Simultaneous Laparoscopic Nephroureterectomy and Cystectomy: A Preliminary Report

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ABSTRACT

Purpose: Patients with muscle-invasive bladder cancer and concomitant upper urinary tract tumors may be candidates for simultaneous cystectomy and nephroureterectomy. Other clinical conditions such as dialysis-dependent end-stage renal disease and non-functioning kidney are also indications for simultaneous removal of the bladder and kidney. In the present study, we report our laparoscopic experience with simultaneous laparoscopic radical cystectomy (LRC) and nephroureterectomy.

Materials and Methods: Between August 2000 and June 2007, 8 patients underwent simultaneous laparoscopic radical nephroureterectomy (LNU) (unilateral-6, bilateral-2) and radical cystectomy at our institution. Demographic data, pathologic features, surgical technique and outcomes were retrospectively analyzed.

Results: The laparoscopic approach was technically successful in all 8 cases (7 males and 1 female) without the need for open conversion. Median total operative time, including LNU, LRC, pelvic lymphadenectomy and urinary diversion, was 9 hours (range 8-12). Median estimated blood loss and hospital stay were 755 mL (range 300-2000) and 7.5 days (range 4-90), respectively. There were no intraoperative complications but only 1 major and 2 minor postoperative complications. The overall and cancer specific survival rates were 37.5% and 87.5% respectively at a median follow-up of 9 months (range 1-45).

Conclusions: Laparoscopic nephroureterectomy with concomitant cystectomy is technically feasible. Greater number of patients with a longer follow-up is required to confirm our results.

Key words: kidney; ureter; laparoscopy; nephrectomy; cystectomy; TCC
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INTRODUCTION

Transitional cell carcinoma (TCC) of the bladder is the sixth most common malignancy in the United States, accounting for 10% of cancers in men and 4% in women (1). While open radical cystectomy (ORC) and urinary diversion remain the gold standard for treatment of muscle-invasive TCC of the bladder, laparoscopic radical cystectomy (LRC) has been gaining popularity and presently the worldwide experience includes more than 500 cases (2). Treatment of bladder tumor may be complicated with concurrent upper tract disease. Palou et al. have reported a 1.8% incidence of simultaneous upper tract and bladder TCC, where 46% of the bladder tumors were found to be invasive (3).

Radical nephroureterectomy with bladder cuff excision is considered the standard of care for high-grade, invasive, recurrent, or large volume TCC of the upper urinary tract (UUT). Since the first descrip-

tion of laparoscopic nephroureterectomy (LNU) by Clayman et al. (4), several authors have demonstrated improved recovery with equivalent intermediate-term oncologic outcomes using the laparoscopic approach compared to open radical nephroureterectomy (5-8).

In patients with recurrent high grade or muscle invasive bladder TCC and concomitant UUT tumors, simultaneous cystectomy and nephroureterectomy is the principle oncologic procedure of choice (9-11). Other benign clinical conditions including dialysis-dependent end-stage renal disease (ESRD) or non-functioning kidney are relative indications for simultaneous upper unilateral or bilateral nephroureterectomy and lower tract extirpation (9). The aim of this report is to describe our experience with combined laparoscopic radical cystectomy and nephroureterererectomy.

MATERIALS AND METHODS

Between August 2000 and June 2007, 8 patients underwent simultaneous laparoscopic radical cystectomy and nephroureterectomy at our institution. All procedures were performed by the same surgical team. Demographic data and pathologic features of the bladder and upper tract tumors were individually recorded. Perioperative outcomes, postoperative pathologic data and oncologic outcomes were retrospectively reviewed and analyzed.

Our surgical technique for the laparoscopic procedure is as follows. Initially, the patient is placed in 60-degree flank position for transperitoneal radical nephroureterectomy. Port placement is depicted in Figure-1 for nephroureterectomy and cystectomy. Notably, the primary port (12 mm) is inserted at the site of the proposed ileal conduit stoma for a right-sided nephroureterectomy or at the edge of the rectus muscle along a line between the umbilicus and anterior-superior iliac spine for a left-sided nephroureterectomy. During right-sided nephroureterectomy, this port will serve as the left hand port during the upper tract procedure and right hand port during the cystectomy. Conversely, for left-sided nephroureterectomy this port serves as the right hand port for the upper tract procedure and left hand port for the pelvic portion. On the right side, ports 2-5 are placed as for

our standard nephroureterectomy. Notably, port 4 is used for an Allis clamp locked to the side wall as a self-retaining liver retractor and an instrument placed through port 5 is used for lateral retraction. Left-sided port placement mirrors the right except that a port for liver retraction is not needed. After port placement, transperitoneal LNU is performed in a standard manner and our detailed technique has been published previously (5). For subsequent cystectomy and bilateral lymph node dissection, the patient is re-positioned in a low lithotomy position with a full Trendelenburg tilt. The entire surgical field is re-prepared and re-draped for the lower urinary tract portion of the procedure. Laparoscopic radical cystectomy with bilateral limited or extended lymph node dissection is then performed as previously described (12,13). A 12 mm port site is incised vertically in the midline above the umbilicus to be used as the camera port (Port 6 depicted in Figure-1). Later, this port is extended periumbilically
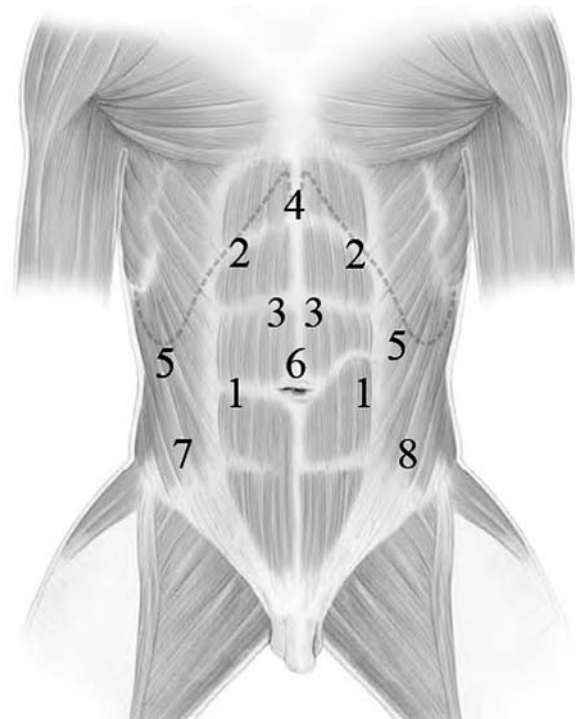

Figure 1 – *Illustration representing the port placement on simultaneous laparoscopic radical cystectomy and laparoscopic nephroureterectomy. Ports 1 to 5 are used for nephroureterectomy. Port 4 is used for liver retraction on the right side. Ports 6 to 8 are used for the pelvic component. Port site 1 also serves as the right and left hand ports for the pelvic portion.*

for intact specimen removal and performance of all bowel work including creation of the neobladder or ileal conduit as well as re-establishment of bowel continuity.

RESULTS

A total of 8 patients (7 males and 1 female) with a median age of 76.5 years (range 65 to 79) underwent LNU and LRC with urinary diversion in the same session. The indication for upper tract surgery was synchronous TCC in 6 patients (unilateral nephroureterectomy) and end-stage renal disease in 2 patients (bilateral nephroureterectomy). Preoperatively, there was a previous history of muscle-invasive or recurrent superficial TCC of the bladder in all patients. Demographic data are detailed in Table-1. Seven (87.5%) patients were classified as ASA score ≥ 3. Of the patients, 7 (87.5%) underwent previous abdominal surgery.

Preoperative tumor characteristics are presented in Table-2. Six patients (75%) had a previous history of intravesical chemo/immunotherapy (mitomycin-2, BCG-4). Five patients (62.5%) presented with carcinoma in situ and 1 patient (12.5 %) had a positive urethral biopsy for tumor. Site of upper tract tumor in 6 patients (right-4, left-2) included ureter in 3, calyx in 1 and multiple locations in 2.

Median total operative time, which included LNU, LRC, pelvic lymph node dissection and urinary diversion, was 9 hours (range 8 to 12). Median estimated blood loss and hospital stay were 755 mL (range 300 to 2000) and 7.5 days (range 4 to 90), respectively. All 8 cases were technically successful without the need to open conversion. There were no intraoperative complications. Table-3 summarizes the intraoperative data.

Postoperatively, 2 (25%) patients had minor complications: prolonged ileus and peritoneal catheter infection in one and wound infection in the other. There was one (12.5%) major complication: sepsis

Table 1 – Demographics data.

Patient	Age (years)	Sex	BMI (kg/m²)	Smoking History	ASA Score	Preoperative Serum Creatinine (mg/dL)	Previous Surgery
1	76	M	28.9	Yes	III	1.7	No
2	77	M	24	Yes	III	7.0 (on dialysis)	Appendectomy, inguinal hernia repair, abdominal aortic aneurysm repair
3	65	M	26	Yes	III	10.2 (on dialysis)	Peritoneal dialysis catheter insertion
4	79	M	18.9	No	III	1.3	Inguinal hernia repair
5	78	M	25.1	Yes	III	3.8	Nephrectomy (duplicated system)
6	71	F	26.5	Yes	IV	0.6	Total abdominal hysterectomy and bilateral salpingo-oophorectomy
7	78	M	24.9	No	II	1.3	Inguinal hernia repair
8	69	M	41	Yes	IV	2.4	Cholecystectomy, ureterolithotomy, appendectomy

* This patient had a long history of superficial bladder cancer and episode of hematuria after 10 years of follow up. ** These patients had TCC of the bladder and end-stage renal disease. They underwent radical cystectomy with concomitant bilateral nephroureterectomy. TURBT = transurethral resection of bladder tumor. CIS = carcinoma in situ. LRC = laparoscopic radical cystectomy, LNU = laparoscopic nephroureterectomy.

Table 2 – Tumor characteristics.

Patient	No Previous TURBT	Previous Intravesical Chemo-therapy	Multifocality	Stage	Grade	CIS	Urethral Involve-ment	Upper Tract Involve-ment	Time from Initial Diagnosis to LRC and LNU (months)
1	1	Yes (BCG)	Multifocal	T1	G3	Yes	No	Left renal pelvis and ureter	120*
2	1	None	Multifocal	T2	G3	Yes	Yes	No **	3
3	1	None	Multifocal	T2	G3	No	No	No **	1
4	Multiple	Yes (mito-mycin)	Multifocal	T2	G3	No	No	Right ureter	2
5	1	Yes (BCG)	Multifocal	Ta	G3	Yes	No	Left lower calyx	8
6	1	Yes (mito-mycin)	Multifocal	Ta	G3	No	No	Right ureter	120
7	1	Yes (BCG)	Multifocal	Tis	G1	Yes	No	Right ureter	24
8	1	Yes (BCG)	Multifocal	T1	G3	Yes	No	Right re-nal pelvis and ureter	2

* This patient had a long history of superficial bladder cancer and episode of hematuria after 10 years of follow up. ** These patients had TCC of the bladder and end-stage renal disease. They underwent radical cystectomy with concomitant bilateral nephroureterectomy. TURBT = transurethral resection of bladder tumor. CIS = carcinoma in situ. LRC = laparoscopic radical cystectomy, LNU = laparoscopic nephroureterectomy.

due to peritonitis from an enterocutaneous fistula and pelvic abscess. Median time for resumption to oral intake was 4 days (range 1 to 19). Table-4 demonstrates the postoperative and pathological data.

Median follow-up was 9 months (range 1 to 45). Of the 6 patients undergoing unilateral LNU, 2 (33.4%) required dialysis (one that had a previous contralateral nephrectomy and another due to postoperative renal failure and sepsis). There were no cases of local recurrence and only one (12.5%) patient developed distant metastasis and died 8 months postoperatively. Four other patients have died

during follow-up including one during hospital stay, 2 from unknown cause (at 1 and 36 months) and 1 from cardiac disease at 45 months. The patient who died during the hospital stay developed an entero-cutaneous fistula due to a small bowel perforation proximal to the ileal anastomosis at postoperative day 7. He underwent fistula resection and drainage of an abscess. However, the urine leak was consistent and he, therefore, underwent a right percutaneous nephrostomy tube placement. However, this patient developed sepsis and renal failure and died at 90 days after surgery. Other patient who died at 1 month

Table 3 – Intraoperative data.

	Type of Surgery	Total OR Time*	EBL (units of blood transfusion)	Type of Urinary Diversion	LNU Approach	No. of Pelvic Lymph Nodes Dissected	Type of Incision to Extract Specimen and Perform Bowel Work	Intraoperative Complications
1	Laparoscopic radical cystoprostatectomy + left LNU	9	1500 cc	Ileal conduit **	Transperitoneal	0 ***	Pfannenstiel	No
2	Laparoscopic cystoprostatectomy + bilateral LNU	9	300 cc	None ****	Transperitoneal	6	Pfannenstiel	No
3	Laparoscopic cystoprostatectomy + bilateral LNU	12	1000 cc (2)	None ****	Transperitoneal	15	Pfannenstiel	No
4	Laparoscopic cystoprostatectomy + right LNU	9	510 cc	Ileal conduit **	Transperitoneal	8	Small midline incision	No
5	Laparascopic cystoprostatectomy + left LNU	8	350 cc	None *****	Transperitoneal	6	Small midline incision	No
6	Laparascopic cystectomy + right LNU	8	350 cc	Ileal conduit	Transperitoneal	14	Small midline incision	No
7	Robotic-assisted laparascopic cystoprostatectomy + right LNU	9	1000 cc	Ileal conduit	Transperitoneal	2	Small midline incision	No
8	Laparascopic cystoprostatectomy + right LNU	11	2000 cc	Ileal conduit	Transperitoneal	14	Small midline incision	No

* Include nephroureterectomy, cystectomy; pelvic lymph node dissection (PLND) and urinary diversion. ** Laparoscopic intracorporeal urinary diversion. *** PLND was not performed because it would not stick to the prognosis and thereby save the patient additional morbidity. **** These patients had transitional cell carcinoma of the bladder and end-stage renal disease. They underwent radical cystectomy with concomitant bilateral nephroureterectomy. ***** Nephroureterectomy in solitary kidney. EBL = estimated blood loss, LNU = laparoscopic nephroureterectomy.

Table 4 – Postoperative and pathological data.

Patient	LOS (days)	Oral Intake (days)	Postoperative Complications	Blood Transfusion	PSM	PLN	LRC Pathology	LNU Pathology	Site of Upper Tract Tumor
1	90	19	Pyelonephritis, ileus, urine leak, enterocutaneous fistula, pelvic abscess, pneumonia	None	Negative	None	pT1G3	pT1	Left renal pelvis and ureter
2	5	1	None	None	Negative	2 out of 6	pT4 G3	pT0	None
3	28	7	Prolonged ileus and peritoneal catheter infection	4 units	Negative	None	pT2 G2	pT0	None
4	5	3	None	2 units	Negative	None	pT2 G2	pT3	Distal ureter
5	4	2	None	None	Negative	None	pT2 G2	pT2	Renal pelvis
6	6	4	Wound infection	None	Negative	None	pT0	pTa	Right ureter
7	9	5	None	2 units	Negative	None	pT3 G2	PTis	Distal ureter
8	9	4	None	2 units	Negative	None	pTis	pTis	Renal pelvis and ureter

LOS = length of hospital stay; PSM: positive surgical margin, PLN = positive lymph node.

was discharged 28 days after surgery and died 2 days later from unexplained causes. The family did not grant permission for a postmortem evaluation. Three patients are alive with an overall survival and cancer specific survival rate of 37.5% and 87.5%, respectively.

COMMENTS

Synchronous or metachronous presentation of TCC in the upper and lower genitourinary tract has been reported at varying rates throughout the literature. In 1989, Olbring et al. reported 11 cases (1.7%) of subsequent TCC of the renal pelvis or ureter in 657 patients with bladder cancer (14). Of 1,529 patients with primary superficial bladder tumors, Rodriguez et al. reported a 2.6% incidence of upper tract urothelial cancer (15). Herr et al. reviewed a cohort of 86 patients with bladder tumor followed for at least 15 years and found that 21% developed UUT tumors at a median of 7.3 years (16). Accordingly, they have recommended lifelong upper tract surveillance for urothelial cancer in patients with bladder tumor. Miyake et al. reported an incidence of 13.2% of simultaneous bladder and UUT tumors in a total of 106 cases (17). From our report, we noted a 7.9% (6 in 76 for our entire LRC series to date) incidence of concurrent UUT TCC in our LRC series.

Simultaneous nephroureterectomy, radical cystectomy and bilateral pelvic lymph node dissection is a challenging surgical procedure independent of the approach. The patients are often high-risk surgical candidates as demonstrated by the 87.5 % of patients classified as ASA score ≥ 3 in our series. With regards the technique used, special note must be made for the need to re-position the patient between the nephroureterectomy and cystectomy portions. Moreover, the ureter is never divided during the entire procedure and the urethra at the prostate apex should be sewn shut for intact specimen extraction to prevent any tumor spillage. In our series, 7 (87.5 %) patients underwent previous abdominal surgery suggesting that previous surgery was not a contraindication for the laparoscopic approach.

The various options for the urinary diversion portion of the procedure depend on clinical condition of the patient, the status of the urethra, patient preference and surgeon experience. In this series, all patients primarily underwent extracorporeal ileal conduit urinary diversion because they were all elderly and at high surgical risk with multiple medical and surgical co-morbidities. Our recent report confirms that the open-assisted laparoscopic approach for urinary diversion portion of the procedure is technically more efficient and associated with a quicker recovery profile and decreased complication rates compared with the pure laparoscopic approach during LRC (18).

The extended pelvic lymph node dissection during LRC, adhering to established oncological principles, has been previously shown to be technically feasible (13). The survival appears to be better in patients in whom > 14 lymph nodes were removed (19). In our series, a limited lymphadenectomy was used in patients with a high-risk surgical or in technically difficult cases (i.e. prior surgery) revealing a median yield of 6 lymph nodes. Extended pelvic lymphadenectomy was used later with our evolving experience in patients with better clinical conditions with an increased median yield of 14 lymph nodes. Only one patient had positive nodes. We stress our pelvic lymph node dissection was limited in our early experience.

A simultaneous, bilateral approach is justified in patients with ESRD, because synchronous upper tract TCC has been reported to be more frequent in patients with renal insufficiency (20). In that group, concomitant radical cystectomy with bilateral nephroureterectomy avoids the need for urinary diversion and removes almost all urothelium at risk for tumor recurrence. Care should be taken during renal dissection, mainly in patients with previous surgery, to prevent injury to the adrenal glands for subsequent adrenal insufficiency risk. The specimen can be removed through a Pfannenstiel incision. In female patients, extraction of the specimen en bloc through the vagina is a viable option (21).

For upper tract surgery, the conventional advantages of the laparoscopic approach include earlier resumption of oral intake, reduced narcotic analgesia requirement and decreased length of hospital stay (22).

CONCLUSIONS

In this study, we have demonstrated the technical feasibility of simultaneous laparoscopic unilateral or bilateral nephroureterectomy and radical cystectomy and urinary diversion in patients with concomitant upper tract TCC or ESRD and bladder cancer. A greater number of patients and increased experience are needed to reduce the total operative duration and complications. Further studies are required to validate our results.

CONFLICT OF INTEREST

None declared.

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EDITORIAL COMMENT

Recently, the laparoscopic approach has gained acceptance and more robust data support for radical cystectomy with pelvic lymphadenectomy. The authors should be commended for presenting the feasibility of simultaneous laparoscopic nephroureterectomy and radical cystectomy in a very selective subset of patients from a single, tertiary referral institution with high-volume laparoscopic surgery for urologic malignancy. In this initial series, we noted a high morbidity with two procedure related deaths (< 30 days after discharge) probably due the advanced age and comorbidities of the study subjects, combined with the surgical challenging scenario.

Additionally, this study covers a long timeframe so the major complications observed in cases 1 and 3 might be related to the learning curve of this complex procedure. From the technical standpoint, we should emphasize the high rate of previous pelvic/abdominal surgery, and that not all diversions were performed in an open-assisted manner that is currently the standard-of-care for laparoscopic radical cystectomy, fact that may be contributed for a longer operative time and postoperative complication. Moreover, the extension of the lymphadenectomy was not ideal, what can potentially compromise the specific-survival in these patients. As the authors concluded, large studies are necessary before we can have further conclusions on these preliminary results.

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