Characteristics and outcomes of men who fail to leak on intubated urodynamics prior to artificial urinary sphincter placement

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Introduction: *To report the characteristics and anti-incontinence outcomes of men who fail to demonstrate incontinence on intubated urodynamics (UDS).*
Materials and methods: *From 2005 to 2013, the records of men who underwent UDS prior to artificial urinary sphincter (AUS) were reviewed. The histories, UDS, endoscopies, and anti-incontinence outcomes of men who failed to demonstrate incontinence on intubated UDS were recorded. In our UDS protocol, the urodynamic urethral catheter was removed and the UDS was repeated to elicit incontinence without the urethral catheter. The valsalva leak point pressure (VLPP) was obtained via the rectal catheter in these men.*
Results: *All men were status post radical prostatectomy for prostate cancer. Nineteen percent (32) of the study population (169) had non-demonstrable incontinence on intubated UDS. Mean age at the time of UDS was 62 (range 48-81). All patients demonstrated incontinence on UDS upon removal of the urethral catheter. Their mean VLPP was 79.3 (SD 36.7). Fifty-six percent (18) of these men had an anastomotic stricture (AS) and 37.5% (12) had a history of radiotherapy treatment, of which six also had an AS. Mean pads per day at the time of UDS was 4.6 (SD 2.9). At a mean follow up of 40.7 months (SD 24.7) from AUS placement, mean pads per day was 0.87 (SD 1.2).*
Conclusions: *Men who fail to demonstrate incontinence on intubated UDS have a high rate of AS and history of radiotherapy treatment, which is a known cause for urethra fibrosis and scarring. Regardless, these men can achieve excellent anti-incontinence outcomes.*

Key Words: urinary incontinence, urodynamics, urinary sphincter, artificial, urethral stricture

Introduction

Urodynamics (UDS) are routinely performed in men with post prostatectomy urinary incontinence (PPI) prior to an anti-incontinence operation.[1] Reasons for performing UDS in this setting include assessing for detrusor dysfunction (mainly to document a reasonable storage reservoir), and measuring the valsalva leak point pressure (VLPP), which may quantify the degree of sphincter incompetence.

During the UDS, patients are prompted to valsalva with the goal of reproducing their incontinence. A urodynamic phenomenon seen in a subset of patients is the inability to reproduce a patient's incontinence with the urodynamic urethral catheter in situ. When this occurs, it is common practice to remove the urethral catheter, repeat the valasalva maneuver and leave the rectal catheter in place.[2] This maneuver invariably "unmasks" the patient's incontinence and allows for measurement of the VLPP via the rectal catheter.

It is unknown why this urodynamic phenomenon occurs. Despite its common occurrence in the urodynamic evaluation of men with PPI, it has not been studied as to why some men fail to leak on intubated urodynamics. Some authors have suggested that it may result from urethral scarring.[3,4] However, there are no studies to date that examine the incidence of urethral stricture in this cohort of patients, as diagnosed cystoscopically. As well, there are no studies that report the rate of radiotherapy exposure in this group of patients, which is a known cause for urethral injury and fibrosis.[5] We investigate whether this common urodynamic phenomenon truly results secondary to urethral fibrosis.

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We present the UDSs, endoscopies and anti-incontinence outcomes of men with symptoms of stress incontinence necessitating corrective surgery who experienced the urodynamic phenomenon of failing to leak on intubated urodynamics. We hypothesize that these men will have a high rate of anastomotic stricture and urethral scarring, as well as a high rate of exposure to radiotherapy.

Materials and methods

After obtaining IRB approval, records of men who underwent UDS at our institution between 2005 and 2013 prior to artificial urinary sphincter (AUS) placement were reviewed. Out of these, the histories, UDS, endoscopies and anti-incontinence outcomes of men that had no leakage on intubated UDS were recorded. All men had persistent bothersome PPI.

UDS in these men were conducted in a standard and similar fashion as described by Huckabay et al.2 A 7-F urethral catheter was used for all UDS. Patients who did not demonstrate leakage on intubated urodynamics were refilled to cystometric capacity and the urethral catheter was removed. They were instructed to valsalva and the VLPP was recorded from the rectal catheter. A single urologist interpreted the UDS.

Flexible cystoscopy was conducted in all patients after the UDS with a 16-F flexible cystoscope. The presence of an anastomotic stricture (AS) was noted and the size of the stricture was recorded. Patients with concomitant AS and PPI who were committed to an anti-incontinence procedure were treated with a staged aggressive transurethral bladder neck incision and AUS placement. AUS placement was contingent upon demonstrating successful AS treatment (defined by absence of stricture recurrence at a minimum of 6 weeks status post transurethral bladder neck incision). AUS placement was conducted in a standard fashion as previously described with the AMS- 800 (American Medical Systems, Minnetonka, MN, USA).[6]

Results

Baseline history

Out of 169 men that underwent UDS at our institution prior to AUS placement during the study period, 32 men (19%) had non-demonstrable leakage on intubated UDS. The mean patient age at the time of UDS was 62 (range 48-81). Of the 32 men who did not leak on intubated urodynamics, 20 underwent open radical retropubic prostatectomy, 6 underwent laparoscopic radical prostatectomy, 4 underwent robotic assisted laparoscopic radical prostatectomy and 2 underwent open salvage radical prostatectomy. Mean time from prostatectomy to UDS in these men was 3.86 years (SD 3.8). Mean time from UDS to AUS placement was 7 months (SD 9.1). Mean follow up after AUS placement was 40.7 months (SD 24.7).

Urodynamics

UDS results of the 32 patients, who did not leak on intubated urodynamics, are presented in Table 1. No patient had a clinically significant elevation in post void residual urine volume. While five patients had detrusor overactivity, none had associated detrusor overactivity incontinence. Mean cystometric capacity was 307 mL.

TABLE 1. **Urodynamics parameter of patients who did not leak on intubated urodynamics**

1st sensation (mL)	113.5 (SD 98.1)
1st urge (mL)	169.9 (SD 91.3)
Severe urge (mL)	273.8 (SD 114.7)
Cystometric capacity (mL)	306.5 (SD 119.2)
Compliance (mL/cm H_20)	39 (SD 30)
Presence of detrusor overactivity (no. patients)	5
Qmax (mL)	7.5 (SD 6.7)
BOOI	9 obstructed 23.26 (SD 33.8)
Detrusor underactivity (no. patients)	8
VLPP without catheter (cm H_20)	79.3 (SD 36.7)
PVR (mL)	10.9 (SD 20.8)

BOO = bladder outlet obstruction; VLPP = valsalva leak point pressure; PVR = post void residual

None of the patients had demonstrable or radiographic leakage with the 7-F urethral catheter in situ. All 32 patients leaked on urodynamic testing without the urethral catheter. Nine patients were obstructed, three were equivocally obstructed and 20 were unobstructed according to the Abrams-Griffiths nomogram. Of the nine obstructed patients, eight had AS. Eight of the 32 patients had detrusor underactivity defined by Qmax ≤ 15 mL/sec and PdetQmax ≤ 20 cm H_20. Of these eight patients, two had an AS. Mean VLPP taken from the rectal catheter was 79.3 cm H_20 (SD 36.7).

Anastomotic stricture and history of radiotherapy

Of the 32 men who did not leak on intubated urodynamics, 18 (56%) had an anastomotic stricture. Fifteen men had an AS on cystoscopy at the time of UDS and three men had a history of AS that had been previously treated prior to UDS. The 15 men who were diagnosed by cystoscopy at the time of UDS had a mean AS size of 7.8F (SD 3.5). Of the men with AS, six had a history of radiotherapy treatment (four had undergone adjuvant radiotherapy [70.2 Gy-72 Gy] and two patients had undergone salvage prostatectomy after treatment with 81 Gy and 50.4 Gy + brachytherapy). Six patients had a history of receiving adjuvant radiotherapy but were not found to have a stricture on cystoscopy [range 50.4 Gy-70.2 Gy]. Eight patients had no history of radiotherapy or stricture on cystoscopy. Figure 1 illustrates the percentage of men who did not leak on intubated UDS who had AS and/or a history of radiotherapy exposure.

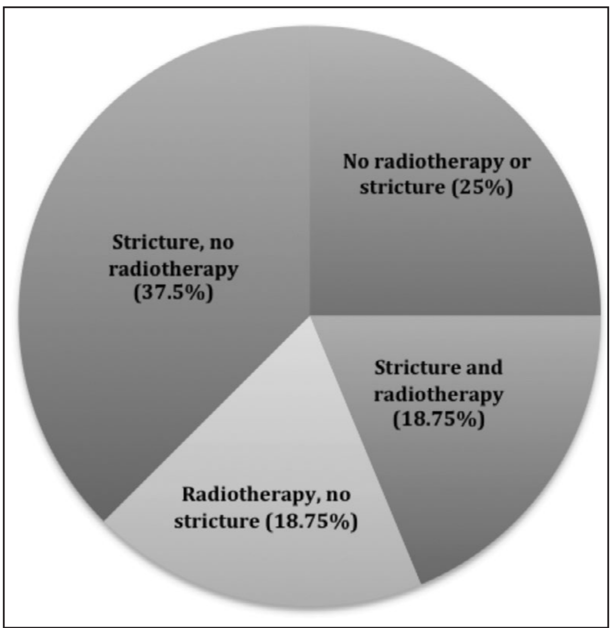

Figure 1. Percentage of men who had anastomotic stricture and/or a history of radiotherapy treatment.

Anti-incontinence outcomes

All of the 32 men who did not have demonstrable leakage on intubated urodynamics complained of bothersome urinary incontinence. Mean pads per day at the time of urodynamics were 4.6 (SD 2.9). Implanted AUS cuff size was 4 cm in 21 patients, 4.5 cm in five patients, 5 cm in three patients, and 5.5 cm in three patients. A 61 cm-70 cm water pressure-regulating balloon was used in all patients. Nine of the 32 men (28%) required AUS revision. AUS cuff size was downsized in seven patients, one patient required AUS removed in order to treat a recalcitrant AS (patient who underwent salvage prostatectomy after combined external beam radiotherapy/brachytherapy), and one patient had their AUS replaced for malfunction. The mean time from AUS placement to revision was 17.5 months (SD 20.1). At a mean follow up of 40.7 months (SD 24.7) from AUS placement, the mean number of pads per day was 0.87 (SD 1.2).

Discussion

Post prostatectomy urinary incontinence is a well-established complication of radical prostatectomy with a varying reported incidence.[7] Multiple studies have investigated the urodynamic findings of men with PPI.[8-11] These studies have shown the majority of men with PPI have intrinsic sphincter deficiency (ISD). Other etiologies for PPI found on UDS include detrusor dysfunction and concomitant detrusor dysfunction/ISD.[12,13]

AUS placement is considered the gold standard treatment for PPI with excellent success rates reported.[14] UDS play an important role in the management of patients with PPI who are committed to an anti-incontinence operation to rule out detrusor dysfunction and confirm ISD. UDS may also provide information as to quantifying the degree of sphincter incompetence as measured by the VLPP.

The urodynamic urethral catheter may artifactually change the results of the UDS. Smith et al demonstrated the VLPPs, taken from the rectal catheter in 20 men with PPI, were lower after removal of the 7-F urethral catheter.[3] Flood et al reported that of 21 men with incontinence, 10 only demonstrated leakage without a 10-F urethral catheter.[15] Undoubtedly, the urodynamic urethral catheter impacts the results of the urodynamic evaluation of men with PPI.

The mechanism as to which the urethral catheter prevents leakage during the UDS in men is unclear.

Groutz et al suggested that the urethral catheter might cause obstruction in men with a poorly compliant urethra.[4] They used a difference > 10 mL between Qmax on intubated uroflow and free uroflow to define poor urethral compliance. Urethral scarring and poor compliance may also be an etiology for ISD and PPI. Tuygun et al measured urethral fibrosis on pelvic MRI in patients with and without PPI.[16] They found that men with PPI had more urethral fibrosis than in men without PPI and suggested that urethral fibrosis may contribute to ISD by damaging the urethral sphincter. Paparel et al graded the severity of urethral fibrosis on post prostatectomy MRI and found that men with severe fibrosis had a tendency to have worse incontinence, although this association was not found to be statistically significant.[17]

The urodynamic phenomenon of the 7-F urethral catheter "masking" PPI is common. Huckabay et al demonstrated that 35% of 60 men with PPI did not leak on intubated UDS.[2] As measured from the rectal catheter, they found that these men had a higher VLPP than those men who did leak on intubated UDS. Their study focused on the urodynamic evaluation of men with PPI. Although they paid specific attention to men who did not have a VLPP on intubated UDS, endoscopies or anti-incontinence outcomes were not reported for these patients.

In the current study, we report the cystoscopic findings and anti-incontinence outcomes in men who demonstrate the urodynamic phenomenon of not leaking on intubated UDS and then having incontinence "unmasked" by removal of the urethral catheter. Of the 32 men who demonstrated this phenomenon, 15 had a concomitant stricture at the time of UDS and 3 had prior treatment for stricture disease. Therefore 56% of men in this group had visible evidence of urethral scarring. Of the other 44% of men who had no history of visible stricture, 43% had a history of radiotherapy, which is a known risk factor for urethral injury and fibrosis. Therefore, in our cohort of men, only 25% of patient who had non-demonstrable leakage on intubated UDS had no history of stricture or radiotherapy.

Aside from urethral scarring, there are other potential etiologies for this UDS phenomenon in the 25% of patients who had no findings of stricture or history of radiotherapy. The 7-F urethral catheter may cause discomfort to the patient and lead to an intensified contraction of the pelvic floor during valsalva. Another possible explanation is that patients may have generated a higher valsalva pressure without the urethral catheter in situ, which lead to demonstrable leakage. It is also possible that patients may not have been filled to true capacity. This is unlikely, as in our UDS protocol, all patients are filled to maximum cystometric capacity. Furthermore, in our UDS protocol, if a patient does not leak with the urethra catheter in situ, they are refilled to a similar capacity before removing the UDS catheter. Lastly, leakage produced without the urethral catheter could represent urge incontinence that could not be measured given absence of the urethral catheter. This is highly unlikely given the low rate of DO in this group (two men without AS). Therefore, we consider this etiology to be unlikely. Urethral scarring and stricture disease should be considered as the primary etiology for this UDS phenomenon.

Prior literature has demonstrated the efficacy of AUS implantation is patients with adverse implantation features.[18] Walsh et al studied the AUS outcomes in 98 men with PPI and demonstrated that patients who received radiotherapy had a similar improvement in incontinence compared to those patients without a history of radiotherapy.[19] However, patients treated with radiotherapy did have a statistically higher revision rate (44%) compared to those who were not treated with radiotherapy (11%).

Even in cases where revision is required, patients can still achieve excellent anti-incontinence outcomes. Raj et al studied patients who required a secondary AUS procedure (revision or replacement) and compared their anti- incontinence outcomes to the outcomes of patients after their first procedure.[20] They found a similar anti-incontinence outcome in patients who underwent primary and secondary AUS implantation, supporting the efficacy of AUS revision and replacement.

In our series of patients who did not leak on intubated urodynamics, excellent anti-incontinence outcomes were achieved. The mean pads/day after AUS placement (including revisions) in this group of patients was 0.87. Similar to published series on AUS implantation in patients with adverse implantation features and/or radiotherapy, 28% of these patients required revisions. These patients too ultimately had excellent outcomes after revision. Therefore, we believe that although not leaking on intubated UDS is secondary to urethral scarring and poor urethral compliance, these men can still be successfully treated with AUS. They should be counseled however that they might be at an elevated risk of requiring revision.

The main limitation of this paper is the lack of a control group. Given the small sample size, the heterogeneity of this group, the fact that not all patients that underwent AUS surgery had UDS at our institution, and the retrospective nature of this study, it would be difficult to match these patients with similar controls. Although a n = 32 is the largest cohort available describing men who fail to leak on intubated UDS, it is not large enough to allow for statistical comparison of a control group, taking into account and controlling for other variables (type of prostatectomy, age, comorbidities, etc). Similarly, although we have previously shown that there is a higher rate of urodynamically proven detrusor underactivity in the laparoscopic/robotic prostatectomy population versus open,[21] the small sample size of patients in the current study (22 open versus 10 laparoscopic/robotic) prohibited testing if the type of prostatectomy affected the occurrence of the urodynamic phenomenon studied. Notably, the rate of AS in this group of patients was markedly higher than the 4% rate of symptomatic AS that was found at our institution after radical prostatectomy in a prior published report.[22] This would support that urethral scarring is the etiology for failing to leak on intubated UDS.

Conclusion

Failure to demonstrate leakage on intubated urodynamics is a common urodynamic phenomenon seen in the evaluation of men with PPI. These men have a high rate of anastomotic stricture. A history of radiotherapy, which is known to reduce compliance, was also common in this cohort. Similar to men with adverse implantation features, these men can achieve excellent anti-incontinence outcomes with AUS, although they should be counseled that they might be at elevated risk of requiring revision. □

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