Comparison of functional and oncological outcomes between uterus-sparing radical cystectomy and standard radical cystectomy in females: A retrospective study

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Purpose: This study aimed to compare the functional and oncological outcomes of females who underwent uterus-sparing radical cystectomy (USRC) and standard radical cystectomy (SRC).

Materials and Methods: Between February 2009 and December 2020, 90 female patients who underwent radical cystectomy with urinary diversion were included in this study, comprising the USRC and SRC groups. Functional outcomes were assessed in 63 patients who only underwent radical cystectomy with neobladder formation. Questionnaire scores, clean intermittent catheterization (CIC) rate, and urinary continence rate were analyzed. Oncological outcomes were assessed in 86 patients, regardless of the urinary diversion type. Overall survival (OS), cancer-specific survival (CSS), and recurrence-free survival (RFS) were compared.

Results: CIC rate was significantly lower in the USRC group than in the SRC group (14.7% vs. 48.0%; p=0.005). The continence rate was significantly higher in the USRC group than in the SRC group (85.3% vs. 40.0%; p=0.001). There were no significant differences in OS (p=0.890), CSS (p=0.700), or RFS (p=0.270) between the two groups. In multivariate analysis, uterine preservation did not significantly increase the hazard ratio (HR) of OS (HR, 0.62; 95% CI, 0.18–2.11; p=0.450), CSS (HR, 0.99; 95% CI, 0.22–4.40; p=0.990), or RFS (HR, 0.46; 95% CI, 0.19–1.11; p=0.840).

Conclusions: USRC resulted in higher continence rates and lower CIC rates than SRC without negatively affecting oncological outcomes. Hence, with thorough deliberation, USRC should be considered for females undergoing radical cystectomy.

Keywords: Bladder cancer; Cystectomy; Females; Hysterectomy; Uterus-sparing

INTRODUCTION

Bladder cancer is the 17th most common neoplasm in females, and the incidence is globally on the rise [1-3]. Radical cystectomy with urinary diversion is the recommended surgical treatment for muscle-invasive bladder cancer (MIBC) or high-risk-non-MIBC (NMIBC). Alternatively, for females with high risk of local recurrence due to the proximity of genital organs, the preferred method is standard radical cystectomy (SRC) involving en bloc resection of the bladder and...
adjacent pelvic organs, including the uterus [4-6]. However, uterine involvement in bladder cancer was only 0.3%–12.5% in previous studies, and routine hysterectomy during radical cystectomy has been questioned among urological surgeons [7-13]. Moreover, removal of the uterus can lead to functional complications, including hypercontinence, which requires clean intermittent catheterization (CIC), chronic urinary incontinence, infertility, and cessation of sexual life [9,12]. Therefore, there is substantial interest in uterus preservation during radical cystectomy to maintain urinary and sexual function [12,14,15]. In the present study, we compared the functional and oncological outcomes of radical cystectomy with or without uterus preservation to determine whether uterus-sparing radical cystectomy (USRC) can lead to superior functional outcomes without compromising oncological outcomes in females.

**MATERIALS AND METHODS**

1. **Patient selection**

This study was approved by Institutional Review Board of Seoul National University Hospital (IRB no. 2204-103-1316). Informed consent was waived due to the retrospective nature of study. We conducted a retrospective study of 90 females who underwent radical cystectomy with urinary diversion between February 2009 and December 2020. Patient data was retrospectively acquired by reviewing institutional electronic medical records, as well as the Seoul National University Prospectively Enrolled Registry for Urothelial Cancer [16]. Four patients were excluded from this study; three patients were excluded due to their histology, which does not fall into the major types of bladder cancer (urothelial cell carcinoma, squamous cell carcinoma, and adenocarcinoma), and the operation could not be completed in one patient due to severe intra-abdominal adhesions [17]. All surgeries were performed by three surgeons (predominantly by one surgeon, n=87, 96.7%). According to the surgical procedure, patients were categorized into two groups: USRC (radical cystectomy with uterus preservation, n=40) and SRC (radical cystectomy with preoperative hysterectomy or intraoperative hysterectomy, n=46). There were two types of urinary diversion: orthotopic ileal neobladder (n=63) and ileal conduit (n=23). Oncological analyses were conducted in all patients regardless of the urinary diversion type; however, functional analyses were only conducted in females who underwent radical cystectomy with continent urinary diversion (Fig. 1).

Females with MIBC or high-risk NMIBC who underwent radical cystectomy, with or without neoadjuvant chemotherapy and adjuvant chemotherapy, were included. All patients were diagnosed based on pathological results of transurethral resection or bladder biopsy. Preoperative imaging studies included computed tomography (CT) and pelvic magnetic resonance imaging (MRI). Currently, there are no official guidelines for USRC [12]. In this study, the patient who showed no uterine invasion on preoperative pelvic MRI met the criteria for preserving the uterus, regardless of

![Fig. 1. Patient selection flowchart. USRC, uterus-sparing radical cystectomy; SRC, standard radical cystectomy.](image-url)
clinical T stage. In addition, the patients had a chance to discuss their preference for uterine preservation preoperatively with their doctors.

2. Follow-up
In an outpatient clinic, patients were evaluated at 3-month intervals within the first year following surgery and at 6-month intervals thereafter. Radiological examination was performed every 6 months to detect recurrence, and cystoscopy was only performed when the follow-up imaging study showed suspicious urethral recurrence. Moreover, to check the functional aspects of the patients who underwent continent urinary diversion, the need for CIC was determined on an individual basis, and the number of daily pad uses was checked. Uroflowmetry with bladder ultrasound scan was performed during every outpatient clinic visit, and urodynamic study (UDS) was performed 12-months postoperatively. CIC was indicated for patients with a residual urine volume greater than, or equal to, 100 milliliters, as assessed in either the bladder ultrasound scan or UDS. To check the functional aspects of the patients who underwent continent urinary diversion, the need for CIC was determined on an individual basis, and the number of daily pad uses was checked. Uroflowmetry with bladder ultrasound scan was performed during every outpatient clinic visit, and urodynamic study (UDS) was performed 12-months postoperatively. CIC was indicated for patients with a residual urine volume greater than, or equal to, 100 milliliters, as assessed in either the bladder ultrasound scan or UDS. The Korean version of the Functional Assessment of Cancer Therapy-Vanderbilt Cystectomy Index (FACT-VCI) questionnaire was administered to each patient to evaluate their quality of life both preoperatively and postoperatively.

3. Oncological outcomes
Oncological outcomes were assessed in 86 patients who underwent radical cystectomy regardless of the urinary diversion type (USRC, n=40; SRC, n=46). Recurrence was confirmed by biopsy or imaging. Overall survival (OS), cancer-specific survival (CSS), and recurrence-free survival (RFS) were compared between groups.

4. Functional outcomes
Functional outcomes were assessed in 63 patients who underwent radical cystectomy with orthotopic neobladder substitution only (USRC, n=35; SRC, n=28). Among 63 patients, 26 (USRC, n=14; SRC, n=12) who fully completed the FACT-VCI survey were included in the questionnaire analysis. Excluding the missing data, data from 59 patients (USRC, n=34; SRC, n=25) were assessed for CIC rate and daily pad use.

1) The Functional Assessment of Cancer Therapy-Vanderbilt Cystectomy Index
The FACT-VCI is a questionnaire developed by Cookson and colleagues that can objectively assess life quality of patients who underwent radical cystectomy and urinary diversion has been validated [18,19]. The questionnaire is comprised of 27 items that are categorized into the physical, functional, emotional, and social/family well-being domains, along with 17 items that are especially related to urinary, sexual, and bowel functions [19]. Patients with higher scores have a better quality of life. FACT-VCI has been linguistically and psychometrically validated in the Korean language, and patients were asked to answer the Korean version of the FACT-VCI during the outpatient clinic visit [18,20]. The scores of the questionnaire before the surgery and within 12-month post-surgery were compared between the two groups.

2) Clean intermittent catheterization
Since incomplete emptying of the bladder is quite common among females who undergo orthotopic neobladder substitution, approximately 30% of females need CIC [4]. Therefore, the rates of CIC in the SRC and USRC groups at 12 months postoperatively were compared.

3) Urinary continence
Urinary continence was evaluated using the number of pads required per 24 hours. The severity of incontinence was categorized as follows: no pad was labeled as fully continent, pad=1 was labeled as socially continent, and pad>1 was considered incontinent [21,22]. Continence rates at 12 months postoperatively were analyzed.

5. Statistical analysis
A descriptive analysis was used to summarize the clinicopathological characteristics of the patients. The results are expressed in terms of number, median (interquartile range), and column percentages. An independent t-test was used for continuous variables, and a chi-squared test (or Fisher’s exact test for cells less than five) was used for categorical variables. Univariate and multivariate Cox regressions were conducted to analyze variables associated with OS, CSS, and RFS, and the results are shown in terms of hazard ratios (HRs) and 95% confidence intervals (CIs). Kaplan–Meier analysis was performed to determine the 2-year survival rate for OS, CSS, and RFS. The mean preoperative and postoperative FACT-VCI total scores were calculated using the two-way analysis of variance (ANOVA). Statistical significance was set at a p-value <0.05. Statistical analyses were performed using the IBM Statistical Package for the Social Sciences version 25 (IBM Corp., Armonk, NY, USA) and MedCalc for Window version 19.4 (MedCalc Software bv, Ostend, Belgium).
| Parameter                          | Total (n=86) | USRC (n=40) | SRC (n=46) | p-value |
|-----------------------------------|--------------|-------------|------------|---------|
| **Age (y)**                       | 69 (33–89)   | 69 (33–84)  | 69 (44–89) | 0.910a  |
| **Follow-up period (mo)**         | 23.7 (2.6–131.9) | 25.9 (4.7–85.3) | 18.8 (2.6–131.9) | 0.090a  |
| **Body mass index (kg/cm²)**      | 23.6 (15.6–41.6) | 24.5 (17.3–30.8) | 22.4 (15.6–41.6) | 0.160a  |
| **Types of surgery**              |              |             |            | 0.050b  |
| Open                              | 60 (69.8)    | 32 (80.0)   | 28 (60.9)  |         |
| Robotic                           | 26 (30.2)    | 8 (20.0)    | 18 (39.1)  |         |
| **Types of urinary diversion**    |              |             |            | 0.005b  |
| Neobladder                        | 63 (73.3)    | 35 (87.5)   | 28 (60.9)  |         |
| Ileal conduit                     | 23 (26.7)    | 5 (12.5)    | 18 (39.1)  |         |
| **Preoperative clinical stage**   |              |             |            | 0.330b  |
| <T2                               | 34 (39.5)    | 18 (45.0)   | 16 (34.8)  |         |
| ≥T2                               | 52 (60.5)    | 22 (55.0)   | 30 (65.2)  |         |
| **Pathologic stage**              |              |             |            | 0.210b  |
| <T2                               | 41 (47.7)    | 22 (55.0)   | 19 (41.3)  |         |
| ≥T2                               | 45 (52.3)    | 18 (45.0)   | 27 (58.7)  |         |
| **Histological types**            |              |             |            | 0.330b  |
| Urothelial carcinoma              | 72 (83.7)    | 36 (90.0)   | 36 (78.3)  |         |
| Squamous carcinoma                | 11 (12.8)    | 3 (7.5)     | 8 (17.4)   |         |
| Adenocarcinoma                    | 3 (3.5)      | 1 (2.5)     | 2 (4.3)    |         |
| **Clinical T stage**              |              |             |            | 0.101b  |
| T0/Ta/Tis/Tis                    | 5 (5.8)      | 4 (10.0)    | 1 (2.2)    |         |
| T1                                | 29 (33.7)    | 14 (35.0)   | 15 (32.6)  |         |
| T2                                | 37 (43.0)    | 19 (47.5)   | 18 (39.1)  |         |
| T3                                | 11 (12.8)    | 3 (7.5)     | 8 (17.4)   |         |
| T4                                | 4 (4.7)      | 0 (0.0)     | 4 (8.7)    |         |
| **Pathologic T stage**            |              |             |            | 0.620b  |
| Urothelial carcinoma              | 72 (83.7)    | 36 (90.0)   | 36 (78.3)  |         |
| T0/Tis/Ta/Ta                     | 16 (22.2)    | 11 (30.6)   | 5 (13.9)   |         |
| T1                                | 13 (18.1)    | 7 (19.4)    | 6 (16.7)   |         |
| T2                                | 8 (11.1)     | 4 (11.1)    | 4 (11.1)   |         |
| T3                                | 16 (22.2)    | 7 (19.4)    | 9 (25.0)   |         |
| T4                                | 2 (2.8)      | 1 (2.8)     | 1 (2.8)    |         |
| ypT0/ypTis/ypTa                  | 8 (11.1)     | 4 (11.1)    | 4 (11.1)   |         |
| ypT2                              | 1 (1.4)      | 0 (0.0)     | 1 (2.8)    |         |
| ypT3                              | 6 (8.3)      | 2 (5.6)     | 4 (11.1)   |         |
| ypT4                              | 2 (2.8)      | 0 (0.0)     | 2 (5.6)    |         |
| Squamous cell carcinoma           | 11 (12.8)    | 3 (7.5)     | 8 (17.4)   |         |
| T0/Tis/Ta/Ta                     | 2 (18.2)     | 0 (0.0)     | 2 (25.0)   |         |
| T1                                | 2 (18.2)     | 0 (0.0)     | 2 (25.0)   |         |
| T2                                | 2 (18.2)     | 1 (33.3)    | 1 (12.5)   |         |
| T3                                | 3 (27.3)     | 1 (33.3)    | 2 (25.0)   |         |
| ypT2                              | 1 (9.1)      | 1 (33.3)    | 0 (0.0)    |         |
| ypT4                              | 1 (9.1)      | 0 (0.0)     | 1 (12.5)   |         |
| Adenocarcinoma                    | 3 (3.5)      | 1 (2.5)     | 2 (4.3)    |         |
| T2                                | 1 (33.3)     | 0 (0.0)     | 1 (50.0)   |         |
| T3                                | 2 (66.7)     | 1 (100.0)   | 1 (50.0)   |         |
| **Pathologic lymph node stage**   |              |             |            | 0.190b  |
| N0                                | 75 (87.2)    | 33 (82.5)   | 42 (91.3)  |         |
| N+                                | 11 (12.8)    | 7 (17.5)    | 4 (8.7)    |         |
RESULTS

Eighty-six patients were enrolled for the final analysis (urothelial cell carcinoma, n=72; squamous cell carcinoma, n=11; and adenocarcinoma, n=3). Nineteen patients received neoadjuvant chemotherapy, and 17 patients received adjuvant chemotherapy. Among the 86 patients, 40 (46.5%) underwent USRC and 46 (53.5%) underwent SRC alone. There were no statistically significant differences in the clinical and pathological T stage between the USRC and SRC.
groups. There was no significant difference between the two groups in terms of pathological lymph node stage and surgical margin positivity. The median follow-up period was 23.7 months; the USRC group had a longer median follow-up period than the SRC group, but the difference was not statistically significant. The USRC group had a higher open surgery rate than the SRC group (80.0% vs. 60.9%, p=0.050). Orthotopic neobladder substitution was performed at a higher rate in the USRC group than in the SRC group (87.5 vs. 60.9%, p=0.005). Patient demographics are summarized in Table 1.

1. Oncological outcomes

In the USRC group, eight of the 40 patients (20.0%) died at a median follow-up of 25.9 months from metastasis. In the SRC group, seven of the 46 patients (15.2%) died at a median follow-up of 18.8 months, 5 from metastatic disease and two from other causes. Twelve (30.0%) patients in the USRC group and 15 (32.6%) patients in the SRC group experienced recurrence. Among the 12 patients with recurrence in the USRC group, only one patient showed recurrence in the uterus (8.3%). OS, CSS, and RFS probabilities following USRC and SRC were obtained via Kaplan–Meier survival curves. The 2-year OS, CSS, and RFS rates were 82.0%, 81.9%, and 78.0%, respectively, in the USRC group. The 2-year OS, CSS, and RFS rates were 85.9%, 83.0%, and 64.7%, respectively, for SRC group. There were no significant differences in OS (p=0.890), CSS (p=0.700), or RFS (p=0.270) between the two groups (Fig. 2).

Confounding factors that might influence patient prognosis were adjusted using multivariate cox regression analysis. It was found that uterine preservation did not significantly increase the HR of OS (HR, 0.62; 95% CI, 0.18–2.11; p=0.450), CSS (HR, 0.99; 95% CI, 0.22–4.40; p=0.990), or RFS (HR, 0.46; 95% CI, 0.19–1.11; p=0.840) after adjusting for several parameters shown in Tables 2–4.

2. Functional outcomes

The mean preoperative and postoperative (within 12 months) FACT-VCI total scores were compared between the USRC and SRC groups. The average preoperative scores for the USRC and SRC groups were 104.8 and 100.9, respectively. The postoperative average scores for the USRC and SRC groups were 96.72 and 99.69, respectively (Fig. 3). Although

| Prognostic factor            | Univariate analysis | Multivariate analysis |
|------------------------------|---------------------|-----------------------|
| Age (continuous variable)    | 1.02                | 1.03                  |
| 95% CI                       | 0.96–1.07           | 0.97–1.09             |
| p-value                      | 0.560               | 0.390                 |
| Preservation                 |                     |                       |
| Standard radical cystectomy  | Referent            | Referent              |
| Uterus-sparing radical cystectomy | 0.93             | 0.62                  |
| 95% CI                       | 0.34–2.58           | 0.18–2.11             |
| p-value                      | 0.890               | 0.450                 |
| Preoperative clinical stage  |                     |                       |
| <T2                          | Referent            | Referent              |
| ≥T2                          | 3.23                | 2.25                  |
| 95% CI                       | 0.91–11.48          | 0.60–8.50             |
| p-value                      | 0.070               | 0.230                 |
| Pathologic stage             |                     |                       |
| <T2                          | Referent            | Referent              |
| ≥T2                          | 6.17                | 6.14                  |
| 95% CI                       | 1.69–22.43          | 1.53–24.55            |
| p-value                      | 0.006*              | 0.010*                |
| Lymph node positive          |                     |                       |
| Negative                     | Referent            | Referent              |
| Positive                     | 2.16                | 2.61                  |
| 95% CI                       | 0.61–7.66           | 0.60–11.26            |
| p-value                      | 0.240               | 0.200                 |
| Surgical margin positive     |                     |                       |
| Negative                     | Referent            | Referent              |
| Positive                     | 2.34                | 3.06                  |
| 95% CI                       | 0.75–7.45           | 0.84–11.13            |
| p-value                      | 0.140               | 0.910                 |
| Neoadjuvant chemotherapy     |                     |                       |
| No                           | Referent            | Referent              |
| Yes                          | 2.12                | 1.94                  |
| 95% CI                       | 0.66–6.82           | 0.52–7.26             |
| p-value                      | 0.210               | 0.320                 |
| Adjuvant chemotherapy        |                     |                       |
| No                           | Referent            | Referent              |
| Yes                          | 1.20                | 0.52                  |
| 95% CI                       | 0.38–3.78           | 0.13–2.02             |
| p-value                      | 0.760               | 0.340                 |

HR, hazard ratio; CI, confidence interval. *Statistically significant p-value <0.05.
the USRC group showed a greater decline in the postoperative questionnaire score, the difference was not statistically significant (p=0.130). Twelve months after radical cystectomy with continent urinary diversion, 28.8% of the patients underwent CIC (Fig. 4). Patients in the USRC group had significantly lower CIC rates than those in the SRC group (14.7% [5/34] vs. 48.0% [12/25], p=0.005). The complete continence rate 12 months postoperatively, defined as no pad, was 66.1% among all patients (Table 5). The continence rate was significantly higher in the USRC group than in the SRC group (85.3% [29/34] vs. 40.0% [10/25], p=0.001).

**DISCUSSION**

The main objective of bladder cancer treatment is to treat the disease while maintaining the urinary and sexual capabilities. Uterus-sparing surgery or sexual organ-sparing surgery would leave the reproductive organs and nerves intact to bring noticeable progression of functional outcomes [4]. However, concurrent hysterectomy or anterior pelvic exenteration during radical cystectomy remains the conventional treatment for high risk NMIBC and MIBC in females because of the proximity of the sexual organs and the bladder. Nonetheless, postoperative pathological data from previous studies have revealed that uterine invasion is rare. In a large study of 609 patients who underwent radical cystectomy, no patient had concomitant gynecological malignancies [1]. Gregg et al. [7] reported that 20 of 160 patients (12.5%) had uterine invasion. This is believed to be the highest uterine invasion rate reported so far (0.3%–12.5%) [7-13]. In our study, among the 36 patients who did not undergo preoperative hysterectomy, only two (5.5%) had uterine invasions. Since there is no anatomical barrier in the vesicocervical space, most urologists still recommend that hysterectomy be performed during cystectomy to reduce the probability of uterine invasion, especially in postmenopausal patients [4].

| Prognostic factor | Univariate analysis | Multivariate analysis |
|------------------|---------------------|----------------------|
|                  | HR 95% CI p-value   | HR 95% CI p-value    |
| Age (continuous variable) | 1.02 0.96–1.08 0.510 | 1.03 0.97–1.10 0.370 |
| Preservation | | |
| Standard radical cystectomy | Referent | Referent |
| Uterus-sparing radical cystectomy | 1.25 0.41–3.85 0.690 | 0.99 0.22–4.40 0.990 |
| Preoperative clinical stage | | |
| <T2 | Referent | Referent |
| ≥T2 | 2.74 0.75–10.00 0.130 | 1.86 0.46–7.29 0.370 |
| Pathologic stage | | |
| <T2 | Referent | Referent |
| ≥T2 | 9.20 1.99–42.46 0.004* | 8.88 1.80–43.86 0.007* |
| Lymph node positive | | |
| Negative | Referent | Referent |
| Positive | 1.62 0.36–7.31 0.530 | 1.53 0.23–10.11 0.660 |
| Surgical margin positive | | |
| Negative | Referent | Referent |
| Positive | 0.88–9.30 0.080 | 2.89 0.78–10.66 0.110 |
| Neoadjuvant chemotherapy | | |
| No | Referent | Referent |
| Yes | 1.86 0.49–6.93 0.360 | 1.83 0.42–8.06 0.430 |
| Adjuvant chemotherapy | | |
| No | Referent | Referent |
| Yes | 1.43 0.44–4.66 0.550 | 0.80 0.17–3.72 0.780 |

HR, hazard ratio; CI, confidence interval.
*Statistically significant p-value <0.05.
Outcomes of USRC and SRC in females

In another study by Ali-El-Dein et al. [11], the risk of secondary gynecologic organ invasion was increased by high-grade bladder tumors and positive lymph node status [12]. Therefore, patients with unifocal, organ-confined bladder cancer that is distant from the bladder neck, bladder base, and trigone can be considered suitable candidates for sexual organ-sparing cystectomy [1]. In this study, the indications for USRC were different from those reported in previous studies. If the patient had no metastasis in either preoperative imaging studies (CT or MRI) and no uterine invasion on pelvic MRI, she was considered suitable for USRC regardless of clinical T stage, tumor focality, tumor size, and tumor location. Among patients who were considered suitable candidates for USRC, the uterus was either preserved or removed based on the discretion of doctors and consensus from patients. Hysterectomy was performed on patients whose preoperative MRI indicated intraoperative uterine invasion or suspicion of uterine invasion. Hence, this study applied broader utilization of USRC in selected patients.

Achieving oncological control is the primary goal of radical cystectomy. Among the 86 patients, 40 (46.5%) underwent USRC and 46 (53.5%) underwent SRC alone. There were no significant differences between the two groups in terms of OS, CSS, and RFS. Cox regression analysis was used

Table 4. Univariate and multivariate Cox regression analyses of variables associated with recurrence-free survival

| Prognostic factor                  | Univariate analysis | Multivariate analysis |
|-----------------------------------|---------------------|-----------------------|
|                                   | HR 95% CI p-value   | HR 95% CI p-value     |
| Age (continuous variable)         | 0.99 0.95–1.03 0.560| 1.004 0.97–1.05 0.840 |
| Standard radical cystectomy       | Referent            | Referent              |
| Uterus-sparing radical cystectomy | 1.62 0.70–3.69 0.230| 0.46 0.19–1.11 0.840  |
| Preoperative clinical stage <T2  | Referent            | Referent              |
| ≥T2                               | 2.78 1.12–6.91 0.030*| 1.97 0.77–5.08 0.160  |
| Pathologic stage <T2              | Referent            | Referent              |
| ≥T2                               | 3.81 1.62–8.93 0.002*| 3.39 1.30–8.85 0.013* |
| Lymph node positive Negative      | Referent            | Referent              |
| Positive                          | 2.99 1.26–7.10 0.010*| 4.06 1.50–11.01 0.006*|
| Surgical margin positive Negative | Referent            | Referent              |
| Positive                          | 1.51 0.57–4.00 0.400| 2.64 0.87–7.96 0.085  |
| Neoadjuvant chemotherapy No       | Referent            | Referent              |
| Yes                               | 3.57 1.59–7.99 0.002*| 3.25 1.29–8.22 0.013* |
| Adjuvant chemotherapy No          | Referent            | Referent              |
| Yes                               | 1.16 0.49–2.78 0.730| 0.46 0.17–1.25 0.130  |

HR, hazard ratio; CI, confidence interval.
*Statistically significant p-value <0.05.

Fig. 3. Preoperative and postoperative mean Functional Assessment of Cancer Therapy-Vanderbilt Cystectomy Index questionnaire total scores in patients (n=26) who underwent uterus-sparing radical cystectomy or standard radical cystectomy. USRC, uterus-sparing radical cystectomy; SRC, standard radical cystectomy; preop, preoperatively; postop, postoperatively.
to reduce selection bias and adjust for the parameters that may affect the patient’s prognosis: age, clinical stage, pathologic stage, lymph node positivity, surgical margin positivity, and neoadjuvant or adjuvant chemotherapy. The analysis showed that uterine preservation was not an independent predictor of OS (HR, 0.62; 95% CI, 0.18–2.11; p=0.450), CSS (HR, 0.99; 95% CI, 0.22–4.40; p=0.990), and RFS (HR, 0.46; 95% CI, 0.19–1.11; p=0.840). Thus, we inferred that this study’s broad indication of uterine preservation, which depends mainly on preoperative pelvic MRI, did not negatively affect the oncological outcomes of the USRC group. Increasing evidence shows that diffusion-weighted MRI may provide more precise preoperative staging and may decrease clinical under staging in reproductive organ-sparing cystectomy candidates [1]. Moreover, pathologic stage ≥T2 significantly increased the HR in OS (HR, 6.14; 95% CI, 1.53–24.55; p=0.010), CSS (HR, 8.88; 95% CI, 1.80–43.86; p=0.007), and RFS (HR, 3.39; 95% CI, 1.30–8.85; p=0.013). Although this study included uterus-preserved patients with ≥cT2b disease, a higher pathologic stage increased the HR in all survival curves. Hence, careful consideration must be given to patients who are expected to have a higher T stage, although they have no uterine invasion on preoperative MRI. In one study, the 2-year OS in females who underwent radical cystectomy without gynecologic organ involvement was 73% [23]. In this study, the 2-year OS rates of the USRC and SRC groups were 82.0% and 85.9% (p=0.890), respectively.

In addition to achieving oncological control, optimizing functional outcomes is another challenge in radical cystectomy. Females who underwent radical cystectomy and neo-bladder substitution had a higher rate of incontinence and frequently required CIC due to incomplete bladder voidance than males [4,24]. One potential reason might be the lack of attention paid to nerve-saving during radical cystectomy in females. In females, the autonomic nerve of the inferior hypogastric plexus runs along lateral sides of the cervix and the rectum, leaving them vulnerable to injuries that could lead to incontinence and sexual dysfunction during pelvic surgeries, such as hysterectomy [1,4,25,26]. Gross et al. [4] reported that patients who underwent cystectomy with sexual organ preservation more often maintained both daytime and nighttime continence than those who underwent SRC. A continence rate of 87.5% was achieved for both day and nighttime continence. Although our study could not divide the continence rate into day and night due to a lack of information in the database, the 24-hour continence rate was 85.3% in the USRC group, which is in line with the study by Gross. This was significantly higher than the 24-hour continence rate in the SRC group (85.3% vs. 40.0%, p=0.001). Daytime and nighttime continence rates were reported to be 64%–100% and 50%–89%, respectively, in other studies regarding sexual organ-sparing [25]. Moreover, ‘hypercontinence’ (incomplete emptying of the bladder) is another complication that can arise from concomitant hysterectomy during radical cystectomy. The reported CIC rate ranges from 0% to 31% [25], and Gross et al. [4] reported that the rate of CIC was the same in both groups. In the current study, CIC rate was 28.8% in the entire cohort. Evaluating the CIC rate separately, the CIC rates of the USRC and SRC groups were 14.7% and 48.0% (p=0.005). The outcomes of this study showed that the continence rate was higher, and the CIC rate was lower after USRC than after SRC.

The present study has some limitations. The study was
Conducted retrospectively at a single center with a limited number of patients. A key limitation of this study was selection bias. Since there are still no clear guidelines for the application of USRC, the decision regarding whether to spare the uterus was based on the surgeon’s discretion, which may have influenced the oncological outcomes. Nevertheless, this is inherent to the nature of this study, and we used Cox regression analysis to adjust for factors that may affect the oncologic prognosis of patients. Moreover, the follow-up period may be inadequate, and further long-term investigations are needed in the future. Lastly, sexual function and postoperative fertility were not evaluated in this study because of the limited data available. In the future, USRC may enable female patients to achieve better sexual and reproductive outcomes.

CONCLUSIONS

The standard utilized in this study is differentiated from that used in previous studies in that it decided whether to preserve the uterus of the female patients undergoing radical cystectomy depending primarily on the preoperative MRI results. For females, USRC resulted in higher continence rates and lower ISC rates than SRC without negatively affecting oncological outcomes. Hence, with thorough deliberation, USRC should be considered for females undergoing radical cystectomy and urinary diversion.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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AUTHORS’ CONTRIBUTIONS

Research conception and design: Jae Suk Park and Ja Hyeon Ku. Data acquisition: Chang Wook Jeong, Hyeon Hoe Kim, and Ja Hyeon Ku. Statistical analysis: Jae Suk Park. Data analysis and interpretation: Jae Suk Park, Hyeong Dong Yuk, Chang Wook Jeong, Cheol Kwak, and Ja Hyeon Ku. Drafting of the manuscript: Jae Suk Park. Critical revision of the manuscript: Jae Suk Park and Ja Hyeon Ku. Supervision: Hyeong Dong Yuk, Chang Wook Jeong, Cheol Kwak, Hyeon Hoe Kim, and Ja Hyeon Ku. Approval of the final manuscript: all authors.

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