UIJ UroToday International Journal®

www.urotodayinternationaljournal.com
Volume 3 - December 2010

Comparison of Videocystourethrography and Ambulatory Urodynamic Monitoring in Identifying the Causes of Overactive Bladder Symptoms

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Submitted September 22, 2010 - Accepted for Publication October 27, 2010

ABSTRACT

INTRODUCTION: The purposes of the present study were to: (1) compare the findings from videocystourethrography (VCU) with those from ambulatory urodynamic monitoring (AUM) to determine their level of agreement in identifying the causes of overactive bladder (OAB) symptoms; (2) examine changes in the diagnoses that were made following the first test (VCU) after the patient had the second test (AUM).

METHODS: This was a retrospective analysis of our AUM database during 2007 and 2008. The inclusion criteria were: (1) female patients over the age of 18 years with OAB symptoms; (2) complete documentation of all OAB symptoms; (3) results from both VCU and AUM. Patients were referred for AUM because the findings following VCU did not explain the presenting symptoms. The frequency and type of OAB symptoms and the results from the tests were recorded and compared.

RESULTS: A total of 100 women fulfilled the inclusion criteria. The mean age was 56 years (range, 19-87 years). The cause of the OAB symptoms was defined in 55% of the patients following VCU and 64% of the patients following AUM. Detrusor overactivity (DO) was not identified for any patients following VCU; it was found in 32 patients following AUM. Urgency with or without urge urinary incontinence was the symptom most frequently associated with DO. Of the 100 patients, 45 women had normal results from the VCU. Nine of these women also had normal results following AUM. For the remaining 36 women, the results from AUM identified abnormalities that could explain their symptoms. The most common findings were DO (58%) and urodynamic stress incontinence (16%).

CONCLUSION: Results from VCU for patients with symptoms of OAB should be interpreted with caution. AUM appears to be a more discerning tool in identifying DO. Clinicians should interpret urodynamic results in conjunction with clinical symptoms, particularly if a continence surgery is contemplated. AUM is particularly recommended for complex cases.

Abbreviations and Acronyms

AUM = ambulatory urodynamic monitoring
DO = detrusor overactivity
ICS = International Continence Society
LUTS = lower urinary tract symptoms
OAB = overactive bladder
UDS = urodynamic study
USI = urodynamic stress incontinence
UUI = urge urinary incontinence
VCU = videocystourethrography
VD = voiding dysfunction

KEYWORDS: Overactive bladder; Detrusor overactivity; Urodynamics; Ambulatory urodynamic monitoring.

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CITATION: *UroToday Int J*. 2010 Dec;3(6). doi:10.3834/uij.1944-5784.2010.12.13.

UroToday International Journal®

original study

Comparison of Videocystourethrography and Ambulatory Urodynamic Monitoring in Identifying the Causes of Overactive Bladder Symptoms

INTRODUCTION

The International Continence Society (ICS) defines *overactive bladder syndrome* as urgency with or without urge urinary incontinence, usually with frequency and nocturia [1]. Although overactive bladder (OAB) is a clinical diagnosis, detrusor overactivity (DO) is a urodynamic observation that is characterized by involuntary detrusor contractions that may be spontaneous or provoked during the filling phase [1].

OAB syndrome is a prevalent condition affecting 16.6% of the population aged 40 years and older in Europe. The prevalence tends to increase with age. The prevalence of incontinence among patients with OAB is higher in women than men. In addition, patients with OAB have reduced quality of life. OAB syndrome is associated with various comorbidities such as increased risk of falls and fractures, urinary tract and skin infections, sleep disturbances, and depression. In addition, OAB is often undertreated and underdiagnosed [2].

There is a poor correlation between OAB symptoms and the urodynamic diagnosis of DO, with better correlation in men than women. OAB symptoms are not equally predictive of DO; DO was diagnosed in 69% of men and 44% of women with urgency and 90% of men and 58% of women with urgency and urge urinary incontinence. Urinary frequency is the least predictive symptom of DO [3].

The main aim of urodynamic studies (UDSs) is to determine the underlying cause of the patient's symptoms. However, there are other aims in clinical practice. UDSs provide us with information about lower urinary tract function and dysfunction and their impact on the upper urinary tract. In some cases, it is also possible to predict the outcome or undesirable side effects of a planned treatment [4].

In some clinical practices, ambulatory urodynamic monitoring (AUM) is reserved for the investigation of complex cases or those where conventional cystometry or videocystourethrography (VCU) did not identify any abnormalities to account for the patient's symptoms. AUM is also useful for patients who fail to respond to antimuscarinics. Finally, AUM may be used in medical research.

The differences in the results of VCU and AUM for patients with OAB are not well known. The purposes of the present retrospective study were to: (1) compare the findings from VCU with those from AUM to determine their level of agreement in identifying the causes of OAB symptoms; (2) examine changes in the diagnoses that were made following the first test (VCU) after the patient had the second test (AUM).

METHODS

This was a retrospective analysis of the AUM database in a tertiary urogynecology referral center. The data were from patients tested between 01/01/2007 and 31/12/2008. Over 100 UDSs are performed every month including conventional cystometry, VCU, and AUM.

Patient Database

The inclusion criteria were: (1) female patients over the age of 18 years with OAB symptoms; (2) complete documentation of all OAB symptoms; (3) results from both VCU and AUM. Patients were referred for AUM because the findings following VCU did not explain the presenting symptoms. Women with long-term suprapubic catheters were excluded.

Procedures

All UDSs were performed according to the ICS Good Urodynamic Practices [5]. UDSs were performed by investigators accredited in UDS following attendance at an ICS Certificate Course in Urodynamics.

All women were sent the King's Health Questionnaire (KHQ) and a 3-day bladder diary. They were instructed to complete both items prior to the UDS.

Videocystourethrography. VCU was carried out using the Aquarius Triton (Laborie; Toronto, Canada). The women were instructed to attend with a comfortably full bladder in order to perform a free-flow study. Thereafter, filling cystometry was performed in the supine position, using single lumen urethral catheter size 10. The contrast medium iohexol (Omnipaque; GE Healthcare, Waukesha, WI, USA), which was kept at room temperature, was instilled at a rate of 100 mL/min. Intravesical pressure was measured using a 4.5 Fr bladder pressure catheter and abdominal pressure was measured using a 4.5 Fr rectal balloon catheter (both from Mediplus Ltd; High Wycombe, UK). Bladder filling was stopped when 500 mL of contrast had been instilled or the woman was unable to delay voiding, whichever occurred first. If DO was not detected during the filling phase, the patient's position was changed from supine to standing and provocative tests were employed. These included hand washing in cold water, listening to running water, and coughing. The provocative tests were employed with simultaneous radiological imaging of the bladder and urethra using fluoroscopy. At the end of the filling phase, a pressure-flow study was performed, and postvoid residual urine volume was measured.

Ambulatory urodynamic monitoring. AUM was carried out using the Gaeltec MPR/2 ambulatory recorder (Gaeltec Devices Ltd; Isle of Skye, Scotland), with Gaeltec catheter tip pressure

doi:10.3834/uij.1944-5784.2010.12.13
http://www.urotodayinternationaljournal.com
ISSN 1944-5792 (print), ISSN 1944-5784 (online)

transducers. A double microtip transducer was inserted into the bladder. Most transducers have a pressure-sensitive membrane a few millimeters beyond the tip of the catheter that causes pressure changes to be recorded whenever the membrane touches the bladder wall. To overcome this technical problem, 2 catheters were inserted and the intravesical pressure change was considered significant only if it was recorded on both transducers [6]. A single catheter tip transducer was inserted into rectum. A Digitimer Uriloss pad (Digitimer Ltd; Hertfordshire, England) was used to monitor urinary leakage. The women were asked to drink a cup of fluid (around 200 mL) every 30 minutes during the 4-hour test. They were instructed to complete a diary of activities throughout the 4 hours and to record if they had urgency, were coughing, or had episodes of leakage. They were told to void when they felt the need. The ambulatory device was connected to a flow meter to measure the flow rate and volume voided. During the test, the lines were checked every hour to ensure accurate subtraction. At the end of the 4 hours, patients were asked to return with a comfortably full bladder. Provocation in the form of a cough test, running water, and star jump (jumping Jack) exercises were employed to recreate symptoms. Patients were then asked to void and the postvoid residual urine volume was measured. The diary of symptoms developed during AUM was used to collaborate with the patient in identifying key times of symptom occurrence and to associate symptoms with the urodynamic trace findings.

Data Analysis

The results of the VCU and AUM tests were summarized in tables. Outcome measures included OAB symptoms and the results of the VCU and AUM procedures.

RESULTS

Over 200 women had AUM during the study period; 100 women fulfilled the inclusion criteria. Their mean age was 56 years (range, 19-87 years).

Comparison of Results from VCU and AUM

All women initially had VCU to investigate the cause of OAB symptoms, followed by AUM because the VCU results were inconclusive. Table 1 contains the a summary of the results from each test.

The largest difference in the findings of VCU and AUM was in the identification of DO. DO was not found using VCU; DO was confirmed in 32% of women who had AUM. Urodynamic stress incontinence (USI) was confirmed in 45% of women following VCU and 25% of women following AUM. There were no appreciable differences in urinary mixed incontinence, voiding dysfunction (VD; defined as peak flow rate < 15 mL/second and postvoid residual urine volume > 150 mL), or USI plus VD; these findings occurred in 1% to 6% of the population.

Table 1. Outcomes Following Videocystourethrography and Ambulatory Urodynamic Monitoring; Percentage Change Between First and Second Tests (N = 100).
doi: 10.3834/uij.1944-5784.2010.12.13t1

Outcome	VCU %N	AUM %N	% Change VCU to AUM
Detrusor overactivity	0	32	+32
Urodynamic stress incontinence	45	25	-20
Mixed incontinence	3	2	-1
Voiding dysfunction	6	5	-1
Urodynamic stress incontinence plus voiding dysfunction	1	0	-1
Normal	45	36	-9
Total definitive results	55	64	+9

Normal findings (defined as normal free flow study, filling cystometry, and pressure-flow study) were found for 45% of the patients following VCU and 36% of the patients following AUM. A definitive cause of OAB symptoms was achieved for 55% of women following VCU and 64% of women following AUM.

Symptoms of DO Confirmed by AUM

Table 2 contains the OAB symptoms for patients with confirmed DO following AUM, expressed as a percentage of the total 100 patients. DO was confirmed for 32 women; some women had more than 1 symptom. Thirty-four percent of the patients presented with urgency alone; 38% reported urgency and urge urinary incontinence (UUI). The presence of urinary frequency did not affect the identification of DO. Urinary frequency alone was present in 20% of the women with DO; 20% of women with DO presented with urgency plus UUI plus frequency or urgency plus frequency combinations. Nocturia alone was found in 28% of the patients. Women with mixed urinary symptoms (eg, OAB plus USI) accounted for 17% of those identified as having DO.

AUM Results for Patients With Normal VCU

Of the 100 total patients, 45 women had normal results from the VCU. Nine of these women also had normal results following AUM. For the remaining 36 women, the results from AUM identified abnormalities that could explain their symptoms. These results are contained in Table 3. The most common findings were DO (57.7%) and USI (15.5%).

Table 2. Overactive Bladder Symptoms for Patients With Confirmed Detrusor Overactivity Following Ambulatory Urodynamic Monitoring, Expressed as a Percentage of the Total N of 100 Patients.
doi: 10.3834/uij.1944-5784.2010.12.13t2

Symptom	%N
Urgency + urge urinary incontinence	38
Urge urinary incontinence	35
Urgency + UI + Frequency	35
Urgency	34
Nocturia	28
Urgency + Nocturia	27
Frequency	20
Urgency + UI + Frequency + Nocturia	20
Urgency + Frequency	20
Overactive bladder + USI	17

DO was confirmed for 32 women; some women had more than 1 symptom.
Abbreviations: UI, urinary incontinence; USI, urodynamic stress incontinence.

Table 3. Outcomes Following Ambulatory Urodynamic Monitoring for Patients With Normal Videocystourethrography (n = 45).
doi: 10.3834/uij.1944-5784.2010.12.13t3

Outcome	n	%n
Detrusor overactivity	26	57.7
Urodynamic stress incontinence	7	15.5
Mixed urinary incontinence	1	2.2
Voiding dysfunction	2	4.4
Normal	9	20.0

DISCUSSION

Although conventional cystometry or VCU are viable diagnostic tests for USI, AUM is considered to be more sensitive in the identification of DO [7]. AUM has been used in the investigation of lower urinary tract symptoms (LUTS) for over 25 years [8]. It has been suggested that long-term bladder monitoring overcomes some of the problems encountered during conventional UDS; fast retrograde bladder filling in conventional UDS is considered provocative by some professionals. In addition, symptoms of incontinence are related to acts of everyday life, all of which are removed in the laboratory setting. Finally, the individual is asked to respond to certain commands during conventional UDS, which may lead to cortical suppression of detrusor activity [6].

There is a poor correlation between LUTS and conventional UDS. van Waalwijk van Doorn et al [9] studied 100 patients with LUTS. All patients underwent AUM after conventional UDS did not provide results that corresponded with their symptoms. AUM diagnosed DO twice as often as conventional UDS. Only 5 patients had normal traces on AUM, compared with 32 on conventional UDS. However, USI was identified in 13 patients with conventional UDS, compared with 8 patients with AUM.
The sensitivities of conventional UDS and AUM in the investigation of LUTS are different. Anders et al [10] compared the results of AUM with those of conventional UDS in 475 women with LUTS. The authors concluded that AUM was more sensitive than conventional UDS in diagnosing DO, but less sensitive in diagnosing USI. Furthermore, Radley et al [8] studied 106 women with symptoms suggestive of OAB. They concluded that, in contrast to VCU, AUM provides objective evidence of DO in the majority of women with OAB syndrome and is considered the more sensitive tool for the detection or exclusion of DO. In addition, in women with OAB, a stable VCU trace should be interpreted with caution.

The management of patients who present with LUTS may be influenced by AUM. Swithinbank et al [11] studied 111 women and 11 men for whom AUM was performed after conventional UDS failed to explain their symptoms. The authors showed that AUM results influenced the management of over 90% of their patients. However, this change in management may not translate to more effective treatment [12].

The use of AUM is limited by the high prevalence (38%-69%) of abnormal detrusor contractions detected in asymptomatic volunteers. The results of some studies suggest that AUM is oversensitive in the identification of DO [13,14]. Salvatore et al [15] showed that the diagnosis of abnormal detrusor contractions on AUM depends on the technique used to conduct the test and the method used to interpret the trace. In their study, the prevalence of abnormal detrusor contractions varied from 11.5% to 76.9%. The variation depended on the definition used and interpretation of the trace and the diary, with or without the woman present at the end of the test.

Our results showed that 38% of women who reported urgency with or without UUI had DO that was identified with AUM. We

also found that the presence of urinary frequency with other OAB symptoms did not increase the identification of DO with AUM. These findings have also been shown by Hashim and Abrams [3].

Nocturia was the presenting symptom in 27% of women with DO; this percentage did not change when we included urgency and nocturia as a single variable. DO was identified in 30% and 70% of patients following VCU and AUM, respectively, in another report [8]. In our study, 32% of patients were identified by AUM as having DO; none of these patients were identified by VCU. These results are consistent with those of other studies [8,10]. In our study, the diagnoses were made in the presence of the patient, using the diary to identify key times and to associate symptoms with the urodynamic trace findings. This procedure may improve the accuracy of the outcome.

USI was diagnosed in 45% of women following VCU compared with 25% following AUM; this confirms previous results showing that VCU is more sensitive in diagnosing USI than other urodynamic tests [7]. In addition, it is likely that what was interpreted as USI on VCU may had been DO incontinence.

Forty five women were found to have a normal trace on VCU; 36 patients had a normal result from AUM. Of the 45 patients with a normal VCU, 36 patients (80%) had findings that could explain their symptoms with AUM. DO was the most frequent finding in this subgroup (58%), followed by USI (16%). AUM had been shown to change the initial VCU findings in another study [16]. Such results have important clinical implications.

In the present study group, if we treated the women who presented with OAB symptoms based only on VCU results, 45% of the women would have been offered treatment for USI. This may have included a continence procedure. However, following AUM, some of the women who were identified as having USI were identified as having DO.

OAB syndrome is a clinical diagnosis that is suggestive of an underlying DO. Therefore, it is not surprising that VCU and AUM both failed to identify any abnormalities that would account for the symptoms in 9% of the women in our study. Clinicians should interpret urodynamic results in conjunction with clinical symptoms, particularly if a continence surgery is contemplated.

The present study is limited by its retrospective design and small number of patients. In addition, other diagnostic tools (eg, transvaginal ultrasound, voiding cystourethrogram, magnetic resonance imaging) could be tested to determine their potential to identify the causes of OAB symptoms.

CONCLUSIONS

Results from VCU for patients with symptoms of OAB should be interpreted with caution. AUM appears to be a more discerning tool in identifying DO. Clinicians should interpret urodynamic results in conjunction with clinical symptoms, particularly if a continence surgery is contemplated. AUM is particularly recommended for complex cases.

Conflict of Interest: none declared.

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