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Original Article

Are patients with the symptoms of overactive bladder and urodynamic detrusor overactivity different from those with overactive bladder but not detrusor overactivity?

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Abstract

Background: The aim of this study is to identify the differences between patients with overactive bladder (OAB) and detrusor overactivity (DO) and those with OAB but without DO.
Methods: We prospectively recruited patients with OAB symptoms between December 2008 and September 2009. All patients were required to complete a 3-day frequency–volume chart. Symptom severity was evaluated using the International Prostate Symptom Score (IPSS) and Overactive Bladder Symptom Score (OABSS) questionnaires. All patients also underwent urodynamic studies. Demographics, symptom severity, urinary frequency and volume, and urodynamic variables of patients with and without DO were compared.
Results: Of the 133 enrolled patients (76 women and 57 men), DO was diagnosed in 80 patients (60.2%). All demographic variables were similar among the OAB patients, regardless of DO status. Total IPSS and OABSS scores did not differ between the OAB and DO groups. However, the nighttime urinary frequency subscore on the OABSS differed significantly between OAB patients with DO and without DO ($p = 0.048$). There were no significant differences in terms of urodynamic variables, urinary frequency, or urine volume between OAB patients with and without DO.
Conclusion: Patients with OAB symptoms and urodynamic DO show different clinical symptoms than OAB patients without DO. Patients with DO experience more frequent nocturnal urinary episodes.

Keywords: detrusor overactivity; frequency–volume chart; International Prostate Symptom Score; overactive bladder; Overactive Bladder Symptom Score

1. Introduction

According to the International Continence Society (ICS) (2002), overactive bladder (OAB) syndrome is defined as urinary urgency, with or without urge incontinence (UUI), that usually presents with increased frequency and nocturia without the presence of a proven infection or other obvious pathological condition. OAB symptoms are suggestive of urodynamically demonstrable detrusor overactivity (DO). DO is a urodynamic observation characterized by involuntary detrusor contractions during the filling phase that may be spontaneous or provoked.[1]

Previously published studies show that the symptomatic diagnosis of OAB does not correlate with urodynamically demonstrable DO. The diagnosis of OAB, when based on urinary symptoms, results in the underreporting of DO, and only about 55% of patients with OAB symptoms are diagnosed with DO.[2] Additionally, some investigators have reported clinical differences between patients diagnosed with OAB and urodynamic DO and those diagnosed with OAB but not urodynamic DO. Patients diagnosed with OAB and DO tend to be older and are more often incontinent.[3] Nevertheless, the actual association between OAB and DO is not clear. The

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aim of this study is to identify the differences between patients diagnosed with OAB and urodynamic DO and those with OAB but not urodynamic DO.

2. Methods

We prospectively recruited patients with OAB symptoms from our urology outpatient clinic between December 2008 and September 2009. The study protocol was reviewed in advance by the ethics committee of our hospital before any patients were recruited. Informed consent was obtained from each patient prior to participation in this study. All patients were interviewed in order to obtain detailed personal and medical histories. Patients with overt neurological disorders (e.g., spinal cord pathology) were excluded. Among women diagnosed with mixed urinary incontinence (MUI), only those who complained of urgency as the dominant symptom or were equally bothered by UUI and stress urinary incontinence (SUI) were enrolled. All patients were required to complete a 3-day frequency–volume chart in order to document urinary volume, incontinence and urgency episodes, and daytime and nighttime frequencies.

Symptom severity was evaluated using the International Prostate Symptom Score (IPSS) and Overactive Bladder Symptom Score (OABSS) questionnaires. The IPSS questionnaire consists of seven questions, each rated on a severity scale of 0 to 5. The OABSS is a 4-item questionnaire developed to evaluate OAB symptoms.[4] The maximal scores are 2, 3, 5, and 5 for daytime frequency, nighttime frequency, urgency, and urgency incontinence, respectively.

All patients underwent catheter-free uroflowmetry, postvoid residual (PVR) urine measurement, and urodynamic pressure-flow studies. Additionally, the bladder contractility index (BCI), which was defined as the pressure at maximum flow (PdetQmax) + 5 × the maximum flow rate (Qmax), was calculated in men using the variables defined in a previous urodynamic study (UDS).[5] Detrusor contractility was measured in women using the modified projected isovolumetric pressure (PIP1) index, which was calculated by adding Qmax to PdetQmax to the usual urodynamic units.[6] Male bladder outlet obstruction (BOO) was defined based on a provisional ICS method for the definition of obstruction, which defined BOO as (PdetQmax − 2Qmax) > 40.[7] PSA levels and prostate size were also measured in men.

The demographics, IPSS scores, OABSS scores, frequency–volume charts, and urodynamic variables were compared between patients with and without DO. The Mann-Whitney U-test was used to analyze the continuous variables, and the Fisher's exact test was used to analyze the categorical variables. p-values < 0.05 were considered statistically significant. Except for the urodynamic variables that were separately analyzed for men and women, all other variables were analyzed regardless of gender.

3. Results

The mean age of the patients was 66.5 ± 11.1 years (range: 23–88 years). DO was diagnosed in 80 patients (60.2%), including 42 women (55.3%) and 38 men (66.7%). The percentages of men and women with DO and OAB did not differ significantly. Among the men diagnosed with DO, 9 (23.7%) were also diagnosed with BOO. Among the women diagnosed with DO, 12 (28.6%) were also diagnosed with MUI. Most of the women with MUI complained of urgency as the dominant symptom, except for three patients who were equally bothered by UUI and SUI. Demographic variables, including age, body mass index (BMI), waist circumference, concomitant systemic diseases, smoking habits, constipation, and histories of primary nocturnal enuresis, were similar between OAB patients regardless of DO status (Table 1). In women with OAB, SUI and menopause did not increase the probability of presenting with DO. In men with OAB, neither prostate-specific antigen (PSA) levels nor prostate size were associated with a diagnosis of DO. Additionally, among men with DO, a diagnosis of BOO was not associated with larger prostates.

The IPSS and OABSS scores did not differ between the two groups; however, the subscore for nighttime frequency on the OABSS differed significantly between OAB patients regardless of DO status ($p = 0.048$). The median subscore for nighttime frequency of patients with DO was 3 (range: 0–3), while the median subscore of patients without DO was 2 (range: 0–3). The probability of presenting with DO increased as the severity of nocturia increased.

Except for the bladder volume at the first desire to void, and bladder capacity, which were both lower in both men and women with OAB and DO, there were no significant differences between men with OAB and women, regardless of DO status, in terms of the results of the PVR variable examinations, catheter-free uroflowmetry, or urodynamic pressure-flow studies (including the maximum flow rate, maximal detrusor pressure, detrusor pressure at maximal flow, and BCI for men and PIP1 for women) (Tables 2 and 3). Among men with DO, a diagnosis of BOO was not associated with a low flow rate.

There were no significant differences in the variables measured on the frequency–volume charts (24-hour frequency, number of urgent urinary incontinence episodes, nocturia, nocturnal urine ratio, 24-hour urine production, and maximal

Table 1
Demographic variables

	With DO	Without DO	P value
Age (mean ± SD yrs)	67.58 ± 14.92	64.91 ± 12.98	0.102
BMI ≧ 24 (%)	53.2	57.8	0.696
Waist circumference: M > 90 cm F > 80 cm (%)	56.4	68.2	0.299
Diabetes mellitus (%)	26.0	19.6	0.519
Hypertension (%)	48.6	43.1	0.586
Chronic pulmonary obstructive disease (%)	6.2	4.3	1.000
Hyperlipidemia (%)	21.3	21.3	1.000
Hyperuricemia (%)	13.4	14.3	1.000
Smoking (%)	13.6	9.5	0.757
Constipation (%)	33.9	31.0	0.831
Nocturnal enuresis history (%)	22.2	18.5	0.764

DO = detrusor overactivity; BMI = body mass index.

Table 2
Urodynamic study results for men

	With DO	Without DO	P value
First desire to void (mean ± SD ml)	68.54 ± 37.61	168.11 ± 98.35	<0.001
Cystometric capacity (mean ± SD ml)	96.74 ± 48.53	286.21 ± 107.06	<0.001
Free Qmax (mean ± SD ml/sec)	16.37 ± 8.97	22.07 ± 10.50	0.120
Free Qmean (mean ± SD ml/sec)	9.11 ± 4.85	11.59 ± 5.79	0.213
Post-void residual (mean ± SD ml)	71.96 ± 98.45	48.89 ± 50.86	0.649
BCI (mean ± SD)	101.4 ± 36.25	93.84 ± 32.97	0.400
MaxPdet (mean ± SD cmH_2O)	64.17 ± 33.27	52.11 ± 37.12	0.062
PdetQmax (mean ± SD cmH2O)	64.5 ± 27.15	56.75 ± 26.45	0.464

DO = detrusor overactivity; Free Qmax = catheter-free maximum flow rate; Free Qmean = catheter-free average flow rate; BCI = bladder contractility index; MaxPdet = maximum pressure; PdetQmax = pressure at maximum flow.

Table 4
Frequency volume chart variables

	With DO	Without DO	P value
24 hour frequency (mean ± SD)	11.26 ± 3.64	11.01 ± 4.30	0.613
24 hour production (mean ± SD ml)	1764.54 ± 691.95	1784.49 ± 643.93	0.820
Maximum voided volume (mean ± SD ml)	337.50 ± 98.12	383.93 ± 155.93	0.207
Minimum voided volume (mean ± SD ml)	53.88 ± 35.91	55.73 ± 31.99	0.428
Nocturia (mean ± SD)	2.04 ± 1.26	1.91 ± 1.59	0.447
Urge urinary incontinence (mean ± SD)	1.63 ± 2.37	1.16 ± 1.67	0.336
Urgency (mean ± SD)	2.62 ± 3.06	1.9 ± 2.37	0.165
Nocturnal urine ratio (%)	34.28	33.22	0.960
First morning void (mean ± SD ml)	200.72 ± 89.29	214.24 ± 119.18	0.692

DO = detrusor overactivity.

and minimal voided volumes) between OAB patients with and without DO (Table 4).

4. Discussion

Previous studies have reported that conventional UDS is neither sensitive nor specific in regard to urodynamic DO or the subjective symptoms of OAB. The diagnosis of OAB is based on urinary symptoms, and only about 55% of patients with OAB symptoms are diagnosed with DO.[2] Similarly, in this study, about 60% of patients with OAB were also diagnosed with DO. On the contrary, a previous study reported that about 40% of men and 30% of women without OAB symptoms also present with DO, according to the definitions of UDS.[8]

Previously reported studies also report that OAB patients with nocturia and/or UUI are at high risk of being diagnosed with DO on urodynamic evaluation. Hashim and Abrams stated that urgency, UUI, and nocturia significantly increase the chances of developing DO.[8] In addition, UUI and nocturia were associated with DO in the study performed by Khan et al.[9] However, in this study, only nocturia was found to be a significant predictor of DO, and the probability of presenting with DO increased as the severity of nocturia increased. The reason why this study does not indicate UUI as a predictor of developing DO might be due to the high incidence of UUI in our patients. Approximately 86.3% of our patients were diagnosed with UUI, which is significantly higher than the rate of 25% reported in the study performed by Hashim and Abrams.[8] The study group described here presented with more severe OAB symptoms than most patients with UUI, rendering UUI as an unreliable predictor. Krystal et al reported that nocturnal DO often occurs in association with nocturia in most patients diagnosed with DO and OAB.[10] Detrusor instability also plays a role in the pathophysiology of nocturia, similar to how it plays a role in the occurrence of daytime voiding in those diagnosed with DO and OAB. Therefore, nocturia is considered a valuable predictor of DO.

Table 3
Urodynamic study results for women

	With DO	Without DO	P value
First desire to void (mean ± SD ml)	71.06 ± 43.75	155.89 ± 78.80	<0.001
Cystometric capacity (mean ± SD ml)	131.68 ± 76.26	284.14 ± 104.24	<0.001
Free Qmax (mean ± SD ml/sec)	35.68 ± 18.83	32.45 ± 15.37	0.658
Free Qmean (mean ± SD ml/sec)	18.81 ± 9.47	16.43 ± 10.61	0.272
Post-void residual (mean ± SD ml)	11.84 ± 14.96	38 ± 50.38	0.077
PIP1 (mean ± SD)	45.41 ± 21.77	43.29 ± 16.51	0.748
MaxPdet (mean ± SD cmH_2O)	43.47 ± 40.70	31.25 ± 15.93	0.508
PdetQmax (mean ± SD cmH2O)	31.79 ± 25.09	33.67 ± 17.58	0.317

DO = detrusor overactivity; Free Qmax = catheter-free maximum flow rate; Free Qmean = catheter-free average flow rate; PIP1 = projected isovolumetric pressure; MaxPdet = maximum pressure; PdetQmax = pressure at maximum flow.

It is interesting to note that the objective recording of nocturnal frequency on the frequency–volume charts did not differ statistically between patients with and without DO. Stav et al suggested that there is a weak correlation between urinary frequencies obtained from medical histories and the frequencies recorded in diaries.[11] In this study, patients used a 3-day frequency–volume chart to accurately record the frequency of nocturia. OABSS was used to evaluate lower urinary tract symptoms among OAB patients over a 1-week period, which grades nocturia on a 4-point scale. The accuracy of the frequency–volume chart depends on the patient's cooperation, age, and level of cognitive abilities. All of these factors could result in discrepancies between the patient's subjective reports regarding nocturnal frequency and the objective recording of nocturnal frequency using the frequency–volume chart.

Haylen et al reported that DO patients tend to be older.[3] Similarly, Guralnick et al stated that patients with DO are older.[12] However, age was not a significant predictor of DO in

this study. Few studies have evaluated the association between demographic variables and DO; however, we extensively evaluated several demographic variables, including age, concomitant systemic diseases, smoking habits, constipation, menopause, coexistence of SUI, and history of primary nocturnal enuresis, to determine which factors might serve as predictors of urodynamic DO in OAB patients. Regardless, no significant demographic predictors were revealed in this study.

Blaivas et al proposed that most men with OAB also have coexisting urological problems.[13] Their data shows that the most common diagnoses were benign prostatic enlargement (32% of cases), BOO (22%), and complications following prostate cancer treatment (20%). Idiopathic OAB was diagnosed in only 5% of their study population. Furthermore, between 46% and 66% of men with prostatic obstruction on urodynamic studies are diagnosed with DO.[14–16] A previous study also showed a statistically significant correlation between BOO and prostate size.[17] We compared prostate sizes between men with OAB and DO and those without DO, however no significant difference in prostate size was found. Additionally, among men with DO, the coexistence of BOO did not relate to large prostate size or low urinary flow.

In the urodynamic portion of this study, the bladder volume at the first desire to void and cystometric capacity were lower in both men and women diagnosed with OAB and DO. Sensory urgency is generally defined as increased bladder sensation during filling, a low first desire to void, and low bladder capacity in the absence of a known urinary tract infection or DO. Hyalen et al stated that sensory urgency belongs in the same spectrum of bladder dysfunction as DO.[3] Guralnick et al reported that infused volumes are significantly smaller in patients with UDS-proven DO when there is a strong urge to urinate although no differences were noted in the bladder sensation at first desire to void.[12] Other UDS variables did not differ significantly between men and women with OAB, regardless of DO status. Similarly, the variables recorded on the frequency–volume charts did not help make differential diagnoses. Guralnick et al found that patients with DO had smaller maximum volumes per void, decreased 24-hour urine outputs, and a higher number of incontinent episodes.[12] A previous study also revealed that a voiding diary, assuming that the directions are properly followed, is reliable and appears to be suitable for documenting changes in the symptoms of OAB patients.[18] However, among noncompliant patients, the absence of urinary symptoms is frequently encountered.[19] Detailed and accurate recording on frequency–volume charts is critical for diagnosis.

Although the present study found that nocturnal frequency, when subjectively recorded, is more frequent in OAB patients with DO, this finding is only an academic interest. We are still unable to explain this finding based on the current understanding of the molecular mechanisms involved in bladder sensation, particularly those that occur during sleep. Therefore, the empirical use of pharmacological agents, without UDS, to treat OAB symptoms continues to be the treatment standard. UDS is used only if medical treatment fails or unexplainable emptying symptoms also present.

A limitation of this study is that the sample size was small, so selection bias could have occurred. Also, prostate size was defined as a two-category variable, and the cutoff value was 40 g; however, there is no consensus regarding what represents a small or large prostate, and our size limits do not reflect any standardized measurements. The study group should be expanded in future studies in order to confirm the findings observed here.

In conclusion, OAB patients with DO experience more nocturia episodes, as determined by the results of the OABSS questionnaire. This finding should be verified using a larger study population.

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