ORIGINAL ARTICLE

Laparoscopic radical cystectomy with extracorporeal ileal neobladder for muscle-invasive urothelial carcinoma of the bladder: technique and short-term outcomes

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Abstract

Objectives To report the surgical outcomes of laparoscopic radical cystectomy (LRC) with extracorporeal orthotopic ileal neobladder (OIN) in patients with muscle-invasive urothelial carcinoma of the bladder (UCB).

Materials and methods Between October 2009 and December 2011, 37 patients with muscle-invasive UCB underwent a LRC with OIN. Indications included (a) muscle-invasive UCB T2–4a, N0–Nx, M0; (b) high-risk and recurrent non-muscle-invasive tumors; (c) T1G3 plus CIS; and (d) extensive non-muscle-invasive disease that could not be controlled by transurethral resection and intravesical therapy. Demographic data, perioperative, and postoperative variables were recorded and analyzed.

Results The median operating time was 330 min, with a median estimated blood loss of 410 ml. Median length of stay was 12 days, and the mean length of the skin incision to extract the specimen and for the configuration of the neobladder was 7 ± 1 cm. The complication rate was 21.6 % (Clavien II). No Clavien III–V complications were reported. Daytime and nocturnal continence were preserved in 95 and 78 %, respectively. No local recurrence or port site metastasis occurred. Median time to disease recurrence was 14 months (IQR 9–24), and 1-year cancer-specific survival was 91.9 %.

Conclusions Laparoscopic radical cystectomy with extracorporeal ileal neobladder is a challenging procedure but technically feasible, allowing low morbidity and oncological safety. Long-term oncological results are required to definitely recognize this procedure as a standard treatment for bladder cancer.

Keywords Bladder cancer · Laparoscopy · Surgical technique · Outcomes

Introduction

Radical cystectomy (RC) with bilateral pelvic lymphadenectomy (PLND) provides excellent tumor control for patients affected by muscle-invasive urothelial carcinoma of the bladder (UCB) [1, 2].

Although open RC with extended PLND remains the gold standard for treatment for muscle-invasive urinary bladder cancer and high-risk superficial tumors resistant to intravesical treatment, an increasing interest is being observed in minimally invasive techniques such as laparoscopic radical cystectomy (LRC) with intra- or extracorporeal urinary diversion [3]. Since the first procedure by Parra [4], the laparoscopic radical cystectomy has been increasingly shown to be a clinically safe approach that can duplicate the standard technique, but provides potential advantages in terms of smaller incisions, decreased postoperative pain, quicker recovery time leading to shorter hospital stay, decreased blood loss, and fluids imbalance [5–13]. Nevertheless, complication rates, functional results, and long-term oncologic outcome of LRC have to be defined, and prospective studies comparing LRC to open surgery are still required [7, 14].

In the current report, we present our technique and our preliminary experience with 37 patients who underwent LRC with extracorporeal OIN.

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Materials and methods

Between October 2009 and December 2011, 37 patients with muscle-invasive UCB underwent a LRC and bilateral PLND with an extracorporeal Hautmann ileal neobladder.

Prior to the operation, written informed consent was obtained from all patients.

A prospective institutional-review-board-approved datasheet was constructed for this study. The following information were collected: age, gender, body mass index (BMI), prior abdominal surgery, specific comorbidities as well as American Society of Anaesthesiologists (ASA) score, tumor stage and grade, surgical margin status, number of removed lymph nodes, operative time, and estimated blood loss (EBL). Additional collected data included transfusion data, conversion to open surgery, length of stay (LOS), length of mobilization and convalescence, time to resumption of oral intake, incision length and time to removing drainage, ureteral stents, and bladder catheter.

Both medical and surgical complications occurring at any time after surgery were captured and were recorded with a grade (I, II, IIIa, IIIb, IVa, IVb, or V) assigned according to the modified Dindo–Clavien classification [15], and their quality was evaluated by the Martin criteria [16].

Indications to perform LRC with OIN included (a) muscle-invasive UCB T2–3, N0–Nx, M0; (b) high-risk and recurrent non-muscle-invasive tumors; (c) T1G3 plus CIS; (d) extensive non-muscle-invasive disease that could not be controlled by transurethral resection and intravesical therapy; and (e) absence of tumor in urethra, urethral stricture, abnormal abdominal straining, and decompensated renal function.

The exclusion criteria included (a) patient refusal of LRC; (b) the presence of contraindications to LRC; (c) the presence of contraindications to neobladder, including tumor in urethra, urethral stricture, abnormal abdominal straining, and decompensated renal function; and (d) extensive muscle-invasive UCB (T4 disease).

All operations were performed by two surgeons (F.G., N.M.), who had completed at least 200 laparoscopic procedures each before the beginning of the study, thus reducing the learning curve effect.

Preoperatively, all patients underwent staging procedures to rule out metastatic disease by computed tomography (CT) or magnetic resonance imaging (MRI), while bone scan was reserved for patients with bony symptoms.

Radical cystectomy specimens were analyzed according to the 2002 TNM classification [17]. Postoperative follow-up was conducted at 3-month intervals during the first year, at 6-month intervals during the second year, and annually thereafter. Follow-up visits consisted of a history, physical examination, and routine biochemical profile. Ultrasonography of the abdomen, urography, and chest X-rays was performed at 3, 6, and 12 months postoperatively, then annually unless otherwise clinically indicated. Abdominal/pelvic CT scans were performed 6 months postoperatively and once per year thereafter.

All patients reporting the need of no pad were defined as continent.

Surgical technique

A 5-port fan-shaped transperitoneal approach is used. Bilateral PLND is performed first. The boundaries of a standard PLND are bifurcation of the common iliac artery proximally, the genitofemoral nerve laterally, the circumflex iliac vein and lymph node of Cloquet distally, and the hypogastric vessels posteriorly, including the obturator fossa. Extended PLND to the aortic bifurcation is performed if there are positive results of frozen lymph node evaluation or in the presence of a preoperative evaluation of T3 disease and pelvic lymphadenopathy. The lymphadenectomy specimens are extracted with a 10-mm Endobag.

The mobilization of ureter begins with identification and division of umbilical artery. Hence, the ureter is careful bluntly isolated from the cross over the iliac vessels deep to the entrance of its intramural course in the bladder and it is secured by clips. The distal portion is sent for frozen section evaluation. The same steps are made on the other side.

In male patients, the ampullae of the vas deferens are transected bilaterally, and seminal vesicles are dissected and maintained en bloc with the bladder. The Denonvilliers' fascia is incised, and the presence of rectal fat confirms the proper plane of dissection that must remain between the prostate anteriorly and the rectal fat posteriorly.

The endopelvic fascia is incised with cold scissors, and the puboprostatic ligaments are divided.

Next, the dorsal vein complex is ligated with a 0 Vicryl on a CT needle, and the urethra is completely dissected, after visualization of the colliculus seminalis. Care is taken to hold the urethra as long as possible, with a dissection performed very close to the prostate. The urethra at the prostate apex is occluded with a 2-0 Vicryl suture, and the transected catheter maintained inside the bladder to prevent local spillage of urine. The pedicles and the remaining posterior attachments of the prostate are divided.

The specimen is removed intact by a 15-mm Endobag (Covidien formerly Tyco Healthcare GmbH, Neustadt/Donau, Germany). The extraction is done by a 7–8-cm midline periumbilical incision, which is then used for the extracorporeal creation of ileal neobladder.

The orthotopic neoblader pouch is created by suturing opened small bowel together to form a new bladder. As usual, a 55–60-cm segment of ileum located 15 cm away from the ileocecal junction is isolated using an Endo GIA device and detubularized. The continuity of the small bowel is restored using a 3.0 Biosyn suture; a spherical neoblader is constructed extracorporeal as well and fashioned as a Hautmann's.

Each ureter is spatulated and separately anastomosed to the afferent limb using the Bricker technique with continuous 4-0 Vicryl sutures [18]. Ureters are intubated with 9-French catheters and temporarily attached to the anterior wall of the pouch with absorbable sutures (Vicryl 3.0).

Both catheters and suprapubic cystostomy are exteriorized through the anterior wall of the pouch and subsequently will be passed through the trocar hole in the left fossa and the trocar hole in the right fossa, respectively.

After appropriate positioning of the ileal neoblader in its orthotopic position, a vesicourethral anastomosis is completed by an interrupted Vicryl 2/0 suture. A 20-F Foley catheter is placed under vision before the anastomosis is completed. After completing the vesicourethral anastomosis, the neoblader is filled to confirm its watertight integrity. Thereafter, a Blake drain is placed into the pelvis, the trocars are removed, and the fascia is closed with interrupted 0 sutures. The skin is closed with surgical staples.

Results

Study population (Table 1)

Patient population was generally young (median age 67, IQR 57–73), non-obese (median BMI 27.5 kg/m^2, IQR 22.4–30.2), and healthy (median preoperative ASA score 2, IQR 1–3). Twenty patients (54 %) had a primary muscle-invasive disease, and seventeen (46 %) presented with a recurrence after intravesical therapy. None of patients had a neoadjuvant systemic chemotherapy or radiotherapy.

Intra- and postoperative outcomes (Table 2)

The median operating time was 330 min, with a median EBL of 410 ml. The median time to perform the laparoscopic radical cystectomy was 110 min. Median LOS was 12 days, and the mean length of the skin incision to extract the specimen and perform the neoblader formation was 7 ± 1 cm.

Postoperative management included intra-abdominal drain removal on postoperative day 2 or 3, bilateral ureteral stent removal on postoperative day 8–9, and transurethral

Table 1 Preoperative data

	LRC with OIN
N	37
Median age (years, *IQR*)	67 (57–73)
Gender (female/male ratio)	0.48
Median BMI (kg/m^2, *IQR*)	27.1 (22.4–30.2)
ASA score (no., %)	
I	12 (32.4)
II	25 (67.6)
Clinical stage (no., %)	
cT1 (plus Cis)	12 (32.4)
cT2	19 (51.4)
cT3	6 (16.2)
cT4	0
Cardiovascular disease (%)	10.8
Pulmonary disease (%)	8.1
Prior abdominal/pelvic surgery (%)	32.4
Appendectomy	4 (10.8)
Hysterectomy	5 (13.5)
Laparoscopic inguinal hernia repair	3 (8.1)

and suprapubic catheter removal on postoperative day 14 after performing a cystography.

Postoperatively, two patients (5.4 %) required blood transfusion (Clavien II) and 3 patients (8.1 %) had superficially located wound infections, managed by conservative would treatment leading to prolonged but satisfactory wound healing (Clavien II). After removal of the ureteral splints, two patients (5.4 %) presented with pyelonephritis, which resolved after treatment with antibiotics, without creatinine increase or hydronephrosis (Clavien II). In one (2.7 %) patient, a deep venous thrombosis occurred without pulmonary embolism on 3 days postoperative day could be managed with low molecular weight heparin (Clavien II). No Clavien III–V complications were reported.

Nine of 10 Martin criteria were met in this study.

Daytime and nocturnal continence were preserved in 95 and 78 %, respectively.

Oncologic outcomes (Table 2; Fig. 1)

The histopathologic analysis revealed an organ-confined disease (pT0–pT2) in 67.5 % and locally advanced disease (pT3–pT4) in 32.5 %. The rate of lymph node metastases was 18.9 %, and PSM were detected in 1 case (2.7 %) of pT4 UCB.

Median follow-up was 13 months (7–26). No local recurrence or port site metastasis occurred. Median time to disease recurrence was 14 months (IQR 9–24), and 1-year cancer-specific survival was 91.9 %. Three patients (8.1 %) died due to their progressive disease, whereas 2

Table 2 Intraoperative and postoperative data

	LRC with OIN
N	37
Median operating time (min, *IQR*)	330 (280–510)
Median time for laparoscopic radical cystectomy (min, *IQR*)	110 (60–130)
Median time for PLND (min, *IQR*)	75 (60–110)
Median time for neobladder and anastomosis (min, *IQR*)	145 (124–240)
Median blood loss (ml, *IQR*)	410 (320–770)
Transfusion rate (%)	5.4
Hemoglobin decrease (g/dl)	2.7 ± 0.5
Postoperative day of oral intake	4.3 (3–8)
Mobilization (days, *IQR*)	2 ± 1 (1–3)
Median length of stay (days, *IQR*)	12 (10–18)
Mean skin incision (cm)	7 ± 1
Median convalescence (days, *IQR*)	21 (16–27)
Conversion to open surgery (no.)	0
Complications rate (%)	
Clavien I	0
Clavien II	21.6
Clavien III	0
Clavien IV	0
Clavien V	0
Urinary continence (%)	
Daytime	95
Nocturnal	78
Tumor stage (no., %)	
pT0	1 (2.7)
pT1	5 (13.5)
pT2a	7 (18.9)
pT2b	12 (32.4)
pT3a	7 (18.9)
pT3b	4 (10.9)
pT4	1 (2.7)
Tumor grade (no., %)	
Low grade	4 (10.8)
High grade	33 (89.2)
Mean removed LN number	18 (8–26)
LN metastases (%)	18.9
PSM (%)	2.7
Median follow-up (months)	13
IQR	(7–26)
Overall survival (%)	86.5
Cancer-specific survival (%)	91.9
Progression-free survival (%)	81.1
Median time to disease recurrence (months, *IQR*)	14 (9–24)

patients (5.4 %) died for unrelated causes. During the same period, a progression to metastatic disease occurred in 7 patients (18.9 %).

Discussion

Open radical cystectomy (ORC) with different techniques of urinary diversion remains the gold standard procedure for treatment for muscle-invasive bladder cancer with a recurrence-free survival of 75–85 % in organ-confined disease and of 45–55 % in locally advanced disease, but it also presents high rates of complications even in expert hands (28–58 %) [1, 2].

In order to reduce perioperative complication rates while preserving good oncological and functional outcomes, efforts have been taken to apply minimally invasive surgical techniques such as laparoscopic radical cystectomy (LRC) to this evolving filed of oncologic surgery. After the first LRC performed by Parra in 1992 [4], many refinements of the instruments and surgical approach have been associated with an increased application of laparoscopy in the therapy of UCB [3, 5–14, 19–21].

In our experience, LRC with OIN approach resulted feasible and safe, ensuring the advantages of minimal-invasive surgery. Laparoscopy provides excellent view, reduce blood loss and transfusion requirements due to pneumoperitoneum-induced tamponade, improve urinary continency, and minimize bowel manipulation. We consider that the external reconstruction of ileal neobladder does not reduce the advantages of minimal-invasive laparoscopic approach, but reduces the operative time in comparison with the intracorporeal, supporting the experience of previous authors.

Nevertheless, our median operative time of 330 min could be considered quite long and consuming when compared to robotic cystectomy. However, LRC is currently performed in a few high-volume reference centers, and its diffusion has been limited by the steep learning curve. Conversely, robotic-assisted LRC is arising as a promising procedure, able to bridge the technical difficulties of conventional LRC in favor of a broader diffusion of
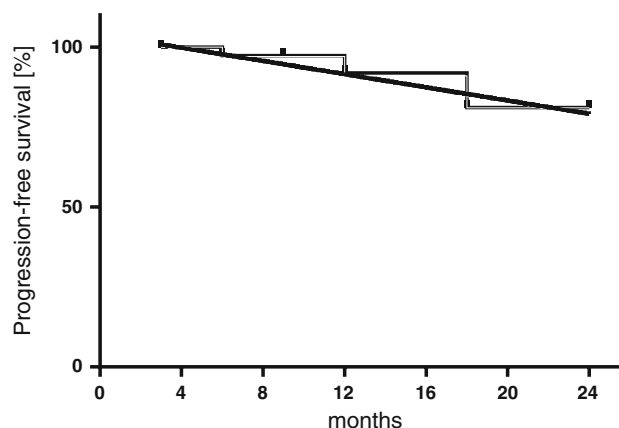
Fig. 1 Progression-free survival at follow-up

minimally invasive treatment for muscle-invasive UCB [21].

Our results are supported by the literature. In a recent study, Huang et al. [3] could demonstrate that LRC with OIN could achieve the established oncologic criteria of open surgery, with lower complications rate.

In 2008, a review of the literature [12] concluded that LRC with extracorporeal constructed urinary diversion was a safe and effective operation for appropriate patients with bladder cancer, with perioperative and functional outcomes which were comparable with open surgery. Nevertheless, at most institutions, the reconstructive urinary diversion was typically being performed extracorporeal through a mini-laparotomy, thus reducing the operating time but still preserving the reduced invasivity of laparoscopy [19].

Numerous studies showed that survival after RC is closely correlated with the number of lymph nodes removed, and the mean number of retrieved lymph nodes reported in the literature was of 15.5 [22–25]. In our cohort, the mean lymph nodes removed was 18 (range 8–26), and this is comparable with the data reported in the literature for ORC [22–25].

To this end, the present study demonstrated non-inferiority of LN yield between laparoscopic and open radical cystectomy, confirming that it is possible to achieve an extended and complete procedure also during LRC.

Lymph node metastases were reported in 18.9 % of the patients with locally advanced disease.

Median time to disease recurrence was 14 months (IQR 9–24), and 1-year cancer-specific survival was 91.9 %.

However, longer median follow-up periods are required, and even if all the previous single institution experiences worldwide reported favorable short-term oncologic outcomes, the controversy regarding oncological results still exists.

There are several limitations to the present study that must be acknowledged however. Firstly, this was a retrospective study hence imparting an inherent selection bias that cannot be overcome. Another limitation of the present study includes the small cohort of the patients and the short follow-up. Finally, one might argue that any surgical technique should be compared to the standard one before one can draw any conclusions concerning its benefits. In this analysis, no control group was considered as this was actually outside the scope of the present manuscript. Thus, the actual oncological safety of LRC remained to be proven, and long-term oncological outcomes are also needed.

Conclusions

Laparoscopic radical cystectomy with extracorporeal ileal neobladder is a challenging procedure but technically feasible, allowing low morbidity and oncological safety. Long-term oncological results are required to definitely recognize this procedure as a standard treatment for bladder cancer.

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