Original Article

Comparative outcomes of internal, external, and no stent in ureteroileal anastomosis for ileal orthotopic neobladder reconstruction

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Background: Ureteral stents, including internal stents and stentless techniques, are commonly employed in urological procedures such as urinary stone management and deformity correction. However, their use in radical cystectomy for bladder cancer remains relatively limited. This study aimed to compare the efficacy of internal stent, external stent, and no-stent treatments for ureteroileal anastomosis in laparoscopic radical cystectomy (LRC) combined with ileal orthotopic neobladder (IONB). The goal was to compare postoperative outcomes and complications to identify the optimal stent choice.

Methods: A retrospective analysis was conducted on 51 patients who underwent LRC with IONB between April 2013 and December 2023. Patients were divided into three groups: internal stent (Group A), external stent (Group B), and no stent (Group C). Baseline characteristics, perioperative data, and postoperative complications were compared across three groups.

Results: Among the 51 patients (42 males, 9 females; median age: 62 years), internal stents were used in 18 (35.3%, Group A), external stents in 20 (39.2%, Group B), and no stents in 13 (25.5%, Group C) patients. Group A demonstrated significantly shorter hospital stays compared to Groups B and C (P=0.02). Abnormal renal function occurred less frequently in Group A (16.7%) and Group B (15.0%) than in Group C (53.8%, P=0.04). Early postoperative hydronephrosis was significantly different among the three groups (Group A: 5.6%, Group B: 5.0%, Group C: 38.5%; P=0.02). Ureteroileal anastomotic stricture (UIAS) was observed less frequently in Group A (0%) than in Group B (12.5%) and Group C (20.0%, P=0.01). No significant differences were found in other perioperative characteristics or complications.

Conclusions: Internal stents reduce early postoperative complications, including hydronephrosis and renal dysfunction, while lowering the risk of late UIAS. Internal stent use is a safe and effective option that promotes faster recovery and better postoperative outcomes.

Keywords: Ileal orthotopic neobladder (IONB); laparoscopic radical cystectomy; stent; stricture; ureteroileal anastomosis

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Introduction

Bladder cancer is the ninth most common cancer worldwide, with a notably greater incidence rate in men than in women. It ranks as the sixth most common cancer and the ninth leading cause of cancer-related deaths among men (1). For muscle-invasive bladder cancer or high-risk nonmuscle-invasive bladder cancer, radical cystectomy with urinary diversion (RCUD) remains a cornerstone of treatment.

Two widely used forms of urinary diversion are orthotopic neobladder (ONB) and ileal conduit (IC) diversion. Studies have shown that ONB can significantly improve the quality of life of patients compared to IC and is more readily accepted by patients (2-5). ONB better simulates normal bladder function, allowing patients to maintain a more natural way of urination post-surgery.

In recent years, the study of the urinary microbiota has become an important area in the postoperative recovery of muscle-invasive bladder cancer patients. Research indicates that the urinary microbiota of patients who undergo ONB is closer to that of healthy individuals and possesses beneficial metabolic and physiological functions (6). This suggests that ONB can better support maintaining a healthy state. For patients requiring RCUD, an ileal ONB (IONB) offers significant benefits after surgery (7).

Despite advances in surgical techniques and the implementation of enhanced recovery after surgery (ERAS) protocols, which significantly reduce postoperative complications, complications remain common (8). In 1983, Jarowenko *et al.* (9) demonstrated that using ureteral stents during surgery can promote healing of the ureteroenteric anastomosis and reduce related complications. Compared with the traditional method of leading the ureteral stent out of the body and anchoring it on the skin at the other end, Micali *et al.* (10) later reported that using double J stents placed in the ureteral neobladder during surgery is a safe alternative and more conducive to postoperative recovery.

However, research has shown that the use of internal stents significantly increases the likelihood of stent-related infections and complications, leading to a higher rate of emergency care visits and additional burdens on patients (11). As a result, stent-free surgery for RCUD has garnered considerable attention. Multiple studies have demonstrated that stent-free surgery is safe and feasible (12-14).

Currently, there are no systematic evaluations of the efficacy of using internal stents, external stents, or no stents during laparoscopic radical cystectomy (LRC) combined with IONB. This study aimed to provide comparative data to guide clinical decision-making and optimize patient outcomes. We present this article in accordance with the STROBE reporting checklist (available at https://tau.amegroups.com/article/view/10.21037/tau-24-530/rc).

Highlight box

Key findings

- Compared to the stentless group, the use of stents (whether internal or external) significantly reduces early postoperative complications, including renal dysfunction and early hydronephrosis.
- Patients in the internal stent group experienced a significantly shorter postoperative hospital stay and had the lowest incidence of ureteroileal anastomotic stricture, demonstrating better postoperative recovery outcomes.

What is known and what is new?

- Our study found that the incidence of early postoperative complications following radical cystectomy was 51%, which is consistent with previous reports. To the best of our knowledge, this study is the first to directly compare the outcomes of internal stents, external stents, and stentless techniques in laparoscopic radical cystectomy with ileal orthotopic neobladder (IONB). Our findings indicate that internal stents provide better postoperative outcomes.

What is the implication, and what should change now?

- The findings suggest that routine use of internal stents during laparoscopic radical cystectomy with IONB reconstruction should be considered to reduce postoperative complications and improve overall recovery in patients undergoing ureteroileal anastomosis.

Methods

Clinical data

The clinical and surgical data of 51 patients with LRC combined with ONB who were treated at The Third Affiliated Hospital of Sun Yat-sen University between April 2013 and December 2023 were retrospectively analyzed. The inclusion criteria for patients were as follows: (I) preoperative complete bilateral renal computed tomography urography (CTU) and pelvic magnetic resonance imaging (MRI); (II) pathological results indicating muscle-invasive bladder cancer or high-risk recurrence of non-muscle-invasive bladder cancer with failure of intravesical instillation of Bacillus Calmette-Guerin (BCG) or chemotherapy drugs; (III) normal renal function before surgery (mainly determined by serum creatinine); and (IV) comprehensive records of pathological results and

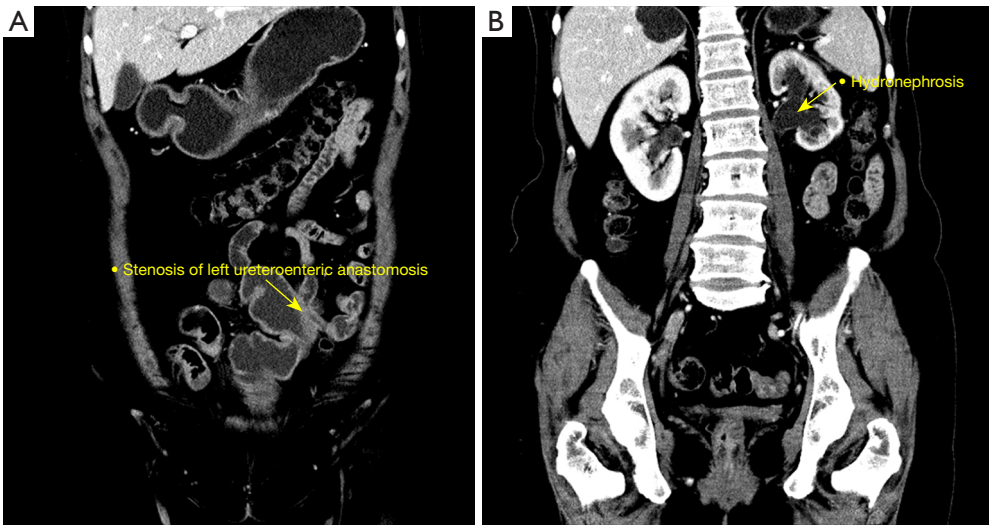

Figure 1 Postoperative ureteral-intestinal anastomosis stricture example. (A) Imaging reveals a stricture at the left ureteral-intestinal anastomosis. (B) This stricture has led to left renal hydronephrosis.

laboratory and imaging results. The exclusion criteria were as follows: (I) the presence of tumor metastases identified during preoperative staging; (II) ONB reconstruction was not feasible, such as advanced age, late-stage cancer (e.g., cT4b), or pre-existing ureteral stenosis.

A total of 51 patients met the study criteria and were included. The collected demographic and preoperative data included age, sex, American Society of Anesthesiologists (ASA) score, preoperative serum albumin levels (g/L), and pre- and postoperative serum creatinine levels (μmol/L). Medical history encompassed comorbidities such as hypertension, diabetes mellitus, coronary artery disease, preoperative hydronephrosis, and tumor pathology. Perioperative parameters included operative time (min), estimated intraoperative blood loss (mL), time to first flatus (days), and length of hospital stay (days). Postoperative complications recorded were renal dysfunction, febrile urinary tract infections, ureteroileal anastomotic leakage, bowel obstruction, hydronephrosis, urinary calculi, bladder neck stricture, and ureteroenteric anastomotic stricture. Postoperative complications within 30 days were classified and graded according to the Clavien-Dindo system. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The present study protocol was reviewed and approved by the Institutional Review Board of The Third Affiliated Hospital of Sun Yat-sen University (approval No. SL-II2024-245-01) and individual consent for this retrospective analysis was waived.

Definition

Early postoperative complications within 30 days were defined as early complications, and postoperative early hydronephrosis is defined as hydronephrosis detected within 30 days after surgery by ultrasound or bilateral kidney CTU examination. According to the Clavien-Dindo classification system, mild complications are defined as grade II or below, while grade III or higher complications are considered severe (15). Febrile urinary tract infection was defined as postoperative fever (>38 ℃) with positive urine routine and urine culture results, while other signs of urinary tract infection were excluded. Serum creatinine levels were categorized according to the hospital's reference range. Renal dysfunction was defined as serum creatinine levels >116 μmol/L. Specifically, ureteroileal anastomotic stricture (UIAS) is identified through imaging studies (e.g., CTU) as a localized narrowing at the ureteroileal anastomosis site with a diameter of less than 3 mm, accompanied by imaging evidence of renal pelvis dilation (hydronephrosis) (*Figure 1*).

Surgical technique

The operations were performed by one surgeon with extensive experience in LRC, preoperative intestinal preparation and uretero-enteric anastomosis were performed. We selected the mesenteric vascular supply area at both ends of the ileum, 15–20 cm away from the

ileocecal region, which is approximately 40 cm long (16). Then, the ileum was anastomosed using a linear stapler, and the mesenteric defect was closed. The ileal segment was fashioned into a "W" shaped neobladder. During the operation, the ureter was carefully isolated to avoid iatrogenic damage to its blood supply. The ureteral stump was removed and fully scraped, followed by hemipapillary plasty performed on both sides of the ureter. The ureteral stump was then implanted into the newly incised ileal wall. A 26 cm, 4.5 F stent was placed in the ureter, and fixed to the ureteral stump using 5-0 Vicryl sutures. Double J tubes were placed in the internal stent group, while Single J tubes were used in the external stent group. In the nonstent group, a ureteral external stent was inserted into the ureter to guide the anastomosis and prevent the ureteral lumen from being closed during the anastomosis. The stent was removed after leak detection to confirm the watertightness of the anastomosis. One hundred milliliters of normal saline was injected into the neobladder to confirm its water tightness. For the internal stent group, the suture dehisced one month after the double-J stent was removed cystoscopically.

Statistical analysis

All the data were analyzed using SPSS 19.0 statistical software (IBM SPSS Inc., Chicago, IL, USA), and all the graphs were created using GraphPad Prism 9.1.0 (GraphPad Software, San Diego, CA, USA) for data visualization. For continuous variables, the mean (standard deviation) or median [interquartile range (IQR)] was calculated according to the normality of the variables. One-way analysis of variance (ANOVA) was used for normally distributed data, and the Kruskal-Wallis test was used for nonnormally distributed data. Categorical variables were presented as counts (percentages), and Fisher's exact test or the Chi-squared test was used. To evaluate the potential impact of the extended study period on postoperative outcomes, the study population was divided into two phases based on the surgery dates: early phase (April 2013 to December 2018) and late phase (January 2019 to December 2023). The incidence of postoperative complications between these two phases was compared using univariate analysis. And we generated box plots using GraphPad Prism with the Tukey method to identify outliers. Outliers were defined using the IQR method. Specifically, any data point that fell below Q1 – 1.5 × IQR or above Q3 + 1.5 × IQR was considered an outlier. A two-sided $P<0.05$ was considered to be statistically significant.

Results

Patient demographics

The preoperative characteristics are shown in *Table 1*. Fifty-one patients, 42 males and 9 females, were included in this study. Among them, 18 (35.3%), 20 (39.2%), and 13 (25.5%) patients underwent RC using internal stents (Group A), external stents (Group B), and no stents (Group C), respectively. The median reported ages of Group A, Group B, and Group C were 63 (IQR, 56–68), 62 (IQR, 54–65), and 61 (IQR 53–68) years, respectively, and the median BMIs were 23.0 (IQR, 20.4–25.0), 24.0 (IQR, 21.2–26.0), and 23.8 (IQR, 22.8–27.0) kg/m^2, respectively. No differences in baseline characteristics were found among the three groups.

Perioperative outcomes

Table 2 reports the perioperative characteristics and time to stent removal. The median operative times for the three groups were 408 (IQR, 340–568) minutes for Group A, 509 (IQR, 365–603) minutes for Group B, and 400 (IQR, 368–446) minutes for Group C (P=0.20). The estimated intraoperative blood loss was 100 (IQR, 100–200) mL for Group A, 200 (IQR, 100–275) mL for Group B, and 200 (IQR, 75–200) mL for Group C (P=0.33). The postoperative time to first flatus was 3.0 (IQR, 2.0–5.3) days for Group A, 4.0 (IQR, 3.0–6.0) days for Group B, and 4.0 (IQR, 3.0–5.5) days for Group C (P=0.61). The median postoperative hospital stay was significantly shorter in Group A (12 days, IQR, 8–23 days) compared to Group B (24 days, IQR, 17–40 days) and Group C (20 days, IQR, 15–27 days) (P=0.02) (*Figure 2A*). And the median removal time for internal stents was 29.0 (IQR, 28.0–30.0) days, and for external stents, it was 14.0 (IQR, 13.0–20.0) days.

Postoperative complications

In this study, the overall median postoperative follow-up time was 12 months. The median postoperative follow-up time was 14 (IQR, 4–24) months in Group A, 13 (IQR, 6–32) months in Group B, and 10 (IQR, 4–35) months in Group C. *Table 3* summarizes the postoperative complications of the patients, with 26 of 51 patients (51.0%) developing early postoperative complications. According to the Clavien-Dindo system, complications were classified as mild (grade I or II) or severe (grade III or higher). No grade V complications were observed within 30 days after surgery.

Table 1 Baseline demographics characteristics

Variables	Group A (internal stent, n=18)	Group B (external stent, n=20)	Group C (stentless, n=13)	P value
Age (years)	63.0 (56.0–68.0)	62.0 (54.0–65.0)	61.0 (53.0–68.0)	0.40
Gender				0.72
Male	16 (88.9)	16 (80.0)	10 (76.9)	
Female	2 (11.1)	4 (20.0)	3 (23.1)	
Smoking status	8 (44.4)	9 (45.0)	5 (38.5)	0.94
Hypertension	7 (38.9)	9 (45.0)	1 (7.7)	0.07
Diabetes	4 (22.2)	7 (35.0)	1 (7.7)	0.22
Coronary heart disease	4 (22.2)	2 (10.0)	2 (15.4)	0.64
ASA score				0.38
1–2	15 (83.3)	13 (65.0)	11 (84.6)	
3–4	3 (16.7)	7 (35.0)	2 (15.4)	
T stage				0.23
1–2	16 (88.9)	14 (70.0)	12 (92.3)	
3–4	2 (11.1)	6 (30.0)	1 (7.7)	
Grade				0.18
Low grade	2 (11.1)	6 (30.0)	5 (38.5)	
High grade	16 (88.9)	14 (70.0)	8 (61.5)	
Preoperative hydronephrosis	2 (11.1)	2 (10.0)	1 (7.7)	>0.99
BMI (kg/m^2)	23.0 (20.4–25.0)	24.0 (21.2–26.0)	23.8 (22.8–27.0)	0.28
Preoperative hemoglobin (g/L)	136.0 (122.0–150.3)	137.0 (125.3–151.8)	133.0 (114.0–144.0)	0.60
Albumin (g/L)	40.0 (34.3–44.1)	40.1 (38.5–42.9)	40.7 (36.9–42.0)	0.64
Serum creatinine (μmol/L)	76.5 (70.0–92.0)	73.5 (65.3–93.3)	82.0 (69.5–102.9)	0.58

Continuous variables are reported as median (interquartile range) and categorical variables are reported as n (%). One-way analysis of variance was used to analyze ordinally distributed and continuous variables. Chi-squared test and Fisher's exact test were used to assess categorical variables. ASA, American Society of Anesthesiologists; BMI, body mass index.

Table 2 Perioperative features

Variables	Group A (internal stent, n=18)	Group B (external stent, n=20)	Group C (stentless, n=13)	P value
Median follow-up time (months)	14.0 (4.0–24.0)	13.0 (6.0–32.0)	10.0 (4.0–35.0)	0.82
Stent removal time (days)	29.0 (28.0–30.0)	14.0 (13.0–20.0)	–	–
Operation time (minutes)	408.0 (340.0–568.0)	509.0 (365.0–603.0)	400.0 (368.0–446.0)	0.20
Estimated blood loss (mL)	100.0 (100.0–200.0)	200.0 (100.0–275.0)	200.0 (75.0–200.0)	0.33
Postoperative hospital stay (days)	12.0 (8.0–23.0)	24.0 (17.0–40.0)	20.0 (15.0–27.0)	0.02*
Postoperative hospital stay (excluding outliers) (days)	9.0 (8.0–20.0)	24.0 (17.0–32.0)	20.0 (15.0–27.0)	0.01*
Time to flatus (days)	3.0 (2.0–5.3)	4.0 (3.0–6.0)	4.0 (3.0–5.5)	0.61

Values are presented as median (interquartile range). Kruskal-Wallis *H* test was used to analyze non-normally distributed continuous variables. The "–" symbol indicates that the stentless group did not undergo stent insertion and therefore does not require reporting of stent removal time. For the internal and external stent groups, stent removal time is reported, although the P value is not statistically significant due to predetermined insertion times. *, P<0.05.

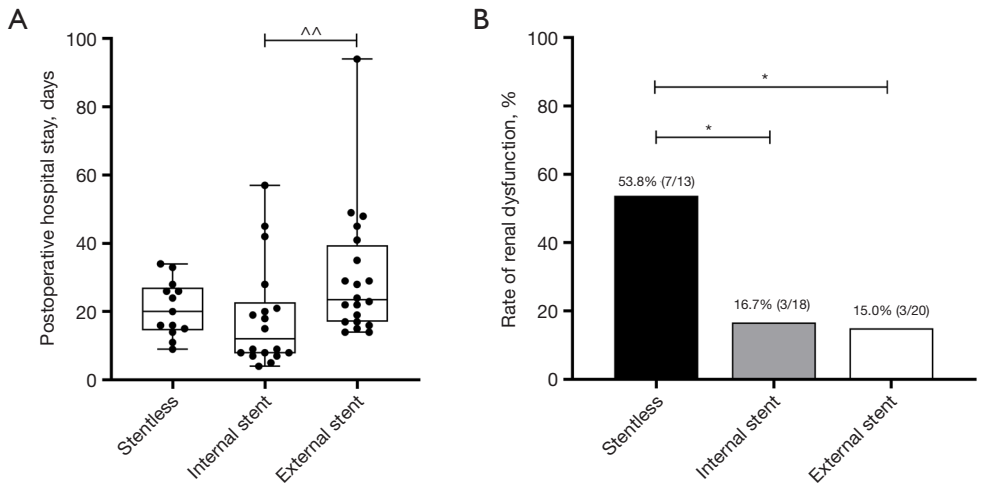

Figure 2 Postoperative hospital stay and the incidence of renal dysfunction among the internal stent (Group A), external stent (Group B), and stentless groups (Group C). (A) Postoperative hospital stay was significantly longer in the external stent group compared to the internal stent group. (B) Renal dysfunction rates, with the stentless group highest, followed by the internal stent group, and the external stent group lowest (significant differences). ^^, P<0.01 *vs.* internal stent group; *, P<0.05 *vs.* stentless group.

Table 3 Postoperative complications

Variables	Group A (internal stent, n=18)	Group B (external stent, n=20)	Group C (stentless, n=13)	P value
Readmission within 30 days of discharge	2 (11.1)	0 (0.0)	1 (7.7)	0.35
Early complications (<30 days)				
Renal function determined by serum creatinine				0.04*
Normal	15 (83.3)	17 (85.0)	6 (46.2)	
Abnormal	3 (16.7)	3 (15.0)	7 (53.8)	
Febrile urinary tract infection	7 (38.9)	6 (30.0)	3 (23.1)	0.70
Intestinal obstruction	4 (22.2)	3 (15.0)	1 (7.7)	0.64
Early hydronephrosis	1 (5.6)	1 (5.0)	5 (38.5)	0.02*
UIAL	2 (11.1)	0 (0.0)	2 (15.4)	0.17
Complications according to modified Clavien-Dindo system				0.45
Minor complications, grade I–II	9 (50.0)	6 (30.0)	6 (46.2)	
Major complications, grade III–V	2 (11.1)	1 (5.0)	2 (15.4)	
Overall postoperative complications				
Hydronephrosis	4 (22.2)	11 (55.0)	8 (61.5)	0.054
Neobladder calculus	0 (0.0)	2 (10.0)	0 (0.0)	0.33
Incisional hernia	1 (5.6)	1 (5.0)	0 (0.0)	>0.99
Neobladder urethral anastomotic stricture	1 (5.6)	2 (10.0)	2 (15.4)	0.66
UIAS (patients)	0 (0.0)	5 (25.0)	4 (30.8)	0.03*
UIAS (number of ureters)	0 (0.0)	5 (12.5)	5 (20.0)	0.01*

Values are presented as number (%). Chi-squared test and Fisher's exact test were used to assess categorical variables. *, P<0.05. UIAL, ureteroileal anastomosis leakage; UIAS, ureteroileal anastomosis stricture.

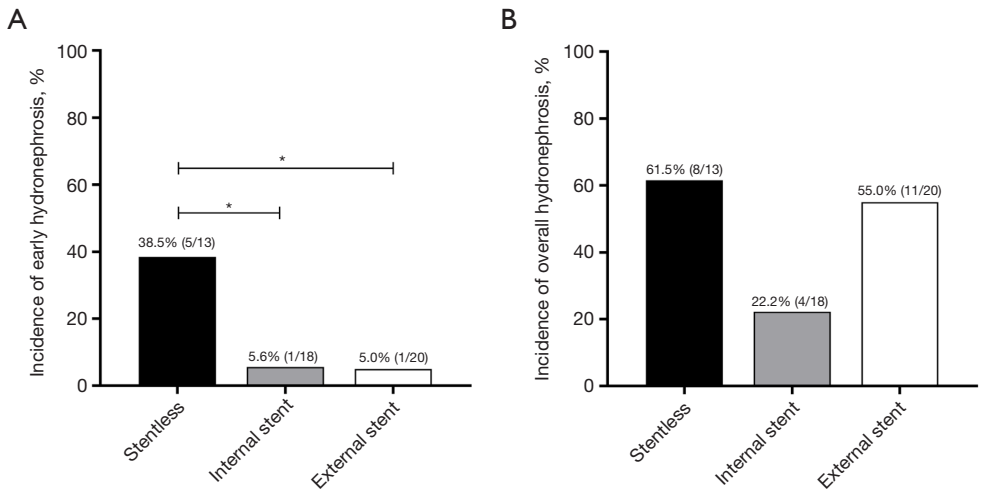

Figure 3 Comparison of postoperative hydronephrosis incidence among the internal stent (Group A), external stent (Group B), and stentless groups (Group C). (A) Early postoperative hydronephrosis incidence was significantly higher in the stentless group compared to the internal and external stent groups, with no significant difference between the internal and external stent groups. (B) Although the stentless group had the highest overall incidence of hydronephrosis, there was no significant difference among the three groups. *, P<0.05 *vs.* stentless group.

According to the severity of complications, 21 patients (41.2%) had mild complications, and 5 patients (9.8%) had severe complications. There were 3 patients (16.7%) in Group A, 3 patients (15.0%) in Group B, and 7 patients (53.8%) in Group C with abnormal renal function 30 days after surgery; statistical analysis revealed significant differences among the three groups (P=0.04) (*Figure 2B*). In addition, compared with those in Groups A and B, the incidence of early postoperative hydronephrosis in Group C significantly increased (38.5% in Group C *vs.* 5.6% in Group A and 5.0% in Group B, P=0.02) (*Figure 3A)*; however, in terms of total postoperative hydronephrosis, the incidence in Group A was lower than that in Groups B and C, but the difference was not significant (22.2% in Group A *vs.* 55.0% in Group B and 61.5% in Group C, P=0.054) (*Figure 3B*). Ureteroileal anastomosis leakage (UIAL) was observed in 2 cases (11.1%) in Group A and 2 cases (15.4%) in Group C, while no cases were observed in Group B (P=0.17), indicating a marginally non-significant difference.

In terms of postoperative complications, we found that the incidence of UIAS was significantly lower in Group A compared to both Groups B and C, based on the number of patients (*Figure 4A*). However, there was no statistically significant difference between Groups B and C. When comparing the incidence based on the number of ureters per anastomosis or renal units (RUs), a significant difference was observed only between Groups A and C, while no significant difference was found between Groups A and B (*Figure 4B*) (P=0.03 for patients and P=0.01 for RUs). A total of 99 RUs were included: 34 in Group A, 40 in Group B, and 25 in Group C. No UIAS was detected in Group A, 5 (12.5%) in Group B, or 5 (20.0%) in Group C (P=0.01). The overall ureteroenteric anastomotic stricture rate was 10.1% (10/99). However, no statistically significant differences were observed among the three groups in other perioperative clinical characteristics or postoperative complications, including febrile urinary tract infection (P=0.70), intestinal obstruction (P=0.64), incisional hernia (P>0.99), neobladder calculus (P=0.33), urethrovesical anastomotic stricture (P=0.66), or readmission within 30 days post-discharge (P=0.35). Among the 5 patients with UIAS in Group B, 2 had mild hydronephrosis secondary to stenosis without renal impairment and did not require treatment. Three patients required further treatment due to stenosis: 1 had severe hydronephrosis and renal impairment and underwent nephrostomy; the other 2 experienced recurrent febrile urinary tract infections and underwent transurethral dilatation with double J stent placement, with significant symptom improvement postoperatively. In Group C, 4 patients developed UIAS, 2 of whom required treatment: 1 underwent surgery due to bladder leakage and stenosis 6 months after surgery, with good results, while the other had hydronephrosis and increased creatinine levels, requiring stent placement. Treatment for this patient was stopped 5 months after surgery due to tumor recurrence. The remaining 2 patients had no renal impairment and did

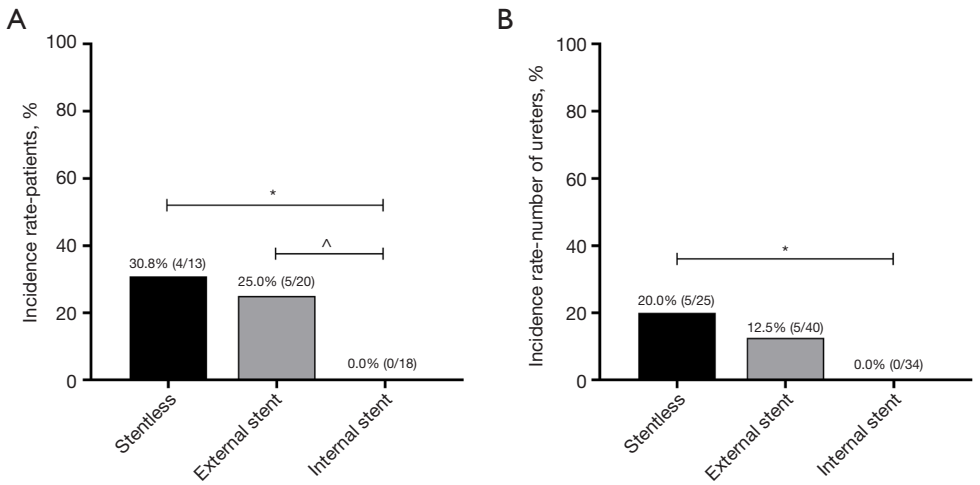

Figure 4 Comparison of the incidence of ureteroenteric anastomotic stricture among the internal stent (Group A), external stent (Group B), and stentless groups (Group C). (A) Based on the number of patients, the incidence of ureteroenteric anastomotic stricture in the internal stent group was significantly lower than in the stentless and external stent groups, while there was no statistical difference between the external stent and stentless groups. (B) Based on the number of ureters, the incidence of ureteroenteric anastomotic stricture in the internal stent group was significantly lower than in the stentless group, with no statistical difference between the internal stent and external stent groups. ^, P<0.05 *vs.* external stent group; *, P<0.05 *vs.* stentless group.

not receive treatment.

Impact of surgical timing on postoperative outcomes

We compared the incidence of postoperative complications during the early and late phases of surgery. The results showed no statistically significant differences in the incidence of postoperative complications between the two phases (*Table 4*).

Regarding renal dysfunction, the incidence was 30.3% (10/33) in the early phase and 16.7% (3/18) in the late phase (P=0.34). Febrile urinary tract infections occurred in 36.4% (12/33) of early-phase patients and 22.2% (4/18) of late-phase patients (P=0.36). The incidence of early hydronephrosis was 18.2% (6/33) in the early phase and 5.6% (1/18) in the late phase (P=0.40). For ureteroileal anastomotic leakage, the incidence was 6.1% (2/33) in the early phase and 11.1% (2/18) in the late phase (P=0.61). And mild complications (Clavien-Dindo grade I–II) occurred in 42.4% (14/33) of early-phase patients and 38.9% (7/18) of late-phase patients. Severe complications (Clavien-Dindo grade III–V) occurred in 12.1% (4/33) and 5.6% (1/18) of patients in the early and late phases, respectively (P=0.76). Moreover, UIAS, the incidence per patient was 24.2% (8/33) in the early phase and 5.6% (1/18) in the late phase (P=0.13). Similarly, the incidence per ureter was 13.8% (9/65) in the early phase and 2.9% (1/34) in the late phase (P=0.16).

Comparison of median length of stay with and without outliers

One outlier was identified in both the internal and external stent groups (*Figure 5*). Excluding outliers: the median length of stay was 9.0 (IQR, 8.0–20.0) days in the internal stent group (n=17), 24.0 (IQR, 17.0–32.0) days in the external stent group (n=19), and 20.0 (IQR, 15.0–27.0) days in the non-stent group (n=13) (P=0.01). Including outliers: the median length of stay was 12.0 (IQR, 8.0–23.0) days in the internal stent group (n=18), 24.0 (IQR, 17.0–40.0) days in the external stent group (n=20), and 20.0 (IQR, 15.0–27.0) days in the non-stent group (n=13) (P=0.02) (*Table 2*).

Discussion

Radical cystectomy (RC) combined with urinary diversion (UD) has long been considered the standard treatment for muscle-invasive bladder cancer (BCa). Previous studies have suggested that intraoperative placement of ureteral stents significantly reduces the incidence of postoperative complications in patients with urinary system stones (17,18). However, whether ureteral stents should be routinely placed during RC remains an unresolved issue (12-14,19,20).

Table 4 Relationship between operative time and postoperative complications

Variables	Surgery time (early stage, n=33)	Surgery time (late stage, n=18)	P value
Early complications (<30 days)			
Renal function determined by serum creatinine			0.34
Abnormal	10 (30.3)	3 (16.7)	
Febrile urinary tract infection	12 (36.4)	4 (22.2)	0.36
Intestinal obstruction	4 (12.1)	4 (22.2)	0.43
Early hydronephrosis	6 (18.2)	1 (5.6)	0.40
UIAL	2 (6.1)	2 (11.1)	0.61
Complications according to modified Clavien-Dindo system			0.76
Minor complications, grade I–II	14 (42.4)	7 (38.9)	
Major complications, grade III–V	4 (12.1)	1 (5.6)	
Overall postoperative complications			
Hydronephrosis	17 (51.5)	6 (33.3)	0.25
Neobladder calculus	1 (3.0)	1 (5.6)	>0.99
Incisional hernia	2 (6.1)	0 (0.0)	0.53
Neobladder urethral anastomotic stricture	5 (15.2)	0 (0.0)	0.15
UIAS (patients)	8 (24.2)	1 (5.6)	0.13
UIAS (number of ureters)	9 (13.8)	1 (2.9)	0.16

Values are presented as number (%). Surgery time: early stage (April 2013 to December 2018); late stage (January 2019 to December 2023). Chi-squared test and Fisher's exact test were used to assess categorical variables. UIAL, ureteroileal anastomosis leakage; UIAS, ureteroileal anastomosis stricture.

In this study, we found that the placement of internal stents in patients undergoing IONB reconstruction is both safe and effective, as it not only reduced the incidence of postoperative complications but also accelerated postoperative recovery.

Previous studies have reported that the incidence of postoperative complications after RC ranges from 30% to 70% (21,22). In this study, the incidence of early postoperative complications was 51.0%. Shabsigh *et al.* (21) reported that the types of postoperative complications included gastrointestinal complications (29%), infectious complications (25%), wound-related complications (15%), cardiac complications (11%), and genitourinary complications (11%). However, in our cohort, the most common early postoperative complication was febrile urinary tract infection (31.4%), followed by renal insufficiency (25.5%), intestinal obstruction (15.7%), early postoperative hydronephrosis (13.7%), and UIAL (7.8%). Among overall postoperative complications, the most common were hydronephrosis (45.1%) and UIAS (10.1% of RUs).

In this study, the overall incidence of UIAL was 7.8%. Although no UIAL cases were observed in group B, there was no statistically significant difference among the three groups (0.0% in group B *vs.* 11.1% in group A and 15.4% in group C; P=0.17). This conclusion is consistent with a recent meta-analysis (20).

Interestingly, 5 patients (9.8%) had preoperative hydronephrosis, including 2 patients (11.1%) in Group A, 2 patients (10.0%) in Group B, and 1 patient (7.7%) in Group C. Preoperatively, all patients had normal renal function, and there were no statistically significant differences among the groups regarding preoperative hydronephrosis or renal function. Among these 5 cases of hydronephrosis, 3 were attributed to benign prostatic hyperplasia and 2 to ureteral stones. The 2 cases of hydronephrosis caused by ureteral stones were not considered as ureteral stenosis, as the obstruction occurred beyond the ureteral orifice.

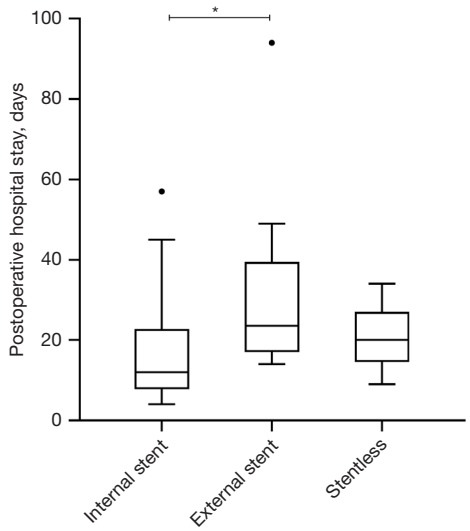

Figure 5 Box plot of postoperative length of stay in the internal stent (Group A), external stent (Group B), and stentless groups (Group C). The box plot shows that both the internal stent and external stent groups have one outlier each. After excluding the outliers, the postoperative length of stay remained statistically significant between the internal stent and external stent groups. *, P<0.05.

Furthermore, the hydronephrosis resolved following stone removal, and no UIAS was observed postoperatively. Based on these findings, we did not exclude the 5 patients with preoperative hydronephrosis from this study. Notably, although there were no significant preoperative differences, the incidence of postoperative complications varied significantly among the groups. The incidence of postoperative hydronephrosis and renal dysfunction in Groups A and B was significantly lower than in Group C (hydronephrosis: 16.7% in Group A and 15.0% in Group B *vs.* 53.8% in Group C, P=0.04; renal dysfunction: 5.6% in Group A and 5.0% in Group B *vs.* 38.5% in Group C, P=0.02). However, there was no significant difference between Groups A and B. These results suggest that ureteral stent placement after RCUD reduces early postoperative hydronephrosis and better preserves renal function. This is consistent with the findings of Sari Motlagh *et al.* (23), who reported that postoperative hydronephrosis is a risk factor for renal function decline in patients undergoing RC.

Ureteral stent placement is commonly used in urological surgeries, and it has been reported to increase the incidence of complications within 30 days post-surgery, including urinary tract infections (UTIs) (11). This study aimed to further explore the impact of stent placement on postoperative UTI rates. The results showed that ureteral stent placement was associated with an increased incidence of postoperative UTIs. Specifically, the UTI rates were 38.9% in Group A, 30.0% in Group B, and 23.1% in Group C. Although Group A had the highest UTI rate, the differences among the groups were not statistically significant (P=0.70). There are several potential explanations for these findings. First, ureteral stents, as foreign bodies, may facilitate bacterial colonization, thereby increasing the risk of infection. However, stents also aid in drainage, helping to flush out bacteria from the kidney, ureter, and neobladder. This dual effect might explain why the increased UTI rates did not reach statistical significance.

Another point worth discussing is that this study observed 10 cases (10.1%) of UIAS, calculated based on the number of ureters. The incidence of postoperative UIAS in Group A was significantly lower than that in the other two groups (0.0% in Group A *vs.* 12.5% in Group B and 20.0% in Group C, P=0.01). The incidence of UIAS in Group B was similar to that reported by Micali *et al.* (10), while the incidence of UIAS in Group C (20.0%) was significantly greater. We speculate that this may be related to postoperative inflammation leading to fibrous tissue hyperplasia at the time of ureterostomy. Additionally, only temporary stents were used during surgery in Group C. During the subsequent healing of the ureteroenteric anastomosis, the wound lacked the support of the stent, making it easier to form strictures during the healing process. However, previous animal studies have shown that ureteral wound healing takes 4 weeks or even longer (24-27). For patients who received ureteral external stents in Group B, we routinely removed the external stents 2 weeks after surgery, whereas the internal stents in Group A were generally removed 1 month after surgery. This may result in better wound healing at the ureteral anastomosis site in patients who receive internal stents. In addition, the median time for diagnosing UIAS after external stent placement in this study was 12 months, and the median time for diagnosing UIAS after stent-free surgery was 2.5 months, while Yang *et al.* (19) reported that the median time for diagnosing UIAS after RCUD surgery was 7–18 months. This may be related to the small sample size in the nonstent group, and the sample size needs to be increased for further research.

Although this study is the first to compare complication rates among different stent placement methods (internal stent group, external stent group, and non-stent group)

and analyze outcomes based on surgical timing, dividing cases into early and late phases, the comparison showed no significant differences in postoperative complications between the two phases, further supporting the reliability of the results across the extended time period. However, there are some limitations to this study. First, the small sample size may affect the generalizability and reliability of the findings. Further studies with larger sample sizes are necessary for a more comprehensive comparison and analysis. Furthermore, significant differences were observed in the postoperative length of stay when including *vs.* excluding outliers (including outliers: P=0.02 *vs.* excluding outliers: P=0.01). The two outliers were related to severe postoperative complications: one case of ureteroileal anastomotic leakage in the internal stent group and one case of intestinal obstruction requiring surgical intervention in the external stent group, both of which resulted in significantly prolonged hospital stays. Given that excluding these outliers could potentially underestimate the impact of severe postoperative complications on the length of stay, we opted to retain them in the analysis. Additionally, the postoperative follow-up period in this study was relatively short, with a median follow-up time of 12 months (13.5 months for the internal stent group, 12.5 months for the external stent group, and 10 months for the no-stent group). The shorter follow-up period in this study might explain why no UIAS were observed in the internal stent group. Although this study is the first to compare complication rates among different stent placement methods and analyze outcomes based on surgical timing, dividing cases into early and late phases, the comparison showed no significant differences in postoperative complications between the two phases, further supporting the reliability of the results across the extended time period. However, the conclusions are limited by the small sample size and short follow-up duration. Future research should include larger sample sizes and longer follow-up periods to further validate these findings. This will help provide a more comprehensive understanding of the long-term effects of different stent placements, offering clinicians more reliable references to optimize surgical strategies, reduce postoperative complications, and improve overall patient prognosis and quality of life.

Conclusions

In summary, in the case of *in situ* urinary diversion, the placement of an internal stent during surgery can significantly shorten the postoperative hospital stay, and the placement of internal and external stents can reduce the incidence of hydronephrosis and renal dysfunction within 30 days after surgery. The placement of an internal stent is associated with a low incidence of postoperative UIAS.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://tau.amegroups.com/article/view/10.21037/tau-24-530/rc

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://tau.amegroups.com/article/view/10.21037/tau-24-530/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The present study protocol was reviewed and approved by the Institutional Review Board of The Third Affiliated Hospital of Sun Yat-sen University (approval No. SL-II2024-245-01) and individual consent for this retrospective analysis was waived.

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