Role of Urodynamic Study in the Management of Pelvic Organ Prolapse in Women

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Purpose: Pelvic organ prolapse (POP) and lower urinary tract symptoms (LUTS) usually coexist and are common among women. Since the efficacy of urodynamic studies (UDS) in evaluating these conditions is subject to controversy, this study aimed to assess the accordance between urodynamic findings and LUTS and to determine the importance of UDS in women with POP.

Methods: This cross-sectional study was conducted on women over 18 years with symptomatic POP referred to the female urology clinic of Kerman University of Medical Sciences, Kerman, Iran, during 2017-2018. Patients who met the inclusion criteria were included in the study with informed consent. The Pelvic Floor Disability Index (PFDI-20) was completed for each patient. Pelvic examination was performed using the Pelvic Organ Prolapse Quantification System (POPQ). Subsequently, multi-channel UDS was performed, and the findings were analyzed in SPSS 20, using Chi-square or Fisher's test.

Results: A total of 200 women with symptomatic POP were included in the study. Stress, urge, and mixed urinary incontinence showed significant accordance with the urodynamic findings (urodynamic stress incontinence and/or detrusor overactivity). However, there was no significant relationship between urinary voiding LUTS and urodynamic findings.

Conclusion: UDS should be performed for selective patients with POP. According to the results of the present study, UDS can help us provide consultation for POP patients with voiding LUTS. However, in POP patients with urinary incontinence, this test cannot provide further information and should be performed based on the patient's condition.

Keywords: pelvic organ prolapse; urodynamic study; urinary incontinence; voiding dysfunction

INTRODUCTION

Pelvic organ prolapse (POP), defined as the herniation of the pelvic organs to or beyond the vaginal wall, is a common condition affecting millions of women. POP and urinary incontinence (UI) have significant impacts on women's quality of life, affecting their daily activities, sexual function, and social interactions[1-5]. The odds of developing POP increase by 40% with every ten-year increase in age[6]. Therefore, as the population age advances, the economic burden of POP treatment increases.

POP has various symptoms, including the lower urinary tract symptoms (LUTS) (e.g., storage symptoms, voiding symptoms, and UI)[7]. Urodynamic studies (UDS), especially cystometry and pressure flow study, have become standard tools for the evaluation of patients with POP and LUTS. Several studies have documented the use of UDS to demonstrate SUI on prolapse reduction in women with POP. Furthermore, UDS is used for the evaluation of concomitant storage symptoms to demonstrate detrusor overactivity[8]. However, the correlation between POP symptoms and UDS is not completely clear, and performing the UDS is costly[9-13].

This study aimed to assess the LUTS based on questionnaire in patients with POP, urodynamic findings of patients with POP, the need for UDS in the examination of these patients.

METHODS

This cross-sectional study was conducted on women referred to the female urology clinic of Kerman University of Medical Sciences, Kerman, Iran, during 2017-2018. Women with symptomatic pelvic organ prolapse were considered eligible for the study. The inclusion criteria were as follows: being over 18 years old and having symptomatic POP stage $\geq$1. On the other hand, the exclusion criteria were as follows: having active infection of the urogenital system, urethral stricture, bladder stones, neurological disorders, urogenital cancer, and history of a gynecological procedure such as POP surgery or hysterectomy, as well as consuming drugs affecting the urinary system.

A total of 200 women, who met the inclusion criteria, entered the study with informed consent. Their demographic information, medical history, and obstetric history were recorded. Moreover, the Pelvic Floor Disabil-

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Table 1. The relation between stages of POP and different types of UI based on PFDI questionnaire scores

	SUI			UUI			MUI		
	Yes	No	*P*-value	Yes	No	*P*-value	Yes	No	*P*-value
Stage1	4	7	0.236	3	8	0.895	3	8	0.192
Stage2	56	69		38	87		23	102	
Stage3	35	24		20	39		19	39	
Stage4	2	3		1	4		1	4	

ity Index (PFDI-20) was completed for all patients, and the UDI- 6 section of this questionnaire was used to assess the lower urinary tract symptoms in such a way that if the answer to each question was yes with a score of 2,3, or 4, then the answer was interpreted as "yes", otherwise the answer was considered "no". We assessed urinary incontinence and voiding LUTS based on questions 16 and 17 and question 19 respectively in addition to the history. The Pelvic Organ Prolapse Quantification System (POPQ) was used to perform the pelvic examinations. Urine culture and bladder ultrasound scan were also used before UDS. Next, multi-channel UDS, including uroflowmetry, filling cystometry, and pressure flow study were performed by Medkonsult medical technology (MMT) Urodynamic system (Model: Uromic Blues). All women were studied with UDS by a female urologist using a standardized protocol in accordance with urodynamic practices guidelines of International continence Society (ICS). We used proper pessaries for prolapse reduction to detect occult SUI in cases with high stage prolapse (3 and 4). The terminology used to describe the UDS terms and observation were based on ICS standardization Committee[14]
Bladder outlet obstruction was considered based on the Blaivas and Groutz nomogram[15] and Detrusor underactivity was defined as voiding detrusor contraction of less than10 cm H2O and MFR less than 15 cc/s.[8].

The statistical analysis was performed using SPSS version 20. The chi-square test was conducted for investigating the relation between two discrete variables. If more than 25% of cells had expected counts of less than 5, Fischer's exact test was performed.

The Ethics Committee of Kerman University of Medical Sciences approved the present study.

RESULTS

A total of 200 women over 18 years with symptomatic POP were evaluated in this study. The mean age and parity of the participants were 53.22 ± 11.35 years and 5.65±4.12, respectively. Also, 108 (54.5%) women had reached the age of menopause. The urinary symptoms section (UDI-6) of PFDI-20 showed that 94 (47%) women were suffering from voiding LUTS, 97 (48.5%) from stress UI (SUI), 62 (31%) from urge UI (UUI), and 46 (23 %) from mixed UI (MUI). On the other hand, 41 (20.5 %) of the women did not have any complaints of UI.

In terms of age, the prevalence of SUI, UUI, and MUI was 8.3%, 8%, and 6.4%, respectively, in women aged between 18 and 35 years. Also, the prevalence of SUI, UUI, and MUI was 34%, 32.3%, and 36.2% in women aged 36-50 years, respectively. Finally, in women over 51 years of age, the prevalence of SUI, UUI, and MUI was 57.7%, 59.7%, and 57.4%, respectively.

According to the results of POPQ, the prevalence of anterior compartment prolapse stages, in descending order, was as follows: stage 2 (64%), stage 3 (29.7%), stage 1 (3.6%), and stage 4 (2.6%). Moreover, the prevalence of posterior compartment prolapse stages, in descending order, was as follows: stage 2 (59%), stage 3 (25.1%), stage 1 (13.3%), and stage 4 (2.6%). And finally, the prevalence of apical prolapse stages, in descending order, was as follows: stage 2 (84.6%), stage 1 (7.7%), and stage 4 (7.7%).

Table 2. Characteristics of Urodynamic tests in women with POP (n=200)

	N	%
Detrusor overactivity	43	21. 5
Urodynamic stress incontinence	73	36.5
reduced bladder sensation	22	11
Increased bladder sensation	2	1
Bladder outlet obstruction	10	5
Underactive detrusor	18	9
	Mean	SD
cystometric capacity	328.66Cc	81.5
Maximum flow rate	24 Cc/S	18.89
Post void residual	21.5 Cc	3.47
Detrusor pressure at maximum flow	23.72 Cm^3	18.89

Relationship between UI based on the questionnaire and POP severity in examination

No significant relationship was found between UI in the questionnaire and POP severity (**Table 1**).

Urodynamic findings

The results of UDS in patients with POP are presented in (**Table 2**).

Relationship between UI based on the questionnaire and urodynamic findings

Overall, 71 (73%) of women with SUI based on the questionnaire (n=97) had SI according to the urodynamic test. Moreover, two out of 103 women, who had not complained of SUI, were found to have SI according to the urodynamic test. There was a significant relationship between this compliant and urodynamic findings ($P < 0.001$) (**Table 3**).

The present results showed that 40 (64.5%) of patients with UUI based on the questionnaire (n=62) had detrusor overactivity (DO) according to the urodynamic test. Also, 25.8% of these women had detrusor overactivity incontinence (DOI). Three (2%) out of 138 women, who did not complain of UUI, showed signs of DO on the urodynamic test one of whom (0.7%) had DOI. There was a significant relationship between this compliant and urodynamic findings ($P < 0.001$). Also, 21.7% of women with MUI (n=46) had DO and SI, based on the urodynamic test. Only one of the patients with SUI had concomitant DO and SI, according to the urodynamic test. The relationship between this condition and urodynamic findings was significant ($P < 0.001$) (**Table 3**).

Relationship between voiding LUTS based on the questionnaire and POP severity on examination

The results showed that 20%, 47.5%, 51.7%, and 60% of patients with stage 1, 2, 3, and 4 POP complained of difficulty in bladder emptying, respectively. However,

Table 3. The relation between different types of UI based on questionnaire and Urodynamic tests.

		Do		USI		
		Yes N (%)	No N (%)	Yes N (%)	No N (%)	*P*-value
UUI	Yes n=62	40(64.5)	22(35.4)	-	-	< 0.001
	No n=138	3(2.17)	135(97.8)	-	-	
SUI	Yes (n=97)	-	-	71(73)	26(27)	< 0.001
	No (n=103)	-	-	2(1.94)	101(77.7)	
MUI	Yes (n=46)	10(21.7)	36(78.3)	10(21.7)	36(78.3)	< 0.001
	No (n=154)	1(0.6)	153(99.4)	1(0.6)	153(99.4)	

no significant relationship was observed between the stage of POP and voiding LUTS ($P > 0.05$) (**Table 4**).

Relationship between voiding LUTS based on the questionnaire and urodynamic findings

The mean values of the maximum flow rate (MFR) in patients with stage 1, 2, 3, and 4 POP were 24, 22, 20, and 16 cc/s, respectively. Patients with MFR<12 cc/s and detrusor pressure (Pdet) at Qmax>25 cmH2O were considered to have a bladder outlet obstruction (BOO), while those with MFR<12 cc/s and Pdet at Qmax<20 cmH2O were considered to have an underactive detrusor (UAD). Among 94 patients with voiding LUTS based on the questionnaire, 5.3% had BOO, 9.6% an underactive bladder (UAB), and 85.1% were normal. Also, among 106 patients without voiding LUTS according to the questionnaire, 4.7% had BOO, 8.5% UAB, and 86.5% were normal. Based on these findings, no significant relationship was found between the patient's history and urodynamic findings ($P > 0.05$) (**Table 5**).

DISCUSSION

UDS is one of the available methods for evaluating LUTS in order to determine the function of bladder and urethra. This method is normally used before POP interventions, with or without anti-incontinence surgery, to make or confirm a diagnosis, predict the treatment outcomes, and facilitate discussion during counseling. However, there are disagreements regarding the effectiveness of these studies, and the correlation between the patients' symptoms and urodynamic findings is controversial. This study addresses how patients' clinical symptoms relate to our findings in the urodynamic study and whether it is necessary to perform the test before prolapse surgery.

In a study by James L et al., conducted in the United States on the importance of UDS in women with POP and UI, it was found that the need for UDS before surgery was under question. However, there is less controversy over the importance of UDS in patients who are candidates for further surgeries or have postoperative symptoms[16]. A study conducted in 2017 revealed that patients with simple UI could undergo surgery without UDS. This is due to the fact that the results of preoperative UDS would not cause significant changes in the outcomes of surgery. However, UDS is advised for patients with complex SUI to ensure the necessity of surgery and avoid unnecessary procedures[17]. Notwithstanding, the final decision may vary for each person, based on the clinical examination[18].

Relationship between the questionnaire results and POP severity

According to a study by Lena Dain et al. in Israel, an increase in the prolapse stage leads to a notable rise in urinary symptoms, such as voiding LUTS, SUI, and UUI [19]. However, no significant relationship was found between the POP severity and the patient's symptoms, based on the questionnaire results in the present study.

UDS in patients with POP and SUI

UDS is commonly used to assess SUI associated with the reduction of prolapse (also known as occult or latent SUI), which occurs in women with POP only after the prolapse is reduced. Several studies have documented the use of UDS in detecting SUI among women with POP; however, its impact on postoperative outcomes remains highly debated. In a study by Mouritsen L et al. (2003) conducted in Denmark on the symptoms of patients with prolapse, 13-65% of women without complaints of SUI showed symptoms of SI on the urodynamic test, after prolapse reduction (occult SUI). Therefore, they concluded that patients with prolapse, who do not complain of SUI, should be evaluated using UDS before surgery[20].

In another study by Balci et al. (2017), conducted in Istanbul, Turkey, 287 patients with POP were evaluated. According to this study, 20 out of 85 patients who had not complained of SUI had SI based on the urodynamic test, and the prevalence of occult SUI (OSI) was reported to be 23.5% [21]. In the present study, 73% of patients with SUI based on the questionnaire showed signs of SI on the urodynamic test (Urodynamic SI). Also, 2 (1.94%) out of 103 patients, who had not complained of this condition, developed USI (OSI). Overall, the relationship between this complaint and urodynamic findings was significant ($P < 0.001$). Since the urodynamic results were in accordance with the questionnaire results, UDS does not seem to have a significant value in evaluating SUI in patients with POP.

Table 4. The relation between stages of POP and Voiding LUTS.

	Voiding LUTS		
	Yes N (%)	No N (%)	*P*-value
Stage1 (n=15)	3(20)	12(80)	0.158
Stage2(n=122)	58(47.5)	64(52.5)	
Stage3(n=58)	30(51.7)	28(48.3)	
Stage4(n=5)	3(60)	2(40)	

Table 5. The relation between Voiding LUTS and Urodynamic test in women with POP.

		BOO	UAB	Normal	*P*-value
Voiding LUTS	Yes n=94	5(5.3%)	9(9.6%)	80(85.1%)	0.943
	No(n=106)	5(4.7%)	9(8.5%)	92(86.5%)	

UDS in patients with POP and Storage LUTS

Moreover, UDS is used for evaluating concomitant storage symptoms in POP patients. Storage symptoms are reported in up to 86% of patients with POP. Caruso et al. conducted a study on 537 patients with UI in 2010 and showed that 278 patients had a history of UUI, 58.6% of whom had DO, based on the urodynamic test. Furthermore, according to the urodynamic test, 45.7% of patients with a history of SUI (n=306) had USI. It was concluded that there was a significant relationship between UI, based on the patient's medical history, and urodynamic findings[22]. In another study by Foster et al. (2007), only 2% of patients with a history of UUI had DO according to the urodynamic test. They concluded that there was no significant relationship between the overactive bladder (OAB) symptoms and DO on the urodynamic test, which is inconsistent with the findings of the present study[23].

In a study conducted in 2011 in Europe, aiming to assess the relationship between urodynamic findings and urinary symptoms in women with prolapse, a total of 802 patients were evaluated. The results showed that 61.8% of these patients had SUI symptoms, and 68.6% had symptoms of OAB. Moreover, 33.8% and 18.7% of patients had urodynamic SI and DO, respectively, and 24.3% had concomitant urodynamic SI and DO. It was concluded that UI and OAB had independent relationships with SI and DO on the urodynamic test. They also mentioned that alternative methods, such as questionnaire and cystoscopy, could not be more effective than UDS, although the effectiveness of UDS in preoperative evaluation is under question. Therefore, UDS is suggested as the gold standard in the evaluation of urinary disorders before prolapse surgery to prevent unexpected postoperative outcomes[24].

In the present study, 64.5% of patients with UUI based on the questionnaire (n=62) had DO, according to UDS. Also, 25.8% of these patients had DOI. Moreover, 3 (2%) out of 138 patients, who had not complained of UUI, showed signs of DO on the urodynamic test, one of whom (0.7%) had concomitant UUI. The relationship between this complaint and urodynamic findings was significant ($P < 0.001$). Since UDS findings were in accordance with the questionnaire results, UDS does not seem to have a high value in evaluating the storage symptoms of patients with POP.

UDS in patients with POP and voiding LUTS

Another use of UDS is the evaluation of voiding symptoms or elevated post-void residual (PVR) urine in patients with POP. Bladder outlet obstruction (BOO) is a common urodynamic finding among women with advanced POP. However, these symptoms may improve after the surgical correction of prolapse due to the resolution of obstruction. In this regard, Lena Dain et al. (2010) conducted a study in Israel and examined 81 women with prolapse. The results showed that 17.5% of patients with a history of voiding LUTS (n=40) had BOO based on the urodynamic test. Moreover, 7.3% of women who did not have a history of voiding LUTS (n=40) showed signs of obstruction on the urodynamic test. Therefore, no significant relationship was found between voiding LUTS and urodynamic findings in patients with prolapse[19].

In the present study, UDS revealed that 5.3% and 9.6% of patients with voiding LUTS (n=94), according to the questionnaire, had BOO and UAB, respectively. Also, according to UDS, 4.7% and 8.5% of patients without voiding LUTS in the questionnaire (n=106) had BOO and UAB, respectively. Based on these results, no significant relationship was found between medical history and urodynamic findings ($P > 0.05$). Therefore, voiding LUTS based on questionnaire does not necessarily predict objective BOO in UDS, which occurred in only a small proportion of symptomatic patients and were not more prevalent in this group compared with asymptomatic patients.

Findings of the present study confirm the results of the study by Lena Dain, which showed that UDS with the reduction of prolapse could help us evaluate the detrusor function and BOO. In contrast, questionnaires do not provide accurate information in this area. However, the effectiveness of UDS in predicting the probability of POP repair failure and postoperative voiding dysfunction or OAB is controversial[22,25-27]. This issue was not investigated in the present study due to the limitations of the research, and therefore, further research is suggested in this area.

CONCLUSIONS

In terms of UI, considering the correlation between the symptoms based on the questionnaire and urodynamic findings, performing UDS cannot provide further information in patients with clinical SUI as well as in those with overactive bladder symptoms. Additionally, there was no significant relationship between voiding LUTS based on the questionnaire and urodynamic findings, therefore, performing UDS can help us consult the patients more effectively regarding this issue.

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