Urodynamic parameters evolution after artificial urinary sphincter implantation for post-radical prostatectomy incontinence with concomitant bladder dysfunction

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Introduction: *Urodynamic assessment is strongly recommended before artificial urinary sphincter (AUS) implantation. Detrusor overactivity (DO) and/or hypersensitivity and/or mild loss of compliance are frequently demonstrated in post prostatectomy incontinence. The aim of this study was to evaluate urodynamic parameter changes before and after AUS implantation in patients with urinary incontinence post-radical prostatectomy (RP) and concomitant urodynamic bladder abnormalities.*

Materials and methods: *We performed a retrospective review of charts pre- and post-AUS implantation. Sixteen out of a cohort of 52 patients met our inclusion criteria: stress urinary incontinence (SUI) due to RP and bladder dysfunction (early bladder sensation and/or low compliance and/or small bladder capacity and/or the presence of DO).*

Results: *The mean age of these 16 patients was 68 ± 6.3 years, and the duration of incontinence was 3 ± 2.7 years. The number of pads/day was 5.7 ± 2.3 before AUS implantation, and 1 ± 0.7 after implantation. Average time for the last post-implantation UDS was 43 months (range 7 to 73 months). Comparison of pre- and post-AUS implantation urodynamic parameters revealed statistically significant improvement in bladder capacity from 271 ± 117 to 295.6 ± 151 mL ($p = 0.05$), bladder compliance from 7.6 ± 3.95 to 12.5 ± 10.3 mL/cmH_2O ($p = 0.03$), and decrease in DO from 50% to 25% on cystometrograms.*

Conclusion: *Preoperative urodynamic abnormalities improved after AUS implantation. Thus, mild bladder dysfunction should not be a contraindication to AUS placement for SUI post-RP.*

Key Words: stress urinary incontinence, overactive bladder, bladder compliance, radical prostatectomy, bladder dysfunction, detrusor overactivity, artificial urinary sphincter, urodynamics

Introduction

It is common for patients with post-prostatectomy incontinence (PPI) and concomitant bladder dysfunction (BD) to undergo artificial urinary sphincter (AUS) implantation.[1-4] BD after radical prostatectomy (RP) may present as involuntary detrusor contractions, impaired bladder-filling sensation, low bladder compliance (BC) and blighted detrusor contractility. It has been suggested that these dysfunctions may occur *de novo* during surgery with bladder neck denervation. However, they may also be induced by pre-existing long term bladder outlet obstruction or arise as a consequence of bladder aging.[1]

Routine preoperative urodynamic testing in patients with PPI has recently been challenged. A few studies indicate that concomitant BD, even if demonstrated in urodynamic assessment, might not compromise the success of AUS placement,[5-8] but still urologists are hesitant to implant AUSs in patients with reduced bladder capacity and/or impaired BC and/or detrusor overactivity (DO). The possibility of worsening these dysfunctions, generated by increased outlet resistance, remains a nightmare for urologists. We are surprised not to encounter reports, in the literature, on the evolution of BDs after AUS implantation.

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The aim of the present study was to evaluate the symptoms and urodynamic parameters of patients being treated by AUS to correct PPI and associated BDs. The evolution of BDs after AUS implantation was investigated.

Materials and methods

After institutional review board approval, we examined the charts of all 52 patients undergoing AUS implantation between 1990 and 2005 to correct PPI. Every patient gave informed consent. Of these 52 charts, 16 met our inclusion criteria of PPI and urodynamically-proven BD. All other 36 charts concerned patients with stable, normo-compliant bladders.

The inclusion criteria were DO and/or reduced BC and/or diminished bladder capacity. The diagnosis of urinary incontinence (UI) was based on symptoms strongly related to effort and/or coughing or sneezing and a positive stress test. The stress test was performed in the seated position during urodynamics assessment and in the standing position during initial physical examination.

The exclusion criteria were pure stress incontinence, BD of neurological origin and severe bladder neck or urethral stricture. Pre and post AUS implantation analysis included: complete medical history with recorded incontinence symptoms, frequency of diurnal and nocturnal voiding measured by voiding diary, number of pads/day, use of anticholinergic drugs, and history of pelvic radiation.

Multichannel urodynamics (Laborie Medical Technology, Mississauga, ON, Canada) were analyzed according to our standard technique with patients in the seated position and water instilled as medium at room temperature (50 mL/min). Bladder filling and pressures were monitored by dual-lumen, 8F urodynamics catheter (Laborie Medical Technology), and abdominal pressure, with an 8F rectal balloon catheter (Life-Tech, Inc. USA).

Detrusor pressure was defined as vesical pressure minus abdominal pressure. The filling cystometry parameters recorded were: first sensation, bladder capacity at maximum filling or at first contraction, detrusor leak point pressure, and detrusor compliance. The same test was undertaken before and after AUS implantation.

DO was characterized as involuntary bladder contractions of any magnitude during the filling phase on cystometry, even if not associated with urge. First sensation was considered when the patient became aware of bladder filling. Cystometric bladder capacity, defined as the volume at which patients cannot delay voiding any longer, was deemed to be abnormal if less than 350 mL. BC was calculated by dividing the change in bladder volume by the variation in detrusor pressure from the beginning of filling to either the end of filling or the occurrence of first uninhibited contraction. BC was considered to be reduced if it was less than 20 mL/cmH_2O, and severely decreased if less than 10 mL/cmH_2O.

Statistical analysis of the urodynamic parameters was conducted with StatDirect software before and after AUS implantation. Statistically significant differences were defined as $p < 0.05$ by Student's t test.

TABLE 1. **Demographic data**

Parameters	No.	Mean ± SD
Patients	16	
Age (years)	53-78 range	68 ± 6.34
Duration (years)	1-5 range	3 ± 2.7
Medical problems		
Hypertension	8 (50%)	
Dyslipidemia	4 (25%)	
Ischemic heart disease	3 (18.8%)	
Diabetes mellitus	2 (12.5%)	
Bronchial asthma	1 (6.3%)	
Radiotherapy	5 (31.3%)	

Results

All 16 patients suffered UI as a consequence of intrinsic sphincter deficiency (ISD) with concomitant BD. Their mean age was 68 ± 6.34 years (range 53 to 78), and the mean duration of UI before AUS implantation was 3 ± 2.7 years. Patient demographics are summarized in Table 1.

Table 2, which compares pre and post AUS implantation symptoms, shows significant improvement of all symptoms assessed. Table 3 enumerates the

TABLE 2. **Comparison of pre and post implantation symptoms**

Symptoms	Before AUS	After AUS	p value
Frequency/day	6.7 ± 1.5	4.8 ± 0.5	0.001
Nocturia/night	2.9 ± 1	0.26 ± 0.9	0.003
Urgency ± urge incontinence	8 (50%)	2 (13.3%)	0.001
Number of pads/day	5.7 ± 2.3	1 ± 0.7	0.001

TABLE 3. **Urodynamic parameters pre and post AUS implantation**

Urodynamic parameters	Before AUS	After AUS	p value
First sensation (mL)	171 ± 81	165 ± 99	0.2619
Bladder capacity (mL)	271 ± 117	296 ± 151	0.0468
Bladder compliance (cmH_2O/mL)	7.6 ± 3.95	13±10	0.051
DO (number of patients)	8	4 (50%)	0.05
P_{det}@capacity (cmH_2O)	39 ± 18	40 ± 34	0.2918
ALPP (cmH_2O)	58 ± 23	101 ± 51	0.0563
1-hour pad test (g)	55 ±3 9	n/a	

DO = detrusor overactivity; P_{det}@capacity = detrusor pressure at capacity; ALPP = abdominal leak point pressure

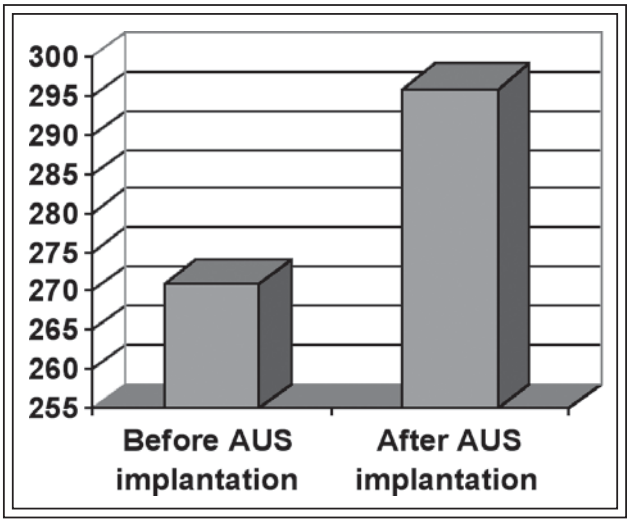

Figure 1. Bladder capacity before and after AUS implantation.

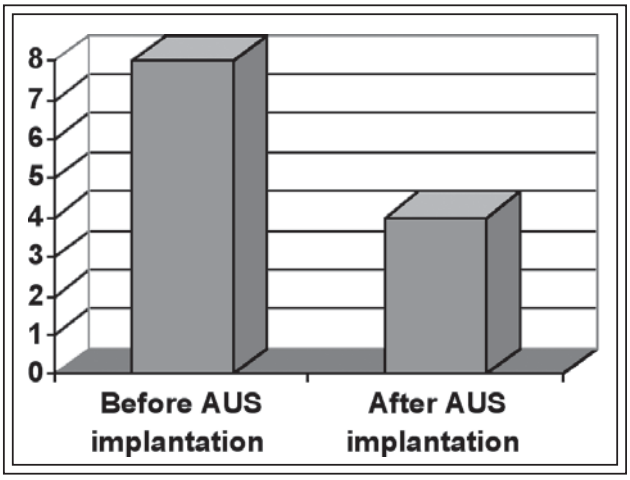

Figure 2. Detrusor overactivity before and after AUS implantation.

urodynamic parameters pre and post implantation. Comparison of these parameters revealed statistically significant restitution of bladder capacity, BC and DO; however, first sensation and detrusor pressure at capacity did not change significantly.

Bladder capacity, which was 271 ± 117 mL before AUS, increased to 296 ±151 mL after AUS implantation, Figure 1. DO was present in eight patients, and disappeared in four (50%) of them postoperatively, Figure 2. Furthermore, BC was impaired in all patients before AUS with a mean of 7.6 ± 3.95 cmH_2O/mL, and recovered significantly in all patients after implantation, with a mean of 13 ±10 cmH_2O/mL, Figure 3.

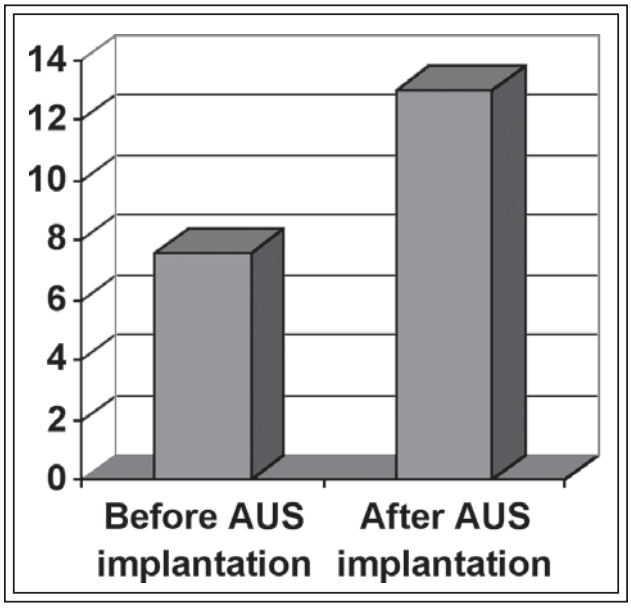

Figure 3. Bladder compliance before and after AUS implantation.

Discussion

UI remains one of the most common complications after RP, causing significant impairment of patients' quality of life.[9] Its incidence varies between 8% and 77%, depending on the authors and their definition of incontinence.[10,11] BD is a significant component of UI post-RP.[1,4,8] It is found in up to 60% of patients.[1,2] Thiel et al reported that 43% of their patients had either low or reduced BC or DO.[7] They also showed that the presence of BD did not worsen clinical outcomes after AUS implantation.[7]

Urologists may be hesitant to implant AUSs in patients with low BC and/or DO because of their experience with neurogenic bladders. In our practice, we usually considered these BDs after RP to be mainly due to bladder de-functionalization secondary to constant leakage. Our study was designed to verify that AUS implantation is not contraindicated in patients with non-neurogenic bladder overactivity and/or impaired BC.

Ficazzola and Nitti evaluated UI in 60 patients post-RP and recorded a 45% incidence of BD as a etiological component.[2] In other studies, a weak sphincter combined with BD was diagnosed in 39%.[1] Reduced BC and DO represent *de novo* BD probably due to bladder denervation during RP.[12] In our experience, ISD combined with BD occurred in 50% of patients.

Sensory urgency with or without urge incontinence is one of the major symptoms of these patients. It has been observed in 30% to 50% of cases.[2,5,7] In our cohort, 50% of patients had symptoms of urgency and urge incontinence that disappeared in most cases after AUS implantation.

Reduced BC is relatively frequent (8%-39%) in patients post-RP.[2-5,7,9,13,14] On the other hand, Winters et al noted a significant decrease in bladder capacity among patients with PPI and DO.[15] In our group of patients, we saw that these two parameters improved significantly after AUS implantation ($p = 0.05$), and DO even disappeared in 50% of patients.

The incidence of *de novo* DO ranges in the literature from 25 to 77%.[9,13] Moreover, most of the time, it is associated with other urodynamic dysfunctions.[9,13] According to Thiel et al, DO was present in 51/86 patients with symptoms of urgency, and 39 patients had persistent DO after AUS placement.[7] Groutz et al evaluated the cause of post-RP incontinence and reported mixed urinary incontinence (MUI) in 33.7%, but it was the sole urodynamic finding in only of patients 3.6%.[16] Winters et al recorded a very similar incidence of MUI in 34% of patients and DO alone in 3.3%.[15] MUI occurred in 50% of our patients.

Conclusion

To our knowledge, this is the first report on the evolution of urodynamic parameters after AUS implantation. We observed significant improvement in BC, cystometric capacity and detrusor function. Thus, BD should not be a contraindication to AUS placement to correct incontinence after RP. Our results are in accordance with recently published literature. Even the presence of multiple adverse urodynamic parameters in the same patient should not be a contraindication to AUS implantation. □

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