Intracorporeal laparoscopic U-shaped ileal neobladder construction with three ports: a pilot study

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Abstract

Introduction: *Radical cystectomy is one of the most complex operations in urology, in which orthotopic ileal neobladder construction is an important part. With the development of laparoscopic instruments and surgical techniques, laparoscopic radical cystectomy has been shown to be feasible and safe and has obvious benefits. However, intracorporeal laparoscopic U-shaped ileal neobladder construction with three ports is rarely reported.*
Aim: *To share our experience in intracorporeal laparoscopic U-shaped ileal neobladder construction with three ports in patients with bladder cancer and explore the feasibility, safety and benefits of this procedure.*
Material and methods: *From January 2018 to December 2019, 32 patients with bladder cancer underwent laparoscopic intracorporeal radical cystectomy and orthotopic neobladder. In this article, complete intracorporeal U-shaped ileal neobladder construction with three ports will be presented.*
Results: *The median estimated intraoperative blood loss was 130 ml. The median total operative time was 270 min, and ileal reservoir construction and anastomosis required 93 min. The median time to recovery of intestinal function following the operation was 3 days. At a median follow-up of 13 months, 8 patients had hydronephrosis.*
Conclusions: *Intracorporeal laparoscopic U-shaped ileal neobladder construction with three ports is feasible and safe. This procedure is less invasive and is highly beneficial for patients with difficulty with anastomosis of the ileum and urethra due to high mesenteric tension.*

Key words: *laparoscopy, bladder cancer, neobladder, high mesenteric tension.*

Introduction

Radical cystectomy (RC) combined with bilateral pelvic lymphadenectomy (PLND) is the reference standard for the treatment of muscle-infiltrating (MIBC) and high-risk non-muscle-infiltrating bladder cancer (NMIBC). With the development of laparoscopic instruments and surgical techniques, laparoscopic radical cystectomy has been shown to be feasible and safe and has obvious benefits [1–3]. In the pursuit of minimally invasive surgery, laparoscopic or robot-assisted laparoscopic radical cystectomy with five ports and with a single port have emerged as effective treatments, but the trauma of the five-port method is still substantial, the efficacy of the single-port method is limited, and both surgical durations are considerable.

In order to shorten the duration of the surgery, some surgeons have made improvements to the reservoir [4, 5], in which Dr. Zhou's team designed the Institute of Urology Peking University neobladder (IUPUB), a U-shaped neobladder, and the follow-up outcomes indicated that the technique is feasible and safe [6]. However, in most laparoscopic neobladder construction, the procedures were completed outside the abdominal cavity, which is difficult for

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obese patients and those with short mesenteries. At the same time, high mesenteric tension may cause a challenging situation in anastomoses between the neobladder and urethra, resulting in extended operation times and tissue tearing. In addition, exposing the intestine is not conducive to the postoperative recovery of intestinal function. In the current project, all the anastomoses were performed in the abdominal cavity, thus decreasing invasiveness, reducing the difficulties of anastomosis, and avoiding ureteral torsion or angulation, thereby reducing postoperative complications such as hydronephrosis.

Table I. Demographic and pathologic characteristics of patients

Characteristics	Value
Gender, female/male, *n*	1/31
Age [years] median (range)	60.5 (31–73)
BMI [kg/m²] median (range)	27.08 (21.47–31.14)
Nephrarctia before operation, *n*	1
Hydronephrosis before operation, *n*	3
Previous TURBT, *n*	9
Preoperative creatinine [μmol/l] mean (range)	75.8 (54–126)
Postoperative creatinine [μmol/l] mean (range)	79.3 (55–223)
Incidental prostate adenocarcinoma, *n*	1
Postoperative intestinal obstruction, *n*	1
Hydronephrosis after operation, *n* (%)	8 (25%)*
Ureteral calculus, *n* (%)	1 (3%)
Urination control, *n*	
Controlled in day	30
Uncontrolled	2
Controlled completely	3
Cancer recurrence, *n* (%)	3 (9%)
Death	2
Pathologic stage, *n*:	
T1	15
T2	9
T3	7
T4a	1
Metastasis, *n*:	
N0	28
N1	4
M0	21
Mx	11

**Include 3 patients with hydronephrosis before operation, 1 patient with hydronephrosis caused by ureteral calculus, 1 case caused by recurrence, and 1 patient who underwent ureterovesical replantation 13 months later. TURBT – transurethral resection of bladder tumor.*

Aim

The objective of this paper is to share our experience in intracorporeal laparoscopic U-shaped ileal neobladder construction with three ports in patients with bladder cancer and explore its feasibility, safety and benefits.

Material and methods

Patients

Between January 2018 and December 2019, 32 patients (1 female and 31 male) with bladder cancer underwent intracorporeal laparoscopic U-shape ileal reservoir construction in our hospital. The characteristics of patients, including age, gender, body mass index (BMI), and TNM stage of bladder cancer, are presented in Table I. All of them underwent an abdominal and pelvic computed tomography (CT) scan or magnetic resonance imaging (MRI), and cystoscopy before RC. Their preoperative examinations were provided to evaluate their ability to tolerate the operation. All patients signed an informed consent form. The study was approved by the Ethics Committee of the second affiliated Hospital of Anhui Medical University, Hefei, China. All operations were performed by the same surgeon with advanced laparoscopic technique.

Surgical technique

Anesthesia and posture

After general anesthesia, the patients were placed in the Trendelenburg position, the hips were raised, and legs and shoulders were fixed.

Locations of trocars

The operation was performed with three ports. The first puncture point was located at 2 cm above the umbilicus. The pneumoperitoneum needle was inserted with 15 mmHg abdominal pressure by filling with CO_2. The trocar (diameter 10 mm) was placed into the first point for observation. The trocars (diameter 12 mm and 5 mm) of the second and third puncture points were then placed, located at

the pararectal line, 2 cm and 4 cm below the umbilicus, respectively (Photos 1 A, B).

Procedures prior to ileal neobladder construction

Bilateral ureters were freed and bladder and pelvic lymph nodes completely resected according to the established procedure [7]. The prostate (males) and uterus (females) were removed at the same time. It is worth mentioning that the maximum length of the urethra should be preserved so that the reservoir can be smoothly anastomosed with the urethra. The urethra was ligated with Hem-o-lok before the incision, and a catheter was placed to prevent cancer cells from seeding. In females, the vagina can be used as a channel for removing specimens. Bilateral ureters were extracted through the second and third puncture points, ureteral nipples were established, F6 ureteral stents were inserted, and stents were fixed with absorbable sutures.

Selected and fixed ileum segment

An F18 catheter was used to determine the location of the urethra, and the ileal canal was pulled gently to clear the fixed point between the canal and urethra. In general, the point was about 30 cm from the ileocecal valve, and the ileum was fixed to the Denonvilliers fascia with a 2-0 5/8c barbed suture to form a V-shaped canal. A 1 cm incision was made on the ileum above the fixed point, and the posterior lip of the incision was anastomosed with the posterior urethral wall (Photos 2 A and B). Perineal pressure can be used to assist in the process. The ileal canal was then excised proximally and distally at 20 and 15 cm from the fixed point, respectively.

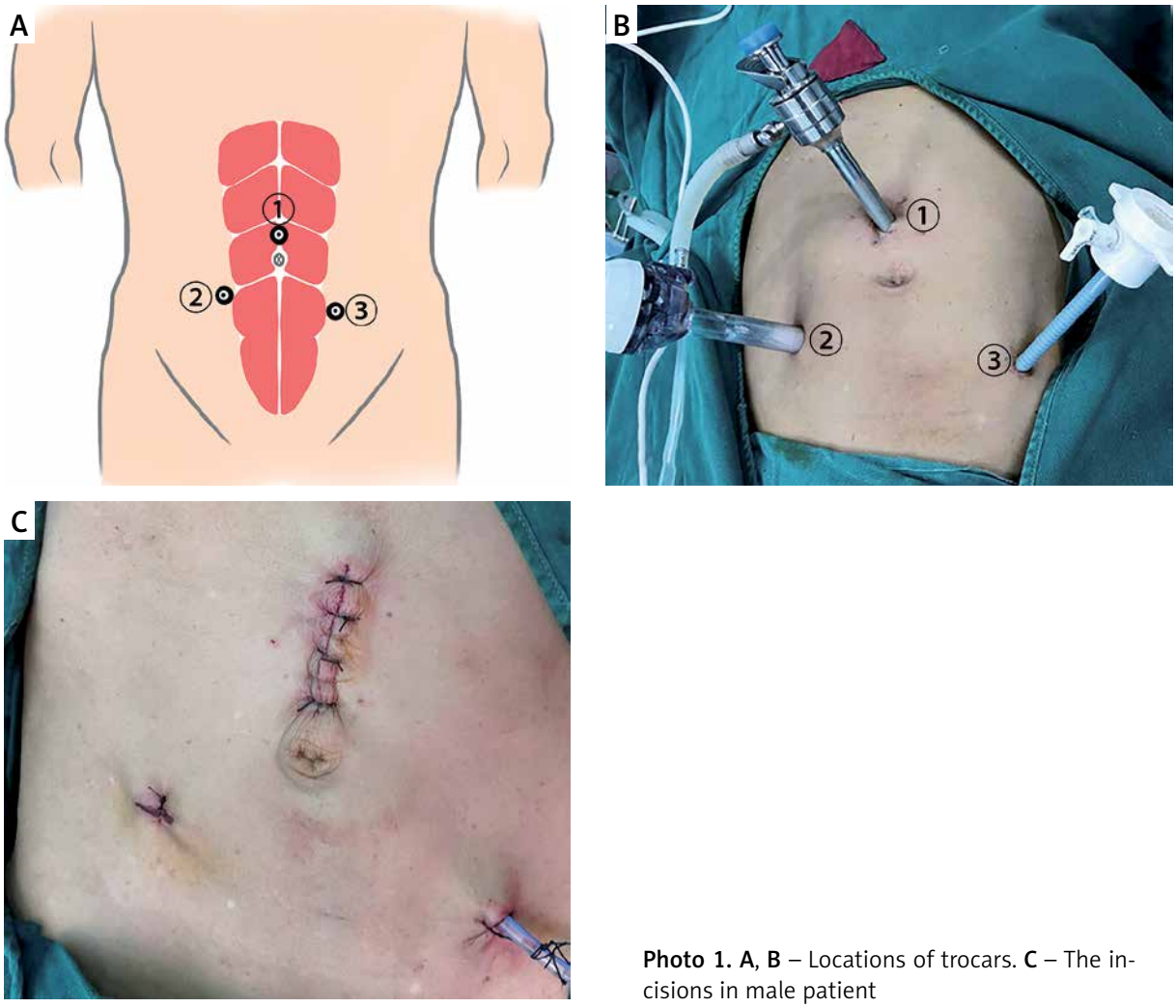

Photo 1. A, **B** – Locations of trocars. **C** – The incisions in male patient

Anastomosis of ileum segment and urethra

The distal and proximal ileal canals were anastomosed side-to-side with an intestinal stapler. The canal was detubularized with a 5 cm proximal ileal chimney preserved (Photo 2 C). The intestinal secretions and food residue were removed, and the medial free wall of the V-shaped intestinal canal was continuously sutured with a 3-0 absorbable barbed suture (Photo 2 D). The ileum and urethra were anastomosed clockwise or counterclockwise around the catheter (Photo 2 E), and we then injected 5 ml of saline into the catheter balloon and pulled the catheter gently.

Implantation of ureteral nipples

The left ureteral nipple was inserted into the chimney about 2 cm, then fixed and sutured with 4-0 absorbable suture. The right nipple was placed into the distal canal and wrapped and sutured with the intestinal wall and sutured (Photo 2 F).

Completion of U-shaped ileal neobladder construction

The other wall of the detubularized V-shaped canal was continuously sutured to form a U-shaped reservoir (Figure 1), and we then injected 50 ml of saline into the reservoir along the catheter to test its watertight integrity.

Removal of specimen

The abdominopelvic cavity was rinsed with sterile water and assessed for obvious bleeding. For male patients, we lengthened the first incision about 5 cm to take the specimen bag out. We then placed

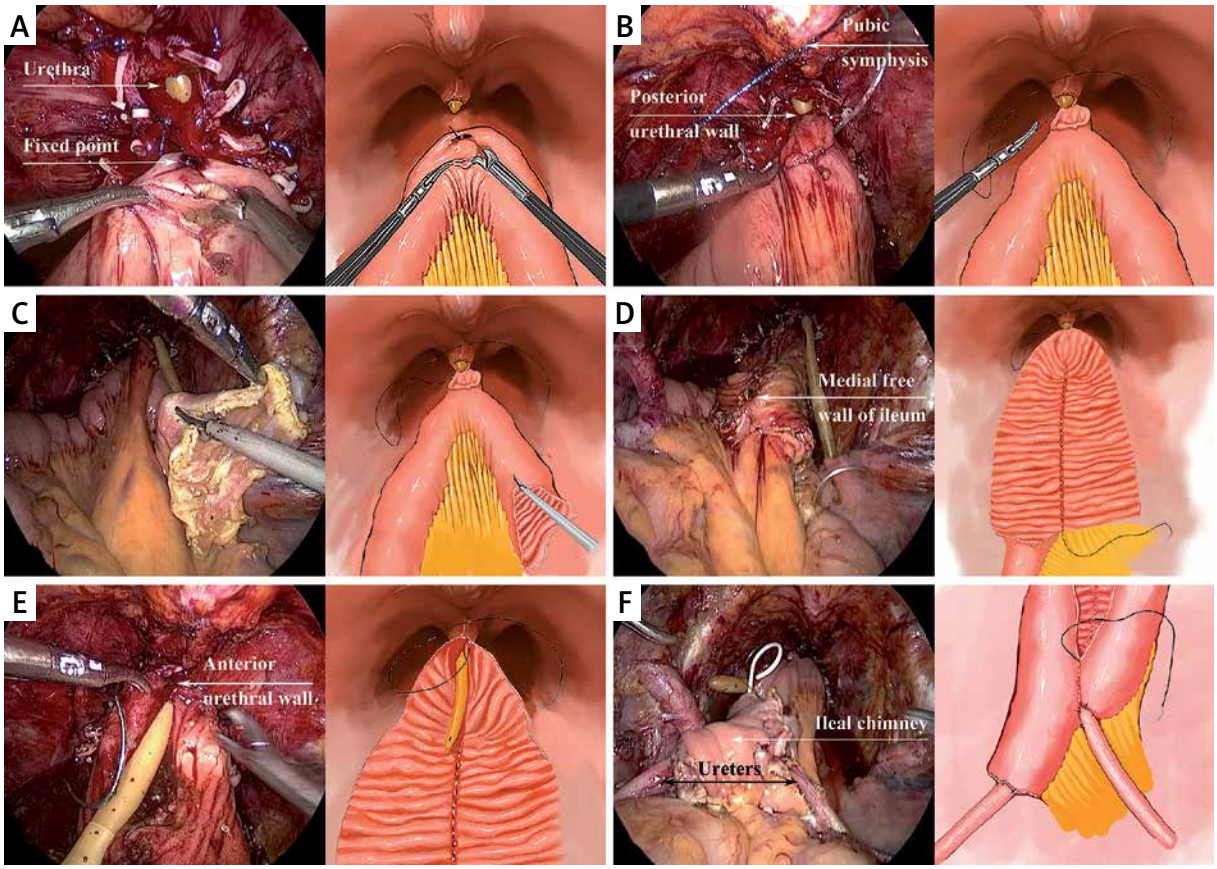

Photo 2. Neobladder construction. **A** – Fixing the ileum on Denonvilliers fascia to form a V-shaped ileal canal and making a 1 cm incision on the ileum above the fixed point. **B** – Anastomosing the posterior lip of the incision with the posterior urethral wall. **C** – Parallel detubularization of the canal. **D** – Suturing the medial free wall of the V-shaped ileal canal continuously. **E** – Anastomosing the ileum and urethra around the catheter. **F** – Completing the transplantation of bilateral ureteral nipples

the pelvic drainage tube and sutured the abdominal wall (Photo 1 C).

Results

All the patients were operated on successfully and discharged. Perioperative data of patients are shown in Table II. The median estimated intraoperative blood loss was 130 ml. The median total operative time was 270 min and ileal neobladder construction and anastomosis required 93 min. The median time to recovery of intestinal function following the procedure was 3 days.

The patients' demographic and pathologic characteristics are shown in Table I. The mean preoperative creatinine was 75.8 µmol/l, and postoperative creatinine was 79.3 µmol/l. Eight patients had hydronephrosis following the operation, including 3 patients with hydronephrosis before RC, 1 case caused by ureteral calculus, 1 case caused by cancer recurrence of bilateral ureters, and 1 patient who underwent ureterovesical replantation 13 months later. Thirty patients had control of urination during the day, and 3 patients had control of urination during the night as well. Three patients had a recurrence of their cancer, including 2 patients who died.

Discussion

Ileal neobladder construction is an important surgical procedure in RC. This operation does not change the original voiding path and maintains controllable urination, which has less of an adverse impact on patients' lifestyle and psychology than an ileal conduit [8]. In the process of reservoir construction, the intestinal operation is usually performed outside the abdominal cavity, such as the selection of ileum segment, construction of reservoir, and implantation of ureteral nipples. However, this is difficult in patients with high mesenteric tension and obesity, which increases the risks of the operation and prolongs surgical and recovery durations.

Total intracorporeal RC and neobladder construction does not require intestinal procedures outside the body. Selecting the best length of ileum under direct observation, followed by fixing the ileum on the Denonvilliers fascia, is helpful in reducing mesenteric tension and facilitating anastomosis [9], which can prevent postoperative urine leakage to some extent. Therefore, this operation is more suitable for patients with obesity and short mesenteries.

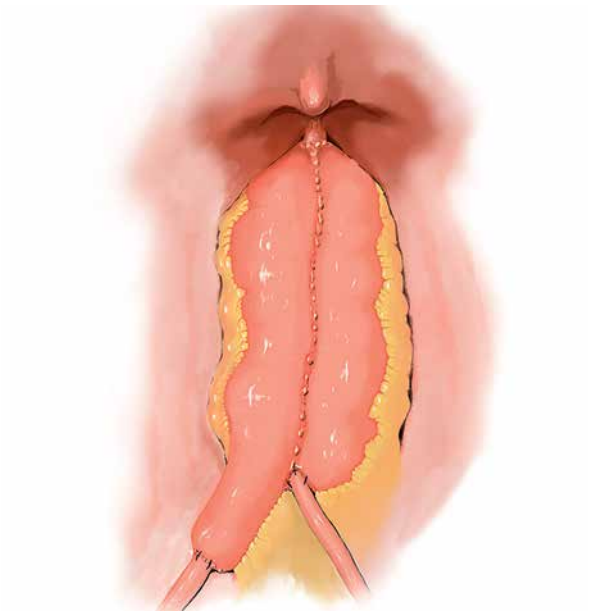

Figure 1. The U-shaped ileal neobladder

Some studies have demonstrated that retaining the maximum urethral length can optimize bladder control following radical prostatectomy [10], which indicates that reserving a longer urethra can not only reduce difficulties with anastomosis, but also has great benefits for bladder control. For cases with high mesenteric tension, perineal pressure [11], barbed suture [12] and reducing abdominal pressure [13] can be used to reduce the tension during anastomosis. In addition, with the use of barbed sutures, tightening sutures slowly to reduce the anastomotic gap can minimize the risk of tissue tearing [12].

Hydronephrosis is a common complication of radical cystectomy. The main causes of postoperative hydronephrosis are ureteral angulation, anastomotic stricture, reflux and ureteral ischemia [14].

Table II. Perioperative data of patients

Characteristics	Value
Estimated blood loss [ml] median (range)	130 (80–230)
Anastomosis time [min] median (range)	93 (85–118)
Total operative time [min] median (range)	270 (201–411)
Time to flatus [h] median (range)	48 (44–120)
Time to liquid diet [days] median (range)	3 (2.5–7)
Hospital stay after operation [days] median (range)	10 (5–23)
Follow-up time [months] median (range)	13 (7–17)

In our procedure, anastomosis between ureters and the ileal reservoir can avoid ureteral angulation, thus reducing postoperative hydronephrosis to a certain extent. In the operation, bilateral ureters are implanted respectively, which is beneficial for further treatment such as cystoscopy.

In conventional radical cystectomy, laparoscopic surgery with five ports is more common, but this involves more trauma and is more unaesthetic. The present method uses three incisions and avoids intestinal exposure and loss of temperature, which can minimize trauma and accelerate the recovery of bowel function postoperatively, although it has higher requirements for laparoscopic technique from surgeons. In addition, Enhanced Recovery After Surgery (ERAS) can reduce the rate of gastrointestinal complications significantly [15]. Therefore, our team created a feasible and repeatable standardized surgical technique to conduct laparoscopic radical cystectomy which can greatly reduce the difficulty and speed of the operation [7]. In this article, the operating time, intraoperative blood loss, postoperative intestinal function recovery time and hospital stay are all within an acceptable range. The time is no longer, or even shorter than, robot-assist laparoscopic or extracorporeal ileal reservoir construction [6, 16–19], and the operation is clearly safe and feasible. Due to the limitation of the application time and the number of cases, additional research on postoperative complications is needed. In summary, the present surgical technique has substantial advantages over the traditional procedure.

Conclusions

Intracorporeal laparoscopic U-shaped ileal neobladder construction with three ports has been presented and is feasible, safe and repeatable. This procedure is of great significance for patients with difficulty with anastomosis of the ileal neobladder and urethra due to high mesenteric tension.

Supplementary materials

The operation video can be obtained by clicking the following link: https://pan.baidu.com/s/19nWvXGYM_OpUBf4zsEGQuQ (Extraction code: x6qk).

Acknowledgments

Youlu Lu and Xin Wang have contributed equally to this article.

Conflict of interest

The authors declare no conflict of interest.

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