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Urodynamic Findings in Men Presenting with Incontinence After Open Versus Robotic Radical Prostatectomy

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ABSTRACT

Introduction: Urodynamic findings in patients with post-prostatectomy incontinence (PPI) following either an open radial retropubic prostatectomy or a robotic-assisted laparoscopic prostatectomy are not well described.
Methods: After IRB approval, we performed a retrospective review of urodynamic findings in patients presenting to our institution with PPI following either an open or robotic prostatectomy from 1985 through 2009.
Results: One hundred and twenty-six patients were identified for analysis (74 robotic, 52 open). Intrinsic sphincter deficiency was the cause of PPI in the majority of patients in both groups. Detrusor pressure at peak flow was significantly higher, and peak flow rate was significantly lower in patients who had undergone an open procedure. Anastomotic stenosis (AS) was also higher following an open procedure. Detrusor over- and underactivity were similar between the groups.
Conclusions: Following an open compared to a robotic prostatectomy, patients experienced elevated voiding pressures and decreased peak flows, presumably secondary to the increased incidence of AS observed in those patients.

INTRODUCTION

Radical prostatectomy (RP) continues to represent a gold standard in the treatment of localized prostate cancer. While providing excellent cancer control for patients, it has been consistently associated with urinary incontinence (UI) and erectile dysfunction [1-3]. Urodynamic findings in patients with UI following radical prostatectomy have been reported by several authors in an effort to characterize the nature of their incontinence. It is now widely accepted that intrinsic sphincter deficiency (ISD) is at least a contributing factor in the majority of men with post-prostatectomy incontinence (PPI) [4-10]. Chae and Mayo found sphincteric deficiency in 96% of men with PPI in their cohort, and it was the sole cause in over half [5].

Several other urodynamic findings following RP have been reported, including a decrease in bladder compliance (BC), a decrease in maximum cystometric capacity (MCC), and an increase in detrusor overactivity (DO) [6,8]. While improvements in these variables are seen over time in some patients, they often do not return to baseline on repeat urodynamic studies performed 3 years following RP [6,8].

More recently, detrusor underactivity (DU), or hypocontractility, has been reported on urodynamics in a number of patients following radical prostatectomy [11,6,9]. Damage to nerves innervating the bladder during prostatectomy has been suggested as a factor contributing to the decrease in contractility. Others have theorized that some of these men had dysfunctional bladders prior to surgery from years of benign prostatic hyperplasia and bladder outlet obstruction. These patients may have trained themselves over time to compensate with abdominal straining and therefore developed detrusor dysfunction and hypocontractility prior to RP.

While many have examined urodynamics in incontinent patients following RP, the difference in post-operative urodynamic

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parameters in patients who underwent radical retropubic (RRP) versus minimally invasive prostatectomy is not nearly as well reported. Here we report the results of urodynamic studies from patients who presented to us with PPI and compare findings from patients who underwent RRP to those who underwent a minimally invasive technique.

MATERIALS AND METHODS

Patients presenting to our institution with a chief complaint of persistent PPI undergo a standard evaluation, which includes a history and physical examination, urinalysis, office cystoscopy, and comprehensive urodynamic evaluation. Urodynamic assessment is performed in accordance with International Continence Society Standards [12]. Water cystometry is performed at room temperature with a fill rate of 10% of bladder capacity per minute based on a voiding diary. A 7 Fr dual lumen catheter is used for filling and intravesical pressure measurements, and a rectal catheter estimates abdominal pressure. At a fill of 200 ml, patients are asked to Valsalva and then cough to measure Valsalva leak-point pressure (VLPP). This is repeated at MCC and at several other time points during the fill, if necessary, to demonstrate incontinence. At capacity patients are asked to void to completion, during which the peak flow (Qmax) and detrusor pressure at peak flow (PdetQmax) are measured. Post-void residual (PVR) is then measured by catheter drainage after completion of voiding. The entire study is repeated at least once for each patient to ensure consistent results. Detrusor overactivity is defined as any uninhibited/inappropriate detrusor contraction during filling. Detrusor underactivity is defined as those patients with a Qmax < 15 ml/sec and a PdetQmax < 20 cm H_2O as previously described [11].

After approval from the local institutional review board, we identified patients with PPI presenting for evaluation between September 2006 and May 2011. Patients without complete urodynamic data and those with missing details regarding the surgical technique used for their prostatectomy were excluded. Data was obtained from a review of the office and inpatient medical records, and it included patient demographics, basic medical history, prostate cancer history, urodynamic parameters, and incontinence severity. The first urodynamic test obtained upon presentation was used for analysis. All urodynamic tests were performed at our institution with a single technician and a single physician interpreting each. All patients included in this analysis had either an open radical retropubic prostatectomy or a DaVinci robotic-assisted prostatectomy (DVP). Patients found to have an urethrovesical anastomotic stricture (AS) had their urodynamics obtained following treatment of the stricture.

Statistical analysis was performed using SPSS v 20 software. Continuous variables were compared using the Mann-Whitney U test, and categorical variables were compared with the chi-square test. Results were considered statistically significant if they had a P value ≤ 0.05 with a 2-tailed test.

RESULTS

One hundred and twenty-six patients presenting with PPI to our institution with available prostate cancer history and urodynamic results were included in the analysis. Of the 126 patients, 74 underwent a DVP from April 2001 through September 2009. The remaining 52 patients had a RRP performed between January 1985 and August 2008. As expected, given our transition from open to robotic prostatectomies, significantly more open procedures were performed early and more DVPs performed later in the series (P = 0.0005, Table 1). The average age at prostatectomy was 62.1 compared to 61.6 years in the robotic versus the open cohort (P = 0.3). The 2 groups were also similar in terms of race, body mass index, incidence of diabetes mellitus, tobacco use history, and history of prior pelvic radiation (Table 1). Significantly more patients in the open group had a history of an AS that was treated prior to undergoing urodynamic evaluation (6.8% versus 36.5%, P = 0.005), and pad use at presentation was higher in the open cohort (3.4 versus 4.6 pads per day, P = 0.006).

Urodynamics were obtained on each patient when they presented with a complaint of persistent PPI and were considering treatment options. On average, the study was performed 2.7 years following prostatectomy in the robotic cohort and 8.8 years following prostatectomy in the open group (P = 0.005). Urodynamic comparisons between the 2 groups are outlined in Table 2. Incontinence secondary, at least in part, to ISD (stress incontinence with VLPP < 100 cm H_2O) was demonstrated in 93.5% versus 93.7% (P = 0.62), and a VLPP of < 60 cm H2O was found in 59.4% and 65.2% (P = 0.34) of patients open and robotic groups, respectively. Patients with a history of an open procedure on average had higher detrusor pressure at peak flow (22 versus 27.8 cm H2O, P = 0.05) and a lower peak flow rate (18.7 versus 14.9 ml/sec, P = 0.016). When stratified further, a history of a previously treated AS was associated with higher detrusor pressures and lower peak flows in both the open and robotic cohorts (Table 3), suggesting AS as a contributing factor in those urodynamic findings. There were no significant differences between any of the other urodynamic variables tested, though there was suggestion of a trend towards higher rates of DO in the open group. Rates of DU were not statistically different between the open and robotic cohorts (18.9% versus 19.2%, P = 0.57).

DISCUSSION

Radical prostatectomy has been shown to have characteristic changes on urodynamics post-operatively. These urodynamic findings include an increase in the incidence of ISD, a decrease in cystometric capacity and bladder compliance, and an increase in both detrusor overactivity and detrusor under activity [5-11]. Some of these variables have been shown to improve with time, but even 3 years following prostatectomy, they may not

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Table 1. Patient demographics.

	DVP	RRP	*P* value
Age at prostatectomy (years ± SD)	62.1 ± 7.0	61.6 ± 6.7	$P = 0.3$
Year of prostatectomy			
Before 1990	0	2 (4%)	$\chi^2 = 49.53$, $P = 0.0005$
1990-1995	0	11 (22%)	
1996-2000	0	10 (20%)	
2001-2005	28 (38.4%)	20 (40%)	
2006-2009	45 (61.6%)	7 (14%)	
Race			
White	55 (74.3%)	37 (71.2%)	$\chi^2 = 2.87$, $P = 0.24$
Black	17 (23.0%)	10 (19.2%)	
Other	2 (2.7%)	5 (9.6%)	
Body mass index, kg/m² (mean ± SD)	28.5 ± 4.1	27.7 ± 3.5	$P = 0.29$
Diabetes mellitus	16 (21.9%)	12 (23.1%)	$\chi^2 = 0.023$, $P = 0.52$
Current tobacco use (pack/day ± SD)	0.04 ± 0.2	0.1 ± 0.34	$P = 0.37$
Former smoker	33 (45.2%)	29 (55.8%)	$\chi^2 = 1.36$, $P = 0.16$
History of pelvic radiation	11 (14.9%)	13 (25%)	$\chi^2 = 2.03$, $P = 0.12$
History of anastomotic stricture	5 (6.8%)	19 (36.5%)	$\chi^2 = 17.57$, $P = 0.0005$
Pad use at presentation, pads/day (mean ± SD)	3.4 ± 2.0	4.6 ± 2.4	$P = 0.006$

Mann-Whitney U: 2-tailed significance
Chi square: χ^2, 2-tailed significance

Table 2. Urodynamics.

	DVP	RRP	*P* value
Detrusor overactivity	19 (25.7%)	21 (40.4%)	$\chi^2 = 3.05$, $P = 0.06$
Detrusor underactivity	14 (18.9%)	10 (19.2%)	$\chi^2 = 0.002$, $P = 0.57$
VLPP, cmH_2O (mean ± SD)	55.9 ± 29.7	52.4 ± 32.8	$P = 0.35$
VLPP < 60 cmH_2O	38 (59.4%)	30 (65.2%)	$\chi^2 = 0.39$, $P = 0.34$
VLPP > 100 cmH_2O	4 (6.3%)	3 (6.5%)	$\chi^2 = 0.003$, $P = 0.62$
PdetQmax, cmH_2O (mean ± SD)	22.0 ± 17.3	27.8 ± 19.4	$P = 0.05$
Peak flow, ml/sec (mean ± SD)	18.7 ± 11.4	14.9 ± 11.2	$P = 0.016$
Post-void residual, ml (mean ± SD)	10.2 ± 30.7	13.6 ± 35.8	$P = 0.21$
Post-void residual > 50 ml	5 (6.8%)	3 (5.8%)	$\chi^2 = 0.05$, $P = 0.57$
Normal compliance	69 (93.2%)	51 (98.1%)	$\chi^2 = 1.57$, $P = 0.21$

Mann-Whitney U: 2-tailed significance
Chi square: χ^2, 2-tailed significance

have yet returned to baseline [6,8].

In this study we compared post-operative urodynamics in men presenting with PPI who had undergone an open or robotic prostatectomy. Our goal was to clarify whether a different surgical approach had variable effects on post-operative voiding patterns seen on urodynamics. Our data have echoed what many others have shown—that ISD contributes to PPI in the majority of patients.

In those patients who had undergone RRP, we demonstrated significantly higher voiding pressures and lower peak flow rates compared to their robotic counterparts. This phenomenon is at least partly explained by an increased incidence of treated anastomotic strictures in the RRP group. When these patients were excluded from the analysis, both of these urodynamic differences lost statistical significance. Additionally, patients with a history of AS all had significantly higher detrusor voiding pressures and lower peak flow rates compared to those without an AS history, regardless of the type of prostatectomy performed. Despite treatment, AS may continue to cause some increased outflow resistance as illustrated in these urodynamic findings. Given the extended follow-up in the open compared to the robotic cohort, it is difficult to make many inferences regarding the relative rates of AS in the 2 groups. Strictures may have developed in a higher proportion of patients undergoing a DVP if followed longer. That being said, others have also reported a higher rate of AS in men undergoing open compared to minimally invasive prostatectomy; therefore, we can speculate that this finding would remain significant regardless of extended follow-up.

Another objective of this study was to evaluate the relative rates of DU in these 2 groups, as previous studies have shown a higher incidence of DU in patients who had undergone a minimally invasive procedure [11]. Contrary to the work by Chung et al., our data did not show increased rates of DU in patients following DVP compared to men who had undergone an open procedure. We also found a lower rate of DU than previously reported, with less than 20% of either group having this urodynamic finding. There are several potential

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explanations for these disparate results. There was a significant time passage in both groups following prostatectomy before undergoing their urodynamic testing. As demonstrated by Giannantoni and colleagues, DU may improve with time, and had the urodynamics of our sample been performed earlier we may have seen higher rates [6]. However, Chung and associates did not show time lapse from prostatectomy to urodynamics to be predictive of risk for DU [11]. Further research to clarify this discrepancy is worthwhile.

Matsukawa and colleagues showed a significantly increased rate of DO in patients undergoing an open compared with a laparoscopic prostatectomy, which also accounted for some increased incidence of PPI in their series [7]. We did not find a statistically significant difference in DO between the 2 groups in our study, but we did have a *P* value approaching significance, suggesting that trend. It is possible that this is a true difference that may have been statistically significant with a more balanced follow-up between the groups. Similar to the discussion surrounding DU, it is plausible that open prostatectomy has a larger effect on bladder innervation, which leads to these changes in detrusor function.

There are several limitations to this study. First, it is retrospective in design and suffers from those inherent biases. Data on the surgical approach for prostatectomy and urodynamic results were not available on all patients, and therefore we were unable to evaluate the entire cohort of patients referred for PPI. This may have inadvertently biased our results by including more recent patients that have charts in the new electronic medical record that are often more complete. Additionally, more time passed in the open group prior to undergoing urodynamics, and robotic procedures were performed more frequently in more contemporary patients. This has the potential to inadvertently bias the findings on urodynamics between the 2 groups. Finally, many of the patients included in this analysis were referred from outside institutions, some of them specifically referred to undergo a male sling procedure as opposed to an artificial urinary sphincter. This could potentially have excluded patients with poor detrusor function, severe incontinence, or urgency and urge incontinence if those patients were not referred secondary to concerns by their primary urologist that these findings would preclude them from sling placement.

CONCLUSIONS

Stress urinary incontinence from ISD is the primary etiology of post-prostatectomy incontinence. Patients undergoing an open prostatectomy were more likely to have higher voiding pressures and lower peak flow rates, presumably, at least in part, due to a higher incidence of anastomotic strictures.

Table 3. Voiding pressure and flow in patients with versus without a history of a treated anastomotic stenosis following radical prostatectomy.

	PdetQmax	Peak Flow
DVP, AS	38.7	10.3
DVP, no AS	21.8	17.4
P value	0.003	0.025
RRP, AS	38.5	7.24
RRP, no AS	20.7	19.5
P value	0.025	0.019

Mann-Whitney U: 2-tailed significance

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