 (60–71)	65 (58–69)	70 (43–90)	67 (37–85)
Men/Women	14 (67)/7 (33)	17 (85)/3 (15)	51 (85)/15 (15)	42 (72)/16 (28)	126 (84%)/24 (16%)	128 (84%)/24 (16%)
Body Mass Index, *kg/m*^{2}	27.5	28.4	27.9	29	27.8	28.2
Neoadjuvant Chemotherapy	*	*	19 (32)	26 (45)	41 (27%)	55 (36%)
Surgical blood loss, *mL*	258	575	516 (*mean*)	676 (*mean*)	300 (200–500)	700 (500–1000)
Surgical Complications						
None	14 (67)	10 (50)	23 (38)	20 (34)	49 (33)	47 (31)
Clavien Dindo I-II	5 (28)	7 (35)	24 (40)	26 (45)	68 (45)	71 (47)
Clavien-Dindo III-V	2 (5)	3 (15)	13 (22)	12 (21)	33 (22)	34 (22)
Urinary diversion	extracorporeal	—	extracorporeal	—	extracorporeal	—
T Stage	*TxN+: 4 (19)*	*TxN+: 7 (35)*				
T0			13 (22)	7 (12)	22 (15)	31 (20)
Ta, Tis			15 (24.7)	14 (24.2)	25 (17)	25 (16)
T1	T0-T2: 14 (67)	T0-T2: 8 (40)	7 (12)	11 (19)	19 (13)	15 (10)
T2			8 (13)	7 (12)	38 (25)	33 (22)
T3	T3-T4: 3 (14)	T3-T4: 5 (25)	12 (20)	15 (26)	35 (23)	32 (21)
T4a/T4b			5 (8.3)	4 (6.9)	10 (6)/1 (1)	14 (9)/3 (2)
Length of stay, *days*	5.1	6	8 (*mean*)	8 (*mean*)	6 (5–10)	7 (6–10)
Surgical time, *min*	252	212	456 (*mean*)	329 (*mean*)	428 (322–509)	361 (281–450)
Extended lymph node dissection	21	20	13 (22)	26 (45)	76/149 (51%)	84/152 (55%)

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	Nix et al. [26] ***n*** **(%) OR mean (range)**		**Bochner et al. [28]** ***n*** **(%) OR median (range)**		**Parekh et al. [29]** ***n*** **(%) OR median (range)**	
	[+]RARC (21)	**[Ç]ORC (20)**	**[+]RARC (60)**	**[Ç]ORC (58)**	**[+]RARC (150)**	**[Ç]ORC (152)**
Lymph nodes resected	19 (12–30)	18 (8–30)	31.9 (*mean*)	30 (*mean*)	23.3 (12.5%)	25.7 (14.5%)
Positive surgical margins	0	0	2 (3.6)	3 (4.8)	9 (6%)	7 (5%)

[+]*Robotic-assisted radical cystectomy.*
[Ç]*Open radical cystectomy.*
[*]*Not mentioned.*

Table 1.
Comparative findings between randomized controlled trials.

meta-analysis also reported a longer surgical time in comparison to ORC [33]. A prolonged operative time could be associated to peri-operative complications, such as, deep vein thrombosis, wound infection and increase anesthetic risk [32].

7.3 Urinary diversion

In a retrospectively study of 2,125 patients, Hussein et al. reported the outcomes of 1,094 patients who underwent RARC with intra-corporeal urinary diversion (ICUD) [38]. ICUD was associated with a shorter surgical time (357 VS 400 minutes, $p<0.001$), less surgical blood loss (300 VS 350 mL, $p<0.001$) and fewer blood transfusions (5% VS 13%, $p<0.001$) than extra-corporeal urinary diversion (ECUD) but high-grade complications were more frequent (57% VS 43%) 30 days after surgery. The incidence of high-grade complications decreased significantly trough time, from 25% in 2005 to 6% in 2015 (p<0.001) and remained stable [38]. The ICUD is very complex robotic procedure but the decision to perform a type of urinary diversion (neo-bladder o cutaneous pouch) should not be based on the surgical approach [18].

The modified Y-neo-bladder intra-corporeal technique performed in the Clinique Saint-Augustin, described by Asimakopoulos and two of the authors of this chapter, is an almost spherical urinary reservoir without the need to transpose either ureter [19]. This will allow the neobladder to remain aligned in a natural fashion and enables a tension-free ureter-neo-bladder anastomosis (buttonhole anastomosis). The reported data obtained via voiding charts indicated low 12-month voiding frequency with no pathological post-void residual volume, good mean maximal functional bladder capacity and no need for clean intermittent catheterization [19].

7.4 Complications

Previously, multiple articles and reviews have stated a lower rate of peri-operative complications related RARC [37]. The RCT elaborated by Bochner et al. described a rate of peri-operative complications grade 2–5 (Clavien-Dindo) of 62% for RARC and 66% for ORC [39]. In accordance with those findings, a recent RCT meta-analysis found similar peri-operative complication rate for RARC and ORC within 30 days [33]. Sathianathen et al. and Khan et al. meta-analysis, reported no difference in the 90-day incidence of major complications (Clavien Dindo III-V) between both approaches (RR 1.06, CI 95% 0.75–1.49) [32, 37].

One key benefit of the robotic surgery is lower surgical blood loss (mean difference of 300 mL), it is possible to suggest that RARC may reduce the rate of transfusion [32–34, 36]. In contrast, multiple articles have reported no difference in the rate of blood transfusion and others up to 77% reduction in the odds for blood transfusion [24, 26]. Wang et al. reported an estimated median blood loss of 400 (100–1200) mL for RARC and 750 (250–2500) mL for ORC (p=0–002), 0.5 (0–3) and 2 (0–7) units of blood for transfusion respectively (p=0.007) [36].

Sathianathen meta-analysis included two studies that reported the blood transfusion rate as a result, the peri-operative blood transfusion necessity was lower for RARC (42% risk reduction) [32]. As previously mentioned, an odds reduction of blood transfusion might be one of the benefits of the robotic approach because of the clinical impact, risks and adverse effects of blood transfusions should not be foreseen (hemolysis, anaphylaxis).

7.5 Length of hospital stay

n the article of Wang and his group, the median length of hospital stay days for RARC was 5 (4–18) days and 8 (5–28) days for ORC (p=0.007) [36]. The length of stay <5 days for the RARC group was 40/139 (29%) and 27/146 (18%) for ORC group (p=0.0407) [29]. The length of stay had no statistical difference in the analysis of Tang and his group (weighted mean difference: −0.60, 95% CI: −1.61–0.40, p=.24) [33]. Sathianathen et al. also reported a minimal marginal and no statistical difference in length of stay for the RARC group (RR −0.63, CI 95% −1.21−−0.05) [32].

7.6 Learning curve/surgeon volume

The International Robotic Cystectomy Consortium reported a learning curve of twenty-one robotic procedures to achieve a surgical time cutoff of 390 minutes. In contrast, a learning curve of more than 30 procedures was required for a PSM rate below 5%. Beyond 50 cases an improvement in the surgeon's performance (a decrease mean operative time and a higher lymph node yield) has been seen [28, 32, 40].

8. Conclusion

The robot-assisted cystectomy for the male or female with the intra-corporeal urinary diversion is a feasible technique and safe in experienced surgeon hands. There exist different types of intra-corporeal neo-bladders. The "Y" neo-bladder technical aspects of this procedure are part of the arsenal to choose. The results between open radical cystectomy and robotic need more studies to improve the data and the real results for the upgrade of the procedure. There is not yet enough evidence in the literature, even if the actual results are promising.

Conflict of interest

The authors declare no conflict of interest.

Notes/Thanks/Other Declarations

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Nomenclature

RARC	robot-assisted radical cystectomy
ORC	open radical cystectomy
RC	radical cystectomy
NB	neo bladder
RCT	randomized controlled trial
ICUD	intra-corporeal urinary diversion
ECUD	extra-corporeal urinary diversion
IRCC	international robotic cystectomy consortium

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