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RESEARCH

Outcomes after robot-assisted radical cystectomy with orthotopic neobladder in women

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Abstract

Purpose To investigate functional, oncological and complication outcomes in women undergoing robot-assisted cystectomy (RARC) with intracorporeal orthotopic neobladder.

Methods From a multi-institutional database, we identified females with bladder cancer treated with RARC and intracorporeal orthotopic neobladder. We evaluated the continence rate, short-term oncological outcomes, and complication rates. Analyses were repeated and stratified by the status of preserving gynecological organs.

Results The study involved 146 patients with the median age 60 years (IQR, 51–66 years). Pelvic organ-preserving procedure (POP) was performed in 77 patients (53%). Overall daytime and nighttime continence rates were 54% and 53%, respectively. For POP, the continence rate was 58% for both daytime and nighttime continence. In the non-POP cohort, the continence rate was 50% for daytime and 49% for nighttime continence. Both groups had balanced positive surgical margin rates (5,3% for POP and 4,7% for non-POP). In the whole cohort, high-grade (Clavien-Dindo ≥3) early and late complication rate was 7,5% and 7,5%, respectively.

Conclusions Robot-assisted radical cystectomy with intracorporeal orthotopic neobladder in females demonstrate excellent functional and complication outcomes. Pelvic organ-preserving cystectomy enhances urinary continence rates without adversely affecting surgical margins. Orthotopic neobladder in selected women with bladder cancer, along with pelvic organ-preserving cystectomy may be used for improved functional outcomes without compromising oncological results.

Keywords Female cystectomy · Functional outcomes · Pelvic organ-preserving cystectomy · Orthotopic neobladder · Robot-assisted radical cystectomy

Introduction

Radical cystectomy (RC) with urinary diversion remains the standard-of-care for muscle-invasive bladder cancer (MIBC) and for selected patients with high-risk non-MIBC [1]. Women are three to four times less likely to develop bladder cancer than men [2], but are often diagnosed with more advanced disease [3]. Traditionally, anterior pelvic exenteration, which includes the removal of the anterior wall of the vagina, hysterectomy and removal of fallopian tubes and ovaries, has been performed in addition to cystectomy. The concern with preserving pelvic organs is mainly contributed to oncological results, fearing preoperative understaging, positive surgical margins and an elevated risk of local recurrencies. However, advancements in preoperative assessment, the adoption of minimally invasive surgical techniques and enhanced comprehension of pelvic anatomy with the increased awareness of quality-of-life issues have led to the introduction of a more pelvic organ-preserving approach.

The two most common urinary diversions are the ileal conduit and the orthotopic neobladder. Advantages of ileal

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conduit are shorter operative time and less complicated surgical procedure. Yet, many studies demonstrate better quality-of-life with comparable mortality and morbidity rates after orthotopic neobladder reconstruction [4–7]. Historically, however, neobladder is less frequently performed in women than in men [8]. Functional impairments, such as sexual and urinary dysfunction are common after RC in both sexes, although most studies have primarily focused on post-prostatectomy outcomes in men [9]. There is limited research on functional outcomes in women after cystectomy. Indeed, pelvic organ-preserving procedure (POP) at the time of RC and orthotopic neobladder demonstrates comparable oncological outcomes with non-POP with good functional outcomes in a selected population [10, 11]. The limitation of the articles reviewed by this systematic review was the small sample size of the studies with relatively short follow-up [11].

The aim of this study is to provide a more comprehensive understanding of functional, oncological, and complication outcomes following RARC and intracorporeal orthotopic neobladder reconstruction in females with bladder cancer. This study seeks to address the current gap, and, to the best of our knowledge, stands as the most extensive study to date investigating these outcomes.

Materials and methods

Study population

This retrospective study included female patients with bladder cancer (BCa) who underwent RARC with intracorporeal orthotopic neobladder reconstruction. Data was collected from a multi-institutional database comprising tertiary referral centers in Europe and in the U.S. We included patients with available data and at least 12 months follow-up time after the surgery. The study was sponsored by the EAU Robotic Urology Section (ERUS) Scientific Working Group.

Additionally, information on pelvic organ-preserving procedure (POP) was gathered to determine if POP improves functional outcomes without affecting oncological outcomes. Pelvic organ-preserving procedure was defined as the preserving of at least the vagina and the uterus during cystectomy. The patients were categorized into two groups based on the POP. Daytime and nighttime urinary continence were recorded separately. Urinary continence was defined as the patient requiring maximum one daily pad. The use of pads or condom devices was recorded. Data on oncological outcomes were reported for the entire cohort and stratified by POP. Complications were divided to early (1–29 days) and late (30–90 days) postoperative complications according to Clavien-Dindo classification, where the most severe complication grade was recorded for an individual patient. In addition, early (1–29 days) and late (30–90) postoperative readmission rates were collected. Data variables were collected from electronical medical records (EMR).

Statistical analysis

All analyses were conducted for the entire cohort and stratified by POP or non-POP. Median values with interquartile range (IQR) were reported for continuous variables, while categorical variables were presented as percentages. To assess the factors influencing urinary continence rates, a multivariable logistic regression was conducted to predict urinary continence at 12 months after surgery. Here, also patients with hypercontinence were counted in. To assess differences between POP and non-POP groups, the Chi-square test and Fisher's exact test were used for categorical variables, and the Mann-Whitney test was utilized for continuous variables. The likelihood ratio test was used to calculate p values in the multivariate models. A P-value < 0,05 was considered statistically significant. All tests were performed in R version 4.0.0. Our study was approved by the Regional Ethics Committee in Stockholm (DNR: 2016/1836-31/1). Informed consents were not collected, and the data used for analyses were pseudonymized.

Results

A total of 146 female patients with bladder cancer who underwent RARC and intracorporeal orthotopic neobladder reconstruction were included in the study. The median age of the patients was 60 years (IQR, 51–66 years), the median operative time was 330 min (IQR, 288–399 min) and the median length of stay was 9 days (IQR, 7–14 days). Pelvic organ-preserving procedure was performed in 77 patients (53%) and was statistically associated with shorter length of stay as compared to non-POP (8 days vs. 14 days, $P < 0{,}001$). All urinary diversions were performed intracorporeally, with 73% of patients undergoing a Studer/Wiklund neobladder reconstruction technique, and all patients in the POP cohort had Studer/Wiklund as the reconstruction technique. Patient characteristics are presented in Table 1.

Urinary continence

In the whole cohort, a total of 51 patients (38%) were pad free, eight patients (6%) needed security pad, 14 patients (10%) reported the use of one daily pad, and 30 patients (22%) were hypercontinent. If these groups were considered together, the daytime continence rate was 76%. In the

Table 1 Patient characteristics

	All ($n=146$)	Organ-preserving ($n=77$, 55%)	Non-organ-preserving ($n=64$, 45%)	*P*-value
Age at operation, median - (IQR)	61 (54–67)	59 (50–66)	62 (56–67)	0,03
ASA score, n (%)				0,33
• 1	33 (22)	14 (18)	18 (28)	
• 2	84 (58)	48 (62)	33 (52)	
• 3	29 (20)	15 (20)	13 (20)	
Median BMI, kg/m^{2,} median – (IQR)	23 (21–26)	23 (21–26)	23 (20–26)	0,41
cT stage, n (%)				0,001
• a/1/CIS	56 (38)	38 (49)	15 (23)	
• 2	73 (50)	28 (36)	43 (67)	
• 3	16 (11)	10 (13)	6 (9)	
• 4	1 (1)	1 (1)	0 (0)	
MIBC/NMIBC				0,03
• MIBC	90 (62)	39 (51)	49 (77)	
• NMIBC	56 (38)	38 (49)	15 (23)	
NAC	71 (49)	36 (47)	34 (53)	0,56
• Yes	75 (51)	41 (53)	30 (47)	
• No				
ypT stage (%)				0,20
• ypT0	31 (44)	15 (42)	16 (47)	
• ypTa/1/CIS	9 (13)	7 (19)	2 (6)	
• ypT2	15 (21)	8 (22)	6 (18)	
• ypT3	15 (21)	5 (14)	10 (29)	
• ypT4	1 (1)	1 (3)	0	
pT stage, n (%)				0,47
• pT0	22 (30)	14 (36)	8 (27)	
• pTa/1/CIS	30 (41)	17 (44)	10 (33)	
• pT2	8 (11)	4 (10)	4 (13)	
• pT3	8 (11)	3 (8)	5 (17)	
• pT4	5 (7)	1 (3)	3 (10)	
PLND template, n (%)	3 (2)	2 (3)	0 (0)	0,05
• No				
• Limited	5 (4)	5 (7)	0 (0)	
• Standard	29 (22)	18 (25)	10 (18)	
• Extended	93 (71)	45 (63)	46 (82)	
• Super-extended	1 (1)	1 (2)	0 (0)	
• Missing	15	6	8	
Lymph node status, n (%)				0,24
• Negative	123 (86)	68 (90)	51 (81)	
• Positive	20 (14)	8 (10)	12 (19)	
• Missing	3	1	1	
Soft tissue margins, n (%)				1,00
• Negative	137 (95)	71 (95)	61 (95)	
• Positive	7 (5)	4 (5)	3 (5)	
• Missing	2	2	0 (0)	
Neobladder technique	102 (73)	72 (100)	26 (41)	-
• Studer/Wiklund	7 (5)	0 (0)	7 (11)	
• Hautmann	23 (16)	0 (0)	23 (36)	
• Gaston				
Operative time, median - (IQR)	330 – (288–399)	360 – (300–420)	300 – (270–370)	0,007
Perioperative bleeding, median -(IQR)	150 – (90–300)	150 – (50–250)	200 – (100–300)	0,05
Length of stay, median - (IQR)	9 (7–14)	8 (7–10)	14 (9–18)	> 0,001

organ-preserving cohort, 29 patients (41%) were pad free, four patients (6%) used security pad, eight patients (11%) used one daily pad, and 20 patients (28%) were hypercontinent. Again, if these groups were considered together, the continence rate was 86%. In the non-organ-preserving cohort, 21 patients (35%) were pad free, three patients (5%) used security pad, six patients (10%) used one pad per day, and nine patients (15%) were hypercontinent. If considered together, the daytime continence rate was 65%. Furthermore, 33 patients (24%) in the whole cohort, 10 patients (15%) in the POP cohort and 23 patients (35%) in the non-POP cohort reported the use of more than two daily pads.

Regarding nighttime continence, in the whole cohort, 41 patients (31%) were pad free, seven patients (5%) needed security pad, 22 (17%) reported the use of one pad overnight, and 24 patients (18%) were hypercontinent. If these groups were considered together, the nighttime continence rate was 71%. In the POP cohort, 24 patients (34%) were pad free, four patients (6%) used security pad, 13 patients (18%) used one pad overnight, and 18 patients (25%) were hypercontinent. If considered together, the continence rate was 83%. In the non-POP cohort, 16 patients (28%) were pad free, three patients (5%) used a security pad, nine patients (16%) used one pad per night, and five patients (9%) were hypercontinent. If considered together, the nighttime continence rate was 58%. Furthermore, 39 patients (30%) in the whole cohort, 12 patients (17%) in the POP cohort and 25 patients (43%) in the non-POP cohort reported the use of uridom or two or more pads overnight. In multivariable analysis, the pelvic organ-preserving procedure was associated with better day- and nighttime continence (OR 3,6; 95%CI 1,4–10,2 for daytime and OR 3,5; 95% CI 1,4–8,8 for nighttime continence, respectively). Tables 2 and 3 demonstrate detailed information on urinary continence rates.

Oncological outcomes

In the pelvic organ-preserving cohort 38 patients (49%) had non-muscle-invasive bladder cancer as their clinical T-stage as compared to 15 patients (23%, $P=0{,}003$) in the non-POP cohort (Table 1). Neoadjuvant chemotherapy was administered to 49% of the patients, and in the final pathology report 44% of patients in the whole cohort had ypT0. Correspondingly, 42% of the patients in POP cohort and 47% in the non-POP cohort had ypT0 (Table 1). Both groups had similar rates of positive surgical soft tissue margins and lymph node-positive disease (Table 4). Furthermore, most of the patients (98%) underwent lymph node dissection (LND), extended LND being the most frequent extent of procedure (93 patients, 71%) and performed more often in patients with non-POP (82% vs. 63%, $P=0{,}047$).

Complications

In the whole cohort, eleven patients (7,5%) had high-grade (Clavien-Dindo ≥3) early complication. The most common early complication was urinary tract infection (30 patients, 21%). Correspondingly, three patients (3,9%) in the POP cohort and eight patients (12,4%) in the non-POP cohort experienced early high-grade complications. In the whole cohort, eleven patients (7,5%) had high-grade (Clavien-Dindo ≥3) late complications. Similarly, urinary tract infection was the most common late complication (11 patients, 7,5%). Furthermore, six patients (7,8%) in the POP cohort and five patients (7,8%) in the non-POP had high-grade (Clavien-Dindo ≥3) late complication (Table 4). Description of the complications grouped by category are shown in Table 5.

Table 2 The rate of urinary continence at one year after surgery

	All, *n* (%)	POP, *n* (%)	Non-POP, *n* (%)	*P*-value
Daytime continence				
• Pad free	51 (38)	29 (41)	21 (35)	
• Security pad	8 (6)	4 (6)	3 (5)	
• 1 pad	14 (10)	8 (11)	6 (10)	
• 2 daily pads	11 (8)	6 (9)	4 (7)	0,015
• ≥3 daily pads	21 (16)	4 (6)	17 (28)	
• Hypercontinent	30 (22)	20 (28)	9 (15)	
• Missing	11 (8)	6 (8)	4 (6)	
Nighttime continence				
• Pad free	41 (31)	24 (34)	16 (28)	
• Security pad	7 (5)	4 (6)	3 (5)	
• 1 pad	22 (17)	13 (18)	9 (16)	
• 2 pads	16 (12)	5 (7)	10 (17)	
• ≥3 pads	22 (17)	6 (9)	15 (26)	0,013
• Uridom	1 (1)	1 (1)	0 (0)	
• Hypercontinent	24 (18)	18 (25)	5 (9)	
• Missing	13 (9)	6 (8)	6 (9)	

Table 3 Multivariable analysis predicting urinary continence

Variable	Multivariable					
	Daytime			Nighttime		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Age	-			-		
• Age under 50 (reference)						
• Age group 50–60	1,5	0,3–8,4		1,5	0,4–6,7	
• Age group 60–70	1,5	0,3–8,5		1,1	0,3–5,3	
• Age group over 70	1,4	0,2–10,3	0,96	1,2	0,2–7,8	0,92
ASA class	-			-		
• ASA class 1 (reference)						
• ASA class 2	0,6	0,2–2,0		0,9	0,3 – 2,6	
• ASA class 3	0,7	0,2–3,1	0,74	1,0	0,3–3,8	0,95
BMI						
• BMI under 20	0,8	0,2–3,3		1,0	0,3–3,6	
• BMI 20–30 (reference)	-	-		-	-	
• BMI 25–30	1,7	0,6 – 5,1		0,7	0,2–2,2	
• BMI 30–35	0,8	0,2–3,3	0,71	0,7	0,2–2,7	0,92
cT status – ≤cT2 (reference)						
• Locally advanced cancer (≥T3)	1,4	0,3–5,2	0,67	0,9	0,2–3,2	0.88
Organ-preserving operation –yes (reference)						
• Organ-sparing	3,6	1,4–10,2	0,007	3,5	1,4–8,8	0,006

Discussion

In this large, multi-institutional study, we investigated the outcomes of female patients who underwent RARC and intracorporeal orthotopic neobladder reconstruction. We found that this surgical approach resulted in reduced incontinence rates as compared with non-organ-preserving technique. In addition, organ-preserving technique showed comparable short-term oncological and complication rates compared to previously reported data on patients operated with incontinent urinary diversion [7, 12].

Historically, the use of orthotopic neobladder in females has been less common than in males, mainly due to concerns on the possible increased risk of local recurrences and postoperative voiding dysfunction [13]. Indeed, Gore et al. demonstrated with nearly 4000 patients from the SEER database who had undergone radical cystectomy that males have higher likelihood to undergo continent reconstruction than women (OR 1,31) [8]. However, even if cross comparison between studies cannot be made, continence rates in our study are close to the rates presented by Martini et al. among men operated with RARC and orthotopic neobladder reconstruction [14], however, in our study, the hypercontinence rates in females were higher. Interestingly, pelvic organ-preserving procedure led to reduced incontinence rates (15% vs. 35%) but also to higher hypercontinence rate compared to non-organ-preserving procedure. In our study, the hypercontinence rate for POP was 28% during daytime and 25% during nighttime as compared with 15% and 9% for non-POP, respectively. These results are consistent with findings from previous studies, which have demonstrated good functional outcomes [10, 15–17] after POP. Most of these studies report patients operated with open approach.

The adoption of pelvic organ-preserving RARC has been slow, mainly due to apprehensions about positive surgical margins and potential secondary malignancies in gynecological reproductive organs. In earlier studies, positive surgical margins have occurred in female cystectomies in around 4–6% of the cases [18, 19], which aligns with our study, wherein we demonstrate a comparable incidence of positive surgical margins in both the pelvic organ-preserving and non-organ-preserving groups (5% in each group). Since our results are based on retrospective data, there is certainly a selection-bias to be considered when making a direct comparison between these groups. Although POP was performed in our study more often to patients with NMIBC, nearly half of the patients had muscle-invasive cancer, which suggests that POP could be safely performed also in selected patients with muscle-invasive tumors when the anatomical location of the tumor is suitable. The lack of long-term oncological follow-up data in our study, however, impedes more profound analysis. In a recent propensity-score matched analysis, POP and non-POP showed similar oncological survival [20], and the risk for gynecological malignancies has not been shown to increase in patients operated with RC compared to control population [21–23].

The impact of radical cystectomy on sexual function and health-related quality of life (HRQoL) in women is underreported. Studies in men with orthotopic neobladder reconstruction have shown improvements in HRQoL compared to ileal conduit diversion, with similar morbidity and mortality profiles [7, 12, 24]. Sexual dysfunction has been a concern

Table 4 Complication rates after RARC with orthotopic neobladder reconstruction

Covariate	All *n* (%)	Organ-preserving *n* (%)	Non-organ-preserving *n* (%)	*P*-value
Classification of early complications				0,02
• CD 1	11 (7,5)	9 (11,7)	1 (1,6)	
• CD 2	42 (28,8)	21 (27,3)	21 (32,8)	
• CD 3a	4 (2,7)	0 (0)	4 (6,2)	
• CD 3b	6 (4,1)	2 (2,6)	4 (6,2)	
• CD 4a	1 (0,7)	1 (1,3)	0	
• CD 4b	0	0	0	
• CD 5	0	0	0	
• No complication	82 (56,2)	44 (57,1)	34 (53,1)	
Early readmissions	32 (23,0)	16 (21,9)	16 (25,4)	0,78
• Yes	107 (77,0)	57 (78,1)	47 (74,6)	
• No	7 (4,8)	4 (5,2)	1 (1,6)	
• Missing				
Early reoperation	5 (4,1)	0 (0)	4 (9,3)	0,02
• Yes	118 (95,9)	76 (100)	39 (90,7)	
• No	23 (15,8)	1 (1,3)	21 (32,8)	
• Missing				
Classification of late complications				0,50
• CD 1	4 (2,7)	3 (3,9)	0 (0)	
• CD 2	13 (8,9)	6 (7,8)	7 (10,9)	
• CD 3a	4 (2,7)	3 (3,9)	1 (1,6)	
• CD 3b	7 (4,8)	3 (3,9)	4 (6,2)	
• CD 4a	0	0	0	
• CD 4b	0	0	0	
• CD 5	0	0	0	
• No complication	118 (80,8)	62 (80,5)	52 (81,2)	
Late readmissions	24 (21,1)	8 (11,4)	16 (39)	0,002
• Yes	90 (78,9)	62 (88,6)	25 (61)	
• No	32 (21,9)	7 (9,1)	23 (35,9)	
• Missing				
Late reoperation	6 (5,0)	1 (1,4)	5 (12,2)	0,02
• Yes	113 (95,0)	73 (98,6)	36 (87,8)	
• No	27 (18,5)	3 (3,9)	23 (35,9)	
• Missing				

for patients with neobladder reconstruction [25], but pelvic organ-preserving approaches may help mitigate this issue.

There are several limitations to our study. Firstly, centers included in this study are high-volume centers with highly experienced surgeons with the capability of perform orthotopic neobladder with or without preserving pelvic organs, and thus results may be difficult to reproduce in smaller institutions. Secondly, the retrospective nature of data collection introduces bias, as decisions regarding pelvic organ-preservation were likely influenced by patient characteristics. Thus, direct comparisons of the pelvic organ-preserving and non-organ-preserving groups may not be entirely reliable. Furthermore, the classification of complications retrospectively without a uniform praxis may lead to underreporting of the complications. Lastly, the absence of long term oncological follow up data, and information on metastasis prevents a complete analysis of the oncological outcomes.

Our study demonstrates that RARC with intracorporeal orthotopic neobladder reconstruction in females can achieve good functional, oncological and complication outcomes. Furthermore, POP reduces incontinence but may result in higher rates of hypercontinence. RARC with intracorporeal neobladder could be considered in females more often as than it is done at present. Further studies with longer follow-up and additional oncological data are needed to confirm these findings and provide more comprehensive comparisons between pelvic organ-preserving and non-organ-preserving approaches.

Table 5 Early and late high-grade complications grouped by category

Complication category	All	Organ-preserving	Non-organ-preserving	*P*-value
Gastrointestinal, ileus				
Early	2 (1,4)	0 (0,0)	2 (3,1)	0,20
Late	-	-	-	
Gastrointestinal, internal herniation				
Early	-	-	-	-
Late	1 (0,7)	1 (1,3)	0 (0,0)	1,00
Genitourinary, ileoneobladder fistula				
Early	1 (0,7)	0 (0,0)	1 (1,6)	0,45
Late	-	-	-	-
Genitourinary, enterovaginal fistula				
Early	1 (0,7)	0 (0,0)	1 (1,6)	0,45
Late	2 (1,4)	0 (0,0)	2 (3,1)	0,2
Genitourinary, hydronephrosis				
Early	1 (0,7)	0 (0,0)	1 (1,6)	0,45
Late	1 (0,7)	1 (1,3)	0 (0,0)	1,00
Genitourinary, ureteroileal anastomosis leakage				
Early	1 (0,7)	0 (0,0)	1 (1,6)	0,45
Late	-	-	-	-
Genitourinary, ureteral stricture				
Early	2 (1,4)	1 (1,3)	1 (1,6)	1,00
Late	4 (2,7)	3 (3,9)	1 (1,6)	0,63
Genitourinary, entero-urethral anastomosis leakage				
Early	4 (2,7)	1 (1,3)	3 (4,7)	0,33
Late	-	-	-	-
Genitourinary, stones in the neobladder				
Early	-	-	-	-
Late	1 (0,7)	1 (1,3)	0 (0,0)	1,00
Genitourinary, urethrovaginal fistula				
Early	-	-	-	-
Late	1 (0,7)	0 (0,0)	1 (1,6)	0,45
Pulmonary, apnea				
Early	1 (0,7)	1 (1,3)	0 (0,0)	1,00
Late	-	-	-	-
Vascular, bleeding				
Early	1 (0,7)	0 (0,0)	1 (1,6)	0,45
Late	-	-	-	-
Infection, urinary tract infection				
Early	-	-	-	-
Late	1 (0,7)	0 (0,0)	1 (1,6)	0,45

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Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

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References

1. Alfred Witjes J, Max Bruins H, Carrión A et al (2023) European Association of Urology Guidelines on muscle-invasive and metastatic bladder Cancer: Summary of the 2023 guidelines. Eur Urol 2024 Jan;85(1):17–31
2. Jemal A, Siegel R, Xu J et al (2010) Cancer statistics, 2010. CA Cancer J Clin 60(5):277–300
3. Burger M, Catto JW, Dalbagni G et al (2013) Epidemiology and risk factors of urothelial bladder cancer. Eur Urol 63(2):234–241
4. Fujisawa M, Isotani S, Gotoh A et al (2000) Health-related quality of life with orthotopic neobladder versus ileal conduit according to the SF-36 survey. Urology 55(6):862–865
5. Dutta SC, Chang SC, Coffey CS et al (2002) Health related quality of life assessment after radical cystectomy: comparison of ileal conduit with continent orthotopic neobladder. J Urol 168(1):164–167
6. McGuire MS, Grimaldi G, Grotas J et al (2000) The type of urinary diversion after radical cystectomy significantly impacts on the patient's quality of life. Ann Surg Oncol 7(1):4–8
7. Parekh DJ, Gilbert WB, Koch MO et al (2000) Continent urinary reconstruction versus ileal conduit: a contemporary single-institution comparison of perioperative morbidity and mortality. Urology 55(6):852–855
8. Gore JL, Saigal CS, Hanley JM et al (2006) Variations in reconstruction after radical cystectomy. Cancer 107(4):729–737
9. Barocas DA, Alvarez J, Resnick MJ et al (2017) Association between Radiation Therapy, surgery, or Observation for localized prostate Cancer and patient-reported outcomes after 3 years. JAMA 317(11):1126–1140
10. Lavallée E, Dovey Z, Pathak P et al (2022) Functional and oncological outcomes of female pelvic organ-preserving Robot-assisted Radical Cystectomy. Eur Urol Open Sci 36:34–40
11. Veskimäe E, Neuzillet Y, Rouanne M et al (2017) Systematic review of the oncological and functional outcomes of pelvic organ-preserving radical cystectomy (RC) compared with standard RC in women who undergo curative surgery and orthotopic neobladder substitution for bladder cancer. BJU Int 120(1):12–24
12. Ali AS, Hayes MC, Birch B et al (2015) Health related quality of life (HRQoL) after cystectomy: comparison between orthotopic neobladder and ileal conduit diversion. Eur J Surg Oncol 41(3):295–299
13. Van Poppel H, Sorgeloose T (2003) Radical cystectomy with or without urethrectomy? Crit Rev Oncol Hematol 47(2):141–145
14. Martini A, Falagario UG, Russo A et al (2023) Robot-assisted Radical Cystectomy with Orthotopic Neobladder Reconstruction: techniques and functional outcomes in males. Eur Urol 84(5):484–490
15. Horenblas S, Meinhardt W, Ijzerman W et al (2001) Sexuality preserving cystectomy and neobladder: initial results. J Urol 166(3):837–840
16. Koie T, Hatakeyama S, Yoneyama T et al (2010) Uterus-, fallopian tube-, ovary-, and vagina-sparing cystectomy followed by U-shaped ileal neobladder construction for female bladder cancer patients: oncological and functional outcomes. Urology 75(6):1499–1503
17. Kulkarni JN, Rizvi SJ, Acharya UP et al (2008) Gynecologic-tract sparing extra peritoneal retrograde radical cystectomy with neobladder. Int Braz J Urol 34(2):180–187 discussion 187–190
18. Mitra AP, Skinner EC, Schuckman AK et al (2014) Effect of gender on outcomes following radical cystectomy for urothelial carcinoma of the bladder: a critical analysis of 1,994 patients. Urol Oncol 32(1):52e51–52e59
19. Kluth LA, Rieken M, Xylinas E et al (2014) Gender-specific differences in clinicopathologic outcomes following radical cystectomy: an international multi-institutional study of more than 8000 patients. Eur Urol 66(5):913–919
20. Zhong W, Xia K, Liu L et al (2023) Long-term survival after female pelvic organ-sparing radical cystectomy versus standard radical cystectomy: a multi-institutional propensity score-matched analysis. Int J Surg 109(9):2742–2750
21. Ali-El-Dein B, Abdel-Latif M, Mosbah A et al (2004) Secondary malignant involvement of gynecologic organs in radical cystectomy specimens in women: is it mandatory to remove these organs routinely? J Urol 172(3):885–887
22. Liedberg F, Jancke G, Sörenby A et al (2017) Should we refrain from performing oophorectomy in conjunction with radical cystectomy for bladder Cancer? Eur Urol 71(6):851–853
23. Lobo N, Uthayanan L, Uribe-Lewis S et al (2023) Gynaecological organ involvement in females undergoing radical cystectomy: a multicentre study. BJU Int 2024 Apr;133(4)
24. Hobisch A, Tosun K, Kinzl J et al (2000) Quality of life after cystectomy and orthotopic neobladder versus ileal conduit urinary diversion. World J Urol 18(5):338–344
25. Nagele U, Anastasiadis AG, Stenzl A et al (2012) Radical cystectomy with orthotopic neobladder for invasive bladder cancer: a critical analysis of long-term oncological, functional, and quality of life results. World J Urol 30(6):725–732

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