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Original article

First morning voided volume as a valuable tool for evaluating patients with overactive bladder

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ABSTRACT

Objective: This study aims to assess whether first morning voided volume (FMV) can be used as a tool to evaluate the symptom severity of patients with an overactive bladder (OAB).
Materials and methods: We prospectively recruited patients with OAB symptoms from January 2009 to April 2010. All the patients completed a 3-day frequency–volume chart, including the measure of FMV and the Overactive Bladder Symptom Score (OABSS) questionnaire. All patients underwent either conventional pressure-flow urodynamic study or videourodynamic study. We analyzed the correlation between FMV, urodynamic studies, and symptom severity.
Results: A total of 102 patients, including 43 men and 59 women, were recruited in the study. FMV was significantly correlated to the daily mean voided volume ($p < 0.001$) and cystometric capacity ($p = 0.026$). It was also negatively correlated to the subscores for daytime frequency ($p = 0.013$) and nighttime frequency ($p < 0.001$) on OABSS. However, no significant correlation was observed between FMV and the total score of OABSS. FMV showed a fair agreement with the maximum voided volume, which can predict small-volume bladders (kappa $= 0.42 \pm 0.08$, $p < 0.001$), whereas the agreement between cystometric capacity and maximum voided volume was poor (kappa $= 0.096 \pm 0.05$, $p = 0.08$).
Conclusion: In patients with OAB, FMV can represent the severity of day- and nighttime frequencies. FMV was also shown to have a better ability in predicting small-volume bladders compared to the cystometric capacity. The measure of FMV may be helpful for patients who have poor compliance with regard to recording the frequency–volume chart.

1. Introduction

According to the International Continence Society (ICS) terminology of 2002, overactive bladder (OAB) is defined as urgency, with or without urgency incontinence, usually with frequency and nocturia, if there is no proven infection or other obvious pathology present.[1] The overall prevalence of OAB was thought to be around 11–16% based on previous studies, and no difference was noted between males and females.[2,3] This clinical condition not only affects personal hygiene and lifestyle, and impacts quality of life negatively, but also has a multidimensional impact on employment.[4] Macroscopically speaking, this disease also has a considerable economic impact.[5]

An initial assessment of OAB including detailed history taking and recording of frequency–volume chart (FVC), also known as "voiding diaries", is essential for the evaluation and management of OAB. Various versions of FVC are available for patients, and debates still exist on the most optimum duration. Based on the patient group of interest, the recommended number of days in previous studies greatly varied from 1 to >7.[6–8] Most of the FVCs now require patients to record the time and volume of each voiding, whereas some FVCs also require patients to record the time and volume of every drink/food they intake.[9] Such detailed recording is at times a burden that patients must endure, and is especially hard on the elderly or when a patient has to work during the daytime. It is a reasonable postulate that as the duration of FVCs increase, the compliance of patients may decrease and consequently affect reliability.[10] If this is seen in a clinical scenario, it may negatively influence the judgment of clinicians.

Therefore, we suspect that a more simple and convenient measurement, such as the first morning voided volume (FMV), might be a useful alternative to FVC. Thus, we conducted a study to analyze the value of FMV as an evaluation tool for patients with OAB.

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2. Materials and methods

We prospectively recruited patients with OAB symptoms from January 2009 to April 2010. Patients who had urinary tract infection, neurogenic bladder, urinary bladder tumor, vesical stones, and lower urinary tract anatomical anomaly were excluded. Approval was given by the Ethics Committee of our hospital after it reviewed the study protocol, prior to recruitment of the patients (the IRB approval number: 201001032IC). Informed consent to participate was obtained from each patient prior to enrolling. General characteristics including age and gender were recorded. All patients completed a 3-day FVC documenting the voided volumes in each episode, incontinence and urgency episodes, day- and nighttime frequencies, and FMV. The first episode of voiding after getting up in the morning was defined as FMV. Patients with a maximal voided volume of less than 300 mL recorded in the FVC were identified to have a small functional bladder capacity, based on a previous study.[11]

All patients completed the Overactive Bladder Symptoms Score (OABSS) questionnaire proposed by Homma et al[12] to evaluate the severity of the OAB symptoms. The OABSS is a four-item questionnaire developed to express OAB symptoms. The maximal scores of each question were 2, 3, 5, and 5, respectively, for the severity of daytime frequency, nighttime frequency, urgency, and urgency incontinence.

All patients also underwent urodynamic studies with either conventional pressure-flow urodynamic study or videourodynamic study. Abdominal pressure was measured using a 24F rectal balloon catheter, intravesical pressure was determined using an 8F transurethral catheter, and the filling cystometrography was performed at a filling rate of 30 mL/minute by injecting warm saline. Videourodynamic study was performed when patients had concomitant voiding symptoms and low urinary flow rate, to identify possible bladder outlet obstruction and localize the point of obstruction.

The correlation between FMV, urodynamic parameters, and symptoms severity was analyzed with Spearman correlation. We also compared the sensitivity and specificity in predicting small functional bladder capacity with FMV and cystometric capacity by using the kappa statistic for agreement with maximal voided volume as the gold standard.

3. Results

A total 102 patients, 43 males and 59 females, were included in the study. The mean ± standard deviation (SD) age of the patients was 66.8 ± 14.0 years (range: 23–85 years). The cystometry (CMG) capacity, mean FMV, and maximal FMV had a negative correlation with age ($p < 0.05$). Such findings were not observed between different genders. Tables 1 and 2 list the results of FVC and OABSS. The mean ± SD cystometric capacity was 173.8 ± 108.4 mL (range: 22–600 mL) and the mean ± SD FMV was 196.6 ± 106.5 mL (range: 20–650 mL). The mean FMV was significantly larger than the cystometric capacity ($p = 0.03$). FMV was equal to the maximum voided volume in 24 patients (23.5%) and was significantly correlated to the cystometric capacity ($p = 0.026$). We failed to find a significant correlation between FMV and postvoid residual urine volume in this study.

Table 1
Results of frequency–volume chart.

Mean void volume (mL)	2054 ± 1735
Mean voiding frequency	12.1 ± 4.0
Mean nocturnal urine volume (mL)	625.3 ± 321.3
Mean nighttime frequency	2.2 ± 1.4
Mean maximum void volume (mL)	349.6 ± 146.7
Mean minimum void volume (mL)	56 ± 37.8
Mean urgency episodes	2.7 ± 3.5
Mean FMV (mL)	196.6 ± 106.5

FMV = first morning voided volume.

Table 2
Results of OABSS.

Mean total OABSS score	10.3 ± 2.8
Mean subscore for daytime frequency	1.2 ± 0.7
Mean subscore for nighttime frequency	2.2 ± 0.9
Mean subscore for urgency	3.8 ± 1.3
Mean subscore for urgency incontinence	2.9 ± 1.6

OABSS = overactive bladder symptom score.

Although there was no significant correlation between FMV and the total score of OABSS ($p = 0.424$), the cystometric capacity showed negative correlations with the total score of OABSS ($p = 0.031$) and the subscore for nighttime frequency on the OABSS ($p = 0.023$). The correlations of the mean FMV with the FVC and other OABSS parameters are summarized in Table 3. As we can see in the table, the mean FMV had a significant positive correlation to the mean voided volume, and a significant negative correlation to both mean voiding and nighttime frequency. When comparing with the OABSS parameters, we could find only a significant negative correlation between the mean FMV and the mean subscore of nighttime frequency.

Forty-seven patients (46.1%) were classified as having a small functional bladder capacity. The mean ± SD functional bladder capacity was 349.6 ± 146.7 mL (range: 84–1100 mL). Being the single diagnostic tool in predicting small functional bladder capacity, maximal FMV showed its superiority in both sensitivity and specificity as compared to cystometric capacity (100% vs. 95.9% and 43.3% vs. 15.1%, respectively). FMV was shown to have a reasonable agreement with a significant p value (kappa = 0.42 ± 0.08, $p < 0.0001$), but CMG capacity did not (kappa = 0.096 ± 0.05, $p = 0.082$). When combining both the mean FMV and the cystometric capacity, the sensitivity and specificity were improved to 95.9% and 50.9%, respectively.

4. Discussion

As a tool for the initial assessment of patients with OAB, FVCs provide us with objective data that support the evaluation of symptom severity. Various formats of FVCs have been published in various studies, and the most optimal duration remains debatable. The effort required to record each and every voiding episode is labor intensive, and FVCs with longer duration such as 1 week or 2 weeks may inevitably become a burden and decrease compliance rates. Groutz et al[6] published a study and highlighted that as FVC duration increased, the reliability of the testing increased while

Table 3
Correlations of mean FMV with FVC and OABSS parameters.

	Correlation coefficient	p
FVC parameters		
Mean void volume	0.456	<0.001
Mean voiding frequency	−0.246	0.013
Mean nighttime frequency	−0.365	<0.001
OABSS parameters		
Mean total OABSS score	−0.080	0.424
Mean subscore for daytime frequency	−0.127	0.206
Mean subscore for nighttime frequency	−0.281	0.004
Mean subscore for urgency	0.119	0.236
Mean subscore for urgency incontinence	−0.020	0.843

FMV = first morning voided volume; FVC = frequency–volume chart; OABSS = overactive bladder symptom score.