Predictors of early urinary continence after robotic prostatectomy

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Objective: *We sought to identify predictors of early urinary continence after robot-assisted prostatectomy (RARP) in men who underwent a posterior rhabdosphincter reconstruction.*

Materials and methods: *A prospective analysis was performed in 107 consecutive men who underwent RARP by a single surgeon in an academic center. Men were excluded if they received adjuvant radiation therapy (7 men), were lost to follow up (4), or did not have a posterior rhabdosphincter reconstruction (8 men). Eighty-eight men received a posterior rhabdosphincter reconstruction and were followed in this study. Patient demographic and postoperative urinary control was recorded at interval follow up visits by the physician and research staff. Level of comorbidity was measured with the Charlson Comorbidity Index (CACI). Preoperative urinary function was measured using the International Prostate Symptom Score (IPSS). Continence was defined as men using zero pads per day.*

Results: *Eighty-eight men with a mean age of 59.2 years (43.1-77.6) were followed for a median of 7.6 (range 1.5-16.7) months. The median preoperative PSA and IPSS was 5.0 ng/mL (range 0.95 ng/mL-23 ng/mL) and 8 (range 0-30), respectively. Overall, 91% of the men achieved continence with a median time to continence of 2.3 months. Of those, 50% achieved continence by 6 weeks. Men continent at 6 weeks were significantly younger, had lower IPSS scores, and less comorbidities ($p = 0.01$). Age ($OR = 0.91$, $p < 0.01$) and higher IPSS scores ($OR = 0.28$, $p = 0.03$) were associated with decreased odds of achieving continence at 6 weeks. The presence of coexisting disease was not predictive of continence return. After adjusting for comorbidity, body mass index (BMI), nerve sparing, and IPSS score, only age remained as an independent predictor of early continence ($OR = 0.90$, $p = 0.04$).*

Conclusions: *In conclusion, we found that increased age and increased lower urinary tract symptom (LUTS) severity are associated with decreased odds of achieving continence 6 weeks after RARP. Patient age remains the strongest predictor of early return of continence in a multivariate model. These factors should be used in counseling prior to surgery to meet realistic patient expectations.*

Key Words: robot prostatectomy, prostate cancer, urinary continence, comorbidity

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Introduction

Treatment of prostate cancer can have a profound impact on the patient's quality of life. Rates of incontinence after radical prostatectomy (RP) have varied from

2% to 44% of patients 12 months postoperatively.[1-4] Up to 25% of men found that postoperative urinary incontinence was a moderate to big problem for them within a year after surgery,[1] emphasizing the importance of characterizing factors that may be associated with quick continence return.

Recent advances in surgical technique may be associated with shorter return of continence return. Contemporary series with robotic assisted prostatectomy (RARP) have shown equivalent overall rates of continence return as open RP,[5,6] with more recent series demonstrating a quicker recovery.[7,8] In addition, posterior rhabdosphincter reconstruction as described by Rocco et al[9] also is postulated to be associated with a shortened time to continence.

Age, preoperative urinary function, and nerve sparing have been found to be predictors of overall continence.[2,10-13] Mendiola et al found that although younger men were more likely to have an earlier return of continence compared to older men after RARP, the continence outcomes eventually became equal after one year of follow up.[14] The presence of comorbidities may also play a role in poorer return of function after surgery,[15] however, the relative contribution of these comorbidities in the return of continence has not been well characterized. We sought to evaluate predictors of early urinary continence return after RARP in men who underwent a posterior rhabdosphincter reconstruction.

Materials and methods

From November 2007 to February 2009, 107 consecutive men without preoperative urinary incontinence underwent RARP by a single robotics and minimally invasive fellowship trained surgeon, and followed for a minimum of 6 weeks. Seven men received adjuvant radiation therapy and were excluded from the study due to the effects of pelvic irradiation, four men were lost to follow up, and eight additional men did not receive the posterior rhabdosphincter reconstruction, leaving 88 men for the analysis. Patient data was prospectively collected into a database after receiving approval from the Columbia University institutional review board. Patient data included age, body mass index (BMI), past medical history, preoperative urinary and sexual function, and tumor pathology.

Preoperative urinary function was evaluated using the International Prostate Symptom Score (IPSS).[16] Preoperative lower urinary tract symptom (LUTS) severity was classified into the following three groups based on IPSS scores: scores < 7 were classified as having mild symptoms, 8-19 as moderate problems, and 20-35 as having severe problems. Catheters were removed 7 days after surgery. Those men with bladder neck reconstruction, catheters were removed on postoperative day 10. Postoperative urinary continence was evaluated during each follow up visit at the urologic oncology office at 6 weeks, 3 months, 6 months, 9 months, and 12 months postoperatively. Questions were asked by either the physician or the research staff. Patients who had missing information on continence were contacted by telephone. Men were asked: "what is the average number of pads you use per day at this time: 0 pads, security pad, 1 pad, 2-3 pads, or more than 3 pads?" Continence was defined as zero pad use per day. Men using pads (security or any size) were not considered continent. After the catheter was removed, each patient was counseled on daily pelvic floor rehabilitation with Kegel exercises, however no set physiotherapy program was established as in prior studies.[17]

A posterior rhabdosphincter reconstruction was performed similar to the technique described by Rocco et al.[9] The eight men who did not receive the posterior reconstruction and excluded were not significantly different in clinical, pathological, or rates of continence return compared to those who received the posterior reconstruction. Nerve sparing was performed using anatomic foundations described by Walsh,[18] Menon,[19] and Ahlering.[20]

BMI was examined as a categorical variable using the National Institutes of Health definition of obesity (BMI $\geq$ 30 kg/m^2). Comorbidity was assessed by the Charlson Comorbidity Index score (CACI).[21] Predictors of continence were examined using logistic regression models. Age and BMI were analyzed as continuous variables. IPSS scores and nerve sparing were analyzed as categorical values. CACI scores were assessed as a categorical value of CACI scores 0-2 versus $\geq$ 3. The AJCC Cancer Staging Manual 5th edition was used for pathological tumor staging.[22] All statistical analyses were performed using Stata SE, version 8.0.

Results

Overall, the 88 men in our series had a mean age of 59.2 ± 7.6 (range 43.1-77.6) and were followed postoperatively for a median of 7.6 months (range 1.5 -16.7 months). They had a median IPSS score of 7 and median preoperative PSA level of 5 ng/mL. Thirty-five (39.8%) men had CACI scores of 0 to 1, 30 (34.1%) men had CACI scores of 2, and 23 (26.1%) had CACI scores of 3 or more.

Eighty (91%) of the men achieved continence with a median time to continence of 2.3 months. Of those

TABLE 1. **Continence at 6 weeks postoperatively**

Variable	Continent		
	No	Yes	p-value
Number	44	44	
Mean age	61.5 ± 6.5	56.9 ± 7.9	< 0.01*
BMI	27.8 ± 5.1	26.9 ± 4.5	0.40*
Charlson Comorbidity Index	2.2	1.6	0.01*
CACI score			
0	1 (2.3%)	6 (13.6%)	
1	12 (27.3%)	16 (36.4%)	
2	17 (38.6%)	13 (29.6%)	
≥ 3	14 (31.8%)	9 (20.5%)	
IPSS score (median)	8	6	0.01**
IPSS nocturia score	2	1	0.05**
Preoperative IPSS severity			0.03†
Mild (0-7)	15 (35.7%)	28 (65.1%)	
Moderate (8-19)	23 (54.8%)	12 (27.9%)	
Severe (20-35)	4 (9.5%)	3 (7.0%)	
Nerve sparing			0.24‡
None	9 (20.9%)	5 (11.4%)	
Unilateral	9 (20.9%)	6 (13.6%)	
Bilateral	25 (58.1%)	33 (75.0%)	
Bladder neck reconstruction			1.0‡
No	16 (36.4%)	16 (36.4%)	
Yes	28 (64.6%)	28 (64.6%)	

*Student's t-test; **Wilcoxon-Mann-Whitney test; †Fisher's exact test; ‡Chi-square test

who achieved continence, 50% (44 / 88) men achieved continence by 6 weeks postoperatively. Table 1 describes the clinical and operative characteristics of the patients according to presence or absence of continence at 6 weeks. Those who achieved continence at 6 weeks were significantly younger, had less comorbidity, and had lower preoperative IPSS scores (all $p < 0.05$). Level of nerve sparing was not significantly associated with continence at 6 weeks. Ninety percent (9/10) of men in their 40's achieved continence by 6 weeks, compared to 45.7% (16/35) of men in their 50's, and 37% (16/43) of men in their 60's or 70's. Fifty-seven of the 88 men in the analysis (64.8%) had follow up data from 6 months or more. At 6 months, 96.5% (55/57) of the men achieved continence.

Logistic regression analyses were used to model the relationship between preoperative and operative clinical variables and the return of continence at 6 weeks, see Table 2. Increased age (OR = 0.91, $p < 0.01$) and increased LUTS severity (OR = 0.28, 0.40 $p < 0.05$) were associated with decreased odds of achieving continence at 6 weeks. Having a CACI score > 2 was not significantly associated with achieving continence at 6 weeks (OR = 0.49, $p = 0.14$). However, after adjusting for BMI, CACI score, IPSS score, and nerve sparing, age remained an independent predictor of continence return at 6 weeks (OR = 0.90, $p = 0.04$).

Discussion

Prostate cancer is the most commonly diagnosed noncutaneous cancer in men, with approximately 192,280 new cases and 27,360 deaths in 2009.[23] Despite many improvements in surgical technique, postoperative urinary incontinence remains a relevant concern. In our study, 50% of men achieved total continence at 6 weeks postoperatively, and 96.5% of the men at 6 months postoperatively. Rocco et al[24] reported early return of continence rates of 74% at 4 weeks and Tewari et al[25] reported rates of 83% at 6 weeks with posterior and total reconstructive techniques. This discrepancy may be due to differing surgical technique, but also may be due to

TABLE 2. **Logistic regression analysis of return of urinary function at 6 weeks**

Univariate analysis	**Odds ratio**	**p-value**	**95% CI**
Age	0.91	< 0.01	0.86-0.97
Preoperative IPSS severity			
Moderate (versus mild)	0.28	0.03	0.11-0.71
Severe (versus mild)	0.40		0.08-2.04
CACI score (versus CACI 0-2)	0.49	0.14	0.19-1.25
BMI	0.96	0.40	0.88-1.05
Nerve spare			
Unilateral (versus none)	1.2	0.81	0.27-5.40
Bilateral (versus none)	2.4		0.71-7.97
Multivariate analysis*	**Odds ratio**	**p-value**	**95% CI**
Age	0.90	0.04	0.82-0.98
Preoperative IPSS severity			
Moderate (8-19)	0.57	0.59	0.19-1.71
Severe (20-35)	0.92		0.16-5.38
CACI score (versus CACI 0-2)	2.30	0.25	0.56-9.47

*adjusted for BMI and nerve sparing procedurea

differing definitions of continence; which was defined as requiring no absorbent pads or 1 security pad, or "0 to 1 pad" per day. Although there has been a lack of consensus regarding the definition of continence,[26,27] there is a growing movement towards standardizing the definition of urinary continence as having achieved complete pad-free status.

Incontinence after RARP can limit the daily activities and negatively impact quality of life.[28] Although contemporary published series found continence rates greater than 95% a year after RARP,[5,6] Stanford et al[1] found that 25% of the men found incontinence at 6 months to be a moderate to severe problem for them. Identifying risk factors for early incontinence after RARP can be beneficial to providing realistic expectations of the duration of incontinence, and probability of achieving continence.

We observed that while LUTS severity and age were associated with continence return at 6 weeks in univariate analysis, the most powerful predictor of early continence return after RARP was patient age. After adjusting for presence of comorbidity, nerve sparing, BMI, and LUTS severity, each increase in age by 1 year was associated with a 9% decreased odds of achieving continence at 6 weeks. However, with longer follow up we found that more than 90% of the men regained continence, and that there were no significant predictors of continence after 6 months. This confirms the findings of Hu et al,[29] Mendiola et al,[14] Rogers et al[30] that younger men achieved continence at an earlier time point than older men. Likewise, Eastham et al[31] that young age is an independent predictor of time to continence. Other investigators have not found age to be a significant predictor of continence.[27,32,33] This discrepancy may be due to differences in the age range in each cohort, with a high percentage of relatively young men in previous studies, or due to low rates of incontinence at later follow up times than in the current study, which make identification of a risk factor in a particular subgroup difficult.

The effect of comorbidities on the return of continence was examined because coexisting conditions may cause physiological changes in the body that can influence the return of function postoperatively.[15,34] Pinkawa et al[34] found that the presence of diabetes affected the return of urinary function after prostate cancer treatment, possibly due to the microvascular and neurovascular damage. The current study showed that patient age was an independent predictor of early continence return after RARP after adjusting for comorbidities, suggesting that the poor incontinence outcomes in older patients may be more related to the declines in lean body mass and skeletal muscle with reduced neuronal excitability and plasticity[35,36] than the presence of coexisting diseases.

Several investigators[10,12,37] found that the extent of nerve sparing is independently associated with the return of continence 1 year after robotic or open

prostatectomy. We found that although presence of nerve sparing was not predictive of early continence, the majority (33/58 men; 57%) of those who received bilateral nerve sparing regained continence at 6 weeks compared to only 35.7% and 40% of those who received no or unilateral nerve sparing. Most investigations centered on factors associated with return of continence at 1 year, however, many men would benefit from characterization of factors associated with time to continence especially at an early time point such as 6 months. Therefore, further studies would help elucidate the relationship between nerve sparing and time to continence.

This study does not address the impact of posterior rhabdosphincter reconstruction on continence. The men included in this study all underwent a "Rocco" reconstruction as it is routine practice in our group. Although the study was not designed to test this technique, a match cohort of men without posterior reconstruction did not reveal any statistical improvement in early continence outcome when the two groups were compared. Although the impact on continence with a posterior reconstruction remains controversial, we routinely perform the technique for the secondary endpoints of decreased pelvic hematoma, decline in urinary leak, and decreased tension on the primary anastomosis.

The studies on the influence of BMI on urinary outcomes after RARP are inconsistent. Ahlering et al[38] found that obesity is significantly associated with worse urinary outcomes. However, we found that BMI is not adversely related to the urinary quality of life outcomes, in agreement with other studies with larger cohorts and higher obesity rates.[11,39]

There are several limitations to our study. Our definition of continence was strictly pad-free status, a single question response, and we did not assess the quality of life by using validated instruments to measure urinary function or bother postoperatively. Litwin et al[40] found that there were significant differences in the physician reports and patient self-assessments of quality of life after prostatectomy. This stresses the importance of recording urinary function and bother by validated scales such as the SF36v2 UCLA-PCI questionnaire.[41] We are currently using these forms to follow up on our patients, and will report on the outcomes after longer follow up. Secondly, the identities of the individual comorbidities would be an important asset to fully characterize the effect of comorbidities on the return of function. Lastly, the median follow up time was relatively short at 7.6 months, with only 57 men having more than 6 months of follow up. However, our primary aim was to address the return of continence at a time point of 6 weeks, because there was a paucity of literature regarding risk factors of early return of continence.

Conclusions

In conclusion, we found that increased age and increased LUTS severity are associated with decreased odds of achieving continence 6 weeks after RARP. Patient age remains the strongest predictor of early return of continence in a multivariate model. These factors should be used in counseling prior to surgery to meet realistic patient expectations. □

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EDITORIAL COMMENT

The present study prospectively evaluates 88 consecutive men undergoing RARP followed for a mean of 7.6 months. Urinary continence and predictors of earlier outcomes was sought. Significant findings included a younger age, a lower preoperative IPSS score were associated with continence at 6 weeks following surgery. Higher age (OR = 0.91, $p < 0.01$) and higher IPSS scores (OR = 0.28, $p = 0.03$) were associated with decreased odds of achieving continence at 6 weeks. The presence of coexisting disease was not predictive of continence return. After adjusting for comorbidity, BMI, nerve sparing, and IPSS score, only age remained as an independent predictor of early continence (OR = 0.90, $p = 0.04$). Such findings further support the current published literature on RARP urinary functional outcomes. Unfortunately, the follow up was not long enough to assess longer outcomes at 1 year.

Previously, Mendiola et al reported the impact of age on RARP continence outcomes.[1] A total of 300 patients with > 1 year follow up were evaluated with validated questionnaires. Assessments were performed preoperatively, and at 1, 3, 6, and 12 months following surgery. The three age groups included 21, 129, and 150 patients aged < 50, 50-59, and > 60 years old, respectively. Using Kaplan-Meier curves, younger men achieved continence (defined as 0 to 1 safety pad a day) significantly earlier than older age groups when age groups were compared using a 60-year-old cut off point ($p = 0.02$). However, continence was noted to be equal among all age groups after 1 year of follow up. It would be interesting to know if the present paper's patients also experienced a catch-up effect with longer follow up.

Recently, Shikanov et al have assessed the probability of achieving continence following RARP in elderly patients (> 70 years old).[2] The study cohort included 1436 RARP cases performed at the University of Chicago between 2003 and 2008. Continence (pad-free) status at baseline and 1 year after surgery were evaluated by the UCLA-PCI questionnaire. Among the cohort, 77 (5%) men were 70 years old or older. Age (OR = 0.97, p = 0.002), baseline I-PSS (OR = 0.98, p = 0.02) and Sexual Health Inventory for Men scores (OR = 1.02, p = 0.005) were independently associated with being pad-free. Predicted probabilities (95% CI) of postoperative 1 year continence at age 65, 70 and 75 years were 0.66 (0.63, 0.69), 0.63 (0.57, 0.68) and 0.59 (0.52, 0.66), respectively. In their experience, there appears to be an acceptable probability of achieving continence and potency after robotic radical prostatectomy in well-selected elderly patients.

As the current authors conclude, patient age remains the strongest predictor of early return of continence following radical prostatectomy (RP). Such a factor should be used in counseling prior to surgery to meet realistic patient expectations. As a urology community, we should continue to strive for surgical techniques such as posterior reconstruction[3] and local hypothermia[4] to help improve earlier and sustained post-RP urinary outcomes, particularly in those with higher risk features..

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