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Urodynamic Assessment in Benign Prostate Hyperplasia Evaluation

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Abstract

Objective: Detrusor Overactivity (DO) was evaluated in patients with lower urinary tract symptoms due to benign prostatic hyperplasia with storage symptoms. *Materials and Methods:* A total of 258 men with a mean age 60.4±8.4 years who were admitted in our center between August 2013 and September 2015 with Lower Urinary Tract Symptoms (LUTS) having BPH. These patients were divided into two groups. Group-1 (n=216) who had predominant obstructive voiding symptoms. Group-2 (n=42) had both storage and voiding symptoms. Invasive urodynamics, including filling and voiding cystometry, was done with pressure flow analysis according to the Schäfer nomogram in Group-2 patients. The relative contribution of bladder dysfunction to male LUTS, with a particular emphasis to storage symptoms that characterize overactive bladder was noted. *Results:* Of the 258 patients, 42 (16.3%) had idiopathic or neurogenic detrusor overactivity significantly affect patient symptom score and quality of life. Moreover, bladder dysfunction was significantly affected with the degree of obstruction with both storage and voiding symptoms as measured by the maximum flow rate, post-void residual urine, and prostate volume and Schäfer grade of obstruction. *Conclusion:* DO with severe degree of bladder outlet obstruction in patients with storage symptoms is pathophysiologically the same as idiopathic or neurogenic.

Keywords: Overactive Bladder; Lower Urinary Tract Symptoms; Benign Prostate Hyperplasia.

Introduction

More than 50% of aging men suffer from Lower Urinary Tract Symptoms (LUTS) due to Benign Prostatic Hyperplasia (BPH) and is the most common condition in aging men [1]. LUTS comprise storage symptoms, voiding symptoms and post micturition symptoms [2]. A multinational study showed that 90% of men aged 50 to 80 suffer from irritating symptoms of LUTS [3]. Most of the all men develop subclinical benign prostatic hyperplasia by the age of 50 years. Benign prostatic hyperplasia may cause bladder outlet obstruction in nearly 50% of men over 60 years of age. Evidence has accumulated, however, supporting the role of BPH-related Bladder Outlet Obstruction (BOO) as the direct cause determining bladder dysfunction and indirectly causing urinary symptoms. Other important changes observed with age include an increased prevalence of involuntary detrusor contractions and increased Post Void Residual (PVR) urine volume. We reviewed the relationship between irritating symptoms and urodynamic findings. The relative contribution of bladder dysfunction with storage symptoms of LUTS, that characterize overactive bladder (OAB) is evaluated. The evaluation of BPH either due to storage or voiding disorder can be complimented by urodynamic studies [4]. A small percentage of cases with neurogenic component can be associated due

to detrusor instability for which surgery alone gives poor outcome. The present study centers on the BPH patients with pure bladder outlet obstruction or bladder outlet obstruction associated with the idiopathic or neurogenic component [5]. The evaluation of BPH patients by IPSS symptom score, by anatomical and functional assessment and urodynamic evaluation consisting of cystometrogram, pressure flow studies, uroflomerty, and post void residual urine [6,7]. To study the urodynamic evaluation in the assessment of benign prostatic hyperplasia (BPH). The objective of this study was to identify the contribution of neurogenic component to bladder outlet obstruction due to BPH and to asses neurovesical dysfunction either pure or secondary as a contributing factor for bladder outlet obstruction in BPH patients. This will help us to modify treatment protocol as to improve the treatment outcome in patients with BPH. Finally treatment options with particular attention to male OAB symptoms were considered. We evaluated the efficacy and safety of antimuscarinics for the treatment of OAB, when used alone or in combination with a1-receptor antagonists.

Materials and Methods

The study was in 258 men with a mean age 60.4 ± 8.4 years who were admitted in our center between August 2014 and September 2016 with lower urinary tract symptoms having BPH. Our study was approved by our institutional ethics committee. Written informed consent was taken from all patients for photographing, recording and also its use for scientific and medical education purposes. On admission detailed history was taken and examined in detail to evaluate the cause; clinically all were diagnosed to have BPH answered to International Prostate Symptom Score and underwent Per rectal examination to assess the Grade of hypertrophy and also to assess the benign nature of the gland. Blood biochemistry, urine analysis, ultrasound abdomen was performed, followed by if necessary transrectal ultrasound, simple uroflowmetry, outpatient cystoscopy. Group-1 (n=216) who had predominant obstructive voiding symptoms. Group-2 (n-42) had both storage and voiding symptoms. In Group-2 (n=42) invasive urodynamics, including filling and voiding cystometry, was done with pressure flow analysis according to the Schäfer nomogram. The management was based on the urodynamic evaluation. Patients with stricture urethra and with carcinoma prostate were excluded from the study.

Urodynamic Studies (UDS) was performed with a 6-Fr dual-lumen vesical catheter and a 12-Fr rectal balloon catheter, and the bladder was filled with 30–50mL/min saline with the patient in the sitting position. Prior to the examination, patients were asked to void, at which point the maximum flow rate (Q_{max}) in the sitting position, voiding volume, and post void residual urine volume (PVR) after catheterization were recorded. During bladder filling, the patients were instructed simply to report their sensations to the examiner. The presence of DO, defined as either spontaneous or provoked involuntary detrusor contractions with urgency during the filling phase of baseline cystometry, and total bladder capacity were recorded during filling cystometry. Detrusor pressure at the maximum flow rate (Pdet Q_{max}) in the voiding phase and maximum urethral closure pressure were also recorded by urethral pressure profile. We conducted pressure flow studies and selected the tracing with the highest Q_{max} for each patient. Voiding dysfunction was described as detrusor underactivity (DUA) and BOO. DUA was defined as a Q_{max} of ≤ 15mL/s together with a Pdet Q_{max} of ≤ 20cm H_2O in the UDS. BOO was defined as a Q_{max} of ≤ 15mL/s with a Pdet Q_{max} of >20cm H_2O in the UDS.

Results

All patients in the study were divided into two Groups. In Group-1 (n=216) consisted of patients who had predominant obstructive voiding symptoms. In Group-2 (n=42) patients who had both storage and voiding symptoms. In Group-1, 93 (43.06%) of patients presented in the age group of 61-70 years were as in Group-2, 18 (42.86%) presented in age group of 71-80 years. In Group-2 invasive urodynamics, including filling and voiding cystometry, was done with pressure flow analysis according to the Schäfer nomogram. The management was based on the urodynamic evaluation. The patients with respect to the type of LUTS with BPH we found that in Group-1, 216 (83.72%) of patients, with BPH presented with predominant voiding symptoms and in Group-2, 42 (16.28%) of patients had both storage and voiding symptoms (Figure 1). In our study we found that in Group-1 we had 102 (47.22%) having predominant voiding symptoms of frequency > 7-12 months and in Group-2 as 19 (45.24%) of patients, with BPH presented with both storage and voiding symptoms of > 12 months duration (Table 1). All patients in the study had a clinical diagnosis of BPH. We found that 62 (28.7%) of patients Group-1 and in Group-2 11 (26.19%) presented with severe IPSS score,

warranting surgery (Figure 2). All patients in our study who visited for BPH consultation needed surgery as the treatment modality. On the urodynamic evaluation in patients, with BPH presenting with both storage and voiding symptoms, the dysfunction type was Neurogenic in 14 (33.3%) and Non neurogenic in 28 (66.7%). Combining tolterodine with solifenacin was effective in (62.8%) three-quarters of men with BOO and OAB. The patient with neurogenic dysfunction 13 (30.6%) with both storage and voiding disorder required clean intermittent catherization (CIC) following surgery (Table 2).

Table 1: Demographic details and symptometology in both Groups of patients

	Group – 1 (N = 216)	Group – 2 (N = 42)	Total (N = 258)	P value
Age Distribution				0.011*
51 – 60	48 (22.22%)	5 (11.90%)	53 (20.54%)	
60 – 70	93 (43.06%)	12 (28.57%)	105 (40.70%)	
70 – 80	62 (28.70%)	18 (42.86%)	80 (31.01%)	
> 80	13 (6.02%)	7 (16.67%)	20 (7.75%)	
Voiding Symptoms				< 0.0001*
< 6 Months	99 (45.83%)	8 (19.05%)	107 (41.47%)	
7 – 12 Months	102 (47.22%)	15 (35.71%)	117 (45.35%)	
> 12 Months	15 (6.94%)	19 (45.24%)	34 (13.18%)	
Type of LUTS				< 0.0001*
Storage (St)	*0 (0.0%)*	42 (16.28%)	42 (16.28%)	
Voiding (V)	216 (83.72%)	*0 (0.0%)*	216 (83.72%)	
IPSS Score				0.582
Mild	60 (27.78%)	15 (35.71%)	75 (29.07%)	
Moderate	94 (43.52%)	16 (38.10%)	110 (42.64%)	
Severe	62 (28.7%)	11 (26.19%)	73 (28.28%)	

* Significant, NA: Not Applicable

Table 2: Type of voiding Dysfunction on Urodynamic assessment & treatment outcome in Group - 2 Patients

Type	No
Neurogenic	14 (33.3%)
Non Neurogenic	28 (66.7%)
Treatment out come	
S + Drugs/CIC*	13 (30.6%)
S*	29 (69.1%)

* S - Surgery, CIC- Clean Intermittent Catheterization.

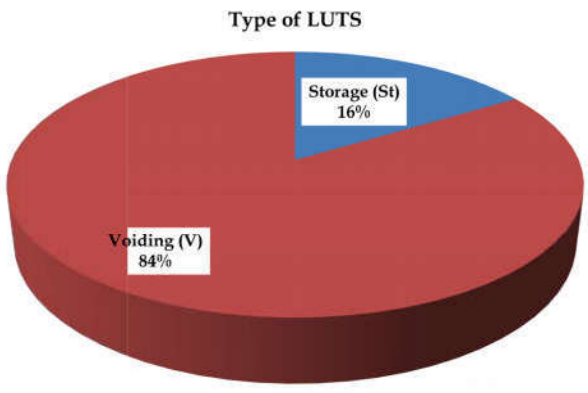

Fig. 1: Distribution of type of LUTS in the total group

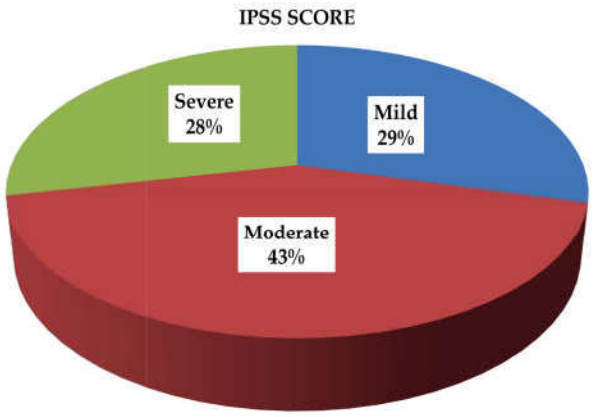

Fig. 2: Distribution of IPSS Score in the total group

Discussion

Benign Prostatic Hyperplasia (BPH) with Lower Urinary Tract Symptoms (LUTS) comprises of storage symptoms and voiding symptoms [8]. Overactive bladder (OAB), which has been previously defined by the International Continence Society (ICS) as 'urgency, with or without urge incontinence, usually with frequency and nocturia' [9]. The role of urinary urgency or urgency incontinence due to overactive bladder is less appreciated. Yet studies have indicated that 30% to 60% of men with BOO also have OAB, a condition that can develop secondary to BOO or from coexisting detrusor overactivity. A growing appreciation of the high prevalence of OAB in men is generating new algorithms in how LUTS is evaluated and treated. Overactivity of the bladder during filling/storage can be expressed as phasic involuntary contractions, as low compliance, or as a combination. Involuntary contractions are most commonly seen in association with bladder outlet obstruction, or aging (probably related to neural degeneration) or may be truly idiopathic. If an individual has urgency urinary incontinence, it can be assumed that an involuntary contraction (DO) has occurred. In patients with LUTS, treatment of OAB may be critical for relief of symptoms with or without BOO.

Benign prostatic hyperplasia has long been considered the key factor in the mechanism of LUTS through which storage and voiding symptoms develop [10,11], and the relief of obstruction is the traditional aim of most therapies designed to improve urinary symptoms in BPH. Symptoms scores and urodynamic studies should be considered separately in the evaluation of men with LUTS. However, both storage and voiding phase symptoms do not consistently correlate with clinical parameters used for objectively evaluating BOO in patients with BPH, such as ultrasound-estimated prostate weight [12,13] and free urine flow and post void residual urine [14,15], and many patients undergoing transurethral resection of prostate still report persistent storage symptoms [16-21]. Indeed, currently several studies support a morphologic and cellular changes in detrusor muscle in determining LUTS. There is considerable overlap between the myogenic and integrative hypothesis, as both causes increased peripheral excitability and is associated with urodynamic DO if the contractions spread to a sufficient proportion of the bladder wall. Morphologic changes in the bladder are compensatory changes in response to increased outlet resistance. These changes include smooth muscle hypertrophy, patchy cholinergic denervation of muscle bundle, increased collagen content, vascular changes, and alterations in electrical properties of detrusor smooth muscle [21-23]. In the initial "compensated" state, there is increasing bladder mass with good contractile response and with areas of focal hypoxia and angiogenesis. With further changes and prolonged obstruction, a "decompensated" state is reached with decreasing compliance and contractile response and further increases in mass with connective tissue replacement [24]. When the collagen component of the bladder wall increases, compliance decreases. Mostwin *et al* [26] showed that Bladder muscle hypertrophy, which can result from outlet obstruction, can also result in decreased compliance because hypertrophic muscle is said to be less elastic than normal detrusor; it also can synthesize increased amounts of collagen. Levin *et al* [23-25] identified five common features associated with partial bladder outlet obstruction in rabbit and human tissue that is increased mass, reduced cholinergic nerve density, reduced mitochondrial substrate use, decreased sarcoplasmic-endoplasmic reticulum calcium ATPase activity, and increased and redistributed connective tissue. Increased mass and connective tissue may lead to a decrease in compliance and functional capacity which may lead to urodynamically demonstrable involuntary contractions. Charlton *et al* [22] demonstrated areas of focal cholinergic denervation in obstructed bladder tissue with consequent supersensitivity of muscarinic receptors to acetylcholine (denervation supersensitivity). There is enough data that seems to exist to support an inhibitory effect of other neurotransmitters (e.g., glycine, γ-aminobutyric acid, opioids, purines, the noradrenergic system) on the micturition reflex at various levels of the neural axis. Bladder filling and consequent wall distention may also result in the release of factors from the urothelium that may influence contractility (e.g., acetylcholine, adenosine triphosphate, nitric oxide, prostaglandins, other peptides, as yet unidentified inhibitory factors).

There may also be a non-neurogenic active component to the storage properties of the bladder. Andersson *et al.* [27,28] have suggested that urothelium released nitric oxide which may have an inhibitory effect on afferent mechanisms as well. Although there clearly are morphologic and cellular changes that occur in the obstructed bladder that are associated with DO, a comprehensive explanation has not been developed. There are some types of dysfunction that represent combinations of storage and voiding

abnormalities (e.g., DO and sphincter dyssynergia in a patient with suprasacral spinal cord injury; DO during storage, detrusor underactivity during emptying). On a cellular level, it is still unknown if DO in the obstructed bladder is pathophysiologically the same as idiopathic or neurogenic DO. In men with persistent LUTS after prostatectomy, further testing will be quite useful to determine the etiology of the symptoms. Half of these patients will have persistent DO, but approximately 16% will have residual obstruction [29].The voiding dysfunction is most often characterized symptomatically by frequency, urgency, and urge incontinence and urodynamically by normal sensation with involuntary contraction at low filling volumes. However, decreased compliance may develop, secondary to the effects of denervation with secondary neuromorphologic changes. Prssure-flow studies differentiate between patients with a low Qmax secondary to obstruction and those in whom a low Qmax is caused by a decompensated or neurogenic bladder, but has limited role in determining the cause of LUTS. Filling cystometry, an invasive urodynamic study, provides information on bladder capacity, the presence and threshold of uninhibited detrusor contractions, and bladder compliance. There was a strong correlation between urge incontinence and DO.

In our study all the patients having LUTS had both storage and voiding type. The symptoms assessed by IPSS scoring system, about 28.7% in Group-1 and 40.5% of patients with BPH presented had IPSS score more than 24. About 83.7% of patients presented with voiding symptoms, 16.3% of patients presented with storage symptoms. About 83.7% of patients with BPH were having obstructive pathology and 33.3% of patients with BPH having both the obstructive as well as neurogenic pathology due to idiopathic or neurogenic DO. It has been found that the group with the obstructive pathology the outcome of surgery was good. The outcome of surgery in obstructive pathology due to BPH along with idiopathic or neurogenic DO was sub optional. These men with symptomatic BOO had an OAB which required combination of tolterodine with solifenacin in the post operative period and some patients required clean intermittent catheterization (CIC) to improve the post void residue [31].

About half of men with symptomatic BOO had an OAB. About three-quarters of men with symptomatic BOO and no OAB improved with tolterodine but only a third with BOO and OAB were helped with solifenacin alone. Combining tolterodine with solifenacin was effective in three-quarters of men with BOO and OAB.

Conclusion

Irritative symptoms are the most bothersome components of BOO, not obstructive symptoms. There is a strong association between OAB and LUTS/BPH. The bladder afferent pathway might play an important role in the pathogenesis and management of OAB.

Conflict of Interest

None declared.

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