Perioperative recovery in different urinary reconstruction approaches of radical cystectomy: Are the advantages of laparoscopy consistent?

Zhenhua Liu¹, Yisen Meng¹, Shaobo Li², Wei Yu¹, Jie Jin¹

¹Department of Urology, Peking University First Hospital and Institute of Urology, National Research Center for Genitourinary Oncology, Beijing, China, ²Department of Pathology, School of Basic Medicine, Fudan University, Shanghai, China

Abstract

Context: Radical cystectomy (RC) has complicated surgical procedures and various ways of urinary reconstruction.

Aims: The aim of this study is to investigate whether the advantages of laparoscopy over open surgery were consistent in the perioperative recovery of different methods of urinary diversion after RC in the general and the elderly (>65 years) population.

Settings and Design: A retrospective study reviewed 452 (elderly 261) patients who received RC from the year 2005–2012.

Subjects and Methods: Of all, 88 patients underwent laparoscopic RC (LRC) and 364 patients underwent open RC (ORC). There were 325 patients received ileal conduit (IC), whereas 127 patients received cutaneous ureterostomy (CU).

Statistical Analysis Used: We used different statistical methods (t-test, Chi-square, etc.) to compare variables outcomes.

Results: For IC urinary diversion, the general patients undergoing LRC had less intra-operative blood loss (566.5 vs. 1320.3 ml, \( P < 0.001 \)), lower blood transfusion rate (11.4 vs. 34.1%, \( P < 0.001 \)), shorter gastrointestinal recovery time (5.7 vs. 6.7 days, \( P = 0.002 \)) and shorter length of hospital stay (LOS) (21.7 vs. 26.0 days, \( P = 0.003 \)) than patients receiving ORC. Similar trends were observed in older patients. For CU urinary diversion, the general and the elderly patients receiving LRC had a shorter mean time to gastrointestinal recovery (\( P = 0.017, P < 0.001 \), respectively) than patients receiving ORC. No differences were found between LRC and ORC in intra-operative blood loss, allogeneic blood transfusion rate and LOS.

Conclusions: In the general and the elderly population, laparoscopic approach could result in more rapid rehabilitation for RC patients, especially in the IC patients.

Keywords: Laparoscopy, perioperative care, radical cystectomy, urinary diversion

Address for correspondence: Dr. Yisen Meng, Department of Urology, Peking University First Hospital and Institute of Urology, National Research Center for Genitourinary Oncology, 8 Xishiku Street, Xicheng District, Beijing 100034, China.
E-mail: mgyss@qq.com

Prof. Wei Yu, Department of Urology, Peking University First Hospital and Institute of Urology, National Research Center for Genitourinary Oncology, 8 Xishiku Street, Xicheng District, Beijing 100034, China.
E-mail: yuweif@126.com

Submitted: 14-Sep-2019, Revised: 04-Nov-2019, Accepted: 27-Nov-2019, Published: 09-Jan-2020

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPedknow_reprints@wolterskluwer.com

How to cite this article: Liu Z, Meng Y, Li S, Yu W, Jin J. Perioperative recovery in different urinary reconstruction approaches of radical cystectomy: Are the advantages of laparoscopy consistent? J Min Access Surg 2020;16:390-8.
INTRODUCTION

Radical cystectomy (RC) still plays an important role in the treatment of muscle-invasive bladder cancer (MIBC) and other high-risk bladder carcinomas. Laparoscopic surgery is gradually gaining popularity in RC because of its advantages such as decreased blood loss, improved convalescence and reduced complications.1-3 However, as a complex surgery, there is more than one procedure of urinary diversion reconstruction procedures for RC (two of them are most commonly used: RC with ileal conduit [IC] and RC with cutaneous ureterostomy [CU]). Which procedure benefits more from laparoscopic surgery, IC or CU? Are there different outcomes for elderly (>65 years) people? In our study, the perioperative recovery of RC’s two procedures (IC and CU) in laparoscopic RC (LRC) and open RC (ORC) was compared.

SUBJECTS AND METHODS

Characteristics of cases

We retrospectively reviewed patients who had undergone RC at our department in the period of 2005–2012. We included patients’ perioperative data such as surgery information, post-operative complications and length of hospital stay (LOS). Exclusion criteria include patients with unclear perioperative status; patients with a history of gastrointestinal disorders; patients taking long-term medications that may interfere with gastrointestinal function; and patients with other diseases that may affect gastrointestinal recovery. The research was approved by the ethics committee of our hospital. In this research, informed consent was obtained from all participants.

Preoperative assessment

Patients were admitted 4 days or more in advance of surgery. Pre-operative examination was performed first, followed by intestinal preparation, including the following: For CU patients, low-fibre diet and macrogol solution 1 L the day before the surgery. For IC patients, low-fibre diet 3 days before the surgery and macrogol solution 1 L the day before the surgery.

Surgical procedure

Internationally accepted operation methods (according to Campbell-Walsh Urology3) of RC (LRC and ORC) and urinary diversion (CU, IC) for patients were selected according to the patient’s condition and intention before surgery.

During CU procedure, according to the length of the ureter, and the patient’s body type, a single or bilateral abdominal colostomy was performed on the right abdominal wall. The ureter was pulled out of the abdominal wall outside the peritoneum. Trim the end of ureter, fix the ureter outer membrane and subcutaneous tissue, split vertically for 1–2 cm, and inverted to make a nipple, which was fixed with the abdominal wall. To prevent hydroureter caused by stenosis after CU, single-J stents were routinely retained after the operation. Most patients require lifelong retention and regular replacement (every 3 months). During IC procedure, most of this kind of surgery in our centre was done extracorporeally. By doing extracorporeally, we could use the same incision from which we take specimen without adding wound additionally. Intestinal loops of about 15 cm were selected from 10 to 15 cm away from the ileocecal region, and the intestinal loops were cut and anastomosed at the ileocecal end to restore intestinal continuity. A tunnel was made in the loose tissue behind the sigmoid colon, and the left ureter was led to the right side. The bilateral ureters were split vertically on the opposite side of the mesangial margin, and the bilateral ureters were anastomosed and combined, and then end-to-end anastomosis was performed with the intestinal loop input tract. The outlet is pulled out by the rectus abdominis for an ostomy.

After the operation, the patients were given a patient-controlled analgesic pump to receive opioid therapy for 2 days. The surgeons encouraged patients to walk on the 1st day after surgery. The nasogastric tube was removed after the bowel sounds were restored or the patient had flatus. The fluid diet was offered the following day. Solid food was provided the day after. Patients were questioned twice daily until the post-operative 7th day regarding the initial bowel movement and consumption of solid food. The GI-1 recovery time was recorded as time of bowel sounds restoration and GI-2 recovery time as time of bowel movement well and tolerance to solid food.

Parameters

We chose some preoperative parameters such as patients’ age, gender and body mass index (BMI) for the analysis. Intra-operative parameters including operation time, volume of intra-operative bleeding, transfusion rate and complications were conducted in the study. Post-operative parameters included nasogastric tube kept, time of drainage tube kept, intensive care unit (ICU) occupancy rate, LOS, time of GI-1 and GI-2, and major and minor complications. We used Clavien classification to grade complications.8 We classified minor complications as grades 1–2, whereas major complications as grades 3–5.

Statistical analysis

We applied SPSS 20.0 software (IBM Corp., Armonk, NY, USA) for statistical analysis. When the continuous variables were tested to conform to the normal distribution, the mean ± standard deviation was adopted, and the
independent sample t-test was applied for the analysis. When it did not conform to the normal distribution, the median and range (minimum–maximum value) were adopted, and the Mann–Whitney rank-sum test was applied. For disordered categorisation variables, Chi-square test was utilised. Pairwise comparison and test results of multiple hypotheses were corrected by Bonferroni method. In the present study, we considered \( P < 0.05 \) as statistically significant.

RESULTS

Patients

Table 1 shows the demographics of the 452 patients undergoing RC. The patients had a mean age of 65.1 years (range: 24–91 years). The patients consisted of 96 (21.2%) women and 364 (78.8%) men. One hundred and twenty-seven patients (28.1%) underwent CU, 325 patients (71.9%) underwent IC. 88 (19.5%) cases received LRC and 364 (80.5%) cases received ORC. The patients had a mean BMI of 24.03 kg/m\(^2\) (range: 14.84–36.89 kg/m\(^2\)) and a mean operative time of 352.1 min (range: 105–650 min). What’s more, the patients’ mean blood loss was 1128.1 mL (range: 50–11600 ml), and mean LOS was 24.83 days (range: 14–35 days).

The pathological findings were urothelium carcinoma for 408 cases (90.3%), squamous carcinoma for 15 cases (3.3%), bladder contracture for 12 cases (2.7%), adenocarcinoma for 7 cases (1.5%), neuroendocrine neoplasm for 4 cases (0.9%), sarcoma for 4 cases (0.9%) and lymphoma for 2 cases (0.4%).

The comparison between laparoscopic radical cystectomy and open radical cystectomy in total patients

As shown in Table 2, we see the comparison between LRC and ORC in total patients. LRC group had shorter GI‑1 (2.85 vs. 4.20 days, \( P < 0.001 \)) and GI‑2 (5.35 vs. 6.40 days, \( P = 0.001 \)) recovery meantime than ORC group. What’s more, LRC group had less ICU admission rate (34.1 vs. 58.5%, \( P < 0.001 \)), less mean bleeding volume (677.4 vs. 1237.0 ml, \( P < 0.001 \)), less allogeneic blood transfusion (14.8 vs. 37.1%, \( P < 0.001 \)) and shorter LOS (21.77 vs. 25.61 days, \( P = 0.002 \)) than ORC group [Table 2].

### Table 1: Demographics and surgical characteristics of radical cystectomy patients

| Characteristic                          | Total (n=452) | Age n ≤65 (n=191) | Age >65 (n=261) | P   |
|-----------------------------------------|--------------|-------------------|-----------------|-----|
| Gender, n (%)                           |              |                   |                 |     |
| Male                                    | 364 (78.8)   | 155 (81.2)        | 201 (77.0)      | 0.288 |
| Female                                  | 96 (21.2)    | 36 (18.8)         | 60 (23.0)       |     |
| Age (year)                              | 65.1±11.51   | 53.88±7.64        | 73.25±5.29      | <0.001 |
| BMI (kg/m\(^2\))                        | 24.03±3.49   | 24.71±3.71        | 23.54±3.24      | <0.001 |
| T stage, n (%)                          |              |                   |                 |     |
| T a-1                                   | 116 (25.7)   | 51 (26.7)         | 65 (24.9)       | 0.666 |
| T 2-4                                   | 336 (74.3)   | 140 (73.3)        | 196 (75.1)      |     |
| N stage, n (%)                          |              |                   |                 |     |
| N 0                                     | 406 (89.8)   | 170 (89.0)        | 236 (90.4)      | 0.623 |
| N 1-2                                   | 46 (10.2)    | 21 (11.0)         | 25 (9.6)        |     |
| ASA score, n (%)                        |              |                   |                 |     |
| 1-2                                     | 393 (86.9)   | 181 (94.8)        | 212 (81.2)      | <0.001 |
| 3-4                                     | 59 (13.1)    | 10 (5.2)          | 49 (18.8)       |     |
| Surgery methods, n (%)                  |              |                   |                 |     |
| Laparoscopy                             | 88 (19.5)    | 40 (20.9)         | 48 (18.4)       | 0.499 |
| Open                                    | 364 (80.5)   | 151 (79.1)        | 213 (81.6)      |     |
| Reconstruction procedures, n (%)        |              |                   |                 |     |
| Ileal conduit                           | 325 (71.9)   | 154 (80.6)        | 171 (65.5)      | <0.001 |
| Cutaaneous ureterostomy                 | 127 (28.1)   | 37 (19.4)         | 90 (34.5)       |     |
| Surgery duration (min)                  | 352±99.5     | 369±202.5         | 332±90.6        | 0.002 |
| Intraoperative blood loss (ml)           | 1128±137.6   | 1172±101.4        | 1095±1164.5     | 0.483 |
| Allogeneic blood transfusion, n (%)     |              |                   |                 |     |
| No                                      | 304 (67.3)   | 129 (67.5)        | 175 (67.0)      | 0.913 |
| Yes                                     | 148 (32.7)   | 62 (32.5)         | 86 (33.0)       |     |
| ICU admission, n (%)                    |              |                   |                 |     |
| No                                      | 209 (46.2)   | 124 (64.9)        | 85 (32.6)       | <0.001 |
| Yes                                     | 243 (53.8)   | 67 (35.1)         | 176 (67.4)      |     |
| Complication, n (%)                     |              |                   |                 |     |
| No                                      | 365 (80.8)   | 163 (85.3)        | 202 (77.4)      | 0.034 |
| Yes                                     | 87 (19.2)    | 28 (14.7)         | 59 (22.6)       |     |
| GI-1 recovery (days)                    | 3.9±1.68     | 3.87±1.78         | 3.98±1.61       | 0.524 |
| GI-2 recovery (days)                    | 6.19±2.59    | 5.93±1.83         | 6.39±3.02       | 0.043 |
| Gastric tube removal time (days)        | 3.5±2.13     | 3.55±1.65         | 3.48±2.42       | 0.727 |
| Drainage tube removal time (days)       | 7.31±3.94    | 7.19±3.96         | 7.41±3.94       | 0.560 |
| LOS (days)                              | 24.83±10.55  | 24.66±10.43       | 24.96±10.66     | 0.769 |

ASA: American Society of Anaesthesiologist, BMI: Body mass index, GI-1 recovery: Time of bowel sounds restoration, GI-2 recovery: Time of bowel movement well and tolerance to solid food, ICU: Intensive care unit, LOS: Length of hospital stay
The comparison between ileal conduit and cutaneous ureterostomy set in total patients

As shown in Table 3, we see the comparison between IC and CU set in total patients. CU set were older (70.21 vs. 63.05 years old), with higher T stage (T stage 2–4: 82.7 vs. 71.1%) and the American Society of Anaesthesiologist (ASA) score (ASA 3–4: 18.9 vs. 10.8%, P = 0.021), had shorter GI-1 (3.36 vs. 4.15 days, P < 0.001) and GI-2 (5.52 vs. 6.46 days, P = 0.003) recovery mean time than ORC group. What's more, IC group had more allogeneic blood transfusion (41.7 vs. 29.2%, P = 0.017) and shorter surgery duration (284.1 vs. 378.7 days, P = 0.002) than IC set [Table 3]. However, there was no difference in complications [Table 4].

The comparison between laparoscopic radical cystectomy and open radical cystectomy in ileal conduit set

Of the 325 patients who received IC for urinary diversion reconstruction, there were 70 patients undergoing laparoscopic surgery and 255 open surgeries [Table 3]. The LRC group had shorter LOS (21.74 vs. 25.98 days, P < 0.001), shorter mean time to GI-1 recovery (3.01 vs. 4.47 days, P < 0.001) and GI-2 recovery (5.74 vs. 6.65 days, P = 0.002) than ORC group. The laparoscopic group also had less ICU admission (28.6 vs. 57.3%, P < 0.001), less mean bleeding volume (566.5 vs. 1320.3 ml, P < 0.001) and less allogeneic blood transfusion (11.4 vs. 31.4%, P < 0.001) than ORC group [Table 5].

The comparison between laparoscopic radical cystectomy and open radical cystectomy in cutaneous ureterostomy set

Of the 127 patients who received CU, eighteen patients underwent laparoscopic surgery and 109 underwent open surgery [Table 3]. Patients receiving LRC had significantly shorter mean time to GI-1 recovery (2.22 vs. 3.55 days, P < 0.001) and GI-2 recovery (3.83 vs. 5.80 days, P = 0.017) than ORC. However, none of the following aspects reached statistical differences between the two groups: intra-operative blood loss, rate of allogeneic blood transfusion, ICU admission or LOS [Table 5].

The laparoscopy group was correlated with more obvious advantages in ileal conduit

The previous two paragraphs compared LRC and ORC in IC and CU set, respectively [Table 5]. In IC set, laparoscopy...
Liu, et al.: Laparoscopy has more obvious advantages in ileal conduit surgery

Table 3: The differences between patients received radical cystectomy with ileal conduit and cutaneous ureterostomy in total cases and in age >65 cases

| Characteristic                      | Surgery methods of total RC cases (n=452) | Surgery methods of age >65 RC cases (n=261) |
|-------------------------------------|-----------------------------------------|-------------------------------------------|
|                                     | Ileal conduit (n=325) | Cutaneous ureterostomy (n=127) | P | Ileal conduit (n=171) | Cutaneous ureterostomy (n=90) | P |
| Gender, n (%)                       | Male | 270 (83.1) | 94 (74.0) | 0.029 | 144 (84.2) | 64 (71.1) | 0.012 |
|                                     | Female | 55 (16.9) | 33 (26.0) | | 27 (15.8) | 26 (28.9) | |
| Age (year)                          | 63.05±11.35 | 70.2±10.29 | <0.001 | 71.96±4.49 | 75.70±5.83 | <0.001 |
| BMI (kg/m²)                         | 24.14±3.49 | 23.74±3.49 | 0.277 | 23.32±3.15 | 23.66±3.29 | 0.438 |
| T stage, n (%)                      | T 1-2 | 94 (28.9) | 22 (17.3) | 0.011 | 50 (29.2) | 15 (16.7) | 0.026 |
| N stage, n (%)                      | N 0 | 290 (89.2) | 116 (91.3) | 0.505 | 154 (90.1) | 82 (91.1) | 0.784 |
|                                     | N 1-2 | 35 (10.8) | 11 (8.7) | | 17 (9.9) | 8 (8.9) | |
| ASA score, n (%)                    | 1-2 | 290 (89.2) | 103 (81.1) | 0.021 | 141 (82.5) | 71 (78.9) | 0.483 |
|                                     | 3-4 | 35 (10.8) | 24 (18.9) | | 30 (17.5) | 19 (21.1) | |
| Surgery methods, n (%)              | Laparoscopy | 70 (21.5) | 18 (14.2) | 0.086 | 35 (20.5) | 13 (14.4) | 0.233 |
|                                     | Open | 255 (78.5) | 109 (85.8) | | 136 (79.5) | 77 (85.6) | |
| Surgery duration (min)              | 378.7±88.9 | 284.1±93.0 | <0.001 | 369.79±82.02 | 282.38±93.68 | <0.001 |
| Intra-operative blood loss (ml)     | 1151.9±1068.0 | 1157.9±1068 | 0.372 | 1141.1±1057.2 | 1010.0±1347.2 | 0.388 |
| Allogeneic blood transfusion, n (%) | No | 230 (70.8) | 74 (58.3) | 0.011 | 123 (71.9) | 52 (57.8) | 0.021 |
|                                     | Yes | 95 (29.2) | 53 (41.7) | | 48 (28.1) | 38 (42.2) | |
| ICU admission, n (%)                | No | 166 (51.1) | 77 (60.6) | 0.067 | 113 (66.1) | 63 (70.0) | 0.521 |
|                                     | Yes | 264 (81.2) | 101 (79.5) | 0.680 | 132 (77.2) | 70 (77.8) | 0.915 |
| Complication, n (%)                 | No | 159 (48.9) | 50 (39.4) | 0.072 | 123 (71.9) | 52 (57.8) | 0.021 |
|                                     | Yes | 166 (51.1) | 77 (60.6) | | 113 (66.1) | 63 (70.0) | |
| GI‑1 recovery (days)                | 4.15±1.66 | 3.36±1.62 | <0.001 | 4.28±1.48 | 3.99±1.69 | <0.001 |
| GI‑2 recovery (days)                | 6.46±2.23 | 5.52±2.26 | 0.003 | 6.74±2.57 | 5.73±3.65 | 0.022 |
| Gastric tube removal time (days)    | 3.94±2.01 | 2.42±3.04 | <0.001 | 4.10±2.33 | 2.30±2.15 | <0.001 |
| Drainage tube removal time (days)   | 7.43±3.97 | 7.01±3.88 | 0.304 | 7.65±3.89 | 6.94±4.02 | 0.171 |
| LOS (days)                          | 25.03±10.59 | 24.33±10.47 | 0.534 | 25.36±10.68 | 24.20±10.62 | 0.416 |

ASA: American Society of Anaesthesiologist, BMI: Body mass index, GI‑1 recovery: Time of bowel sounds restoration, GI‑2 recovery: Time of bowel movement well and tolerance to solid food, ICU: Intensive care unit, LOS: Length of hospital stay, RC: Radical cystectomy

Table 4: Post‑operative complication of laparoscopic and open radical cystectomy in total patients

| Complications                  | RC with ileal conduit | RC with cutaneous ureterostomy |
|--------------------------------|-----------------------|-------------------------------|
|                                | Laparoscopy (%) | Open (%) | P | Laparoscopy (%) | Open (%) | P |
| Minor                          | 11 (15.7) | 56 (22.0) | 0.761 | 2 (11.1) | 15 (13.8) | 0.760 |
| Ileus                          | 3 (4.3) | 32 (12.5) | 0.011 | 1 (5.6) | 3 (2.8) | 0.011 |
| Deep‑vein thrombosis           | 1 (1.4) | 2 (0.78) | 0 | 1 (0.9) | 0 | 0 |
| Pyelonephritis                 | 1 (2.9) | 2 (0.78) | 1 (5.6) | 0 | 2 (1.8) | 1 (0.9) |
| Pneumonia                      | 2 (2.9) | 2 (0.78) | 0 | 2 (1.8) | 0 | 1 (0.9) |
| Ureteral stent dislocation     | 1 (2.9) | 1 (0.39) | 0 | 3 (2.8) | 0 | 3 (2.8) |
| Superficial wound infection    | 1 (1.4) | 12 (4.7) | 0 | 3 (2.8) | 0 | 3 (2.8) |
| Lymphatic leakage              | 1 (1.4) | 3 (1.2) | 0 | 0 | 0 | 0 |
| Pelvic effusion                | 1 (1.4) | 1 (0.39) | 0 | 0 | 0 | 0 |
| Psychological problem          | 0 | 1 (0.39) | 0 | 2 (1.8) | 0 | 2 (1.8) |
| Major                          | 4 (5.7) | 13 (5.1) | 0.837 | 1 (5.6) | 8 (7.3) | 0.837 |
| Wound dehiscence               | 0 | 3 (1.2) | 0 | 1 (0.9) | 0 | 1 (0.9) |
| Cardiopulmonary decompensation | 2 (2.9) | 5 (2.0) | 0 | 2 (1.8) | 0 | 2 (1.8) |
| Cerebrovascular accident       | 1 (1.4) | 2 (0.78) | 0 | 3 (2.8) | 0 | 2 (1.8) |
| Deep abscess                   | 0 | 1 (0.39) | 0 | 1 (0.9) | 0 | 1 (0.9) |
| Bleeding                       | 0 | 0 | 1 (5.6) | 0 | 0 | 0 |
| Rectal injury                  | 1 (1.4) | 1 (0.39) | 0 | 0 | 0 | 0 |
| Renal failure                  | 0 | 1 (0.39) | 0 | 1 (0.9) | 0 | 1 (0.9) |

RC: Radical cystectomy

was associated with more obvious advantages (less blood loss and lower blood transfusion rate; more obvious difference in GI‑2 recovery and in gastric tube removal time) than that in CU set. Hence, we could draw the
Table 5: The differences between laparoscopic and open methods in patients received radical cystectomy with ileal conduit and cutaneous ureterostomy in total cases

| Characteristic | RC with ileal conduit | RC with cutaneous ureterostomy |
|---------------|-----------------------|-----------------------------|
|               | Laparoscopy | Open | Laparoscopy | Open |
| Gender, n (%) |           |       |             |       |
| Male          | 58 (82.9) | 212 (83.1) | 0.956 | 13 (72.2) | 78 (71.6) | 0.954 |
| Female        | 12 (17.1) | 43 (16.9) |       | 5 (27.8) | 31 (28.4) |
| Age (year)    | 62.0±11.69 | 63.3±11.26 | 0.382 | 72.3±9.85 | 69.9±10.36 | 0.360 |
| BMI (kg/m²)   | 23.95±3.363 | 24.64±7.792 | 0.474 | 23.31±3.124 | 23.82±3.552 | 0.565 |
| T stage, n (%) |             |       |             |       |
| T-1           | 20 (28.6) | 74 (29.0) | 0.942 | 6 (33.3) | 16 (14.7) | 0.086 |
| T-2-4         | 50 (71.4) | 181 (71.0) | 12 (66.7) | 93 (85.3) |
| N stage, n (%) |             |       |             |       |
| N 0           | 64 (91.4) | 226 (88.6) | 0.664 | 17 (94.4) | 99 (90.8) | 0.957 |
| N 1           | 6 (8.6) | 29 (11.4) | 1 (5.6) | 10 (9.2) |
| ASA score, n (%) |          |       |             |       |
| 1-2           | 62 (88.6) | 228 (89.4) | 0.829 | 14 (77.8) | 89 (81.7) | 0.746 |
| 3-4           | 8 (11.4) | 27 (10.6) |       | 4 (22.2) | 20 (18.3) |
| Surgery duration (min) | 390.8±80.36 | 375.4±91.00 | 0.198 | 297.6±92.66 | 282.0±93.25 | 0.511 |
| Intra-operative blood loss (ml) | 566.5±613.9 | 1320.3±1109.0 | <0.001 | 1106.1±2686.3 | 1041.9±915.1 | 0.847 |
| Allergenic blood transfusion, n (%) |         |       |             |       |
| No            | 62 (88.6) | 168 (65.9) | <0.001 | 8 (44.4) | 42 (38.5) | 0.634 |
| Yes           | 8 (11.4) | 87 (34.1) |       | 10 (55.6) | 67 (61.5) |
| ICU admission, n (%) |        |       |             |       |
| No            | 50 (71.4) | 109 (42.7) | <0.001 | 8 (44.4) | 42 (38.5) | 0.795 |
| Yes           | 20 (28.6) | 146 (57.3) |       | 10 (55.6) | 67 (61.5) |
| Complication, n (%) |       |       |             |       |
| No            | 55 (78.6) | 209 (82.0) | 0.495 | 15 (83.3) | 86 (78.9) | 0.907 |
| Yes           | 15 (21.4) | 46 (18.0) |       | 3 (16.7) | 23 (21.1) |
| GI-1 recovery (days) | 3.01±0.93 | 4.47±1.68 | <0.001 | 2.22±0.43 | 3.55±1.67 | <0.001 |
| GI-2 recovery (days) | 5.74±1.74 | 6.65±2.31 | 0.002 | 3.83±1.43 | 5.80±3.40 | 0.017 |
| Gastric tube removal time (days) | 3.16±1.11 | 4.15±2.15 | <0.001 | 1.61±1.15 | 2.55±2.12 | 0.008 |
| Drainage tube removal time (days) | 6.94±3.07 | 7.57±4.18 | 0.243 | 5.78±3.64 | 7.21±3.89 | 0.147 |
| LOS (days)    | 21.74±10.82 | 25.98±10.36 | 0.003 | 21.89±10.45 | 24.75±10.46 | 0.286 |

ASA: American Society of Anaesthesiologist, BMI: Body mass index, GI-1 recovery: Time of bowel sounds restoration, GI-2 recovery: Time of bowel movement well and tolerance to solid food, ICU: Intensive care unit, LOS: Length of hospital stay, RC: Radical cystectomy

Liu, et al.: Laparoscopy has more obvious advantages in ileal conduit surgery

**Conclusion**

The advantages of laparoscopy in the elderly group were similar to the general population in the IC method. However, in the CU method, the advantage of laparoscopy was less obvious in the elderly group.

**DISCUSSION**

Laparoscopic radical cystectomy has advantages over open radical cystectomy in more rapid perioperative recovery

Nowadays, RC still plays an important role in the treatment of localised MIBC and other high-risk bladder carcinomas. However, due to the number of steps and complexity involved, the perioperative mortality of RC was 1.2%–3.2% at 30 days and 2.3%–8.0% at 90 days. Post-operative ileus is the most frequent medical complication, which affects about 4%–19% patients, and is correlated with prolonged LOS as well as increased readmission rates. Therefore, the perioperative recovery, especially gastrointestinal recovery of RC, is a key clinical problem.

Laparoscopic surgery is becoming increasingly prevalent, and this minimally invasive approach has proved a good

Characteristics of the elderly group (age >65 years)

To further understand the characteristics of elderly's perioperative recovery, we divided the total population into two groups (elderly group, n = 261) according to the WHO’s definition of the age of the elderly (age >65 years), and studied the characteristics of perioperative recovery of the elderly using the research methods in the total population in subsequent statistics. Table 1 shows elderly group had an average age of 73 years old. Compared with the control group (age <65, n = 191), elderly group had lower BMI (P < 0.001), higher ASA score (P < 0.001), higher chance to choose CU (P < 0.001) and enter ICU (P < 0.001), shorter surgery duration (P = 0.002), higher complication rate (P = 0.034) and longer GI-2 recovery time (P = 0.043).

In Tables 2 and 3, trends in the elderly group were similar to those in the general population. In the comparison of Table 5 (total population) and Table 6 (elderly group), we found that the advantages of laparoscopy in the elderly group were similar to the general population in the IC method. However, in the CU method, the advantage of laparoscopy was less obvious in the elderly group.
The possible reasons for the advantages of laparoscopic radical cystectomy over open radical cystectomy

The possible reasons for the advantages of LRC over ORC are listed below. The operation time of RC is frequently prolonged involving resection of adjacent organs and urinary diversion. That increases the intra-operative invisible dehydration, which may cause splanchic hypoperfusion and manifest as delayed gastrointestinal recovery and failure to tolerate oral diet. LRC is executed in a relatively closed space and decreases intra-operative invisible dehydration than ORC, which may accelerate gastrointestinal recovery. Smaller incisions of LRC can reduce postoperative pain and decrease the dosage of intra-operative anaesthesia and post-operative analgesics. Moreover, the smaller incisions of LRC makes ambulation as early as the day after operation, which shortens time to flatus and oral feeding.

Why the advantages of laparoscopy are more obvious in ileal conduit?

Our study showed LRC with IC, and CU urinary diversions were associated with shorter gastric tube removal time and shorter GI-1 and GI-2 recovery time. However, no differences were found in the intra-operative bleeding

### Table 6: The differences between laparoscopic and open methods in patients received radical cystectomy with ileal conduit and cutaneous ureterostomy in age >65 cases

| Characteristic | RC with ileal conduit | | | RC with cutaneous ureterostomy | | |
|----------------|-----------------------|---|---|---------------------------|---|---|
| Gender, n (%)  |                       |   |   |                           |   |   |
| Male           | 30 (85.7)             | 114 (83.8) | 0.784 | 10 (76.9)                | 54 (70.1) | 0.866 |
| Female         | 5 (14.3)              | 22 (16.2) |       | 3 (23.1)                 | 23 (29.9) |       |
| Age (year)     | 71.7±4.90             | 72.0±4.39 | 0.718 | 77.8±5.02                | 75.3±6.03 | 0.068 |
| BMI (kg/m²)    | 24.03±3.44            | 23.56±3.26 | 0.454 | 22.93±3.59              | 23.39±3.09 | 0.627 |
| T stage, n (%) |                       |   |   |                           |   |   |
| T 1-1          | 11 (31.4)             | 39 (28.7) | 0.750 | 5 (38.5)                 | 10 (13.0) | 0.023 |
| T 2-4          | 24 (68.6)             | 97 (71.3) |       | 8 (61.5)                 | 67 (87.0) |       |
| N stage, n (%) |                       |   |   |                           |   |   |
| N 0            | 32 (91.4)             | 122 (89.7) | 0.761 | 12 (92.3)                | 70 (90.9) | 0.870 |
| N 1            | 3 (8.6)               | 14 (10.3) |       | 1 (7.7)                  | 7 (9.1)   |       |
| ASA score, n (%) |                     |   |   |                           |   |   |
| 1-2            | 29 (82.9)             | 112 (82.4) | 0.944 | 10 (76.9)                | 61 (79.2) | 0.851 |
| 3-4            | 6 (17.1)              | 24 (17.6) |       | 3 (23.1)                 | 16 (20.8) |       |
| Surgery duration (min) |             |   |   |                           |   |   |
| Intra-operative blood loss (ml) |   |   |   |                           |   |   |
| No             | 30 (85.7)             | 93 (68.4) | 0.042 | 9 (69.2)                 | 43 (55.8) | 0.366 |
| Yes            | 5 (14.3)              | 43 (31.6) |       | 4 (30.8)                 | 34 (44.2) |       |
| ICU admission, n (%) |                  |   |   |                           |   |   |
| No             | 22 (62.9)             | 36 (26.5) | <0.001 | 3 (23.1)                | 24 (31.2) | 0.794 |
| Yes            | 13 (37.1)             | 100 (73.5) |       | 10 (76.9)                | 53 (68.8) |       |
| Complication, n (%) |                  |   |   |                           |   |   |
| No             | 23 (65.7)             | 109 (80.1) | 0.070 | 10 (76.9)                | 60 (77.9) | 0.936 |
| Yes            | 12 (34.3)             | 27 (19.9) |       | 3 (23.1)                 | 17 (22.1) |       |
| GI-1 recovery (days) |               |   |   |                           |   |   |
| No             | 3.06±0.84             | 4.60±1.45 | <0.001 | 2.3±0.48                | 3.5±1.76  | <0.001 |
| Yes            | 6.03±2.22             | 6.92±2.63 | 0.067 | 4.08±1.50               | 6.0±3.83  | 0.077 |
| Gastric tube removal time (days) |       |   |   |                           |   |   |
| No             | 3.1±1.14              | 4.3±2.49 | 0.006 | 1.69±1.11               | 2.40±2.27 | 0.273 |
| Yes            | 7.17±3.13             | 7.77±4.06 | 0.416 | 6.23±3.86               | 7.02±4.06 | 0.493 |
| Drainage tube removal time (days) |             |   |   |                           |   |   |
| No             | 21.17±10.73           | 26.52±10.42 | 0.008 | 22.15±9.80              | 24.57±10.79 | 0.454 |
| Yes            | 3 (23.1)              | 24 (17.6) |       | 3 (23.1)                 | 24 (17.6) |       |

ASA: American Society of Anaesthesiologist, BMI: Body mass index, GI-1 recovery: Time of bowel sounds restoration, GI-2 recovery: Time of bowel movement well and tolerance to solid food, ICU: Intensive care unit, LOS: Length of hospital stay, RC: Radical cystectomy
volume, allogeneic blood transfusion rate, ICU admission rate as well as LOS between LRC and ORC with CU procedure.

The advantages of laparoscopy in IC may be due to the following factors. The laparoscopic vision is magnified and the surgical procedure is precise, which contributes to better haemostasis in the operation, resulting in less bleeding as well as lower rate of transfusion. The pathophysiology of post-operative ileus is complicated and may be linked with the extent of post-operative sympathetic activity. The laparoscopic procedure reduces manipulation of intestinal and traction on the mesentery during the surgery, which may help reduce alteration in gastrointestinal transit and sympathetic activity, and also may result in less peritoneal inflammation. The operation procedure of IC is more complicated than that of CU, the operation time is longer and involves more intestinal operations, and that may magnify the advantages of laparoscopy mentioned earlier.

Characteristics of gastrointestinal recovery in elderly patients
In elderly RC patients, the incidence of complications was relatively high. In our study, the incidence of complications in elderly patients was 22.6% (in the control group, the rate was 14.7%). Elderly patients with physical dysfunction, basic complications increased, which is an important factor affecting the incidence of perioperative complications. On the other hand, the gastrointestinal tract recovery in the elderly is relatively slow, which amplifies the difference in gastrointestinal tract recovery between the two surgical methods (IC and CU). Therefore, the advantages of laparoscopic surgery in gastrointestinal tract recovery in the elderly are also related to the selection of surgical methods.

Discussion to the perioperative management
As a retrospective study, all IC surgeries in our department in the past required routine intestinal preparation, and hence, all the cases in the article had done intestinal preparation. Now, increasing literature suggests that bowel preparation is not routinely required. Therefore, more studies may be needed to confirm what kind of patients could benefit from pre-operative bowel preparation. The purpose of being hospitalised in advance is to enable patients to better receive pre-operative examinations (ultrasound, pre-operative blood examination, echocardiography, etc.) and intestinal preparation (especially for patients undergoing IC surgery). Due to the improvement of examination efficiency and re-understanding of preoperative intestinal preparation, most of our patients’ pre-operative hospital stay has been controlled within 3 days recently.

Of all the medical records, there is one laparoscopic CU case of massive bleeding [maximum blood loss 11600 ml, Table 4]. This 79-year-old male has lymph node metastasis and extensive pelvic adhesions. The bleeding is mainly due to the injury of the external iliac vessels when doing lymph node dissection. The surgeon later switched it to open surgery and repaired the vessel. From this case, we could learn that careful operation should be additionally paid attention to avoid injury to blood vessels, especially when the patient has lymph node metastasis and serious adhesion. Adequate blood should be prepared before surgery. If external iliac vascular injury occurs, try to suture the vessel as much as possible, and consult the Vascular Surgery Department for urgent consultation if necessary. Decisively switch to open surgery when necessary.

Like all the other retrospective series, the present non-prospective, non-randomised, single-centre study gets the same limitations and biases, such as potential selection bias and surgeon bias. However, LRC seems to be advantageous in patients’ gastrointestinal recovery, which accelerates the post-operative rehabilitation and cuts down the LOS.

CONCLUSIONS
The laparoscopic approach had a smaller negative impact on the gastrointestinal tract and could result in more rapid rehabilitation for RC patients both in the way of IC and CU. The advantages of laparoscopy are more obvious in the perioperative recovery of IC patients.

Acknowledgement
This work was supported by the Tibetan Natural Science Foundation (Grant No. XZ2017ZR-ZY019).

The study was approved by the Ethics Committee of Peking University First Hospital. Informed consents were obtained from all individual participants included in the study.

Financial support and sponsorship
This work was supported by Tibetan Natural Science Foundation (Grant No. XZ2017ZR-ZY019).

Conflicts of interest
There are no conflicts of interest.

REFERENCES
1. Gill IS, Kaouk JH, Meraney AM, Desai MM, Ulchaker JC, Klein EA, et al. Laparoscopic radical cystectomy and continent orthotopic ileal neobladder performed completely intracorporeally: The initial experience. J Urol 2002;168:13-8.
2. Haber GP, Crouzet S, Gill IS. Laparoscopic and robotic assisted radical cystectomy for bladder cancer: A critical analysis. Eur Urol 2008;54:54-62.
3. Moinzadeh A, Gill IS, Desai M, Finelli A, Falcone T, Kaouk J. Laparoscopic radical cystectomy in the female. J Urol 2005;173:1912-7.
4. Campbell MF, Walsh PC, Wein AJ, Kavoussi LR. Campbell-Walsh Urology. 11th ed. Pennsylvania, USA: Saunders Elsevier; 2015. p. 1334.
5. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: A new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg 2004;240:205-13.
6. Alfred Wijes J, Lebrer T, Compérat EM, Cowan NC, De Santis M, Bruins HM, et al. Updated 2016 EAU guidelines on muscle-invasive and metastatic bladder cancer. Eur Urol 2017;71:462-75.
7. Nielsen ME, Mallin K, Weaver MA, Palis B, Stewart A, Winchester DP, et al. Association of hospital volume with conditional 90-day mortality after cystectomy: An analysis of the national cancer data Base. BJU Int 2014;114:44-55.
8. Porter MP, Gore JL, Wright JL. Hospital volume and 90-day mortality risk after radical cystectomy: A population-based cohort study. World J Urol 2011;29:73-7.
9. Novotny V, Hakenberg OW, Wiessner D, Heberling U, Litz RJ, Oehlschlaeger S, et al. Perioperative complications of radical cystectomy in a contemporary series. Eur Urol 2007;51:397-401.
10. Guilloreau J, Gamé X, Mouzin M, Doumerc N, Mallet R, Sallusto F, et al. Radical cystectomy for bladder cancer: Morbidity of laparoscopic versus open surgery. J Urol 2009;181:554-9.
11. Hemal AK, Kolla 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.
12. Parekh DJ, Reis IM, Castle EP, Gonzalgo ML, Svatek RS, et al. Robot-assisted radical cystectomy versus open radical cystectomy in patients with bladder cancer (RAZOR): An open-label, randomised, phase 3, non-inferiority trial. Lancet 2018;391:2525-36.
13. Giglio MT, Marucci M, Testini M, Brienza N. Goal-directed haemodynamic therapy and gastrointestinal complications in major surgery: A meta-analysis of randomized controlled trials. Br J Anaesth 2009;103:637-46.
14. Davies W, Kollmorgen CF, Tu QM, Donohue JH, Thompson GB, Nelson H, et al. Laparoscopic colectomy shortens postoperative ileus in a canine model. Surgery 1997;121:550-5.
15. Meng YS, Wang Y, Fan Y, Su Y, Liu ZH, Yu W, et al. Impact of different surgical methods of radical cystectomy on the perioperative complications in patients over 75 years. Beijing Da Xue Xue Bao Yi Xue Ban 2016;48:632-7.
16. Chi AC, McGuire BB, Nadler RB. Modern Guidelines for bowel preparation and antimicrobial prophylaxis for open and laparoscopic urologic surgery. Urol Clin North Am 2015;42:429-40.