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Original Article

Comparison of uroflowmetry tests performed with a sensation of normal desire to void versus urgency and correlation of test results with IPSS

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ABSTRACT

Objective: The objective of this study was to evaluate the uroflowmetry test results performed for normal and urgent desire to void and their correlation with International Prostate Symptom Score (IPSS) values in adult male patients having lower urinary tract symptoms (LUTS) complaints.

Material and methods: In this prospective study, a total of 83 patients were included. With a normal desire to void, maximum flowrate (Qmax)-normal, average flowrate (Qaverage)-normal, and void volume (VV)-normal values were obtained. Residual urine volume was examined by suprapubic ultrasound within 5 minutes following uroflowmetry, and calculated. The maximum bladder volume (MBV)-normal value was calculated by adding the residual-normal volume and VV-normal values. The same procedures were repeated the next day with the sensation of urgency, Qmax-urgency, Qaverage-urgency, VV-urgency, residue-urgency, MBV-urgency values were obtained.

Results: Statistically significant difference was determined for all parameters, and higher values were obtained in the urgency group for all parameters ($p<0.05$). A correlation analysis was performed for the Qmax-normal and Qmax-urgency values and the IPSS. Both parameters were not statistically significantly correlated with IPSS, but the correlation coefficient of Qmax-urgency was found to be higher than Qmax-normal ($p=0.85$, Correlation Coefficient=-0.022 for Qmax-normal and IPSS; and $p=0.069$, Correlation Coefficient=-0.214 for Qmax-urgency and IPSS, respectively).

Conclusion: Our study is the first study examining the effect of bladder sensitivity on uroflowmetry parameters in male patients having LUTS. More reliable results might be obtained in adult male patients with LUTS complaints when the uroflowmetry test is performed with a feeling of urgency to void. Our results need to be supported by more objective criteria, rather than subjective criteria such as IPSS.

Keywords: Bladder diseases; urination; urinary bladder.

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Introduction

Many patients with benign prostatic hyperplasia go to hospitals with complaints about difficulty in urinary voiding. The term lower urinary tract symptoms (LUTS) is preferred more today because these symptoms are complex and nonspecific. Although not life-threatening, LUTS affect the quality of life negatively.[1-3] The International Prostate Symptom Score (IPSS) is widely used in the initial diagnosis of LUTS patients as well as in the follow-up period for the efficacy of treatment.[4] The main disadvantage of the IPSS is the difficulty in comprehending the questions by the patients with low sociocultural status; therefore, the data obtained is very subjective. It was also reported in some studies that even the patients with higher education might have difficulty in comprehending these questions.[5]

Uroflowmetry is a non-invasive diagnostic test used in the diagnosis of patients with LUTS.[6] Although it is a non-invasive and practical method, it requires performing repetitive measurements to increase the reliability and also requires employing a special personnel.[7-9] The parameters measured by uroflowmetry come into play by the dynamics of bladder contractility and urethral resistance; in addition, rarely, the tension of the abdominal muscles may also be involved. Therefore, uroflowmetry provides information only about urine flow rate and voiding pattern but not about the etiology of

LUTS.[10] The most important data obtained from uroflowmetry are the maximum flow rate (Qmax), the average flow rate (Qaverage), void volume (VV), and voiding curve.

The Qmax parameter may be considered as the most significant data among the others obtained in the uroflowmetry test. Qmax is a value that is directly affected by detrusor contractility, bladder outlet obstruction (BOO), and VV. Because VV value has a direct effect on uroflowmetry, the level of fullness during the test that provokes urgency for the patient is very important, and it directly affects the test result. Normally, the uroflowmetry test should be done with a normal desire to void as in routine daily life because flowmetry values obtained with bladder sensations of first desire to void, strong desire to void, or urgency differ from those obtained with a sensation of normal desire to void. In daily practice, patients are instructed in advance to come with a full bladder. Sometimes the test is delayed and the patients become uncomfortable because of the urge to urinate; therefore, the test is performed with a sensation of strong desire or urgency to urinate instead of a normal desire. This perhaps leads to false negative results. Although there are studies in the literature on this subject conducted with healthy young males and children, there is no study on the group of adult males with LUTS complaints.[11-15] For this reason, in this study, for the first time in the literature, we compared the results of uroflowmetry tests performed with a sensation of normal desire to urinate versus urgency among adult male patients who had LUTS. We evaluated the correlation between the flowmetry and the IPSS values of these two groups, so we aimed to find out the optimal level of bladder fullness that correlates best with the IPSS.

Material and methods

This prospective study was conducted with adult male patients having LUTS complaints who visited our urology polyclinic. Patients were included after they were informed about the study, and their written informed consent was obtained. Ethical approval for this study was obtained from Health Science University İzmir Tepecik Training and Research Hospital. Patients with a history of lower urinary system surgery, neurological problems, lower urinary tract tumor, and active urinary infections were excluded, and a total of 83 patients were included in the study. The patients filled in the IPSS form, and they were informed about sensations of bladder fullness. A desire to urinate that cannot be delayed for more than 30 minutes was defined as normal, but not more than 5 minutes was urgency. For the patients with a normal desire to urinate, the uroflowmetry test was performed by the help of a nurse in an appropriate test environment. As a result, Qmax-normal, Qaverage-normal, and VV-normal values were obtained. Only patients with a VV ≥100 mL were included in the study, and those with VV < 100 mL were excluded. Postvoid residual urine volume was examined by suprapubic ultrasound within 5 minutes following flowmetry, and residual urine volume was calculated with the following equation: volume = height × width × depth × 0.52. The maximum bladder volume (MBV)-normal value was calculated by adding the residual-normal volume and VV-normal values. The same procedures were repeated the next day with a sensation of urgency, and Qmax-urgency, Qaverage-urgency, VV-urgency, residue-urgency, and MBV-urgency values were obtained.

Main Points:

- Uroflowmetry is an essential test for evaluating patients with LUTS.
- With uroflowmetry, we can estimate the bladder capacity, voiding pattern, and Qmax.
- In our study, all parameters were significantly higher in the urgency group as expected.
- According to our study, more accurate data can be obtained if the test is performed with a feeling of urgency to void.

Statistical analysis

Statistical analyses were performed using Statistical Package for the Social Sciences v.22 (IBM SPSS Corp.; Amork, NY, USA) software. Statistical difference between the normal and urgency groups was analyzed with paired sample *t*-test. Correlation analysis was performed using Pearson correlation test between IPSS values and uroflowmetry values of normal and urgency groups, respectively. The p value <0.05 was considered statistically significant.

Results

The 83 patients included in the study were aged between 19–82 years with a mean age of 58.07±10.11 years. The IPSS range was 2–35, and the mean was 17.35±9.21. Statistically significant difference was determined for all parameters ($p<0.05$) (Table 1). A correlation analysis was performed for the Qmax-normal and Qmax-urgency values and the IPSS values ($p=0.85$, correlation coefficient = –0.022 for Qmax-normal and IPSS; and $p=0.069$, correlation coefficient = –0.214 for Qmax-urgency and IPSS, respectively). Both parameters were not statistically significantly correlated with IPSS, but the correlation coefficient of Qmax-urgency was found to be higher than Qmax-normal (Figures 1 and 2).

Discussion

The bladder is an elastic and contractile organ. The most important factors determining bladder capacity are its elasticity (compliance) and the muscle layer (contraction). According to Laplace's law, the diameter of the bladder during filling is inversely proportional to the pressure created on the bladder wall for a given wall

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tension. Although this increase in pressure during filling influences contraction (voiding) functions to a certain extent and too much contraction of the detrusor muscle beyond a certain volume can increase the bladder wall pressure, this can eventually adversely affect bladder contractility and cause an increase in the amount of residue.[16] In fact according to Laplace, a smaller bladder gives more pressure for a given tension. It is the inability of the muscle to contract when already contracted that gives rise to poor emptying of low volumes.[15-18] Therefore, there is no consensus on the optimal bladder capacity providing the most effective voiding. Herein, the term Expected Bladder Capacity (EBC) comes up. This term is especially important during childhood, and it is formulated for the children aged between 4–12 years as [(Age + 1) × 30]. A capacity of <50% EBC is considered an under-distended bladder, whereas >115% EBC is considered an over-distended bladder.[19] Chang et al.[15] formulated EBC for children as [(Age × 5) + 50]. In their study on children, Dayanc et al.[20] found that the highest frequency pattern was normal voiding pattern in the group with VV of 50–100% EBC, tower voiding pattern in the group with VV of <50% EBC overactive bladder (OAB), again normal voiding pattern in the group with VV of <100% EBC along with an increase in the staccato voiding pattern, and finally staccato voiding pattern in the group with VV of <125% EBC (underactive bladder). According to this study, the optimal range in children was in the group having the closest value to the EBC; however, voiding dysfunctions occurred and pathological voiding patterns appeared as the bladder volumes deviated from normal levels, under or over a certain capacity. Therefore, the reliability of the test decreases under or over a certain bladder capacity; hence, the flowmetry test performed might need to be repeated.[13,20,21]

There is no definitive formula agreed on, although there are nomograms developed for adult patients.[22-24] According to the data obtained from adult nomograms, the threshold value for Qmax was determined as 15 mL/sec with a decrease of 2.1 mL/sec every 10 years in people aged between 24–61 years. However, it is

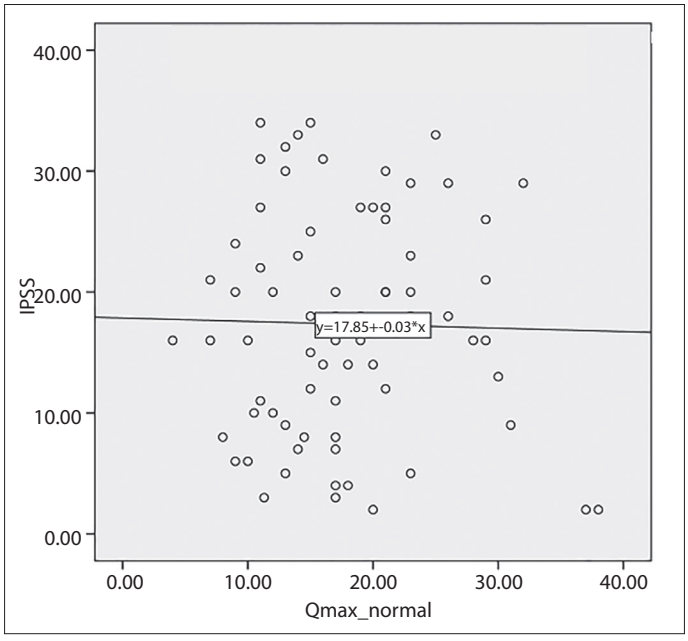

Figure 1. Correlation of IPSS and Qmax-normal
IPSS: International Prostate Symptom Score

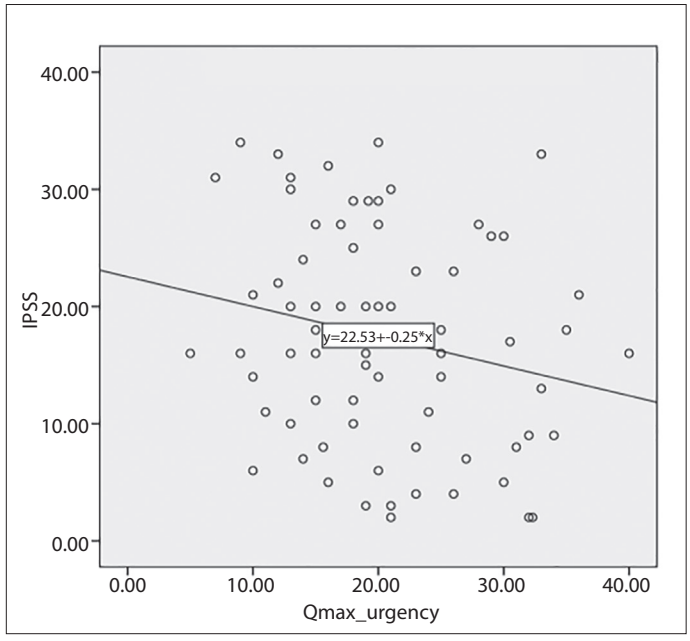

Figure 2. Correlation of IPSS and Qmax-urgency
IPSS: International Prostate Symptom Score

Table 1. Data range of the patients and mean values (n=83)

	Normal	Urgency	p
Qmax (mL sec^{-1})	17.5±6.8	19.7±7.7	0.0001
Qave (mL sec^{-1})	10.2±4	11.1±4.3	0.009
Vmax (mL)	207±104	369±168	0.0001
Residual Volume (mL)	84±67	131±104	0.001
MBV (mL)	291±152	500±197	0.0001

Qmax: maximum urine flow rate; Qave: average urine flow rate; Vmax: maximum urine volume; MBV: maximum bladder volume

not clear whether this decrease is due to BOO and/or decreased contraction capacity of the bladder.[22] Lowest acceptable bladder capacity (LABC) value required to avoid re-testing varies between 20 mL and 150 mL in adult patients, although there is no consensus on it.[22-25] In our study, we accepted the LABC as 100 mL, and the patients with voiding volume below this value were asked to repeat the uroflowmetry tests.

Bladder capacity is measured by methods such as uroflowmetry, frequency-volume charts (FVC), cystometry, and cystoscopy, and it is used for diagnostic purposes in patients having complaints related with LUTS. VV obtained by uroflowmetry and subsequent residual urine volume yield (MBV) value. However, the VV value that results in the most accurate uroflowmetry values for the patient remains controversial. The question that remains is whether flowmetry should be performed when the patient has a normal desire to void or when the patient feels a strong desire to void or urgency.

Pernkopf et al.[22] determined a higher Qmax value and steeper voiding curve with a normal pattern in adolescent men having 350–550 mL VV. It was reported in the same study that Qmax values decreased at VV values over 550 mL, and uroflowmetry results should be interpreted carefully at VV values lower than 350 mL. According to the International Consultation on Incontinence data, the highest Qmax value can be achieved within a VV range of 350–550 mL.[26]

In our study, it was determined that all parameters were statistically significantly higher in the group with a strong desire to void or urgency than the group with a normal desire to void. The mean values±standard deviation obtained for VV were 207±104 and 369±168 mL ($p<0.0001$); Qmax, 17.5±6.8 and 19.7±7.7 mL/sec ($p<0.0001$); Qaverage, 10.2±4 and 11.1±4.3 mL/sec ($p<0.01$); residual urine volume, 84±67 and 131±104 mL; MBV, 291±152 and 500±194 mL ($p<0.0001$) in the normal and urgency groups, respectively (Table 1). According to these results, we can claim that the uroflowmetry tests performed in adult male patients with LUTS complaints give higher values when performed with a strong desire to void or urgency. However, the query remains whether these values are optimum or do these values increase the ratio of false negativity (for Qmax, Qaverage, VV, MBV) or false positivity (for residual urine volume).

In their study conducted on adolescents and adult patients with enuresis, Hofmeester et al.[27] evaluated the reliability of the maximum void volume values obtained by FVC (MVVfvc) (highest void volume within three days excluding the first urine in the morning) and the maximum bladder volume values obtained by uroflowmetry (MBV_{flow}) (total of maximum void volume and residual urine volume). According to MBV_{flow} values, the patients were divided into the three groups (<200 mL, 200–450 mL, >450 mL). Particularly in the second group (200–450 mL), MBV_{flow} and MVVfvc were close to each other. MVVfvc was significantly high in the first group (<200 mL), whereas significantly low in the third group (>450 mL).The authors reported that more accurate results were achieved in uroflowmetry tests of adolescents and adult patients with a maximum bladder capacity (MBV_{flow}) of 200–450 mL.

Kaynar et al.[12] performed at least three uroflowmetry tests for each of the 50 healthy male patients included in their study. The first test was performed with a normal desire to void (can wait 30 minutes), the second test was performed with a strong desire to void (can wait 15 minutes), and the third test was performed in urgency (cannot wait more than 5 minutes). Qmax, Qaverage, VV, and residual urine volumes were compared between the groups, and the first three parameters were found to be statistically significantly higher in the group of immediate urgency, whereas there was no significant difference in residual urine value. Kaynar et al.[12] found the mean VV values of 140±42 mL, 245±64 mL, and 449±105 mL in the groups of normal desire to void, strong desire to void, and urgency, respectively. They suggested to perform flowmetry with a feeling of urgency to void and noted the highest values in uroflowmetry with the VV of 400 mL. This result was consistent with the data of Pernkopf et al.[22] and Hofmeester et al.[27]

In order to figure out why higher values were obtained with urgency to void in our study, we performed a correlation analysis between Qmax data of uroflowmetry groups and their IPSS values. As a result, although there was no statistically significant difference between the two groups in terms of correlation of Q max and IPSS values, we determined that the correlation coefficient was more negative in the urgency group (Figures 1 and 2). We feel that the subjectivity of the IPSS value may be a factor in obtaining statistically insignificant differences. Our study is the first one to examine the effect of bladder sensitivity on uroflowmetry parameters in a group of adult male patients having LUTS complaints.

The limitations of our study are that being single centered and small number of patient population.

In summary, we conclude that more reliable results might be obtained in adult male patients with LUTS complaints when the uroflowmetry test is performed with an urgency to void. These results need to be supported by more objective criteria, rather than subjective criteria such as IPSS, and with larger patient groups.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Health Sciences University İzmir Tepecik Training and Research Hospital (Date: 21.09.2017, Meeting No: 13, Judgement No: 24).

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Conflict of Interest: The authors have no conflicts of interest to declare.

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