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The effect of standing and sitting voiding position on uroflowmetric findings and postvoiding residual volume in men with Benign Prostatic Hyperplasia (BPH)

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ABSTRACT

Background: Some studies proposed that different voiding position can affect voiding quality in men with benign prostatic hyperplasia (BPH). It is said that a particular voiding position can provide better uroflowmetric findings and less post-void residual volume (PVR) in men with BPH. This study aimed to analyze the effect of the two most common voiding positions (standing and sitting) on uroflowmetric findings and PVR in men with BPH to make a recommended voiding position for men with BPH.

Methods: In this cross-sectional study, 36 men with symptomatic BPH were enrolled. The uroflowmetric study was done for each subject in 2 positions: standing and sitting. The following uroflowmetric parameters were studied: maximum flow rate (Qmax), time to maximum flow, average flow rate (Qave), and voiding time. PVR was assessed after eachtest. Data were analyzed by SPSS version 23 for Windows.

Results: The mean Qmax was significantly better in sitting than a standing position (11.106±4.7801 mL/s vs. 9.536±5.3374 mL/s; p=0.018); the mean Qave, time to maximum flow, and PVR were not different between 2 positions. The mean for Qave for standing and sitting positions were 5.014±2.9888 mL/s and 5.508±2.4437 mL/s in, (p=0.058), the mean voiding time were 43.08±7.980 seconds and 40.22±9.897 seconds, respectively (p= 0.31), and the meantime to maximum flow was 12.39±7.454 seconds and 10.06±4.610 seconds, respectively (p=0.192). In contrast, mean PVR was 87.28±44.810 mL and 72.53±42.779 mL, respectively (p=0.091).

Conclusion: The result of this study showed that sitting position had better Qmax than standing position. Incorporating a sitting position with other BPH management might give a synergistic effect that improves urinary flow in men with BPH.

Keywords: Uroflowmetry, Voiding Position, Sitting, Postvoid Residual Volume

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INTRODUCTION

The preferred position of voiding is dependent on the type of available toilet facility, social behavior, and musculoskeletal comorbidities.[1] The preferred voiding position is also different in some countries. In eastern countries, males' preferred voiding position is squatting or sitting due to religious obligation, whereas, in western countries, they usually prefer standing voiding position.[2,3]

Micturition results from the interaction between the bladder and urethra under the control of the central nervous system. Various external and internal factors may influence this event. External factors are; age, sex, and psychological characteristics, whereas internal factors are mainly composed of the anatomy of the bladder, urethra, and other corresponding tissues, like the contractility of the bladder, the degree of bladder obstruction, relaxation of pelvic floor muscles, and anterior muscles of the thigh related to voiding position.[2,4,5] Daily preferred urination position may also affect uroflowmetric parameters. Positions other than patient habits may change results. This theory also needs verification because there are very limited studies on this subject.[6,7]

Uroflowmetry is a simple urodynamic study and frequently used for diagnosis and follow-up of obstructive lower urinary tract symptoms (LUTS).[8] Different voiding position may affect the factors as mentioned earlier significantly.[3] Several studies investigated the uroflowmetric parameters on different voiding positions. These studies reported inconsistent results, some indicating voiding position affects uroflowmetric parameters, whereas some do not influence the uroflowmetric parameters.[5]

BPH is the most common cause of LUTS in males.[9] The uroflowmetric profile of LUTS is characterized by a decreased Qmax, an increased voiding time, and PVR. Therefore, standard clinical management of LUTS aims to improve the uroflowmetric profile, which can be reached pharmacologically using 5a-reductase inhibitors and alpha-blockers.[2,3,10] One study proposed that changing voiding positions may have an effect that can make similar to the impact of standard pharmaceutical management.[3,10] However, due to the heterogeneity of results in these studies, no conclusion can be drawn.[3]

We can assume that standing and sitting voiding positions influence uroflowmetric findings and PVR in men's BPH from the previous studies. We hypothesized that the sitting position would result in better uroflowmetric parameters and less PVR than the sitting position. Based on those mentioned above, the present study aimed to analyze the effect of standing and sitting voiding positions on uroflowmetric findings and PVR in men with BPH.

METHODS

In this prospective cross-sectional study, 36 male patients over age 50 years (mean = 64.81 years; SD = 6.451 years) with LUTS due to BPH were enrolled. All patients had uroflowmetric and transabdominal ultrasonography examination of the urinary tract with a full bladder before and after uroflowmetry to determine PVR. Patients with prostate cancer, urethral and bladder stones, urethral stricture, neurogenic bladder dysfunction, previous urethral instrumentation or catheterization, and history of prior surgery of the bladder, prostate, or urethra. The patients were informed of the study parameters and informed consent was obtained.

Patients who met the inclusion criteria (N = 36) had uroflowmetry using a weight transducer uroflowmeter device (Danflow 1100, Medkonsult Medical Technologies, Olomouc, Czech Republic). They were asked to drink ± 200 mL of water within one to two hours before the procedure and asked to hold their urine until the procedure started. This is to make sure patients will have a full bladder and make sure adequate urine during the procedure to obtain more accurate uroflowmetry results. During the procedure, they were asked to urinate without straining (increasing abdominal pressure) in two different positions. The uroflowmetric study was done two times for each patient. Each was asked to urinate in two positions: standing and sitting. In each position, uroflowmetric findings, including Qmax, Qave, voiding time, and time to maximum flow, were measured. Patients who had voided volume less than 150 mL were asked to retake the procedure one or two hours later when they had larger voided volume. Those who could not have a voided volume of more than 150 mL were excluded. Each test was done during a single clinic visit at the interval of one to two hours between different positions or at various clinic visits; however, all tests were completed within four weeks.

After the test was completed, all patients immediately had an ultrasound for the estimation of PVR. PVR was evaluated by transabdominal ultrasonography using *Portable ultrasound systems (VScan version 1.3, General Electric Company, California, United States)*. For this measurement, we used the prolate ellipsoid method (Volume = Length × Width × Height × 0.52), which was useful for evaluating bladder volumes.[11]

Differences in uroflowmetry parameters in each group were analyzed using the Friedman and Wilcoxon signed-rank tests, and the two groups' results were compared using the Mann-Whitney U test. A p-value of less than 0.05 was considered statistically significant. Data were analyzed using SPSS software (Statistical Package for the Social Sciences, version 23.0, SPSS Inc., Chicago, Ill, USA).

RESULTS

A total of 36 patients was enrolled to study. The mean age of the study population was 64.81 ± 6.5 years (range of age, 52 □ 80 years), and the mean international prostatic symptoms score (IPSS) of the study population were 13.25 ± 3.6 (range of IPSS, 5 □ 19) (Table 1). All patients were able to urinate in two positions. Only 5 patients urinated less than 150 mL during uroflowmetric evaluation and re-evaluated in the subsequent day.

In this study, we found significant differences between the mean Qmax in standing (9.54 ± 5.33 mL/s) and sitting (11.11 ± 4.7 8 mL/s) positions (p=0.018). While the mean Qave only showed slight differences between the two groups (5.01 ± 2.98 mL/s in standing versus 5.51 ± 2.43 mL/s in sitting; p=0.058) (Table 1). It was not surprising that mean time to maximum flow decreased as mean Qmax increased, but there were no significant differences in time to maximum flow between two groups (12.39 ± 7.45 mL/s in standing and 10.06 ± 4.61 mL/s in sitting position; p=0.192) (Table 1). The mean voiding time (43.08 seconds in standing position and 40.22 seconds in sitting position; p=0.31) and time to maximum flow (12.39 seconds in standing and 10.06 seconds in sitting; p=0.192) were also showed no statistically significant differences. Meanwhile, the mean PVR between the two groups were also demonstrated statistically insignificant differences (87.28 ± 44.81 mL/s in standing and 72.53 ± 42.78 mL/s in sitting, respectively; p=0.091). The

Table 1. Uroflowmetric Findings in the Standing and Sitting Positions (N = 72)

Variable	Standing Position			Sitting Position			P
	Range	*Mean*	*SD*	*Range*	*Mean*	*SD*	
Qmax (mL/s)	24.9	9.536	5.3374	19.7	11.106	4.7801	0.018
Qave (mL/s)	17.1	5.014	2.9888	11.7	5.508	2.4437	0.058
Voiding time (sec)	33	43.08	7.98	33	40.22	9.897	0.31
Time to maximum flow (sec)	35	12.39	7.454	21	10.06	4.610	0.192
PVR (mL)	215	87.28	44.810	201	72.53	42.779	0.091

summary of the uroflowmetric findings and PVR between the two groups is shown in Table 1.

DISCUSSION

Uroflowmetric findings and PVR are crucial tests for analyzing voiding dysfunction. Although it does not discriminate bladder outlet obstruction from detrusor insufficiency, it can give valuable objective data about both degrees of obstruction and the treatment's effectiveness.[4,12]

In this study, we found statistically significant higher Qmax values at voiding in the sitting position. A similar study compared the effect of sitting and standing voiding position on uroflowmetry and PVR findings in BPH patients conducted by Salem. *et al.* demonstrated that the sitting position had a better flow than in the standing position.[2]

Other authors who also found differences in uroflowmetric findings due to the different voiding positions presented various reasons for their findings. El-Bahnasawy and Fadl suggested that the thigh and pelvic floor muscles' different positions influenced the uroflowmetry parameters (more relaxation in sitting position).[6] Eryildirim B *et al.* reported that better flow was achieved in the sitting position than in the standing position.[13] They proposed that elevated intra-abdominal pressure is transmitted as a higher pressure on the bladder in the sitting position.

Furthermore, the study conducted by De Jong *et al.* also explained that typical patients with BPH are aged males who are liable to fall.[3] They suggested that they tend to stabilize their position while standing by contracting their pelvic muscles because of the fear of falling. Contraction of these muscles can disturb the urinary flow. Urinate in the sitting position while supporting feet in a secure position will make these muscles relaxed, resulting in better urinary flow. Furthermore, the tension in the anterior and medial hip muscles is decreased in a sitting position. Contraction of the pelvic floor and hip muscles inhibit the detrusor muscle activity, which will result in reduced uroflowmetric profile.

A previous study conducted by Salem *et al.* also showed mean Qave increased and mean time to maximum flow decreased as mean Qmax increased. However, the present study found that the differences for those parameters were not statistically significant.[2]

In a study on 173 prostatic patients to determine the value of uroflowmetry and other modalities in assessing the degree of urinary obstruction, it was confirmed that uroflowmetry is a valuable tool in the evaluation of obstruction in LUTS in males and Qmax reflects bladder outlet obstruction better than other parameters.[10]

The prospective study conducted by Thapa and Agrawal to investigate the correlation between uroflowmetric findings and LUTS in men with BPH patients found that Qmax was the most reliable parameter to represent the severity of LUTS, while Qave and voided volume do not correlate with the severity of LUTS.[10] Whereas, Barry MJ *et al.* have found a positive correlation between Qmax and symptom score and no significant correlation between Qave and LUTS.[14]

The previous study conducted by Salem *et al.* also found no significant differences in time to maximum flow between two positions (15.1 seconds in sitting position and 19.2 seconds in standing positions; $P= 0.91$), although there was a statistically significant difference in Qmax in sitting and standing positions.[2]

The role of PVR in BPH management remains controversial. The trial conducted by Roehrborn *et al.* showed that PVR was a weak predictor of outcomes in BPH treatment.[15] PVR in present studies found no significant difference in sitting and standing position. A study conducted by Thapa and Agrawal also showed that PVR had a weak correlation ($P= 0.331$) with LUTS severity.[10] Consistent with these results, Singla *et al.* also found that PVR had a weak correlation with LUTS severity.[16]

In our study, the differences for PVR volumes between the two positions were not statistically significant (less than 15 mL). In contrast, the mean voiding time showed only a slight difference between the standing position and sitting position. In comparison with our results, In a study conducted by Goel *et al.* found that in the sitting position, PVR was decreased significantly, and the patient tends to had longer voiding time (109.0 ± 11.7 seconds in sitting and 74.1 ± 11.6 seconds in standing positions; $P< 0.05$).[1] Lower PVR in sitting position this study may have been due to an increase in voiding time, as participants felt more comfortable in the sitting position. It is possible that elderly men feel tired while voiding in the standing position and fail to empty the bladder in their hurry.

Even so, another study proposed that a personal preference voiding position may explain the differences in PVR.[6] In clinical practice, some men said they are more comfortable urinating while standing and had a better stream in this position. Yazici CM *et al.* also found lower PVR in the sitting position than the standing position, but the difference was not over 25 mL.[4] However, in this study, they had a nearly equal number of patients who use standing or sitting position in their daily life (57.4% vs. 42.6%, respectively).

We found that mean voiding time in sitting and standing positions was not statistically different (40.22±9.897 vs. 43.08±7.980 seconds, respectively; $P=0.31$), so that should not affect PVR volumes between two positions. However, all of the patients in our study use a standing position in their daily life as a natural voiding position. Natural voiding position is described as a voiding position that had been used for a minimum of 15 years consecutively or 80% of their lifetime.[4]

Yazici CM *et al.* reported that sudden change of habitus cause severe psychological stress on the person and evacuation may not be complete in the new position, thus affecting PVR.[4] In our practice, almost all patients said that they are more comfortable to urinate in a standing position. Their urinary flow is also better in standing position. This study's limitations were the small sample size and the men with an IPSS >19 excluded from this study, compared with the previous study.[17] The correlation between uroflowmetric findings and prostate volume and the patient's effect preferred voiding position (natural voiding position) on the uroflowmetric findings was not analyzed in this study. Furthermore, the order of the voiding position was not standardized. While repeated examination could change the results, this could alter the results. The result of this study showed that Qmax was significantly better in the sitting position. Incorporating a sitting position with other BPH management might give the synergistic effect that improves urinary flow in men with BPH.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this study was reported.

ETHICS CONSIDERATION

The bioethics board approved the study design of Hasanuddin University of Medical Sciences (No:235/UN4.6.4.5.31/PP36/2020).

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AUTHORS' CONTRIBUTIONS

KK and AP conceived the study, participated in its design and coordination, and finalized the manuscript. RK and AP participated in the design, collected the necessary data, reviewed the literature, and wrote a first draft of the manuscript. RK and AAZ have reviewed the literature, edited the draft, revised the statistical analyses, and submitted the manuscript. SB and SY participated in the design of the study. All authors read and approved the manuscript.

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