Supplemental Online Content

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eFigure 1. Survival Analysis Before Propensity Score Matching

ORC	80%	55%	49%	< 0.001
RARC	85%	61%	58%	

ORC	17%	33%	35%	0.001
RARC	12%	28%	30%	

ORC	3%	12%	16%	0.104
RARC	3%	11%	12%	
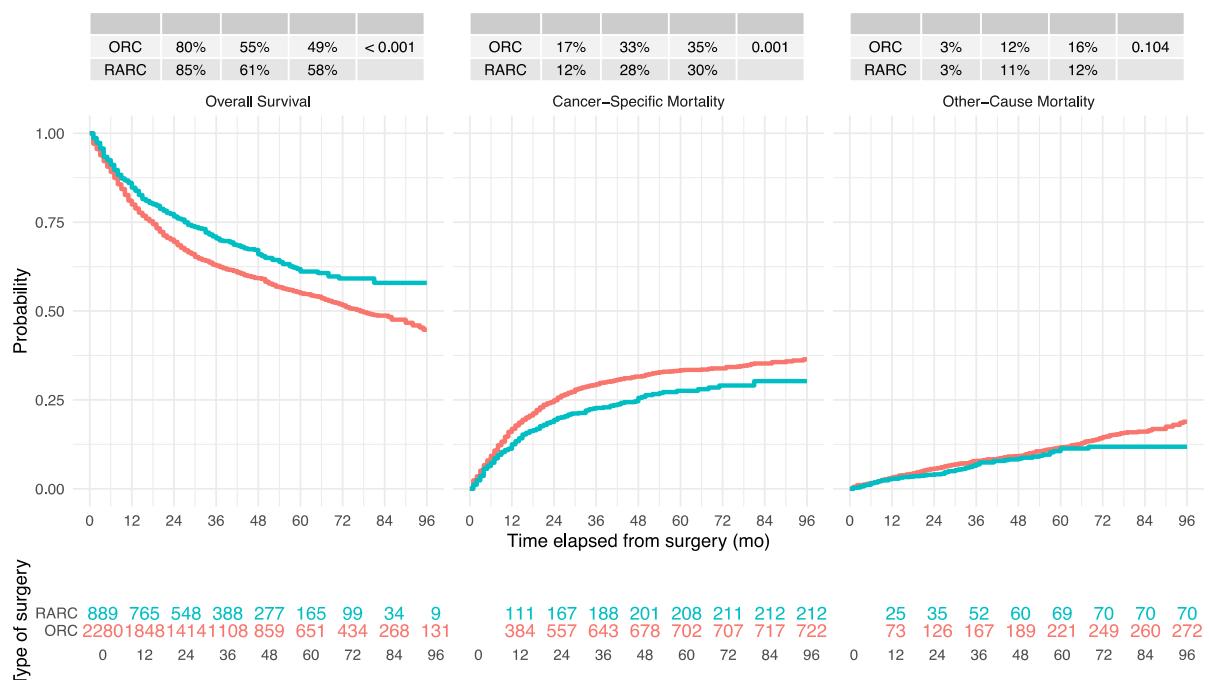
Cumulative incidence functions illustrating cancer-specific (CSM), other-cause mortality (OCM), and overall survival (OS, 1 – all-cause mortality) for patients undergoing open radical cystectomy (ORC) and robot-assisted radical cystectomy (RARC). Tables include the number of events for CSM and OCM, numbers at risk for OS, and estimates for 1, 5 and 7 years. P-value using the Gray's and log-rank tests.

eTable 1. Univariate Cox Regression Model Before Propensity Score Matching

	Characteristics	All-cause mortality		
		HR	95% CI	p*
Female gender	female vs. male	1.05	0.93-1.19	0.43
Age	years, continious (interval 5)	1.17	1.13-1.21	**<0.001**
BMI	kg/m², continious (interval 5)	0.84	0.79-0.90	**<0.001**
ASA score	III/IV vs. I/II	1.62	1.44-1.81	**<0.001**
Prior surgery / RTx	yes vs. no	1.12	0.98-1.28	0.12
Clinical T stage	cT2 vs. Ta/T1/Tis	1.77	1.52-2.05	**<0.001**
	cT3 vs. Ta/T1/Tis	2.41	2.00-2.90	**<0.001**
	cT4 vs. Ta/T1/Tis	3.15	2.50-3.97	**<0.001**
Clinical N stage	cN+ vs. cN-	1.76	1.49-2.08	**<0.001**
NAC	yes vs. no	0.77	0.68-0.87	**<0.001**
Annual hospital volume	11-25 vs. 1-10	0.82	0.68-0.99	**0.04**
	>25 vs. 1-10	0.79	0.67-0.93	**0.006**
Pathological stage	pT2 vs. pT0/pTa/T1/Tis	1.99	1.66-2.38	**<0.001**
	pT3 vs. pT0/pTa/T1/Tis	4.13	3.56-4.79	**<0.001**
	pT4 vs. pT0/pTa/T1/Tis	7.6	6.43-8.98	**<0.001**

BMI: body mass index, ASA: American Society of Anesthesiologists, RTx: radio therapy, NAC: neoadjuvant chemotherapy, HR: hazard ratio, CI: confidence interval. * Bold face reprensenting P < 0.05.

eFigure 2. Propensity Score Distributions Before and After Propensity Score Matching
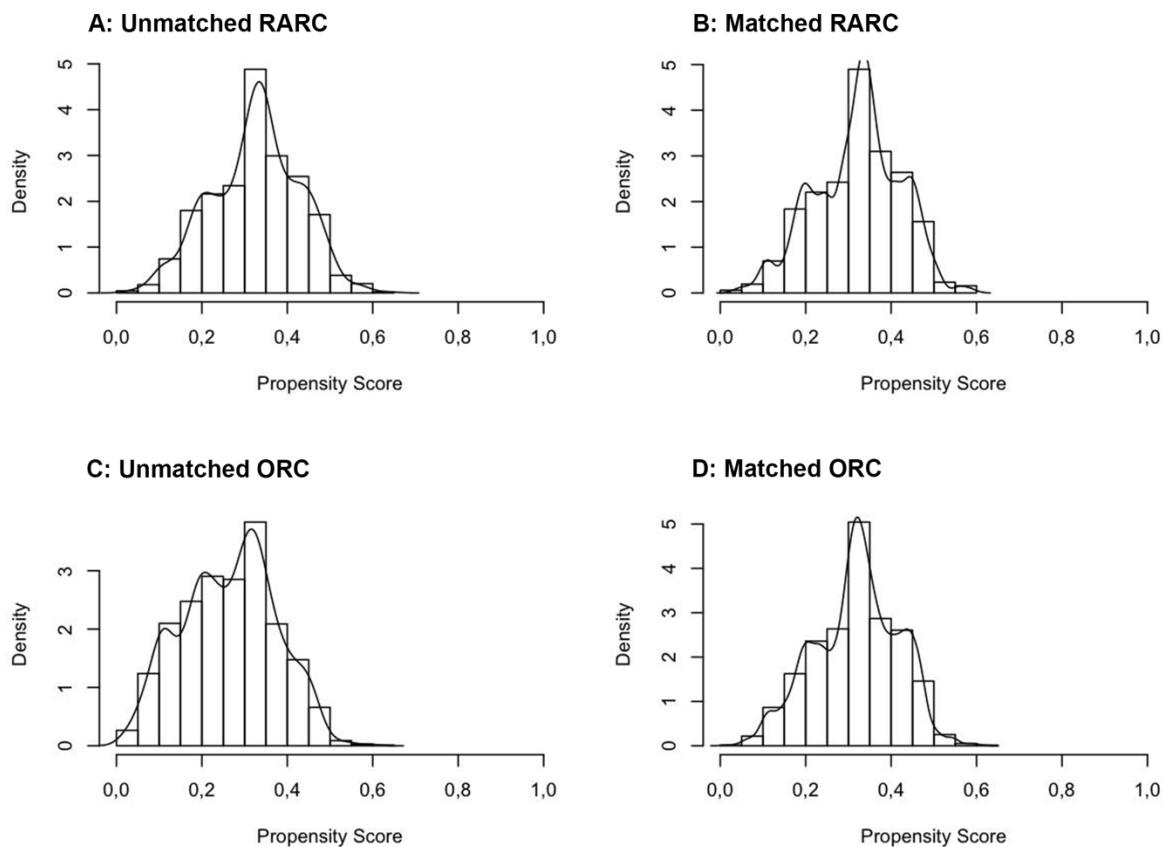
The propensity score distributions for the groups both before and after matching; Figure 1A and C demonstrate an initial dissimilarity on the basis of propensity score distributions. After matching, the distributions of the propensity scores (Figure 1 B and D) were homogeneous and confirmed the adequacy of the propensity score model to achieve balance. RARC: robot-assisted radical cystectomy, ORC: open radical cystectomy

eTable 2. Univariable Cox Regression Analysis and E-Values for Mortality Analysis After Propensity Score Matching

eTable 2 (A). Univariable Cox regression analysis for all-cause, cancer-specific, and other-cause mortality (after matching)

		Before PSM			After PSM								
Variable	Characteristics	All-cause mortality			All-cause mortality			Cancer-specific mortality			Other-cause mortality		
		HR	95% CI	p*	HR	95% CI	p*	HR	95% CI	p*	HR	95% CI	p*
Estimated blood loss	continuous, ml (per 250)	1.04	1.02-1.05	**<0.001**	1.03	1.01-1.04	**0.001**	1.02	1.00-1.04	**0.015**	1.03	1.01-1.06	**0.012**
Blood transfusion	yes vs. no	1.63	1.44-1.85	**<0.001**	1.69	1.45-1.97	**<0.001**	1.71	1.42-2.05	**<0.001**	1.64	1.25-2.16	**<0.001**
No. of removed LN*	continious (interval 5)	0.92	0.90-0.95	**<0.001**	0.90	0.86-0.94	**<0.001**	0.91	0.86-0.95	**<0.001**	0.88	0.82-0.95	**<0.001**
Nodal status	N+ vs. N-	3.11	2.77-3.50	**<0.001**	3.28	2.85-3.78	**<0.001**	3.97	3.39-4.66	**<0.001**	1.79	1.33-2.42	**<0.001**
Complications	CD I-II vs. none	1.00	0.87-1.14	0.97	1.03	0.88-1.22	0.69	1.09	0.90-1.31	0.383	0.89	0.65-1.22	0.460
	CD III vs. none	1.21	1.04-1.41	**0.013**	1.26	1.04-1.51	**0.016**	1.20	0.96-1.50	0.105	1.39	1.01-1.91	**0.041**
	CD IV vs. none	1.88	1.43-2.47	**<0.001**	1.71	1.18-2.50	**0.005**	1.28	0.78-2.12	0.329	2.76	1.54-4.95	**0.001**
Type of surgery	RARC vs. ORC	0.81	0.70-0.93	**0.003**	0.71	0.56-0.89	**0.004**	0.77	0.58-1.01	0.057	0.57	0.37-0.89	**0.013**

*PSM: propensity score matching, LN: lymph nodes, CD: Clavien-Dindo, RARC: robot-assisted radical cystectomy, ORC: open radical cystectomy, HR: hazard ratio, CI: confidence interval. Bold face reprensenting P < 0.05. * in patients undergoing pelvic lymph node dissection*

eTable 2 (B). E-Values for all-cause, cancer-specific, and other-cause mortality (in the matched cohort)										
Variable	**Characteristics**	**All-cause mortality**			**Cancer-specific mortality**			**Other-cause mortality**		
		E-value	**95% CI**		**E-value**	**95% CI**		**E-value**	**95% CI**	
Estimated blood loss	continuous, ml (per 250)	1.21	1.11-NA		1.16	1.00-NA		1.21	1.11-NA	
Blood transfusion	yes vs. no	2.77	2.26-NA		2.81	2.19-NA		2.66	1.81-NA	
No. of removed LN*	continious (interval 5)	1.46	NA-1.32		1.43	NA-1.29		1.53	NA-1.29	
Nodal status	N+ vs. N-	6.01	5.15-NA		7.40	6.24-NA		2.98	1.99-NA	
Complications	CD I-II vs. none	1.21	1.00-NA		1.40	1.00-NA		1.50	NA-1.00	
	CD III vs. none	1.83	1.24-NA		1.69	1.00-NA		2.13	1.11-NA	
	CD IV vs. none	2.81	1.64-NA		1.88	1.00-NA		4.96	2.45-NA	
Type of surgery	RARC vs. ORC	2.17	NA-1.50		1.92	NA-1.00		2.90	NA-1.50	
*LN: lymph nodes, CD: Clavien-Dindo, RARC: robot-assisted radical cystectomy, ORC: open radical cystectomy, CI: confidence interval. * in patients undergoing pelvic lymph node dissection. NA: not applicable*										

eTable 3. Sensitivity Analysis for Year of Surgery, Baseline Characteristic, Outcomes, Univariable Cox Regression Analysis for All-Cause Mortality

eTable 3 (A): Sensitivity analysis for year of surgery, baseline characteristics

		Before propensity matching			After propensity matching		
		ORC (n=2280)	RARC (n=889)	SMD*	ORC (n=1457)	RARC (n=879)	SMD*
Female gender, n (%)		567 (24.9)	216 (24.3)	-0.01	339 (23.3)	213 (24.2)	-0.02
Age (y)		71 (66, 76)	71 (65, 76)	-0.07	71 (65, 76)	71 (65, 76)	-0.01
BMI (kg/m2)		26 (23, 28)	26 (23, 28)	0.21	26 (23, 28)	26 (23, 28)	-0.01
	Missing	27 (1.2)	1 (0.1)		4 (0.3)	1 (0.1)	
ASA score, n (%)							
	I	271 (12.0)	101 (11.5)	-0.02	170 (11.8)	100 (11.5)	-0.02
	II	1327 (58.9)	433 (49.1)	-0.19	778 (53.8)	433 (49.7)	-0.01
	III	635 (28.2)	332 (37.6)	0.2	479 (33.1)	326 (37.4)	0.02
	IV	20 (0.9)	16 (1.8)	0.07	18 (1.2)	13 (1.5)	0.001
	Missing	27 (1.2)	7 (0.8)		12 (0.8)	7 (0.8)	
Prior surgery / RTx, n (%)		429 (19.3)	157 (17.8)	-0.03	278 (19.3)	154 (17.6)	-0.01
	Missing	56 (2.5)	6 (0.7)		13 (0.9)	6 (0.7)	
Clinical T stage, n (%)							
	Tis/Ta/T1	591 (25.9)	244 (27.4)	0.03	413 (28.3)	241 (27.4)	-0.02
	T2	1185 (52.0)	512 (57.6)	0.11	788 (54.1)	505 (57.5)	0.03
	T3	336 (14.7)	86 (9.7)	-0.17	166 (11.4)	86 (9.8)	-0.01
	T4	135 (5.9)	40 (4.5)	-0.07	76 (5.2)	40 (4.6)	-0.01
	cTx	33 (1.4)	7 (0.8)		14 (1.0)	7 (0.8)	
Clinical N stage, n (%)							
	cN+	226 (9.9)	62 (7.0)	-0.12	121 (8.3)	62 (7.1)	-0.02
NAC, n (%)		745 (32.9)	303 (34.2)	0.03	493 (33.9)	300 (34.2)	-0.02
	Missing	17 (0.7)	3 (0.3)		4 (0.3)	3 (0.3)	
Annual hospital vol., n (%)							
	1 - 10	287 (12.6)	35 (3.9)	-0.45	58 (4.0)	35 (4.0)	-0.01
	11 - 25	564 (24.7)	144 (16.2)	-0.23	286 (19.6)	144 (16.4)	-0.01
	>25	1429 (62.7)	710 (79.9)	0.43	1113 (76.4)	700 (79.6)	-0.007
Year of surgery							
	2011-2013	865 (37.9)	173 (19.5)	-0.47	360 (24.7)	173 (19.7)	-0.01
	2014-2015	597 (26.2)	255 (28.7)	0.06	422 (29.0)	251 (28.6)	0.02
	2016-2018	818 (35.9)	461 (51.9)	0.32	675 (46.3)	455 (51.8)	-0.003

Data presented as median (quartile 1, quartile 3) or frequency (percentage). ORC: open radical cystectomy, RARC: robot-assisted radical cystectomy, SMD: standartized mean difference, y: year, BMI: body mass index, ASA: American Society of Anesthesiologists, RTx: radio therapy, NAC: neoadjuvant chemotherapy, vol.: volume.

eTable 3 (B): Sensitivity analysis for year of surgery, outcome parameters				SMD	
	ORC (n=1457)	RARC (n=879)	p	before PSM*	after PSM*
INTRAOPERATIVE PARAMETERS					
Urethrectomy , n (%)	290 (20.0)	170 (19.5)	0.8		
Missing	7 (0.5)	5 (0.6)			
Deviation type, n (%)					
Ileum conduit	1299 (89.2)	694 (79.0)	<0.001		
OBS	103 (7.1)	180 (20.5)			
CCUD	20 (1.4)	1 (0.1)			
Other	34 (2.3)	4 (0.5)			
Missing	1 (0.1)	0 (0.0)			
Estimated blood loss (ml)	700 (400, 1200)	150 (100, 300)	<0.001		
Missing	21 (1.4)	22 (2.5)			
Intra-OP blood transfusion, n (%)	512 (37.2)	63 (7.7)	<0.001		
Missing	82 (5.6)	59 (6.7)			
Peri-OP blood transfusion**, n (%)	478 (50.7)	144 (20.7)	<0.001		
Missing	155 (14.1)	12 (1.7)			
Operation time (min)	320 (244, 420)	320 (260, 380)	0.5		
Missing	24 (1.6)	29 (3.3)			
POSTOPERATIVE PARAMETERS					
Clavien-Dindo classification, n (%)					
I-II	374 (26.4)	283 (32.7)	0.001		
III	264 (18.6)	123 (14.2)			
IV	50 (3.5)	19 (2.2)			
V	21 (1.5)	7 (0.8)			
Missing	41 (2.8)	14 (1.6)			
Re-operation, n (%)	177 (12.4)	82 (9.4)	0.03		
Missing	33 (2.3)	11 (1.3)			
Lenghts of stay (days)	13 (10, 17)	9 (6, 13)	<0.001		
Missing	37 (2.5)	10 (1.1)			
Re-hospitalization in 90d, n (%)	377 (26.8)	291 (33.8)	<0.001		
Missing	50 (3.4)	17 (1.9)			
Pathological T-stage, n (%)					
T0	335 (23.0)	200 (22.8)	0.9	0.05	-0.01
Tis/Ta/T1	321 (22.0)	201 (22.9)		0.04	0.01
T2	260 (17.8)	161 (18.3)		0.02	0.003
T3	377 (25.9)	230 (26.2)		-0.02	0.01
T4	153 (10.5)	80 (9.1)		-0.14	-0.03
pTx	11 (0.8)	7 (0.8)			
Removed lymph nodes, n (%)***	14 (8, 25)	20 (15, 27)	<0.001		
Missing	85 (6.6)	23 (2.8)			
N+, n (%)	279 (19.7)	171 (20.6)	0.6		
Missing	42 (2.9)	48 (5.5)			

Data presented as median (quartile 1, quartile 3) or frequency (percentage). ORC: open radical cystectomy, RARC: robot-assisted radical cystectomy, SMD: standartized mean difference, PLND: pelvic lymh node diessection, OBS: orthotopic bladder substitution, CCUD:

RARC was associated with a lower high-grade complication (CD ≥III) rate compared with ORC (17.2% vs. 23.6%, OR=0.67, 95% CI: 0.54-0.83; p<0.001).

eTable 3 (C): Sensitivity analysis for year of surgery, univariable Cox regression analysis for all-cause mortality				
Variable	**Characteristics**	**All-cause mortality**		
		HR	**95% CI**	**p***
Estimated blood loss	continuous, ml (per 250)	1.03	1.02-1.05	<0.001
Blood transfusion	yes vs. no	1.76	1.53-2.03	<0.001
No. of removed LN*	continious (interval 5)	0.90	0.88-0.93	<0.001
Nodal status	N+ vs. N-	3.34	2.90-3.85	<0.001
Complications	CD I-II vs. none	1.00	0.84-1.18	0.983
	CD III vs. none	1.22	1.00-1.47	0.044
	CD IV vs. none	2.24	1.62-3.11	<0.001
Type of surgery	RARC vs. ORC	0.83	0.72-0.96	0.011
*LN: lymph nodes, CD: Clavien-Dindo, RARC: robot-assisted radical cystectomy, ORC: open radical cystectomy, HR: hazard ratio, CI: confidence interval. Bold face represnenting P < 0.05. * in patients undergoing pelvic lymph node dissection*				

eFigure 3. Sensitivity Survival Analysis for Year of Surgery

ORC	82%	58%	53%	0.011
RARC	85%	61%	58%	
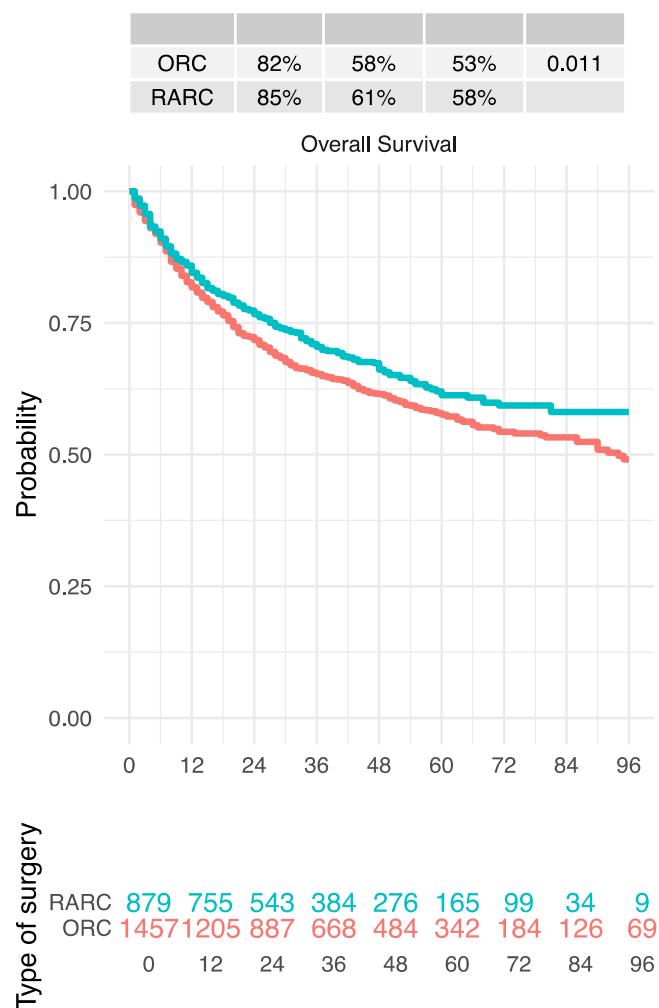
Cumulative incidence functions illustrating overall survival (OS) for patients undergoing open radical cystectomy (ORC) and robot-assisted radical cystectomy (RARC). Tables include the numbers at risk for OS, and estimates for 1, 5 and 7 years. P-value using log-rank tests.

Due to a slightly higher rate of pT4 tumors in the ORC group (10.5% vs. 9.1%) after propensity score matching including the year of surgery, we performed a subgroup analysis and excluded all patients with pT4 tumor. The difference in OS remained statistically significant with a benefit for RARC (p=0.015)