



## Review – Bladder Cancer

# Laparoscopic and Robotic Assisted Radical Cystectomy for Bladder Cancer: A Critical Analysis

Georges-Pascal Haber, Sebastien Crouzet, Inderbir S. Gill \*

Department of Laparoscopic and Robotic Surgery, Glickman Urological and Kidney Institute, The Cleveland Clinic Foundation, Cleveland, Ohio, United States

### Article info

#### Article history:

Accepted March 19, 2008  
 Published online ahead of  
 print on April 1, 2008

#### Keywords:

Laparoscopy  
 Cystectomy  
 Bladder neoplasm  
 Urinary diversion

**EU\*ACME**

[www.eu-acme.org/  
 europeanurology](http://www.eu-acme.org/europeanurology)

Please visit

[www.eu-acme.org/  
 europeanurology](http://www.eu-acme.org/europeanurology) to read and  
 answer questions on-line.  
 The EU-ACME credits will  
 then be attributed  
 automatically.

### Abstract

**Context and Objectives:** Interest in laparoscopic assisted radical cystectomy (LRC) and robotic assisted radical cystectomy (RRC) is increasing at select centers worldwide. In this update we present the recent worldwide experience and critically evaluate the role of minimally invasive radical surgery for patients with bladder cancer.

**Evidence Acquisition:** English-language literature between 1992 and 2007 was reviewed using the National Library of Medicine database and the following key words: laparoscopic, laparoscopic-assisted, robotic, robotic-assisted, and radical cystectomy. Over 102 papers were identified, 48 of which were selected for this review on the basis of their contribution to advancing the field with regard to three criteria: (1) evolution of concepts, (2) development and refinement of techniques, and (3) intermediate- and long-term clinical outcomes. These were evaluated with respect to current techniques and perioperative, functional, and oncological outcomes. Our initial experience is also reported.

**Evidence Synthesis:** Minimally invasive techniques can adequately achieve the extirpative aspects of LRC and extended template lymphadenectomy. At most institutions the reconstructive urinary diversion is now typically being performed extracorporeally through a minilaparotomy. Perioperative data indicate that minimally invasive techniques are associated with reduced blood loss, slightly increased operating time, and shorter hospital stay without any significant difference in postoperative complications compared with open surgery. Intermediate-term oncological outcomes appear to be comparable with the open approach. Worldwide experience continues to increase; >700 surgeries have already been performed.

**Conclusion:** LRC or RRC with extracorporeally constructed urinary diversion is a safe and effective operation for appropriate patients with bladder cancer. Perioperative and functional outcomes are comparable with open surgery. More focus on extended lymphadenectomy is necessary to routinely achieve higher node yields. Surrogate and intermediate oncological outcomes are encouraging, and long-term assessment is ongoing.

Published by Elsevier B.V. on behalf of European Association of Urology.

\* Corresponding author. Cleveland Clinic Foundation, A-100, 9500 Euclid Avenue, Cleveland, Ohio 44195, United States. Tel. +1 216 445 1534; Fax: +1 216 445 7031.  
 E-mail address: [gilli@ccf.org](mailto:gilli@ccf.org) (I.S. Gill).

## 1. Introduction

Open radical cystectomy (ORC) with lymph-node dissection remains the gold standard treatment for recurrent, high-grade, superficial or organ-confined, muscle-invasive bladder cancer [1-3]. However, the worldwide acceptance of laparoscopic surgery for the treatment of renal tumors, the advances in instrumentation design, and the laparoscopic and robotic revolutions regarding radical prostatectomy have naturally paved the way for development of laparoscopic radical cystectomy (LRC) [4]. Herein, we report on the current technique of LRC and review available perioperative, functional, and oncological outcome data in order to place the role of LRC in its contemporary context.

## 2. Methods

The English-language literature between 1992 and 2007 was reviewed using the National Library of Medicine database and the following keywords: laparoscopic, laparoscopic-assisted, robotic, robotic-assisted, and radical cystectomy. Over 102 papers were identified, 48 of which were selected for this review on the basis of their contribution to advancing the field with regard to three criteria: (1) evolution of concepts, (2) development and refinement of techniques, and (3) intermediate- and long-term clinical outcomes. Beginning with the first report in 1992, 76 published original reports on LRC were identified. Six of these studies included retrospective, non-randomized comparisons between ORC and LRC. Twenty-six review articles were also identified. These were evaluated with respect to current techniques and perioperative, functional, and oncological outcomes. Our experience with LRC and robotic radical cystectomy (RRC) exceeds 100 cases. Of these, 23 were done robotically. Perioperative and oncological outcomes in these patients are also reported.

### 2.1. Historical background

The first simple laparoscopic cystectomy for pyocystis was performed by Parra et al in 1992 [5]. In 1995 de Badajoz et al published the first study on LRC for muscle-invasive bladder cancer, wherein the ileal conduit urinary diversion was performed extracorporeally [6]. In 1995 Puppo et al described five cases of a combined laparoscopic and transvaginal anterior pelvic exenteration for bladder cancer: One bilateral cutaneous ureterostomy and four ileal conduits were performed through a minilaparotomy; the surgical specimen was withdrawn en bloc transvaginally [7]. In 2001 Turk et al described a completely intracorporeal LRC with a continent urinary diversion (rectal sigmoid pouch) [8]. A completely intracorporeal reconstruction of the entire LRC and urinary diversion procedure was reported by Gill et al, who also performed the first purely laparoscopic ileal conduit urinary diversion surgery and the first purely laparoscopic orthotopic Studer neobladder reconstruction surgery in 2000 and 2002, respectively [9,10].

### 2.2. Indications and contraindications

LRC is typically offered to patients with organ-confined, nonbulky bladder cancer as determined by preoperative clinical and radiographic findings. Presence of bulky lymphadenopathy, locally advanced disease, uncorrected coagulopathy, and morbid obesity are contraindications for LRC. Prior abdominal surgery, radiotherapy, or neoadjuvant chemotherapy may be relative contraindications for LRC and need to be assessed on a case-by-case basis. Assessment is important because these factors can significantly increase the degree of technical challenge.

### 2.3. Laparoscopic technique

The LRC technique is now approaching standardization, duplicating the established ORC technique. The ureters are dissected from the bladder base up to a point proximal to the common iliac arteries bilaterally and transected distally. In the male, the dissection is started in the cul-de-sac between the rectum posteriorly and the prostate, the seminal vesicles, and the bladder anteriorly. Bilateral vascular pedicles are controlled with sequential firings of the articulating endoscopic gastrointestinal anastomosis (GIA) stapler (Ethicon Endosurgery, Cincinnati, OH, USA) or using a Ligasure system (Valleylab, Boulder, CO, USA; Fig. 1). This postero-lateral dissection is carried out distally up to the midprostate. The urachus is divided high (Fig. 2); the anterior surface of the bladder is mobilized; the endopelvic fascia is incised bilaterally, and the dorsal vein is secured with a stitch or a staple (Fig. 3). If necessary, the technique of nerve sparing is used, which is similar to that used in laparoscopic radical prostatectomy (LRP). To avoid spillage of urine, the urethra is closed before transection. Once the urethra is transected and the dissection is completed, the specimen is immediately entrapped in an Endocatch-II bag (United States Surgical Corp, Norwalk, CT, USA). Tissue samples from the distal ureteral margin and urethral stump margin were sent for frozen-section biopsy [11]. In the female, either a conventional anterior exenteration or a uterus-sparing and vaginal-sparing LRC can be performed [12]. After completion of cystectomy, bilateral extended lymph-node dissection is performed toward the aortic bifurcation, based on the open template: laterally, genitofemoral nerve; medially, perivesical tissue;

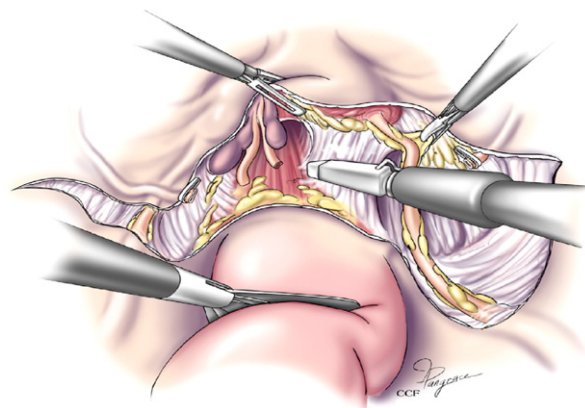
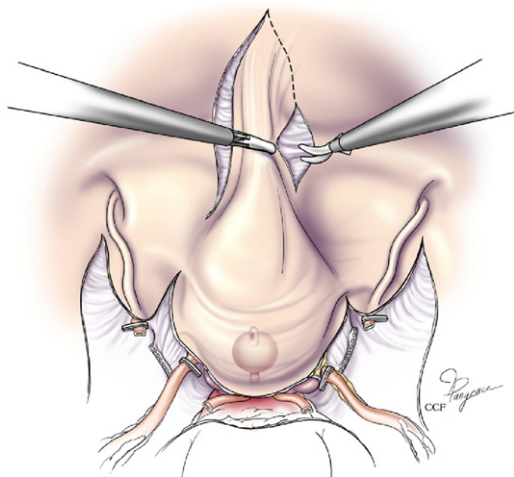
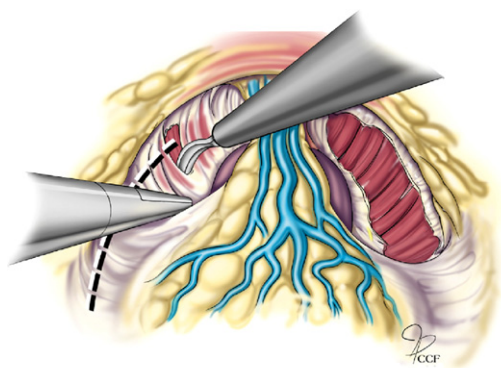


Fig. 1 – Exposure and hemostasis of the vascular pedicles.



**Fig. 2 – Division of the urachus.**



**Fig. 3 – Endopelvic fascia is incised bilaterally, before securing the dorsal vein.**

posteriorly, obturator nerve; distally, node of Cloquet, and proximally, aortic bifurcation and presacral tissue [14]. Some authors start with the extended pelvic lymph-node dissection before performing the LRC [15]. The LRC technique of urinary diversion replicates the ORC procedure with completely intracorporeal bowel work, bilateral uretero-ileal anastomosis, and urethro-neobladder anastomosis. The presently

preferred, extracorporeal technique employs a 5–7 cm peri-umbilical midline minilaparotomy to extract the specimen and to perform the bowel work and the ureteroileal anastomosis. In patients undergoing orthotopic neobladder reconstruction, the urethro-neobladder anastomosis is executed laparoscopically after re-establishing the pneumoperitoneum.

### 3. Results

#### 3.1. Operative outcomes and complications

The selected literature confirm the technical feasibility and low perioperative morbidity of LRC. In our initial 37 patients undergoing LRCs and extracorporeal urinary diversions (18 ileal conduit diversions, 19 orthotopic neobladder reconstructions), the mean operating time was 6.3 h and the mean blood loss was 378 ml. One patient (3%) required a blood transfusion; postoperative time before first oral intake was 3 d, and postoperative time before ambulation was 2.4 d (Table 1). Four patients (11%) presented with major complications that required re-operation: urinary extravasation requiring open revision of the uretero-ileal anastomoses ( $n = 1$ ) and a small bowel obstruction requiring open adhesiolysis ( $n = 3$ ) [16]. Gerullis et al reported their experience with 34 patients undergoing LRC and extracorporeal urinary diversion: the mean operating time was 244 min, the mean blood loss was 325 ml, and the blood transfusion rate was 5.9% [17]. No perioperative mortality occurred. Poor bowel function was observed in three cases (8.8%). Five patients (14.7%) presented with unilateral obstruction of the upper urinary tract between postoperative week 2 and week 5, without flank pain and creatinine increase, raising concerns regarding anastomosis stricture.

Cathelineau et al reported their results of 84 laparoscopic assisted prostatectomies or cystectomies to remove transitional cell carcinomas of the bladder [18]. The median operating time was 280 min, and the mean blood loss was 550 ml, with a

**Table 1 – Pure laparoscopic versus laparoscopic assisted radical cystectomy and urinary diversion: Cleveland Clinic experience (adapted from [15])**

Perioperative outcomes	Pure laparoscopic ( $n = 17$ )	Laparoscopic assisted ( $n = 37$ )	<i>p</i> -value
Operative time (h)	9.4	6.3	<0.0001
Blood loss (cc)	788	378	0.0002
Transfusion (%)	23	3	0.01
Oral intake (d)	6	3	0.005
Ambulation (d)	7.8	2.4	<0.0001
Minor complications (%)	41	14	0.01
Major complications (%)	29	11	0.08
Complications after hospital discharge (%)	18	14	0.69

blood transfusion rate of 5%. There were no conversions to an open technique. Complications occurred at a rate of 8%: one pulmonary embolism, two urinary fistulas, three hematomas, and one pyelonephritis. All the surgical margins were free of tumor invasion.

Simonato et al reported that analgesic requirements were limited to the first postoperative night in 10 consecutive patients [19]. Patients were ambulant between postoperative day 1 and day 3, and bowel activity returned between postoperative day 2 and day 4.

## 4. Discussion

### 4.1. Laparoscopic assisted versus open radical cystectomy

In a recent study, we retrospectively compared our recent, consecutive 50 LRCs (38 men, 12 women) with extracorporeal urinary diversion (13 ileal conduit diversions, 12 orthotopic neobladder reconstructions) with a contemporary cohort of 50 case-matched patients undergoing ORC (34 men, 16 women). There were no significant differences between the LRC and ORC groups with respect to mean patient age (66 vs 67;  $p = 0.61$ ), body mass index (BMI; 27 vs 26;  $p = 0.50$ ), comorbidities, history of prior abdominal surgery, and operative indications. Tumors were organ confined ( $\leq pT2N0$ ), nonorgan confined ( $pT3-4N0$ ), and lymph-node positive ( $pT_{any}N+$ ) in 66%, 28%, and 6% of the LRC patients, respectively, and in 62%, 20%, and 18% of the ORC patients, respectively, with no significant differences between the groups ( $p = 0.15$ ). Compared to ORC, LRC with extracorporeal urinary diversion was associated with reduced blood loss, decreased ileus, and somewhat shorter hospital stay, without

significant differences in operating time and postoperative complications (Table 2) [20].

Basillote et al compared 11 men who underwent ORC to 13 men who underwent LRC with ileal neobladder reconstruction performed extracorporeally [29]. This study showed that the laparoscopic approach was associated with decreased postoperative analgesic use (parenteral morphine: LRC [61 mg] vs ORC [144 mg];  $p = 0.042$ ), more rapid postoperative return to oral intake (LRC [2.8 d] vs ORC [5 d];  $p = 0.004$ ), shorter hospital stay (LRC [5.1 d] vs ORC [8.4 d];  $p = 0.0004$ ), and earlier resumption of light work (LRC [11 d] vs ORC [19 d];  $p = 0.0001$ ). Operating time was not significantly increased with LRC, and complication rate was similar between the two groups. The authors concluded that LRC contributes to decreased postoperative pain and quicker recovery than ORC, with complication rates similar to those of ORC.

Propiglia et al, through a prospective comparative study, compared 20 LRCs to 20 ORCs [21]. The LRC group had less analgesic consumption and a more rapid postoperative return to oral intake ( $p < 0.05$ ). No significant statistical difference was observed between the two groups with respect to intraoperative and postoperative parameters. The authors concluded that LRC contributed to reduced analgesic consumption and allowed early recovery of peristalsis with more rapid return to oral nutrition.

### 4.2. Purely laparoscopic urinary diversion versus laparoscopic assisted urinary diversion

We compared our initial 17 patients who underwent LRC with completely intracorporeal construction of the urinary diversion (purely laparoscopic), with 37 subsequent patients undergoing LRC with extracorporeal construction of the urinary diversion (laparoscopic assisted). Data presented in Table 1

**Table 2 – Laparoscopic assisted radical cystectomy (LRC) versus open radical cystectomy (ORC): Cleveland Clinic experience [20]**

	LRC (n = 50)	ORC (n = 50)	p-value*
Operative time (h)	6.3 ± 0.26	5.3 ± 0.28	0.01
Blood Loss (cc)	363 ± 259	801 ± 684	0.0004
Transfusion (%)	12	40	0.001
Ileus (%)	18	28	0.21
Oral Intake (d)	3.4 ± 1.1	4.2 ± 2.1	0.05
Minor postop. complications (%)	18	22	0.62
Major postop. complications (%)	8	6	0.69
Ambulation (d)	3.0 ± 1.6	3.4 ± 3.3	0.63
Hospital Stay (d)	8.0 ± 3.2	8.7 ± 2.9	0.27
Lymph nodes on final pathology (n)	14.8 ± 7.0	15.8 ± 7.1	0.58
Positive surgical margins (%)	2	6	0.29

\* p-values have been calculated using a t-test for continuous variables and chi-square for categorical variables. Postop., postoperative.

suggest that the laparoscopic assisted urinary diversion technique provides statistically significant decreases in operating time, blood loss, transfusion rate, and more rapid postoperative return to oral intake and ambulation. Minor complications were higher in the purely laparoscopic urinary diversion group, mainly related to prolonged ileus. Major complications requiring re-operation occurred in 29% of patients in the purely laparoscopic urinary diversion group and 11% in the laparoscopic assisted urinary diversion group ( $p = 0.08$ ). The majority of these complications were related to the intracorporeal bowel work and uretero-ileal anastomosis. Complications after hospital discharge were not statistically different when comparing the two techniques [16].

#### 4.3. Nerve-sparing cystectomy

Indications for nerve-sparing cystectomy are limited to select young patients with organ-confined, low-volume, extratrighonal disease who are keen to maintain their sexual potency.

The preservation of sexual function after nerve-sparing radical cystoprostatectomy has rarely been analyzed. Guazzoni et al reported on three patients with laparoscopic nerve-sparing and seminal-sparing cystectomies [24]. All surgical margins were negative. Postoperatively, all three patients resumed normal continence within one month; two patients had normal erections, and one patient required oral sildenafil citrate. Lane et al described the technique of energy-free nerve-sparing LRC with transrectal Doppler ultrasound guidance and reported early outcomes in five select patients with bladder cancer [25]. All patients were free of recurrence at a median follow-up period of 30 mo. At 12 mo, nocturnal continence and daytime continence were preserved in 100% and 75% of patients, respectively. Sexual function was preserved in the female patient and in two of the four male patients. Menon et al described a technique of nerve-sparing, robotic assisted radical cystoprostatectomy [26]. However, their published results on these 14 men lacked potency data.

#### 4.4. Organ-sparing cystectomy in women

Moinzadeh et al reported on an organ-sparing technique of female LRC with preservation of the fallopian tubes, ovaries, uterus, and vagina [12]. Game et al reported on 13 women with neurogenic vesical dysfunction who had an LRC which spared the uterus, fallopian tubes, ovaries, and vagina [13]. Mean duration of the operation was  $325 \pm 36$  min

and mean blood loss was  $323.1 \pm 246.3$  ml. Before surgery, 77% of the women were sexually active; 80% of them were sexually active 4 mo after the surgery.

For female patients, data concerning the effect of radical cystectomy on sexual function are sparse. Menon et al described the preservation of the uterus and vagina in three women who underwent RRC [27]. Functional and oncological outcomes were not presented.

#### 4.5. Laparoscopic prostate-sparing radical cystectomy

Prostate-sparing LRC technique has been described as having promising continence and erectile function results in select young patients for whom preservation of sexual potency and urinary continence are important [28]. Dissection was performed between the seminal vesicles posteriorly and the bladder anteriorly. The bladder neck, along with 1-cm rim of prostate base, was incised. The prostatic adenoma can be resected preoperatively using transurethral resection of the prostate, or intraoperatively using laparoscopic techniques. Arroyo et al reported on 25 patients in this series with a mean operating time of 285 min and a mean blood loss of 640 ml. However, this technique is controversial, and long-term oncological outcomes remain unavailable but are necessary to confirm whether it is safe to propose this surgery for the treatment of young patients with organ-confined malignancies, invasive malignancies, or high-risk superficial bladder malignancies.

#### 4.6. Hand-assisted laparoscopic radical cystectomy

Hand-assisted LRC decreases the advantages of a minimally invasive technique like those reported with pure LRC. It can decrease the learning curve when switching from ORC to LRC. Taylor et al compared eight ORCs to eight hand-assisted LRCs [30]. Hand-assisted LRC appears to have less postoperative analgesic requirements and facilitates earlier postoperative return of bowel function; further, patients enjoy a shorter hospital stay compared to ORC. Mean blood loss tends to be less in the hand-assisted LRC group (637 vs 957;  $p = 0.23$ ), but this did not reach statistical significance. We feel that the presence of the operator's hand may compromise exposure in the limited pelvic surgical space because most surgeons performing LRC have experience with LRP. The expertise gleaned from the former may carry over to pure LRC, thereby negating the need for hand-assisted LRC.

**Table 3 – Robotic assisted radical cystectomy and urinary diversion**

Authors (yr)	n	Urinary diversion	Total operating time (min)	EBL* (cc)	Perioperative complications	Surgical margin
Beecken et al (2003) [29]	1	Extracorporeal	510	200	None	Negative
Menon et al (2003) [26]	14	Extracorporeal	Total: n/a Cystectomy: 140 Ileal conduit: 120 Neobladder: 168	150	1 patient re-explored for bleeding	Negative
Menon et al (2004) [27]	3	Extracorporeal	Total: na Cystectomy: 160 Ileal conduit: 130 Neobladder: 180	166	na	Negative
Balaji et al (2004) [25]	3	Intracorporeal	691	250	1 ileus, conservative treatment	Negative
Hemal et al (2004) [28]	23	Extracorporeal	Total: na Cystectomy: 140 Urinary diversion: 150	200	na	Negative
Pruthi et al (2007) [30]	20	Extracorporeal	366	313	1 patient re-explored for bleeding, 1 patient re-explored for peristomal omental herniation, 1 rehospitalization for vomiting, 1 deep venous thrombosis, 1 rectal injury, 1 delirium tremens	Negative

\* All data presented as mean. EBL, estimated blood loss; na, not available.

#### 4.7. Robotic assisted radical cystectomy

Although the initial clinical publications focused on laparoscopic surgical techniques, recent reports have described the use of robotic assistance [36–38]. The perceived advantage of this RRC technique compared to the purely laparoscopic technique is the decreased learning curve for surgeons without prior experience in laparoscopic surgery. The RRC may facilitate intracorporeal suturing of the uretero-ileal anastomosis, the neobladder anastomosis, and the urethro-neobladder anastomosis. However, Balaji et al reported on the feasibility of RRC with intracorporeal construction of ileal conduit in three patients, although each case took more than 10 h [31]. Menon et al clearly demonstrated that operating time can be reduced with extracorporeal reconstruction of the urinary diversion [26,27] (Table 3). Advantages and oncological outcomes of RRC in a larger series of patients remain unknown.

#### 4.8. Oncological outcomes

While many early studies established the technical feasibility and encouraging perioperative results of LRC, oncological outcomes to define the place of the laparoscopic approach for bladder malignancy are awaited. Hrouda et al reviewed nine papers on LRC [39]. Among a total of 102 patients described in these nine papers, there were no instances of positive surgical margins or inadvertent incisions of the bladder. Simonato et al reported on 10 patients with a mean follow-up period of 26 mo (range: 16–36 mo).

Five patients were alive without any evidence of disease; four patients had died of metastatic disease, and one had died of unrelated causes. No patients had developed local recurrence of metastasis [19]. Deger et al reported on LRCs in 20 patients [40]. At a median follow-up period of 2.7 yr, no patient had developed local recurrence of metastasis; three had developed distant metastases—two of whom died of metastatic disease.

Although reports on oncological outcomes are limited, Haber and Gill [41] reported on oncological data from follow-up periods  $\leq 5$  yr in 37 patients with pathological tumor stage distribution comparable with most contemporary open series. Two patients had focal positive surgical margins. At a mean follow-up period of 31 mo (1 mo–5.5 yr), there were no local or port-site recurrences. Metastases were noted in 5.4% of patients, and the estimated overall survival rate and cancer-specific survival rate after 5 yr were 63% and 92%, respectively. More recently, we have extended our analysis and reported on intermediate-term follow-ups of 76 more patients (56 men, 20 women), with a mean age of 66.5 yr (range: 26–87 yr), who underwent LRC and urinary diversion for invasive or high-risk superficial bladder cancer. In 65 patients (85.5%), extended pelvic lymphadenectomy was performed. The majority of tumors ( $n = 71$ , 93%) were transitional cell carcinomas, two (3%) were adenocarcinomas, and three (4%) were squamous cell carcinomas [48]. Most lesions were of high grade: grade 3 ( $n = 59$ ; 78%), grade 2 ( $n = 16$ ; 20%), and grade 1 ( $n = 1$ ; 2%), and nine (11.8%) patients had concomitant carcinomas in

situ. Pathological staging yielded the following results: pT1N0 ( $n = 9$ ; 12%), pT2N0 ( $n = 41$ ; 54%), pT3N0 ( $n = 14$ ; 18%), and pTanyN+ ( $n = 12$ ; 16%). The median number of excised lymph nodes for patients with extended lymph-node dissection was 17 (range: 10–24). Two (2.6%) patients had positive surgical margins. Follow-up data were available for 67 patients (88.1%), and 10 patients (13.1%) completed a 5-yr follow-up. The mean follow-up period was 25 mo (range: 1–83 mo). At the last follow-up, 54 patients (71%) were alive without evidence of disease, and 13 (29%) were dead: 3 (23%) of metastasis and 10 (77%) of unrelated causes. Three patients (3.9%) had no follow-up. Overall survival rate and cancer-specific survival rate at 2 yr were 84.2% and 94.5%, respectively [20].

Recent reports emphasize the potential benefits of an extended pelvic lymph-node dissection with a radical cystectomy for transitional cell carcinoma and the importance of greater numbers of lymph nodes being examined in improving survival rates [32]. In a report of 22 patients undergoing LRC, Finelli et al described the technical feasibility of an extended, pelvic lymph-node dissection laparoscopically to enhance node yields [14]. The initial 11 patients who underwent a limited dissection were compared with the subsequent 11 consecutive patients who had an extended lymphadenectomy. With a limited lymphadenectomy, the median number of lymph nodes retrieved was 3 (range: 1–15) versus 21 (range: 6–30) for the extended template ( $p = 0.001$ ). The median node yield of the extended laparoscopic lymphadenectomy is commensurate with current open oncological recommendations, which suggest that at least 10–15 lymph nodes need to be removed for histopathological examination [23,42,43]. In a different LRC study, the mean number of lymph nodes retrieved was 15.5 (range: 2–49) [17,19,21,40]. A large series of ORC with extended lymphadenectomy had a mean number of lymph nodes retrieved of 36.5 (1–99) [22,23].

The risk of port-site metastasis is an important issue when approaching bladder cancer laparoscopically. No published reports of port-site metastasis with LRC are available, although an anecdotal report exists of port-site recurrence after an RRC [44].

#### 4.9. Future perspectives

An International Registry for LRC has been organized with the aim of standardizing the operative technique, postoperative data collection, and meticulous long-term follow-up. Each select center had performed at least 10 LRCs. The registry involves 13 centers with published experience in LRC. A total

of 572 patients are included at this writing. The mean age is 65 yr, with a mean BMI of 26. Extirpative procedures mainly included cystoprostatectomy (72%) and female anterior pelvic exenteration (13%). The most common types of urinary diversion techniques included orthotopic neobladder reconstruction (53%) and ileal conduit diversion (35%). The reconstructive part of the procedure was performed extracorporeally in 89% and intracorporeally in 11%. Mean blood loss was 556 ml (range: 30–5000 ml). Mean operating time was 6.2 h (range: 1.6–13.8 h). Mean length of hospital stay was 13 d (range: 3–90 d). Complications occurred intraoperatively in 33 patients (7%) and postoperatively in 139 patients (28%). Nine (2%) positive surgical margins were reported. The mean number of lymph nodes retrieved was 13 (range: 0–36); 80 patients (16%) had nodal involvement. Mean follow-up period in 474 patients (96%) was 18 mo (range: 0.5–72 mo). Overall survival rate and cancer-specific survival rate were 65% and 80%, respectively. Local recurrences were noted in 27 patients (5%); systemic recurrences were recorded in 39 patients (8%), and no port-site recurrences were noted. However, oncological outcomes are encouraging, but preliminary, and need long-term assessment [45].

The feasibility and the efficiency of the extirpative component of LRC are well established. However, laparoscopic reconstruction remains challenging, time-consuming, and associated with major complications. Currently, an orthotopic ileal neobladder reconstruction represents the most physiological bladder substitute after radical cystectomy for cancer and has been used extensively in men and women [33–35].

Completely intracorporeal urinary diversion should be approached with caution until more experience is gained or until endoscopic absorbable staplers, which could decrease the technical difficulty associated with laparoscopic reconstruction, become widely available. In the future, novel bladder substitutes such as tissue engineering [46] and ureteral augmentation [47] may decrease the technical difficulty associated with laparoscopic reconstruction.

## 5. Conclusions

In the well-selected patient, LRC and RRC with extracorporeal reconstruction of the urinary diversion combines the patient-recovery advantages of minimally invasive surgery with the safety of open surgery. LRC offers the potential for reduced blood loss and efficient convalescence without any sig-

nificant increase in complications. From the oncological point of view, intermediate oncological outcomes are encouraging and comparable with contemporary ORC series. Data from the International Registry will further place LRC in its proper context as an alternative to ORC in select patients with high-risk superficial or invasive bladder cancer.

### Conflicts of interest

The authors have nothing to disclose.

### References

- [1] Oosterlinck W, Solsona E, van der Meijden APM, et al. EAU guidelines on diagnosis and treatment of upper urinary tract transitional cell carcinoma. *Eur Urol* 2004; 46:147–54.
- [2] Madersbacher S, Hochreiter W, Burkhard F, et al. Radical cystectomy for bladder cancer today—a homogeneous series without neoadjuvant therapy. *J Clin Oncol* 2003; 21:690–6.
- [3] Quek ML, Stein JP, Clark PE, et al. Microscopic and gross extravesical extension in pathological staging of bladder cancer. *J Urol* 2004;171:640–5.
- [4] Guillonnet B, el-Fettouh H, Baumert H, et al. Laparoscopic radical prostatectomy: oncological evaluation after 1000 cases a Montsouris Institute. *J Urol* 2003; 169:1261–6.
- [5] Parra RO, Andrus CH, Jones JP, Boullier JA. Laparoscopic cystectomy: initial report on a new treatment for the retained bladder. *J Urol* 1992;148:1140–4.
- [6] Sanchez de Badajoz E, Gallego Perales JL, Reche Rosado A, Gutierrez de la Cruz JM, Jimenez Garrido A. Radical cystectomy and laparoscopic ileal conduit. *Arch Esp Urol* 1993;46:621–4.
- [7] Puppo P, Perachino M, Ricciotti G, Bozzo W, Gallucci M, Carmignani G. Laparoscopically assisted transvaginal radical cystectomy. *Eur Urol* 1995;27:80–4.
- [8] Turk I, Deger S, Winkelmann B, Schonberger B, Loening SA. Laparoscopic radical cystectomy with continent urinary diversion (rectal sigmoid pouch) performed completely intracorporeally: the initial 5 cases. *J Urol* 2001; 165:1863–6.
- [9] Gill IS, Fergany A, Klein EA, et al. Laparoscopic radical cystoprostatectomy with ileal conduit performed completely intracorporeally: the initial 2 cases. *Urology* 2000;56: 26–30.
- [10] Gill IS, Kaouk JH, Meraney AM, et al. Laparoscopic radical cystectomy and continent orthotopic ileal neobladder performed completely intracorporeally: the initial experience. *J Urol* 2002;168:13–8.
- [11] Haber G-P, Colombo Jr JR, Aron M, et al. Laparoscopic radical cystectomy and urinary diversion: status in 2006. *Eur Urol Suppl* 2006;5:950–5.
- [12] Moinzadeh A, Gill IS, Desai M, Finelli A, Falcone T, Kaouk J. Laparoscopic radical cystectomy in the female. *J Urol* 2005;173:1912–7.
- [13] Gamé X, Mallet R, Guillotreau J, et al. Uterus, fallopian tube, ovary, and vagina-sparing laparoscopic cystectomy: technical description and results. *Eur Urol* 2007;51: 441–6.
- [14] Finelli A, Gill IS, Desai MM, Moinzadeh A, Magi-Galluzzi C, Kaouk JH. Laparoscopic extended pelvic lymphadenectomy for bladder cancer: technique and initial outcomes. *J Urol* 2004;172:1809–12.
- [15] Hoznek A, Vodros D, Larre S, et al. Extended pelvic lymphadenectomy during laparoscopic radical cystectomy. *J Urol* 2007;177:638.
- [16] Haber GP, Campbell SC, Colombo Jr JR, et al. Perioperative outcomes with laparoscopic radical cystectomy: “pure laparoscopic” and “open-assisted laparoscopic” approaches. *Urology* 2007;70:910–5.
- [17] Gerullis H, Kuemmel C, Popken G. Laparoscopic cystectomy with extracorporeal-assisted urinary diversion: experience with 34 patients. *Eur Urol* 2007;51:193–8.
- [18] Cathelineau X, Arroyo C, Rozet F, Barret E, Vallancien G. Laparoscopic assisted radical cystectomy: the Montsouris experience after 84 cases. *Eur Urol* 2005;47:780–4.
- [19] Simonato A, Gregori A, Lissiani A, Bozzola A, Galli S, Gaboardi F. Laparoscopic radical cystoprostatectomy: our experience in a consecutive series of 10 patients with a 3 years follow-up. *Eur Urol* 2005;47:785–92 (discussion 790–2).
- [20] Haber GP, Campbell SC, Colombo Jr JR, et al. Comparison between open- and laparoscopic assisted radical cystectomy for bladder cancer. *J Urol* 2007;177:548.
- [21] Porpiglia F, Renard J, Billia M, et al. Open versus laparoscopy-assisted radical cystectomy: results of a prospective study. *J Endourol* 2007;21:325–9.
- [22] Leissner J, Ghoneim MA, Abol-Enein H, et al. Extended radical lymphadenectomy in patients with urothelial bladder cancer: results of a prospective multicenter study. *J Urol* 2004;171:139–44.
- [23] Stein JP, Cai J, Groshen S, Skinner DG. Risk factors for patients with pelvic lymph node metastases following radical cystectomy with en bloc pelvic lymphadenectomy: concept of lymph node density. *J Urol* 2003;170:35–41.
- [24] Guazzoni G, Cestari A, Colombo R, et al. Laparoscopic nerve- and seminal-sparing cystectomy with orthotopic ileal neobladder: the first three cases. *Eur Urol* 2003;44: 567–72.
- [25] Lane BR, Finelli A, Moinzadeh A, et al. Nerve-sparing laparoscopic radical cystectomy: technique and initial outcomes. *Urology* 2006;68:778–83.
- [26] Menon M, Hemal AK, Tewari A, et al. Nerve-sparing robot-assisted radical cystoprostatectomy and urinary diversion. *BJU Int* 2003;92:232–6.
- [27] Menon M, Hemal AK, Tewari A, et al. Robot-assisted radical cystectomy and urinary diversion in female patients: technique with preservation of the uterus and vagina. *J Am Coll Surg* 2004;198:386–93.
- [28] Arroyo C, Andrews H, Rozet F, Cathelineau X, Vallancien G. Laparoscopic prostate-sparing radical cystectomy: the Montsouris technique and preliminary results. *J Endourol* 2005;19:424–8.
- [29] Basillote JB, Abdelshehid C, Ahlering TE, Shanberg AM. Laparoscopic assisted radical cystectomy with ileal

- neobladder: a comparison with the open approach. *J Urol* 2004;172:489–93.
- [30] Taylor GD, Duchene DA, Koeneman KS. Hand-assisted laparoscopic cystectomy with minilaparotomy ileal conduit: series report and comparison with open cystectomy. *J Urol* 2004;172:1291–6.
- [31] Balaji KC, Yohannes P, McBride CL, Oleynikov D, Hemstreet 3rd GP. Feasibility of robot-assisted totally intracorporeal laparoscopic ileal conduit urinary diversion: initial results of a single institutional pilot study. *Urology* 2004;63:51–5.
- [32] Liedberg F, Månsson W. Lymph node metastasis in bladder cancer. *Eur Urol* 2006;49:13–21.
- [33] Hautmann RE, Volkmer BG, Schumacher MC, Gschwend JE, Studer UE. Long-term results of standard procedures in urology: the ileal neobladder. *World J Urol* 2006;24:305–14.
- [34] Tanaka T, Kitamura H, Takahashi A, Masumori N, Itoh N, Tsukamoto T. Long-term functional outcome and late complications of Studer's ileal neobladder. *Jpn J Clin Oncol* 2005;35:391–4.
- [35] Schrier BP, Laguna MP, van der Pal F, Isorna S, Witjes JA. Comparison of orthotopic sigmoid and ileal neobladders: continence and urodynamic parameters. *Eur Urol* 2005;47:679–85.
- [36] Hemal AK, Abol-Enein H, Tewari A, et al. Robotic radical cystectomy and urinary diversion in the management of bladder cancer. *Urol Clin North Am* 2004;31(4 Special Issue):719–29.
- [37] Beecken WD, Wolfram M, Engl T, et al. Robotic-assisted laparoscopic radical cystectomy and intra-abdominal formation of an orthotopic ileal neobladder. *Eur Urol* 2003;44:337–9.
- [38] Pruthi RS, Wallen EM. Robotic-assisted laparoscopic radical cystoprostatectomy. *Eur Urol* 2008;53:310–22.
- [39] Hrouda D, Adeyoju AA, Gill IS. Laparoscopic radical cystectomy and urinary diversion: fad or future? *BJU Int* 2004;94:501–5.
- [40] DeGer S, Peters R, Roigas J, Wille AH, Tuerk IA, Loening SA. Laparoscopic radical cystectomy with continent urinary diversion (rectosigmoid pouch) performed completely intracorporeally: an intermediate functional and oncologic analysis. *Urology* 2004;64:935–9.
- [41] Haber GP, Gill IS. Laparoscopic radical cystectomy for cancer: oncological outcomes at up to 5 years. *BJU Int* 2007;100:137–42.
- [42] Herr HW, Bochner BH, Dalbagni G, Donat SM, Reuter VE, Bajorin DF. Impact of the number of lymph nodes retrieved on outcome in patients with muscle invasive bladder cancer. *J Urol* 2002;167:1295–8.
- [43] Konety BR, Joslyn SA, O'Donnell MA. Extent of pelvic lymphadenectomy and its impact on outcome in patients diagnosed with bladder cancer: analysis of data from the Surveillance, Epidemiology, and End Results Program database. *J Urol* 2003;169:946–50.
- [44] El-Tabey NA, Shoma AM. Port site metastases after robot-assisted laparoscopic radical cystectomy. *Urology* 2005;66:1110.
- [45] Haber GP, Gill IS, Rozet F, et al. International registry of laparoscopic radical cystectomy: first report on 392 patients. *J Urol* 2006;175:394.
- [46] Atala A. Tissue engineering for the replacement of organ function in the genitourinary system. *Am J Transplant* 2004;4(Suppl 6):58–73.
- [47] Desai MM, Gill IS, Goel M, et al. Ureteral tissue balloon expansion for laparoscopic bladder augmentation: survival study. *J Endourol* 2003;17:283–93.
- [48] Haber GP, Campbell SC, Frota R, et al. Surrogate and intermediate oncological outcomes of laparoscopic radical cystectomy. *J Endourol* 2007;21(Suppl 1):61S.

### Editorial Comment on: Laparoscopic and Robotic Assisted Radical Cystectomy for Bladder Cancer: A Critical Analysis

Prokar Dasgupta

Department of Urology, 1st Floor Thomas Guy House, Guy's Hospital, London SE1 9RT, United Kingdom  
prokaruro@gmail.com

It is evident from the critical analysis of laparoscopic (LRC) and robotic-assisted radical cystectomy (RARC) published in this issue of the *Platinum Journal* [1] that these are advanced techniques steadily evolving as alternatives to open radical cystectomy (ORC) for bladder cancer. An international registry of LRC is well established, and over 150 RARCs have been performed world-

wide. The important aspects which merit discussion are:

1. **Surgical technique:** This involves posterior dissection between the rectum and prostate, followed by control of the lateral pedicles to the bladder and, finally, anterior dissection and pelvic lymphadenectomy. In women, the vagina is reconstructed with a running intracorporeal suture. Although the advent of robotics has renewed interest in completely intracorporeal reconstruction, most have preferred to perform this extracorporeally, either through an appendix incision or a small midline incision in patients with BMI > 30 [2]. It is possible to achieve an extended lymph node dissection

with LRC and RARC, with equivalent yield to ORC.

2. **Comparison of ORC, LRC, and RARC:** In a nonrandomized comparison, RARC and LRC took longer than ORC but were associated with less blood loss and quicker recovery. RARC had the lowest complication rate of 20%, compared to 50% for LRC and 60% for ORC [3]. This needs to be verified in an appropriately powered randomized controlled trial with composite complication rates as the primary outcome measure.
3. **Oncological outcomes:** Haber and Gill have published medium-term follow-up in 37 patients undergoing LRC, 24 of whom (65%) were alive with no evidence of disease and 11 of whom (30%) were dead, two (5%) from metastasis and nine (24%) from unrelated causes. The 5-yr actuarial overall, cancer-specific, and recurrence-free survival were 63%, 92%, and 92%, respectively [4]. With RARC, at a maximum follow-up of 3.5 yr, the actuarial overall and recurrence-free survival were 95% and 90%, respectively [3]. It thus appears that minimal invasion does not compromise outcomes when compared to ORC [5].
4. **Ergonomics:** One of the advantages of RARC over ORC and LRC may be reduced surgical

fatigue during a long procedure. The hypothesis is that a less tired surgeon makes fewer errors and therefore has lesser complications, although this concept needs further scientific evaluation.

## References

- [1] Haber G-P, Crouzet S, Gill IS. Laparoscopic and robotic assisted radical cystectomy for bladder cancer: a critical analysis. *Eur Urol* 2008;54:54–64.
- [2] Raychaudhuri B, Khan MS, Challacombe B, et al. Minimally invasive radical cystectomy. *BJU Int* 2006;98:1064–7.
- [3] Dasgupta P, Rimington P, Murphy D, et al. Robotic-assisted radical cystectomy. *BJU Int*. In press.
- [4] Haber G-P, Gill IS. Laparoscopic radical cystectomy for cancer: oncological outcomes at up to 5 years. *BJU Int* 2007;100:137–42.
- [5] Wang GJ, Barocas DA, Raman JD, et al. Robotic vs. open radical cystectomy: prospective comparison of perioperative outcomes and pathological measures of early oncological efficacy. *BJU Int* 2008;101:89–93

DOI: [10.1016/j.eururo.2008.03.077](https://doi.org/10.1016/j.eururo.2008.03.077)

DOI of original article: [10.1016/j.eururo.2008.03.076](https://doi.org/10.1016/j.eururo.2008.03.076)

### Editorial Comment on: Laparoscopic and Robotic Assisted Radical Cystectomy for Bladder Cancer: A Critical Analysis

Jens-Uwe Stolzenburg

Department of Urology, University of Leipzig,  
Leipzig, Germany

[stolj@medizin.uni-leipzig.de](mailto:stolj@medizin.uni-leipzig.de)

Evangelos N. Liatsikos

Department of Urology,  
University of Patras Medical School,  
Patras, Greece

Open radical cystectomy is the gold standard for the treatment of organ-confined muscle-invasive or high-risk superficial bladder cancer. Minimally invasive treatments (ie, laparoscopic radical cystectomy and/or robotic radical cystectomy) are recent developments. A plethora of feasibility studies have been performed including completely intracorporeal diversions (conduit, neobladder,

rectosigmoid pouch) and extended lymphadenectomy. Nevertheless, prolonged operating time and complications related to laparoscopic bowel work were reported.

Although there is a vast amount of research on open, laparoscopic, or robotic radical cystectomy, no study has yet to take on a direct prospective comparison of these treatment modalities for bladder cancer. Haber et al [1] present a clear summary to date of the benefits understood to accompany a minimally invasive approach to cystectomy, whether that be pure laparoscopic, laparoscopic-assisted, or robotic. Mastery of the technical feasibility of purely laparoscopic or robotic cystectomy is a challenge, as shown by the higher learning curve and longer surgical time compared to the assisted or open technique seen repeatedly throughout the literature [2,3]. Laparoscopic or robotic cystectomy offer the greatest benefits in comparison to open cystectomy with regard to reduced blood loss, quicker recovery, and

fewer complications [1]. Thus far, long-term oncologic outcomes are similar to those seen for the standard of care [4].

Carefully planned, prospective, randomized studies comparing laparoscopic or robotic techniques to open radical cystectomies are deemed necessary to define their roles in the management of bladder cancer.

## References

- [1] Haber G-P, Crouzet S, Gill IS. Laparoscopic and robotic assisted radical cystectomy for bladder cancer: a critical analysis. *Eur Urol* 2008;54:54-64.

- [2] Galich A, Sterrett S, Nazemi T, et al. Comparative analysis of early perioperative outcomes following radical cystectomy by either the robotic or open method. *JSL* 2006;10:145-50.
- [3] Hemal AK, Killa SB. Comparison of laparoscopic and open radical cystoprostatectomy for localized bladder cancer with 3-year oncological followup: a single surgeon experience. *J Urol* 2007;178:2340-3.
- [4] Haber GP, Gill IS. Laparoscopic radical cystectomy for cancer: oncological outcomes at up to 5 years. *BJU Int* 2007;100:137-42.

DOI: [10.1016/j.eururo.2008.03.078](https://doi.org/10.1016/j.eururo.2008.03.078)

DOI of original article: [10.1016/j.eururo.2008.03.076](https://doi.org/10.1016/j.eururo.2008.03.076)