

Characterization of men with lower urinary tract dysfunction after surgical management of benign prostatic obstruction

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ABSTRACT

OBJECTIVE: To characterize the symptoms and urodynamic findings of men with lower urinary tract dysfunction after a transurethral resection of the prostate (TURP).

MATERIALS AND METHODS: A total of 123 consecutive men with lower urinary tract dysfunction after surgical treatment for lower urinary tract symptoms (LUTS) were analyzed. Men with prostate cancer, stricture, multiple TURPs, radical prostatectomy or prostate cancer treatment were excluded. Parameters assessed by urodynamics included bladder capacity, detrusor contractibility, pressure flow study, and post void residual. Analysis of the variance was used to compare outcomes of urodynamic parameters between the primary diagnoses.

RESULTS: Mean age at TURP was 68 years (range 39 to 88). Symptoms included frequency (68%), nocturia (53%), urgency (44%), and retention requiring catheterization (17%). A total of 72 men (59%) were diagnosed with bladder outlet obstruction (BOO), 30 (24%) with impaired detrusor contractility (DU), and 21 (17%) with detrusor over activity (DO). Among these groups, there was no difference in duration of recurrent symptoms, AUA symptom score, Quality of Life score, or prostate size. Maximum flow was significantly less and post-void residual significantly greater in both BOO and DU groups. Bladder capacity was significantly higher in DU.

CONCLUSIONS: In the modern era, bladder outlet obstruction was the most common cause of recurrent lower urinary tract dysfunction after surgical management of BPO.

Keywords: BPO, TURP, BOO, detrusor overactivity, detrusor underactivity

INTRODUCTION

Transurethral resection of the prostate is the gold standard surgical treatment for lower urinary tract symptoms due to benign prostatic obstruction (BPO). There are several accepted techniques for resection, including laser, which has efficacy equivalent to TURP [1].

Despite the widespread use of the TURP procedure, up to a third of patients undergoing a TURP experience recurrent LUTS [2]. Common storage and voiding complaints include frequency, nocturia, urgency, retention requiring catheterization, incomplete bladder emptying, and slow urinary stream. Etiology of these recurrent symptoms can include bladder outlet obstruction, detrusor over activity or under activity, or may be independent of the previous TURP and is simply secondary to aging.

Established risk factors for TURP complications include increasing age, prostate size greater than 31 cc, medical history of urinary retention requiring catheterization, and pre-operative PVR [3-5]. Few studies have examined this population; therefore, we characterized men with recurrent lower urinary tract dysfunction after a surgical resection of

the prostate.

MATERIALS AND METHODS

After obtaining IRB approval, data was collected on 129 men who had surgical resection of the prostate and had recurrent LUTS for at least 6 months.

Prior to urodynamic evaluation, patients completed the American Urological Association (AUA) symptom index. Complete medical history, physical examination, and serum prostate specific antigen (PSA) were performed and assessed. Men with multiple TURPs, radical prostatectomy, prostate cancer treatment, urethral stricture, and neurogenic bladder were excluded from the study. Prostate size was identified via transrectal ultrasound at time of UDS.

All patients underwent videourodynamic evaluation, including measurement of vesical and abdominal pressure during filling and voiding. Conventional UDS was performed following the recommendation of the

International Continence Society Good Urodynamics Practice protocol [6]. Bladder pressure, abdominal pressure, and detrusor pressure were assessed in the seated position. Bladder pressure was monitored using a dual lumen 7F catheter, inserted transurethraly into the bladder. Abdominal pressure was recorded with the use of a standard rectal balloon catheter. Abdominal pressure was subtracted from total vesical pressure to determine detrusor pressure. Medium-fill cystometry was performed at 30 to 50 ml per minute with 30% diatrizoate maglumine. Videourodynamic findings were interpreted by an experienced urologist and were reviewed retrospectively for confirmation. Diagnoses were made at time of UDS and additionally confirmed retrospectively. Urodynamic studies were performed and reviewed without knowledge of AUA symptom index. Studies were reviewed manually to eliminate any testing artifacts and to accurately determine detrusor over activity, maximum urinary flow, detrusor pressure at maximum flow, bladder capacity and post-void residual (PVR).

The cohort was split into three groups: bladder outlet obstruction, detrusor over activity, and detrusor under activity based upon UDS findings. BOO is characterized by increased detrusor pressure and reduced urine flow rate and was determined by an Abrams-Griffiths number of above 40 [7]. DO is characterized by involuntary detrusor contractions during the filling phase which may be spontaneous or provoked. DU is defined as a contraction of reduced strength and/or duration, resulting in prolonged bladder emptying and/or a failure to achieve complete bladder emptying within a normal time span. A DU diagnosis was based on a pressure at maximum flow of less than 30 cmH₂O and maximum flow of less than 12 ml/sec. To assess detrusor contraction strength the projected isovolumentric pressure (PIP) was calculated [8]. The primary diagnosis was utilized to assign groups. Comparisons of symptom scores between the three groups were conducted by one-way analysis of the variance with the significance level set to $p=0.05$. Student's *t* test was used to analyze symptom scores for detrusor over activity. Other variables analyzed in respect to pressure-flow results and detrusor over activity included age, length of time since TURP, PVR and bladder capacity. Duration of LUTS was reported by patients at time of UDS. Symptom scores were compared to detrusor pressure, PVR and bladder capacity. Correlation coefficient *r*² was used. Analyses were conducted using Microsoft StatPlus (2009 AnalystSoft).

RESULTS

The cohort had a mean age of 68 years (range 39 to 88 years). A third of the cohort (41 men) had laser TURP procedure while the rest had the traditional TURP. No significant difference was observed in the proportions of laser TURPs between the three diagnostic groups. Reported LUTS included frequency (68%), nocturia (53%), urgency (44%), retention (17%), incomplete bladder emptying (10%), slow urinary stream (7%), and hematuria (6%). The cohort's mean AUA and QOL scores at time of UDS were 17.1 and 4.4, respectively. The cohort's mean PVR, bladder capacity, and Qmax were 347 ml, 510 ml, and 5.1 ml/sec, respectively. Mean time between initial TURP and UDS was 7.5 years for the cohort and 6.4, 8.9, and 7.0 years for BOO, DU, and DO groups, respectively. The cohort reported suffering from LUTS for an average of 4.03 years before UDS.

UDS findings diagnosed 59% of the cohort with BOO, 24% with impaired detrusor contractility, and 17% with detrusor over activity

(Table 1). In the BOO cohort ($n=72$), the mean age was 68 years. The mean duration of LUTS were 4.31 years and had an average prostate size of 44.9 cc. Mean AUA Symptom score and Quality of Life score were 17.7 and 4.4, respectively. Reported LUTS included frequency (71%), nocturia (58%), and urgency (44%). Mean bladder capacity, bladder compliance, and PVR were 443 ml, 34 ml/cm H₂O, and 345 ml, respectively (Table 2). Maximum flow was 3.2 ml/sec, at a pressure of 60.3 cmH₂O. Mean Abrams-Griffiths number was 53.8. Of those with BOO as primary diagnosis, 53% ($n=38$) had DO as a secondary diagnosis.

The DU cohort was comprised of 30 men with a mean age of 66 years and mean prostate size of 37 cc. Mean AUA Symptom score and Quality of Life score were 17.4 and 4.6, respectively. LUTS persisted on average 3.81 years and included frequency (57%), retention (37%), nocturia (33%), and urgency (30%) (Table 1). Mean bladder capacity, bladder compliance, and PVR were 751 ml, 63.1 ml/cmH₂O, and 546 ml, respectively. Maximum flow was 4.6 ml/sec, at a pressure of 24.4 cmH₂O. Mean PIP was 47 ± 20 suggesting a very weak contraction (50-100 weak contraction) [9]. Almost half ($n=14$) of the men with DU had a secondary diagnosis of impaired bladder sensation.

Men with DO ($n=21$) had a mean age of 71 years and mean prostate size of 47.2 cc. Symptoms persisted on average 2.72 years. Mean AUA Symptom score and Quality of Life score were 17.4 and 4.6, respectively. Reported LUTS included frequency (76%), urgency (71%), and nocturia (62%). Mean bladder capacity, bladder compliance, and PVR were 404 ml, 38 ml/cmH₂O, and 105 ml, respectively. Maximum flow was 13 ml/sec, at a pressure of 36.6 cmH₂O.

ANOVA between the three groups determined that there was no significant difference in age at TURP, time between TURP and UDS, or duration of LUTS ($P > 0.05$). Similarly, the AUA symptom score and QOL score did not differ greatly. Prostate size was slightly smaller in DU men when compared to DO or BOO men, but the difference was not significant. When comparing the urodynamic findings, all ANOVA comparisons were significantly different with $P < 0.001$ (Table 2).

DISCUSSION

Transurethral resection of the prostate is the gold standard for BOO and has been utilized since the early 1900s. Considering the long history of use and technological advances, still a substantial portion of patients undergoing surgical treatment experience recurrent lower urinary tract dysfunction.

The cohort's average age at first TURP was 68 years, and they were on average 75 years when they sought medical care for recurrent LUTS (Table 1). Age alone can be a secondary cause of LUTS, independent of past TURP interventions. Increasing LUTS could be attributed to increased prevalence of detrusor over activity at older ages [4]; although, contradicting evidence argues that age is not a risk factor for failed-TURPs or detrusor over activity [5,10]. The cohort average age is comparable to the national average age of patients undergoing TURP at 69 years old, suggesting these patients are not at a higher risk of recurrent symptoms or failed procedure [11]. Additionally, there was no significant difference between the three diagnostic groups in either age at TURP or time between TURP and UDS. Djavan et al. concluded that receiving a TURP at the age of 80 years or older puts the patient at a significantly higher risk of TURP failure [12]. Our cohort included only 10 patients (8%) above the age of 80, and therefore cannot suffi-

ciently reproduce this relationship. Men with a history of hypertension or diabetes have a significantly greater likelihood of LUTS, even after

adjusting for age [13,14]. In this cohort, over half (51%) of the men had hypertension and 19% had diabetes at the time of UDS.

Table 1. Characteristics of post-TURP diagnostic groups.

Characteristic (mean ± SD)	Cohort (n=123)	BOO (n=72)	DU (n=30)	DO (n=21)
Age at TURP	68 ± 9.2	68 ± 8.5	66 ± 11	71 ± 8.6
Time between TURP and UDS	7.1 ± 7.4	6.4 ± 6.6	8.9 ± 9.6	7.0 ± 6.0
Patient Reported Duration of Symptoms (years)	4.03 ± 4.2	4.31 ± 4.0	3.81 ± 5.0	2.72 ± 3.5
AUA Symptom Score	17.2 ± 7.3	17.7 ± 7.6	17.4 ± 6.9	15.7 ± 6.7
Quality of Life Score	4.4 ± 1.3	4.4 ± 1.2	4.6 ± 1.1	4.1 ± 1.6
Prostate Size (cc)	43.7 ± 23	44.9 ± 23	37.3 ± 19	47.2 ± 25

*ANOVA comparison between BOO, DU, DO were non-significant ($P > 0.05$).

Table 2. UDS findings of post-TURP diagnostic groups.

Characteristic (mean ± SD)	BOO	DU	DO
Bladder Capacity (ml)	443 ± 238	751 ± 342	404 ± 248
Maximum Flow (ml/sec)	3.2 ± 3.5	4.6 ± 4.1	13 ± 7.1
Pressure at Max Flow (cm H ₂ O)	60.3 ± 25	24.4 ± 9	36.6 ± 15
Post-Void Residual (ml)	345 ± 272	546 ± 413	105 ± 103
Bladder Compliance (ml/cm H ₂ O)	34 ± 18	63.1 ± 36	38 ± 29

*ANOVA comparison between BOO, DU, DO were all significant ($P < 0.001$).

With technological advances, there are many different techniques in approaching a TURP, yet all seem to have comparable efficacy and overall morbidity [15]. A third of the cohort (n=41) underwent the laser TURP procedure while the remaining underwent a traditional TURP. The proportion of laser TURPs did not vary between the BOO (33%), DU (33%), or DO (29%) diagnostic groups. The inclusion of multiple techniques in the sample provides a more accurate representation of men undergoing surgical resection of the prostate.

After dividing the cohort by primary diagnosis, the majority (59%) had been identified as having BOO, while 24% had DU and 17% had DO. The bladder capacity was higher (751 ml) in under active detrusors, when compared to BOO or DO, with 443 ml and 404 ml, respectively. Patients with BOO and DU have significantly higher post-void residual with 345 ml and 546 ml, respectively, than compared to DO patients (105 ml). Patients with DO had a much higher maximum flow rate (13 ml/sec) than either BOO or DU with 3.2 ml/sec and 4.6 ml/sec, respectively. Considering over 50% of BOO have a secondary diagnosis of DO, we would expect the BOO maximum flow rate to be greater. This variance could be attributed to comorbidities leading to a smaller bladder capacity, but is an issue worth future examination.

There was a lack of correlation between subjective patient complaints and urodynamic findings. The majority of patients reported similar LUTS including frequency, nocturia, and urgency; although, DU diagnosed patients complained of retention requiring catheterization at a higher rate. Additionally, men with DU report lower rates of

urgency and nocturia than men with BOO or DO. When comparing the AUA or QOL symptom scores between the three groups, no significant difference was observed (Table 1). All were similarly unhappy with their quality of life, which may reflect the fact that the men all decided to seek care. Subjective patient complaints alone could not differentiate between diagnoses. UDS examination should guide future treatment plans, especially before surgical interventions.

The patient’s prostate size did not significantly differ between groups; therefore is not predictive of obstruction and cannot be used to rule out detrusor over activity or under activity. Furthermore, time between TURP and UDS as well as duration of LUTS did not vary between the groups and cannot be solely depended upon in diagnosing (Table 1).

We characterized an under-studied group that suffers from LUTS despite surgical interventions. This warrants further analysis and improvement upon current treatment. Prior to this study, little information had been gathered on this patient population. In 1997, Nitti et al. analyzed a cohort of 50 patients with recurrent voiding dysfunction following TURP concluded that the men’s subjective complaints were unreliable in predicting UDS results [2]. With the incorporation of laser TURPs, our larger study expands upon analysis of this population in the contemporary setting. Additionally, Nitti et al. found a significantly higher incidence of detrusor over activity (54%) in their cohort, which contrasts our finding of a higher proportion of bladder outlet obstruction (59%). This cohort is currently the largest collection of UDS and self-reported data from men with lower urinary tract dysfunction post-TURP.

Limitations of this study include the retrospective nature of the cohort approach. A selection bias exists, as the men were self-referred for treatment at a tertiary referral center. Furthermore, lower urinary tract dysfunction is largely underreported and therefore these conclusions omit a proportion of men who do not seek treatment for recurrent LUTS. The lack of information on the initial TURP procedure (including pre-TURP diagnosis, primary UDS, operative data) limits our interpretation of the data. Although we can conclude failed TURP patients experience years of LUTS before presenting with moderate severity, analysis of this information is restricted by the lack of knowledge regarding events during this extended period of time. Unknowns include attempting to seek treatment elsewhere, having undergone an unsuccessful TURP

by lack of adequate resection, or experienced prostatic growth since initial TURP. Additionally, information regarding the progression of the recurrent LUTS through repeated questionnaires during the symptomatic years would provide further insight.

CONCLUSIONS

The majority of patients who have LUTS following surgical resection of the prostate are primarily diagnosed with bladder outlet obstruction (59%). This cohort of men has not been commonly studied, and further studies are needed to further characterize these men.

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