Urodynamic changes in females with refractory lower urinary tract symptoms

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Objectives The study aims to evaluate the urodynamic changes in female patients with refractory lower urinary tract symptoms (LUTSs) and to find the urodynamic changes associated with it. We also aim to diagnose the cause of refractory LUTS as it affects the quality of life.

Patients and methods The current study included 80 female patients with refractory LUTS who underwent urodynamic evaluation (uroflowmetry, filling and voiding cystometry). Patient with previous anti-incontinence surgery, pregnancy, bladder tumor, bladder stone, haematuria, patients with ureteric stent, partial cystectomy, and cystocele were excluded from this study.

Results The maximum flow rate (Q_{max}) was low in 41.9% of the patients who were complaining of storage symptoms (urgency, frequency, and nocturia). Increased sensation was reported in 67.5% of the patients. There is a strong positive correlation of increased sensation to urgency, frequency, nocturia, and nocturnal enuresis. Low maximum cystometric capacity (MCC) was reported in 52.5% of the patients. There was a strong positive correlation of decreased MCC to urgency, frequency, nocturia, and nocturnal enuresis. Detrusor overactivity (DO) was found in 57.5% of the patients. There was a statistically significant increase in DO among patients who complained of nocturia. Positive Valsalva stress test was seen in 28.6% of the patients with stress urinary incontinence. Respectively, storage symptoms were reported in 95%, voiding symptoms were reported in 5%, and bladder-outlet obstruction was reported in 10% of the patients.

Conclusion Higher incidence of early sensation, low MCC, and DO is seen in patients with overactive bladder. There is a strong positive correlation between frequency and low Q_{max}. The urodynamic studies are complementary to patients' symptoms, which can be useful to reach a more precise diagnosis and a more appropriate management plan.

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Introduction

Lower urinary tract symptoms (LUTS) include dysuria, urgency, frequency, and incontinence. LUTS are most common in female of all age groups. Its severity increases with age. It affects the quality of life in all aspects [1]. LUTS can get alright on its own in nearly half of the cases. Urologists recommend treatment if necessary [2]. However, some urologists recommend reassurance if there is no reason to suspect serious disease [3]. Urodynamic study (UDS) is important to evaluate storage and voiding function of the bladder. Filling cystometry assesses the bladder sensation, capacity, compliance, detrusor contraction, and leak point pressure. Voiding cystometry assesses the power of bladder contraction and the outlet obstruction. According to the International Continence Society, UDS is not normally required for diagnosing bladder overactivity [4] but useful in cases that are refractory to therapy, before invasive intervention, or when bladder outlet obstruction (BOO) is suspected [5].

Patients and methods

This study was carried out at Al-Azhar University Hospitals from March 2016 to June 2017. It included 80 female patients who complained of LUTS refractory to therapy and thus underwent a UDS. The symptoms of the patients were assessed by overactive bladder (OAB) and incontinence questionnaire. Examination was done to determine any neurological, gynecological, or congenital abnormalities. After complete history and full examination, appropriate medical treatment was advised for 3 months. During that period the patient was advised to come for follow-up every month for assessment. If there was no improvement, a UDS was done. A patient undergoing a UDS was asked to drink fluids to obtain a comfortably full bladder. Initially, a pelvic-abdominal ultra sound was done followed by the UDS. It consisted of uroflowmetry (volume: ≥150 ml and Q_{max}: 20–30 ml/s); filling cystometry in physiological or medium filling rate of 40 ml/min (using normal saline at room temperature through a double lumen urethral catheter); stress leak test; and pressure flow study. No sedation was administered during the study as the patient

should be aware. The patient was placed in a semi-seated lithotomy position. After a detailed explanation to the patient, the examination was begun by passing a catheter into the bladder (5 Fr) to measure the postvoiding residual urine followed by filling the bladder and measuring the intravesical pressure through the catheter. A rectal catheter was placed for measuring the abdominal pressure. The systems were always zeroed at the atmospheric pressure. The patient was periodically asked to cough to check the operation of the equipment and was instructed to report her sensations. The volume of the first sensation of filling, first desire (1 s) and second desire (2 s) were recorded. When the bladder was filled up to 150 ml, the patient was asked to cough (Valsalva) to predict the stress leakage. If it did not occur at 150 ml, the bladder was refilled and the stress test was repeated until the leakage occurred or the bladder capacity was reached. Additionally, any unidentified involuntary detrusor contractions were noted. When the patient had the urge to void, the permission for voiding was given. Then voiding cystometrogram (pressure-flow) was performed and the urodynamic parameters, such as maximum flow rate (Q_{max}) and detrusor pressure at maximum flow (Pdet Q_{max}) were observed.

The data was collected, coded, revised, and entered into the statistical package for social science (IBM SPSS, Chicago, USA), version 20. It was presented as numbers and percentages for categorical data. Quantitative data with parametric distribution was presented as mean, SD, and ranges. For quantitative data with nonparametric distribution median with interquartile range was used. χ^2-Test was used in correlation with the categorical data and Fisher exact test was used when the expected count of P value was less than 5. Independent t-test was used in correlation with quantitative data with parametric distribution, and Mann–Whitney U-test was used in the correlation with quantitative data with nonparametric distribution. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the P value was considered significant if less than 0.05, highly significant if less than 0.01 and nonsignificant if more than 0.05.

Results

The study included a total of 80 female patients who complained of LUTS that was refractory to therapy. A UDS was done according to the inclusion criteria. The mean age of the patients was 35.2±6.08 (20–40) years old. There were six (7.5%) patients with nocturnal enuresis, urgency in 58 (72.5%) patients, frequency in 47 (58.8%) patients, nocturia in 45 (56.3%) patients, weak stream in three (3.8%) patients, urge urinary incontinence (UUI) in 56 (70%) patients, and stress urinary incontinence (SUI) in 49 (61.3%) patients.

Pertaining to uroflowmetry parameters, 18 (22.5%) patients had an inconclusive study (17 patients voided<150 ml and one patient voided>600 ml). There were two (2.5%) patients who could not void during the study. The remaining 60 patients had reliable voided-volume parameters. Additionally, 26 (32.5%) patients had Q_{max} less than 20 ml/s, four had Q_{max} more than 40 ml/s, and in two patients Q_{max} could not be evaluated. The remaining 48 patients had reliable Q_{max} parameters (Table 1).

Forty three patients complained of storage symptoms (urgency, frequency, nocturia). In 18 (41.9%) patients, Q_{max} was low. There was a significant correlation between the frequency and a low Q_{max} (Table 2). According to filling cystometry, increased sensation was reported in 67.5% (Fig. 1) and detrusor overactivity (DO) was reported in 57.5% (Fig. 2). There was a statistically significant increase in the incidence of DO in patients with a history of hysterectomy, repair of

Table 1 Uroflowmetry parameters

	n (%)
Volume	
Normal	60 (75)
Low	17 (21.25)
Could not be done	2 (2.5)
Q_{max}	
Normal	48 (60.0)
Low	26 (32.5)
Super voider	4 (5.0)
Could not be done	2 (2.5)

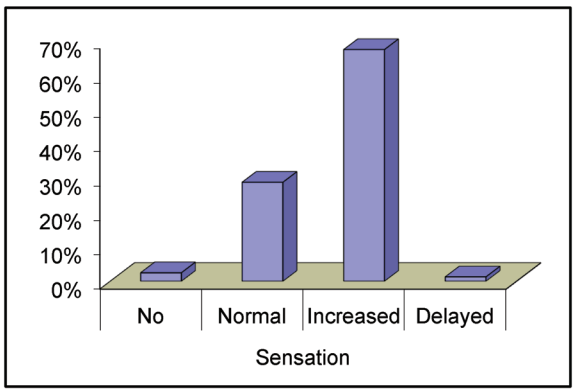
Table 2 Correlation of Q_{max} to storage symptoms

Complaints	*n* (%)	Number of low Q_{max} [*n* (%)]	χ^2-Test
Storage symptoms (urgency, frequency, nocturia)	43 (100)	18 (41.9)	0.208
Urgency	58 (100)	25 (43.1)	0.912
Frequency and nocturia	42 (100)	17 (40.5)	0.169
Frequency	47 (100)	17 (36.2)	**0.041**
Nocturia	45 (100)	18 (40.0)	0.127
Urge incontinence	56 (100)	14 (25)	0.244

Bold: $P < 0.05$ (significant).

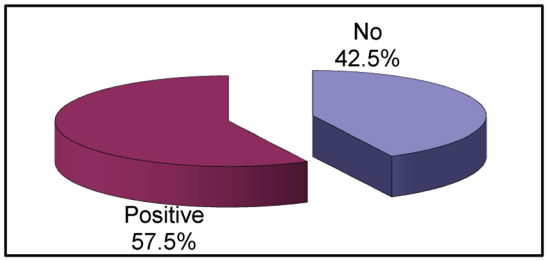
cystocele, or surgery for lumbar disc prolapse (Table 3). There was a significant correlation between the patients who complained of SUI and leakage during the UDS (Table 4).

Figure 1



Sensation in patients.

Figure 2



Detrusor contraction in patients.

There was a statistically significant increase in the incidence of increased sensation and low maximum cystometric capacity (MCC) in patients complaining of storage symptoms (urgency, frequency, nocturia) and nocturnal enuresis. However, in nocturia there was a statistically significant increase in the incidence of increased (early) sensation and low MCC with DO (Table 5).

Discussion

Storage urinary symptoms usually affect the quality of life [6]. Urgency is the main complaint of patients with

Table 3 Correlation of detrusor overactivity to postoperative cases

	n (%)	Recorded detrusor overactivity [*n* (%)]	χ^2-Test
Postrepair of cystocele	5 (6.3)	3 (60)	<**0.001**
Posthysterectomy	3 (3.8)	2 (66.7)	<**0.001**
Postlumbar disc repair	3 (3.8)	3 (100)	<**0.001**

Bold: $P < 0.05$ (significant).

Table 4 Correlation of stress urinary incontinence to stress leakage during urodynamic study

	Stress incontinence [*n* (%)]		χ^2-Test
	Negative	Positive	
Urodynamic Valsalva	35 (71.4)	14 (28.6)	**0.028**

Bold: $P < 0.05$ (significant).

Table 5 Relation of symptomatology to urodynamic findings

Symptomatology	Urodynamic finding																
	Filling cystometry													Voiding cystometry			
	Sensation			MCC		DO		Q_{max}			LP			Power of contraction		Residual urine	
	↑	↓	*N*	↓	*N*	+ve	–ve	↓	↑	*N*	+ve Valsalva	+ve DL		↓	Average	+ve	No
Urgency	47	1	10	36	21	33	25	25	3	29	11	–		1	43	1	57
P value		**0.003**		**0.008**		0.802		0.912			0.557			0.752		0.220	
Frequency	37	–	10	30	17	31	16	17	3	27	9	–		1	36	–	47
P value		**0.021**		**0.014**		0.151		**0.041**			0.418			0.962		NA	
Nocturia	35	–	10	29	16	31	14	18	3	24	9	–		1	34	–	45
P value		**0.037**		**0.011**		**0.039**		0.084			0.359			0.697		NA	
Urge incontinence	41	–	14	33	23	32	24	14	–	41	12	–		1	41	–	56
P value		0.933		0.738		0.879		0.244			0.096			0.141		NA	
Stress incontinence	33	–	16	25	24	28	21	13	–	35	14	–		1	38	–	49
P value		0.385		0.557		0.337		0.877			**0.028**			0.445		NA	
Weak stream	–	–	3	–	3	–	3	3	–	–	–	–		1	2	–	3
P value		NA		NA		NA		NA			NA			**0.002**		NA	
Nocturnal enuresis	3	1	1	3	2	5	1	4	–	2	–	–		–	4	1	5
P value		**0.001**		**0.001**		0.378		0.310			NA			NA		NA	

DO, detrusor overactivity; MCC, maximum cystometric capacity; NA, not available; +ve, positive; –ve, negative. Bold: $P < 0.05$ (significant).

OAB. It is almost always accompanied by frequency and nocturia but UUI may or may not be present [7]. Milsom *et al*. [8] reported that more than half of the general population had symptoms of OAB. The incidence of LUTS was high in females affected with DM, a chronic illness [9]. It was advised not to include UDS at initial stages in patients with uncomplicated OAB [10–12]. A UD finding of DO was not necessary to predict the response to antimuscarinic treatment [13].

In our study of 80 female patients complaining of LUTS refractory to therapy, we aimed to assess the UD findings associated with LUTS. In the current study the OAB symptoms (urgency, frequency, nocturia) were found in 53.75% of the patients. In our study Q_{max} was found to be low in patients complaining of frequency as they emptied their bladders frequently, hence making the normal Q_{max} volume dependent (P=0.041). There was a strong correlation of Q_{max} towards low voided volume (P=0.001). Bhandari *et al*. [14] reported that maximum voided volume found may not be a significant predictor of DO. Additionally, they reported that there was a negative association of maximum voided volume with frequency and nocturia.

The current study showed a strong correlation of increased sensation with urgency, frequency, nocturia, and nocturnal enuresis (P=0.003, 0.021, 0.037, and 0.001, respectively).

The current study agreed with Sekido *et al*. [15], which reported that the severity of storage symptoms (urgency, frequency, and nocturia) was significantly associated with a reduction in MCC. In our study, MCC was low in 62.06% of the patients complaining of urgency (P=0.008), followed by 63.8% of the patients complaining of frequency (P=0.014), and in 46.48% of the patients complaining of nocturia (P=0.011).

In this study, pelvic surgery and lumbar disc repair, were found as risk factors to the LUTS. We demonstrated a strong correlation of DO to the history of repair of cystocele, hysterectomy, and spine surgery. Similar results were reported by Robinson and Cardozo [16]. Also 72.5% of the patients had urgency with DO recorded as 56.8%. In a study by Abrams *et al*. [7] all patients had urgency with DO recorded as 38.7% in 673 patients. Similarly, Jeong *et al*. [17] reported the DO rate as 33% in 513 female patients complaining of OAB symptoms.

UUI was also another symptom of DO, it was reported in 56.89% of the patients complaining of urgency and in 57.14% of the patients complaining of UUI. The current study agreed with Clarke [18] who reported that DO was associated with urgency (87%) and UUI (70%). Presence of DO in patients with OAB had a negative impact on the quality of life [19]. Our current study agreed with van Brummen *et al*. [20] where it was shown that nocturia was also significantly associated with DO (P=0.039). Van Brummen *et al*. [20] reported a correlation between DO and nocturia in 95 female patients with OAB symptoms.

Detrusor contraction during voiding was average in 98.3% of the patients and low in 1.7% of the patients. Significant residual urine was reported in one patient (220 ml) with pelvic floor muscle dysfunction.

In the current study, BOO presented with OAB in 5% of the patients (Pdet at Q_{max}>20 cm H_2O and Q_{max}<12 ml/s). Verdejo *et al*. [21] studied 323 elderly females and found a significant association between OAB and BOO. In a retrospective study on video UDS for 1605 female patients complaining of LUTS, Kuo *et al*. [22] found that half of the patients (49.9%) had voiding symptoms, and in presence of DO BOO was present in 28% of the patients.

Lai *et al*. [23] reported that SUI alone does not require preoperative UDS and it was recommended for mixed incontinence or presence of associated OAB. In their study, there was a positive correlation between the severity of SUI and stress leak.

Our study had inherent limitations of the UDS and was further limited by the small size of the study group.

Conclusion

A UDS should be done in the presence of refractory LUTS or before invasive intervention. It can be complementary to patients' symptoms to reach a more precise diagnosis and a more appropriate management plan. Urgency and nocturia are the most common symptoms of DO. Frequency showed a significant positive correlation with low Q_{max}, as they emptied their bladders more frequently.

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Conflicts of interest

There are no conflicts of interest.

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