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Clinical and Urodynamic Study of Adult Female Patients with Urinary Incontinence

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Abstract

Background Urodynamics provide objective pathophysiological explanations for symptoms and/or dysfunction of the lower urinary tracts. It reproduce patient symptoms during the performance of the study and assist clinicians in determining the precise cause, aid in diagnostic process and follow up of patients with urinary incontinence.

Objective To evaluate the role of urodynamic study in confirming the diagnosis of urinary incontinence in Iraqi women. Differentiate the types of urinary incontinence and assess the importance of risk factors in its development.

Methods This study was performed in the Urology Department, Al-Sader Medical City, Holly Najaf between March 2013 and March 2014. One hundred and twenty female subjects aged 20 to 60 years were studied. They comprised 60 patients and 60 control subjects. Medical history, clinical examination and urodynamic tests were performed for them.

Result Thirty four patients presented with stress urinary incontinence, nineteen with urge type, five with mixed type and only two patients presented with overflow urinary incontinence. The patients were complaining of cough, constipation (most of them in stress type) and presence of cystocele (most of them in stress urinary incontinence patients). In addition, there was positive history of hypertension and positive family history of urinary incontinence. The strong desire to urination and the maximum urinary bladder capacity of patients was significantly smaller than those of control subjects, specifically those patients with stress and urge urinary incontinence.

Conclusion Age, Parity and body mass index significantly affect the prevalence of urinary incontinence in women who have given birth vaginally. Stress urinary incontinence is the most common type of UI among women regardless the small sample size in the study. Cystometric changes of urodynamic study were markedly evident in the stress urinary incontinence patients as compared to the healthy women.

Keywords Urinary incontinence, Urodynamic study, Cystometry, Adult females.

List of Abbreviation: SUI = stress urinary incontinence, UUI = urge urinary incontinence, MUI = mixed urinary incontinence, OFI = overflow incontinence, UI = urinary incontinence, LUT = lower urinary tract, UTI = urinary tract infection.

Introduction

Urinary incontinence (UI) is defined by the International Continence Society as involuntary loss of urine that cause a social or hygienic problem. The reported prevalence varies, with up to 33% of younger women and over 50% of women over 60 years old affected [(1)].

Population studies estimate that 20-30% of women are affected but only 7-12% perceives it as a problem [(2,3)]. UI is a pelvic floor disorder leading to an involuntary loss of urine that commonly affects older adults [(4)]. It is an extremely common complaint in every part of

the world. It causes a great deal of distress and embarrassment, as well as significant costs, to both individuals and societies [5,6].

The main types of UI are stress incontinence (SUI) which is defined as the complaint of involuntary loss of urine on effort or physical exertion (e.g., sporting activities), or on sneezing or coughing [7].

Urge incontinence (UUI), presenting as an involuntary passage of urine associated with an overwhelming urge to urinate as a consequence of abnormal detrusor activity and not connected with increased intra-abdominal pressure [8,9].

Mixed incontinence (MUI) which is defined as involuntary leakage of urine associated with urgency on exertion, effort, sneezing, or coughing.

It has been reported that between 30% and 50% of incontinent women experience MUI [10]. A less common form of UI in women is overflow incontinence (OFI) which is associated with overdistension of the urinary bladder (UB) and can be caused by obstruction, i.e., pelvic organ prolapse or a neurological condition, i.e., spinal cord injury [11].

The most important risk factor is being female [12]. The incidence of UI increases with increasing age [13], pregnancy, child birth [14,15], an increase of body mass index (BMI) [16] and smoking [17].

Since 1976, through the influence of the International Continence Society (ICS), urodynamics has been promoted as an important, objective aspect of the diagnostic evaluation of patients with such symptoms [18].

In the case of incontinence, the most relevant of these tests are directly related to the incontinence itself; that is, they aim to demonstrate involuntary leakage in the test setting. In the last 30 years, cystometry has been established as the gold standard for detailed assessment of lower urinary tract (LUT) symptoms, particularly SUI and UI [19].

The objective of our study is to evaluate Iraqi women with different types of UI and its relation to some confounding risk factors.

Methods

The study was approved by the Institute Review Board of the College of Medicine, Al-Nahrain University. A cross sectional study conducted in Al-Sader Medical City, Holly Najaf for the period from the March 2013 to March 2014. Sixty controls females and 60 patients with UI were involved in the study. Pregnant women or those within six weeks postpartum were excluded. Women with neurologic diseases like spinal cord injury, history of trauma or medications that could cause incontinence, urinary tract malformations, pelvic tumors and those who already undergone corrective surgery for UI were also excluded from the study. General urine examination was made for all participants to exclude urinary tract infection (UTI).

Standardized urodynamic assessment was performed with multichannel urodynamic instrument, Model 10318, Mediwach, Medtronic, UK, including retrograde water cystometry at a filling rate of 50 ml per minute. Filling cystometry performed with infusion of distilled water. The urodynamic procedure was in accordance with the standards recommended by the International Continence Society.

In the beginning of urodynamic test, the patient was asked to empty her UB after she was positioned in lithotomy position on the examination table by 16 F Folly's catheter to remove any residual urine.

Provocative cough testing was carried out initially to assess the correct placement of urodynamic machine lines. Abdominal, vesical and detrusor pressure were measured using external pressure transducers, which were calibrated before each procedure and zeroed to atmospheric pressure using the level of the symphysis pubis as the reference height. A 12Fr microtip catheter was placed in the subject rectum to record abdominal pressure (pabd).

An 8Fr dual microtip catheter with sideway holes, 30 cm long and an infusion port was placed in the UB to record intravesical pressures (pVes). Detrusor pressure (pdet) was measured with a continuous subtraction (pdet = pVes-pabd). A cough and stress maneuvers performed

every 100 cc until maximum cystometric capacity (MCC) was attained.

Cystometrogram parameters including first sensation to void (the patient was asked to mark once she feel any desire to urination), normal desire (when she can tolerate the examination), strong desire to void (when she have severe desire to void), MCC (when the patient can't tolerate the examination any more). The patient was then asked to cough and bounce up and down. Any rises in the detrusor pressure or leakage of urine in response to these activities were recorded. The presence of detrusor overactivity with or without incontinence was annotated. Valsalva leak point pressures were assessed at a minimum volume of 200 mL. At the end, the subject was seated upright and she attempted to void. After voiding was complete the patient was catheterized and post-voiding residual urine was recorded.

Data Analysis

Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS) version 20. Categorical variables were presented as frequencies and percentages. Continuous variables were presented as mean and standard deviation 95% confidence interval. Independent sample t-test was done to find the diffidence between two groups. A *P* value of ≤ 0.05 was considered as significant.

Results

The age of the patients and the control group was matched with no significant difference (37.53±12.54 versus 35.27±10.19 years). The BMI of the patients was 34.42±5.62, which is significantly higher (*P* < 0.001) than 26.13±5.20 of the control group. Regarding the parity, majority (60.0%) of the patients had more than 3 children compared to 40.0% of control group (*P* = 0.001). Thirty four (56.6%) patients presented with SUI, nineteen (31.70%) with UUI, five (8.30%) with MUI and only two patients (3.40%) presented with OFI. History of obstetric surgery (cesarean section), chronic cough, constipation, genitourinary prolapse, hypertension and family history of UI were significantly different between the two groups but not the smoking habit (Table 1).

Table 1. Socio-demographic data of patients with urinary incontinence using Chi square test

Variable		Control (N %)	Urinary Incontinence Patients (N %)	*P* value
Caesarean section	Yes	15 (25.0)	6 (10.0)	0.031
	No	45 (75.0)	54 (90.0)	
Chronic Cough	Yes	1 (1.7)	20 (33.3)	< 0.001
	No	59 (98.3)	40 (66.7)	
Constipation	Yes	3 (5.0)	17 (28.3)	0.001
	No	57 (95.0)	43 (71.7)	
Genitourinary Prolapse	Yes	0 (0.0)	29 (48.3)	< 0.001
	No	60 (100.0)	31 (51.7)	
Hypertension	Yes	9 (15.0)	22 (36.7)	0.007
	No	51 (85.0)	38 (63.3)	
Family History of UI	Yes	2 (3.3)	13 (21.7)	0.002
	No	58 (96.7)	47 (78.3)	
Smoking Habit	Yes	2 (3.3)	6 (10.0)	0.272
	No	58 (96.7)	54 (90.0)	

Cystocele, smoking habit, chronic constipation, and chronic cough were present in high percentages in the SUI patients as compared to the other UI types, whereas history of cesarean section was higher in UUI patients (Table 2).

Table 2. Socio-demographic data of urinary incontinent patients

Variable	Urinary Incontinence patients				Control group N (%)
	SUI N (%)	MUI N (%)	UUI N (%)	OFI N (%)	
Cystocele	18 (52.9%)	2 (40%)	9 (47.3%)	none	0 (0.0)
Smoking	4 (11.76)	2 (40%)	none	none	2 (3.3%)
Constipation	10 (29.4%)	5 (100%)	2 (10.52%)	none	3 (5.0%)
Cough	12 (35.29%)	5 (100%)	3 (15.78%)	none	9 (15.0%)
Cesarean section	5 (14.7%)	3 (60%)	6 (31.57%)	1 (50%)	6 (10.0%)

SUI = stress urinary incontinence, MUI = mixed urinary incontinence, UUI = urge urinary incontinence, OFI = overflow incontinence.

LUT symptoms like cough induced UI, UI before arriving to the water cycle, UI at nighttime, wetting bed, continuity of UI, repeated UTI, using of pack, psychological effect of UI was present in the majority of patients with significant statistical difference as compared to the control group. On the contrary, minority (21.7%) of UI patients have feeling of complete bladder empting after urination versus 68.3% of the control group. None of the control group had positive cough test compared to 39 UI patients (Table 3).

Table 3. Lower urinary tract symptoms in urinary incontinent patients and control group

Variable		Patients (N %)	Control (N %)	*P* value
Cough-induced urinary incontinence	Yes No	48 (80.0) 12 (20.0)	0 (0.0) 60 (100.0)	<0.001
Urinary incontinence before arriving bath	Yes No	52 (86.7) 8 (13.3)	0 (0.0) 60 (100.0)	<0.001
Frequent urination at nighttime	Yes No	46 (76.7) 14 (23.3)	4 (6.7) 56 (93.3)	<0.001
Bed wetting	Yes No	23 (38.3) 37 (61.7)	0 (0.0) 60 (100.0)	<0.001
Continuity of urinary incontinence	Yes No	48 (80.0) 12 (20.0)	0 (0.0) 60 (100.0)	<0.001
Complete bladder emptying	Yes No	13 (21.7) 47 (78.3)	41 (68.3) 19 (31.7)	<0.001
Repeated urinary tract infection	Yes No	34 (56.7) 26 (43.3)	0 (0.0) 60 (100.0)	<0.001
Pack Usage	Yes No	40 (66.7) 20 (33.3)	0 (0.0) 60 (100.0)	<0.001
Psychological effect of urinary incontinence	Yes No	58 (96.7) 2 (3.3)	0 (0.0) 60 (100.0)	<0.001
Cough Test	Positive Negative	39 (65.0) 21 (35.0)	0 (0.0) 60 (100.0)	< 0.001

Table 4 shows the cystometric findings in UI patients and the controls. The strong desire to urinate equals to (388.38±158.78) mL water in UI patients, which is significantly reduced (P < 0.001) as compared to (500.30±103.48) mL water of the control women. Similarly, UI patients exhibit maximum cystometric capacity of (427.78±157.94) mL water in, a value that was significantly less than (537.57±97.57) mL water of the control group (P < 0.001).

Table 4. Cystometric findings in stress urinary incontinence patients and control group using T test

Cystometric findings	Group	Mean ± SD	*P* value
1st Desire to urinate (mL water)	SUI Patients Control	188.45 ± 104.49 219.38 ± 76.51	0.067
Normal desire to urinate (mL water)	SUI Patients Control	297.32 ± 144.95 330. 53 ± 101.03	0.148
Strong desire to urinate (mL water)	SUI Patients Control	388.38 ± 158.78 500.30 ± 103.48	< 0.001
Maximum cystometric capacity (mL water)	SUI Patients Control	427.78 ± 157.94 537.57 ± 97.57	< 0.001

SUI = stress urinary incontinence

Discussion

In the current study, majority of MUI and UUI patients were older (≥ 50 years) than patients with SUI (30-50 years). This finding agree with most of the researches dealing with UI that reveals an increase in the prevalence of MUI and UUI up to middle age and then leveling off at age of 50-70, followed by steady increase among aged population [(15)]. Furthermore, and in harmony with the findings of many researchers [(20)], SUI was predominant in younger and middle age women.

Since collagen is the most important component of the connective tissue and because the age range of the patient of the current study ranges from 27 to 60 years; it is speculated that reduced collagen content in the anterior vaginal wall with aging might contribute to the SUI of those patients. This also noted by Keane *et al* [(21)] who found urodynamic SUI even in premenopausal nulliparous women.

UI is an unwelcome and unacceptable outcome of childbearing. A significant correlation was demonstrated between parity and the prevalence of UI in the present study where 60.0% of the patients had more than 3 children. This would suggest that pregnancy itself might cause mechanical changes, hormonal changes or both, leading to UI [(20)].

Continence changes may be due to injuries, such as perineal tears, muscle trauma, or damage of the pudendal nerve. Notably, incontinence commencing in pregnancy can double the risk of developing postpartum UI, and pre-pregnancy incontinence can quadruple the risk of UI in the postpartum period [(22)]. In a study conducted in Australia reported in one out of three women who have ever had a baby, and six in 10 pregnant women, involuntarily leak urine. This prevalence rate means that from the 41% of Australian women giving birth for the first time each year, there is a potential of 30,900 new cases of childbirth related UI annually [(23)].

The majority of patients in this study presented with SUI followed by UUI and MUI while the minority shows OUI type, a finding, which is in accordance with those reported by Pregazzi *et al* [(24)] and Casey *et al* [(25)]. The small percentage of the patients who reported OUI was also reported by Chancellor *et al* [(26)] who stated that this type was more common in males than females.

Obesity emerged as an important risk factor for both SUI and UUI in this study. This is consistent with the observation of Melville *et al* [(27)] who

noticed that high BMI is a risk factor for UI. An association between obesity and pelvic floor disorders is a relatively consistent finding in epidemiologic studies [28]. Obesity is a potentially modifiable risk factor for bladder symptoms: Women can be encouraged to maintain a healthy weight as strategy to reduce the risk of both SUI and UUI [29].

In recent years, there has been increasing interest in elective cesarean delivery to reduce the long-term maternal risk of pelvic floor disorders and UI [30]. In the present study, most of patients have history of more than three vaginal deliveries. In contradiction to these findings, Chou *et al* [31] demonstrates no statistical difference in the prevalence of UI between vaginal and cesarean delivery after labor, yet, this study followed the patients for 1 year postpartum in primiparas which is a short period for follow up.

In this study, 17% of the patients had history of constipation; about 29% of these patients were diagnosed to have SUI, while all MUI patients reported history of chronic constipation. These findings were in consistence with other studies [32,33]. There is a close relationship between the muscles and nerves that control bladder functions and those that control bowel movements; moreover, the bladder and the colon are close together in the body. Large amounts of stool in the colon can put pressure on the bladder which can cause the bladder to not fill as much as it should, or cause the bladder to contract when the bladder is not supposed to contract. This large amount of stool can also cause the bladder to not empty well [34]. All of these problems can lead to daytime wetting, nighttime wetting, UTIs, and in some cases vesicoureteral reflux. Constipation and straining may weaken pelvic floor muscles, predisposing to SUI [33].

Chronic cough emerge as a risk factor in the study group. Twenty patients reported history of chronic cough; most of them were in the SUI group. The majority of patient with UI reported history of hypersensitive airway as a cause of chronic cough and only six patients reported history of smoking as a cause of chronic cough.

Smoking is an important risk factor for development of SUI among women in European countries [17]. In our society, the smoking is not a public habit, while the air pollution could be the risk factor for development of hypersensitive airway. Many studies reported cough as contributing factor for increasing intra-abdominal pressure leading to development of SUI [35,36].

Near half of the patients enrolled in the present study had have cystocele on the examination; most of them were in the SUI group (52.9%) followed by UUI group (47.3%). Cystoceles, which lead to loss of bladder neck and urethral support represent only one component of anterior vaginal wall prolapse. Cystoceles have been reported to develop in up to 52% of women after their first vaginal delivery [37].

In the present study, patient's psychological mode and limitation in their social and public life are positively associated with incontinence. Women living with UI have been shown to have a significantly lower quality of life compared with those who are continent. Muslim women suffered from additional disruption from UI because of cleanliness requirements for religious obligations.

Different theories have been proposed to explain the association between depressive mood disorders and incontinence. Altered neurotransmitter function in depressed patients could affect the complex bladder innervation, leading to UI. One possible explanation is that a decreased serotonin activity can lead to depression [38] which also has an effect on bladder function [39]. A different theory suggests that the increased activity of the hypothalamic-pituitary axis seen in depressed individuals may determine physiological changes in the bladder, causing incontinence. Alternately, the embarrassment from urine loss may lead to progressive social isolation and subsequent depression over time [40].

About 20% of the patients of the current study reported positive family history of UI; most of

them were in the SUI group. This might disclose a genetic predisposition to the development of UI in women. Other researchers also reported that the daughters of mothers with incontinence had an increased risk for UI [41,42].

Out of the sixty women enrolled in current study, only 22 women answered "yes" to the question "Do you have hypertension"; those women significantly older in age, with high BMI, and pervious urinary disease. This was in agreement with the findings of Chang *et al* [43] who assess the associated risk factors and the prevalence of UI among women with hypertension. In women with hypertension, UI is significantly related to risk factors such as age, DM, BMI, and urinary diseases, in addition, BMI is considered a key risk factor for hypertension.

Regarding the control group, the cystometric values of the first desire, normal desire, strong desire, and maximum cystometric capacity were within the normal ranges recorded by other researchers [44,45].

The values of all types of sensation were lower in UUI and MUI women that are in harmony with the results of other researchers [45,46]. Patients with UUI and MUI demonstrated significantly high volumes of Pdet.max reflecting detrusor instability; this was in consistence with the results of Mardon *et al* [47].

On the contrary, those with SUI and MUI recorded near normal cystometric values, which might signify normal filling sensations in these two groups; a finding also reported by Irwin *et al* [48] and Al-Taee *et al* [45]. This can be explained on the basis of the pathophysiology of these types of incontinence as they results from a sudden increase of abdominal pressure in the absence of detrusor contraction and associated with both intrinsic sphincter dysfunction and urethral hypermobility [49]. SUI is characterized by normal urodynamic finding except identifying leakage from the urethra coincident with increased abdominal pressure [15]. OUI also characterize by normal urodynamic finding apart from presence of post-voiding residual urine due to incomplete bladder emptying [50].

In conclusion, age, parity and BMI significantly affect the prevalence of UI in women who have given birth vaginally. SUI is the most common type of UI amongst women regardless the small sample size in the study. Cystometric changes of urodynamic study were markedly evident in the SUI patients as compared to the healthy women.

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Author Contribution

The authors share the responsibility in preparing and completing this work.

Conflict of interest

The authors declare no conflict of interest.

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