URODYNAMIC STUDY OF PATIENTS WITH OVERACTIVE BLADDER AND ITS CORRELATION WITH BLADDER WALL THICKNESS AND BLADDER TRABECULATIONS

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ABSTRACT

Background

Overactive bladder syndrome (OAB) is a highly prevalent condition. Urodynamics have long been the only option, and still remain the gold standard, for examining people with OAB complaints and composing an appropriate treatment plan. Alternatives for this invasive, expensive, and time-consuming examination have been explored

Objectives

To review if bladder wall thickness (BWT) and bladder trabeculations could be a more objective and easier measurement that potentially could diagnose overactive bladder.

Patients and Methods

Twenty six patients with overactive bladder underwent an urodynamic study for assessing detrusor muscle activity in Department of Urology at Sulaimaniya Teaching Hospital, from July 2009 to October 2009. Further investigations were performed including ultrasonography of the bladder to determine mean bladder wall thickness and cystourethroscopy for detecting the grade of the bladder trabeculation.

Results

There is no significant correlation between mean bladder wall thickness and bladder trabculations with detrusor action analysis (in filling or voiding phase) of urodynamic study.

Conclusion

We cannot depend on increased mean bladder wall thickness or bladder trabeculations for diagnosis of overactive bladder without urodynamic study.

Keywords: *Overactive bladders (OAB), Urodynamic, Mean bladder wall thickness, Bladder trabeculation*

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INTRODUCTION

Overactive bladder (OAB) is a complex symptom, the International Continence Society committee produced definition (Abrahams et al, 2002) as follows: the overactive bladder (OAB) is defined as urgency, with or without urge incontinence usually with frequency and nocturia [1].

Urgency is the wholemark of the OAB. OAB is often associated with urinary frequency and nocturia in the absence of pathologic or metabolic conditions that may cause or mimic OAB, such as urinary tract infection, polyuria, transitional cell carcinoma of the bladder, and underline neurologic abnormalities [2].

Overactive bladder has a high prevalence in the community, (in the Milsom study 16%), and in the National Overactive Bladder Evaluation (NOBEL) study was 16.5% met the criteria for OAB, of these, men and women had the same prevalence overall (16.0%-16.9%) respectively [1].

Overactive bladder (OAB) appears to be multifactorial in both etiology and pathophysiology. Symptoms of OAB are usually associated with detrusor overactivity; over activity is neurogenic, myogenic, or idiopathic in origin [2].

Detrusor overactivity and OAB might arise in circumstances in which the afferent activity of the bladder is inappropriately high for any given degree of bladder distention. This could arise if nerve endings are pathologically sensitized or if they are abnormally numerous [1].

Urodynamic studies are techniques used to obtain graphics recordings of activity in the urinary bladder, urethral sphincter and pelvic musculature. It is an important part of the evaluation of patients with voiding dysfunctions, urinary incontinence and neuropathic disorders [3].

The role of urodynamics need to support the clinical assessment of the overactive bladder symptoms with objective measurement has become accepted by most clinicians specializing in the care of patients [4].

The 1988 International Continence Society terminology report (Abrams et al, 1988) differentiated types of detrusor storage function, as determined by filling cystometry: normal derusor function allows filling with little or no change in pressure; no involuntary phasic contractions occure despite provocation. Overactive detrusor function is a urodynamic observation characterized by involuntary detrusor contractions during the filling phase which may be provoked [1].

Phasic detrusor overactivity is defined by a characteristic wave form and may or may not lead to urinary incontinence. Terminal detrusor overactivity is defined as a single involuntary detrusor contraction occurring at cystometric capacity, which cannot be suppressed and results incontinence usually resulting in bladder emptying (voiding) [4].

Bladder sonography can be used as a technique to examine the bladder wall or intravesical lesions. Ultrasound of the bladder may be performed via a transabdominal, transvagainal, or transrectal approach. The transabdominal approach is the most often used technique [4].

The assessment of BWT (i.e. the thickness of the mucosal layer, detrusor muscles, and adventitia) is an indirect measure of detrusor muscle thickness which is normally equal or less than 6mm [5, 1].

Detrusor muscle hypertrophy could be the result of repeated detrusor contractions against a closed urethral sphincter [5,7].

Trabeculation of the bladder wall, the wall of the distended bladder is normally quite smooth with hypertrophy individual muscle bundles become taut and give a coarsely interwoven appearance of the mucosal surface [3]. Trabeculations can be diagnosed by cystourethroscopy directly visualize lower urinary tract anatomy and macroscopic pathology, which may be responsible for the clinical picture under evaluation [1]. Chapple and Turner-warwick concluded that the endoscopic appearance of trabeculation in male patient usually associated with thick walled bladder but is diagnostic of obstruction.

The aim of the Study was to preview if the bladder wall thickness (BWT) and bladder trabeculation could be a more objective and easier measurement that potentially could diagnose over active bladder.

PATIENTS AND METHODS

We investigated twenty six cases (complaining of overactive bladder symptom) for this study by doing urodynamic study in our unit from July 2009 to October 2009. Their age (16-86 year) old; we excluded pediatric age group.

Case sheets for each patient included history, examination (including neurological examination) and general tests. With urodynamic study bowel preparation was arranged. Ultrasound examination was done by the radiologist using (Siemens Sonoline Omnia) and the bladder was examined by (3.5MHz) transducer through suprapubic transabdominal approach. By three different dimensions the mean bladder wall thickness, was calculated in addition to measuring post voiding residual volume and prostatic size for male patients.

Cystourethroscopy for each patient was done in eleven cases by flexible cystoscope while 15 by rigid cystoscope. Bladder trabeculations were classified into four grades; grade 0- normal, grade 1- mild trabeculation, grade 2- moderate, grade 3- severe trabeculations.

Urodynamic study was done by conventional method (Ellipse system, Andromedia Company). Urine flow study was also performed. Cystometry was done for the patients in lithotomy position. 8F urethral catheter, 12F rectal catheter. Both equipped with a microtip pressure sensor. The pressure sensor was set at zero to atmospheric pressure. The bladder was filled with water at room temperature at a filling speed 25 ml/min.

During bladder filling, we assessed the following parameters: bladder sensation, detrusor activity, bladder compliance, urethral function, and bladder capacity.

RESULTS

A total of 26 cases with lower urinary tract symptoms were collected for this study from July 2009 to October 2009. The mean patient's age was 38.62 years (range 16-86), (table 1). Male to female ratio 1:1 (13 male and 13 female figure 1)

Among these cases, two of them had diabetic mellitus; two had cerebrovascular accidents and one case with intrathecal lipoma. Two cases were complaining of OAB after history of trauma with fracture vertebrae.

During urodynamic study we found six cases with normal findings while twenty (76.9%) cases were with abnormal detrusor activity either during filling or voiding phase. (Figure 2). The detrusor muscle activity during filling phase of urodynamic study reveals twelve cases (46.2%) with normal detrusor function, while fourteen cases (53.8%) with overactive detrusor functions. (Table 2).

Detrusor muscle activity during voiding phase of urodynamic study reveals nine (34.6%) hyporeflexic detrusor function, thirteen cases (50.0%) with normal and 4 (15.4%) cases with hyperreflexia (Table2).

The mean bladder wall thickness reveals seventeen cases (65.4%) normal. While increased mean bladder wall thickness in nine (34.6%) cases (Table 2).

Table 1. Mean patient's age distribution.

Variable	Minimum	Maximum	Mean	Std. Deviation
Age	16	86	38.62	16.928

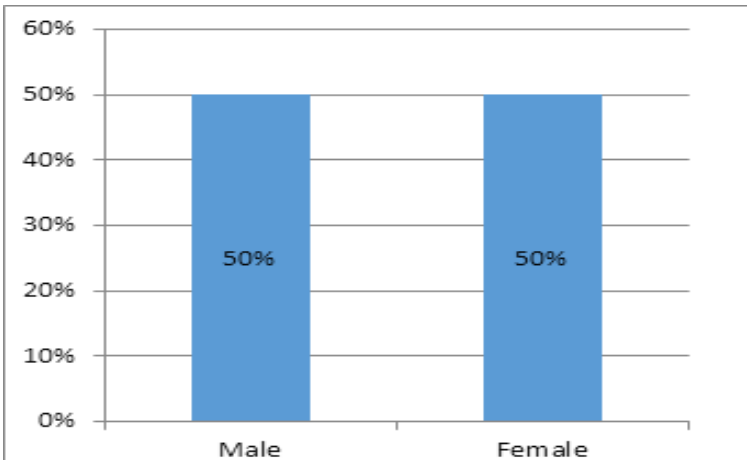

Figure 1. Gender Distribution.

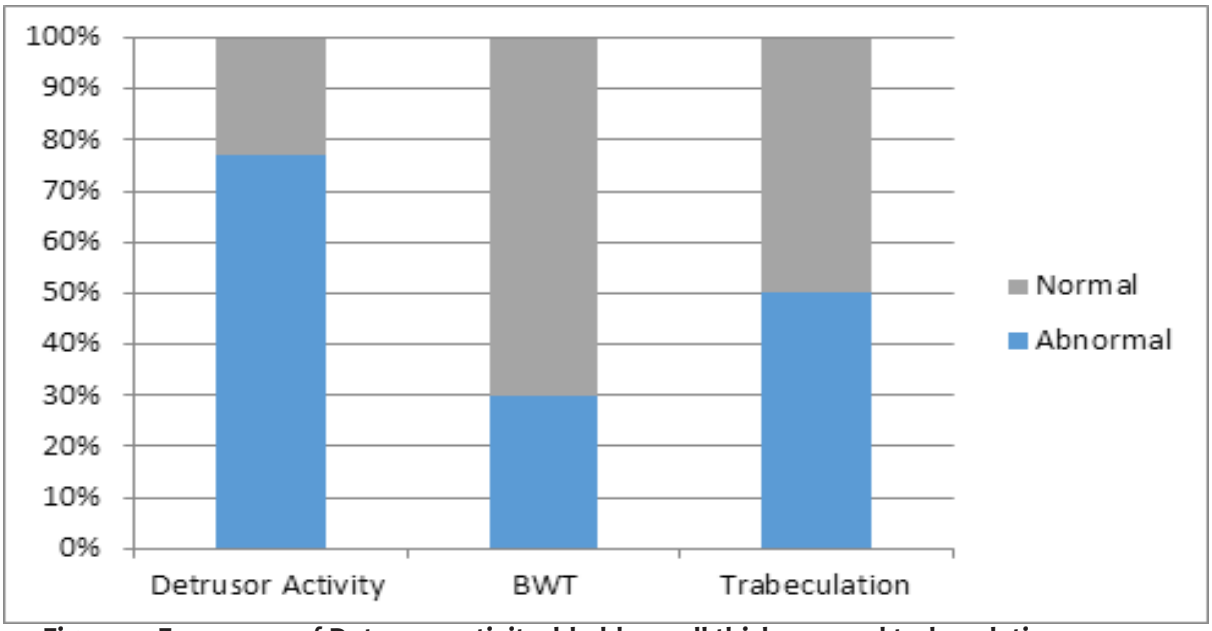

Figure 2. Frequency of Detrusor activity, bladder wall thickness and trabeculation.

Table 2. Frequency of detrusor muscle functioning by urodynamic study and mean bladder wall thickness.

Variables	Frequency	Percent
Filling		
Normal	12	46.2
Detrusor overactivity	14	53.8
Voiding		
Hyporeflexic	9	34.6
Normal	13	50.0
Hyperreflexic	4	15.4
Bladder wall thickness		
Normal	17	65.4
Thickened	9	34.6

The frequency of grade of bladder trabeculations during cystourethroscopical finding reveals eleven cases (42.3%) no trabeculation, grade 1 trabeculation nine cases (34.6%) grade 2 trabeculation five cases (18.2%) and grade 3 trabeculation one case (3.8%). (Figure 3); overall fifteen cases (57.7%) have trabeculation of bladder.

The correlation of the gender of the patient to detrusor function is not significant during filling or voiding phase (p value 0.431, 0.354 respectively). It is also not significant with mean bladder wall thickness (p value 0.216), and grade of bladder trabeculation (p value 0.391), (Table 3).

The correlation of the age of the patient to detrusor functioning during filling phase has significant positive correlation (p value 0.033) while it is not significant during voiding phase (p value 0.987). There is also no significant correlation between age and either mean bladder wall thickness (p value 0.118) or grade of bladder trabeculations (p value 0.462), (Table 4).

In this study there is no correlation of detrusor function (during filling and voiding) with increased mean bladder wall thickness. P values during filling (0.127) and during voiding (0.775), and no correlation with trabeculations. P values during filling was (0.740) and during voiding 0.151), (Table 5).

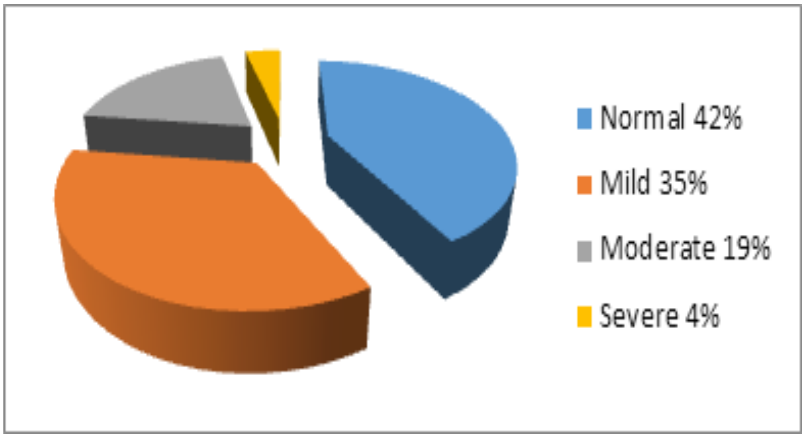

Figure 3. Frequency of trabeculation grades in bladder.

Table 3: correlation between genders with detrusor function. Mean bladder wall thickness and grades of bladder trabeculation.

Variables	Gender		P. value*
	Male No. (%)	Female No. (%)	
Filling			
Normal	5(41.7)	7(58.3)	0.431
Detrusor overactivity	8(57.1)	6(42.9)	
Voiding			
Hypotonic	3(33.3)	6(66.7)	
Normal	7(53.8)	6(46.2)	0.354
Hypertonic	3(75.0)	1(25.0)	
Bladder wall thickness			
Normal	10(58.8)	7(41.2)	0.216
Thickened	3(33.3)	6(66.7)	
Trabeculation			
Normal	5(45.5)	6(54.5)	
Mild	4(44.4)	5(55.6)	
Moderate	4(80.0)	1(20.0)	0.391
Severe	0(0.0)	1(100.0)	

***P value calculated by chi square test.**

Table 4. Correlation between age with detrusor function, mean bladder wall thickness and grades of bladder trabeculation.

Variables	Age (years) Mean ± Std. deviation	P value
Filling		
Normal	31.08±10.44	0.33*
Detrusor overactivity	45.07±19.01	
Voiding		
Hypotonic	39.00±0.34	
Normal	38.08±16.62	0.987**
Hypertonic	39.50±32.35	
Bladder wall thickness		
Normal	42.41±18.76	0.118*
Thickened	31.44±10.12	
Trabeculation		
Normal	43.73±12.28	
Mild	35.44±14.03	
Moderate	37.00±28.74	0.462*
Severe	19.00±0.00	

***P value calculated by t-test, P value calculated by ANOVA.**

Table 5: correlation between detrusor functioning with mean bladder wall thickness and grade of bladder trabeculation.

Variables	Bladder wall thickness			Bladder trabeculations				
	Normal N(%)	Thickened N(%)	P value*	Normal N(%)	Mild N(%)	Moderate N(%)	Severe N(%)	P value*
Filling								
Normal	6(50.0)	6(50.0)	0.127	5(41.7)	4(33.3)	2(16.7)	1(8.8)	0.740
Detrusor overactivity	11(78.6)	3(21.4)		6(42.9)	5(35.7)	3(21.4)	0(0.0)	
Voiding								
Hypotonic	6(66.7)	3(33.3)		6(66.7)	2(22.2)	0(0.0)	1(11.1)	
Normal	9(69.2)	4(30.8)	0.775	5(38.5)	5(38.5)	3(23.1)	0(0.0)	0.151
Hypertonic	2(50.0)	2(50.0)		0(0.0)	2(50.0)	2(50.0)	0(0.0)	

***P value calculated by Chi square test.**

DISCUSSION

From our study, we found twenty cases (76.9%) with abnormal detrusor activity, while nine cases (34.6%) with increased mean bladder wall thickness and fifteen cases (57.7%) had trabeculated bladder in association with overactive bladder.

There is a positive correlation between age of the patient with detrusor functioning during filling phase is (P value 0.033). This may indicate chronicity of the disease. The degenerative changes that occur in bladder muscle and delta fibers (silent fibers) make them hypersensitive during aging process [(2)]. There is no significant correlation during voiding phase.

Age was not significantly correlated with the mean bladder wall thickness and grade of bladder trabeculation. This could be due to low number of cases in this study.

Our results showed that there is no significant correlation between the gender and detrusor functioning during filling and voiding phase, mean bladder wall thickness and grade of bladder trabeculations.

That is because until now there is no evidence of difference alpha fibers, delta fibers and muscarinic

receptors between male and female. The prevalence of OAB rose similarly with age in both men and women. (16.0% and 16.9%, respectively) [1].

There is no significant correlation between detrusor functioning during filling and voiding phase with mean bladder wall thickness, and grade of bladder trabeculation.

Fransisco Cruz showed in a blinded, prospective study, BWT measurements were compared with ambulatory urodynamics when investigating women with storage symptoms of LUTS. Women with a normal ambulatory study had a mean BWT of 5.1 mm, while those with detrusor instability had a mean BWT of 6.7 mm (p<0.05). The authors concluded that ultrasound is a useful additional tool for assessing detrusor instability [5].

Panayi D. proofed that mean BWT shows a stronger association with women's reported LUTS symptoms than the urodynamic diagnosis with 85% of the women in their study with OAB having an elevated means BWT when compared to the 65% of women with OAB who also had detrusor overactivity [10].

Jenn-Ming Yang, studied factors affecting bladder wall thickness on ultrasonographic cystourethrography in female patients with lower urinary tract symptoms. He found a thickened bladder wall was a common finding in female patients with lower urinary tract symptoms [11].

Soligo M. Showed a major improvement in positive and negative predictive value with the concomitant use of ultrasound measurement of bladder wall thickness and OAB symptoms compared with using OAB symptoms alone for diagnosing women with detrusor instability. They therefore strongly suggest the combination of tests before deciding the treatment of women with urinary symptoms if urodynamic is not performed [12].

There is no standardized method of measuring BWT. Assessing BWT with ultrasonography is a very appealing concept for research purposes [5].

Many arguments suggest that BWT is too difficult to measure, including the fact that measurements differ to a large extent from one measurer to another. A quick review of the literature reveals very diverse numbers used as a cut-off to suggest detrusor overactivity, it becomes clear that there is no standard method of measuring BWT. Each centre has its own protocol with advantages and disadvantages, making it difficult to compare studies [5]. In addition to that the ultrasound is operator dependant.

In our study the bladder trabeculation also are not correlated with abnormalities during filling and voiding phase, while Jenn-Ming Yang showed generally the findings at urethroscopy correlate well with the results of urodynamic investigations, in response to several different etiological factors. The bladder wall undergoes distinct morphological changes that are readily recognized macroscopically as trabeculation [13].

Albadawi et al concluded that it remains to be determined whether overactivity and trabeculation represent the cause and effect relationship or are independent manifestation of the same process that initiate structural changes in the aging detrusor in general. It appeared that the filling component of the symptom scores correlated significantly with grade of bladder trabeculation [14].

Anderson and Nordling study showed no correlation of detrusor instability with the grade of trabeculation [15], as in our study.

Moreover we are aware that grade of trabeculation are physician dependant [9] and state of bladder distention during examination [3].

Finally three factors greatly influence the value of urodynamics: The urodynamic technique should be free of technical artifacts, the result of investigations should be reproducible and the clinician should be properly trained and able to interpret the result of urodynamic [4].

n conclusion we cannot depend on ultrasound for increased mean bladder wall thickness or bladder trabeculation for diagnosis of overactive bladder without urodynamic study.

The analysis of detrusor function during urodynamic study was objectively more frequently associated with over active bladder more than with trabeculated bladder and increased mean bladder wall thickness for the diagnosis of OAB.

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