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Evaluation of Voiding Position on Uroflowmetry Parameters and Post Void Residual Urine in Patients With Benign Prostatic Hyperplasia and Healthy Men

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Abstract

Uncertainty remains whether it is best for men to void in a sitting or standing position. The objective of this study is to evaluate the effect of standing and sitting voiding position on uroflowmetry parameters and post void residual urine (PVRU) in patients with lower urinary tract symptoms (LUTS) due to benign prostate hyperplasia (BPH) and healthy men. A total of 116 participants with BPH (Group 1) and 78 healthy men (Group 2) were enrolled in the study. The uroflowmetry parameters were measured in both positions. The PVRU volume was measured using transabdominal ultrasound after each voiding. Uroflowmetry parameters and PVRU were measured and compared between the two different voiding positions using Wilcoxon signed rank test. In Group 1, there were significant statistical differences in uroflowmetry parameters between standing and sitting voiding position. The median of maximum flow rate in Group 1 in standing and sitting position was 14.7 ml/s (IQR; 11.7–17.5) and 11 ml/s (IQR; 8.9–13.3), respectively ($p < .0001$). The median voided volume at standing position was 340 ml (IQR; 276–455) while it was 267 ml (IQR; 194–390) at sitting position ($p < .0001$). Median average flow rate in standing position was 5.9 ml/s (IQR; 4.5–7.5) and 5 ml (IQR; 3.2–6.4) in sitting position. There was a statistically significant difference between the median of PVRU in standing and sitting position ($p < .0001$). In patients with BPH, voiding in standing position showed better uroflowmetry parameters and significant less PVRU volume.

Keywords

voiding position, uroflowmetry, post void residual urine, benign prostate hyperplasia

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Benign prostatic hyperplasia (BPH) is a major global health problem affecting the health of men worldwide, leading to bothersome lower urinary tract symptoms (LUTS). Usually, men with mild symptoms of benign BPH are managed conservatively with lifestyle modifications (Lokeshwar et al., 2019).

Instead, the majority of symptomatic patients with BPH use medications like alpha-blockers and 5-alpha-reductase inhibitors as a first-line treatment. Some patients do not prefer medical treatment or are unable to tolerate the adverse effects (Bishr et al., 2016).

The available guidelines do not include any recommendations regarding the position for urination in patients with BPH, and it is suggested that changing the voiding position may influence uroflowmetry parameters and post void residual urine (PVRU) in patients with LUTS due to BPH, to a degree that could be equivalent to the effects of pharmacological treatment (Norg et al., 2008).

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Uroflowmetry with PVRU measurement is an important and widely used urodynamic test for evaluating voiding dysfunction. Uroflowmetry is a nonspecific test, but it is a valuable, simple, and noninvasive urodynamic test commonly used as an assessment tools for patients with LUTS due to BPH (Yazici et al., 2014).

Uroflowmetry parameters may be affected by various factors such as age, sex, voided volume, and the mental status of patients (Goel et al., 2017). It has been demonstrated that voiding position may be another factor affecting uroflowmetry parameters and PVRU which are dependent on several variables, including the type of available toilet facility, social/cultural behavior, and medical issues such as musculoskeletal comorbidities (De Jong et al., 2014; Ünsal & Cimentepe, 2004a, 2004b).

The uroflowmetry parameters of patients with BPH are characterized by decreased maximum urinary flow rate and increased voiding time in addition to increasing PVRU which may lead to increase urinary frequency, urinary tract infections, and increase risk of urinary bladder stone formation (De Jong et al., 2014; Moore et al., 1991; Riehmann et al., 1998; Salem et al., 2009).

In a systematic review and a meta-analysis conducted by De Jong et al. (2014), it was reported that the urodynamic profile for patients with LUTS who voided while sitting is better than those who voided while standing position. However, no difference was reported in any of the urodynamic parameters among healthy men (De Jong et al., 2014).

The existing literature on the impact of voiding position on uroflowmetry profiles and PVRU for patients with BPH is controversial and conflicting; it is uncertain whether voiding position actually affects voiding profiles, and the best voiding position for BPH patients has not yet been determined (De Jong et al., 2014; El-Bahnasawy et al., 2008; Gupta et al., 2008; Ünsal & Cimentepe, 2004a, 2004b; Yamanishi et al., 1999).

The objectives of this study were to evaluate the influence of standing and sitting voiding position on uroflowmetry parameters and PVRU in patients with LUTS due do BPH and healthy adult men without LUTS.

Materials and Methods

This cross-sectional study was conducted in urology clinic at the Jordan University Hospital, from March 2017 to December 2019. Approval was obtained from the Institutional Review Board at Jordan University Hospital (IRB number 2017/167), and written informed consent was taken from each participant before enrolment in the study.

A total of 196 male patients between 40 years and 75 years participated in the study. They were divided into two groups: Group 1 include 118 men with LUTS due to BPH with international prostate symptom score (IPPS) >7. These patients were receiving alpha-blockers, 5-alpha-reductase inhibitors, or combination therapy. The duration of treatment was not taken into consideration. Group 2 was the control group and consisted of 78 healthy adult men without LUTS.

All participants in both groups were evaluated by means of detailed medical history including IPPS score, physical examination including digital rectal examination, urine analysis, urine culture, prostate-specific antigen, and pelvic ultrasonography while the bladder was full to evaluate bladder capacity, exclude any bladder pathology such as stones or masses, and assess prostatic size and echogenicity.

Patients with a history of neurological disease, diabetes mellitus, urinary tract infection, prostate or urethral surgery, urethral stricture, bladder neck contracture, bladder stones, lower ureteral stone, prostate cancer, bladder cancer, meatal stenosis, phimosis, recent prostate biopsy, previous urethral instrumentation or catheterization, and psychiatric illness were excluded from the study. Patients with ongoing medical treatment interfering lower urinary system functions such as anticholinergics, alpha-blockers, and 5-alpha reductase inhibitors were asked to temporarily stop the medications 24 hr before the uroflowmetry study.

Upon visiting the clinic, when the participants experienced the normal sensation of needing to urinate, they were directed to a private room where the uroflowmetry studies were directed. The room was out of hearing range of other people. The participants were asked to urinate without increasing the abdominal pressure while standing. During a subsequent visit, the same procedure was repeated but this time, they urinated while sitting. Uroflowmetry results with a voided volume less than 150 ml were disregarded and patients were asked to repeat the study the same day or during another visit to the clinic.

In each position, uroflowmetry parameters including maximum flow rate (Qmax), voided volume (VV), average flow rate (Qave), voiding time (VT), flow time (TQ), and time to maximum flow rate (TQmax), were recorded for each position and were compared, using Urodynamic System (Medtronic Duet Logic G2). PVRU was measured after each void using transabdominal ultrasonography (GE, LOGIQ F8)

Statistical Analysis

Demographic data were described using mean $\pm$ SD or median and interquartile range depending on the distribution of the data. For each group, the parameters were compared in sitting and standing positions using a Wilcoxon signed rank test. Additionally, study parameters were compared between Group 1 and Group 2 for

Table 1. Demographic Variables of the Participants.

	Group 1 (cases) $n = 118$	Group 2 (control) $n = 87$	p
Age (year) Mean ± SD	66.4 ± 10.8	60.2 ± 11.3	.0002
BMI (kg/m^2) Mean ± SD	27.8 ± 3.5	26.2 ± 4	.0031
IPSS median (IQR)	20 (15,28)	2 (1,3)	< .0001

Note. SD = standard deviation; BMI = body mass index; IPSS = international symptoms score; IQR = interquartile range.

each position using Mann–Whitney U test. A p-value of less than .05 was considered the cut-off level for statistical significance. All statistical analyses were conducted by using IBM SPSS Statistics for Windows, version 21 (IBM Corp., Armonk, NY, USA).

Results

A total of 196 men were enrolled in the study. The mean age of patients in Group 1 was 66.4 ± 10.8 and that of Group 2 was 60.2 ± 11.3. There were significant statistical differences in terms of age, weight, and IPSS in both groups. The demographic and patient characteristics are presented in Table 1.

For Group 1 patients, the maximum flow rate, voided volume, voiding time, and average flow rate were significantly higher in standing position. However, there were no significant differences in flow time and time to maximum flow rate between the two groups in standing and sitting position. The PVRU volume was significantly higher in sitting position, at 85.5 ml (IQR; 50–134) than in standing position, at 51.5 ml (IQR; 30–95; $p \leq .0001$; Table 2).

In Group 2, the uroflowmetry parameters and PVRU volume were not significantly affected by changes in voiding position, as displayed in Table 2.

Table 3 presents a comparison of uroflowmetry parameters and PVRU volume between both groups in standing and sitting position and there were statistically significant differences.

Discussion

Male LUTS due to BPH is a global health issue. Nowadays, the available guidelines for the management of BPH provided by the American Urological Association (AUA) and the European Association of Urology (EAU) include watchful waiting, pharmacotherapy, and surgical intervention. However, these guidelines do not include any recommendations regarding the voiding position (EAU Guidelines). Changing the voiding position may have an effect that is comparable to medical therapy (Norg et al., 2008). Voiding positing may affect uroflowmetry results which are related to patients health status, and social and cultural issues (De Jong et al., 2014; Ünsal & Cimentepe, 2004a, 2004b).

Since there are no clear and official recommendations concerning optimal voiding position in the management of men with BPH, we aimed to evaluate the effect of standing and sitting voiding positions on uroflowmetry parameters and PVRU in patients with LUTS due to BPH and healthy men.

Our results showed that participants with BPH who voided in a standing position had significantly lower PVRU volumes and optimal uroflowmetry parameters. In contrast, healthy individuals do not show significate statistical differences in both voiding positions. Certainly, this may not be applicable for all patients with BPH who have other mobility and stability co-morbidities.

Studies in the literature report controversial results, regarding the difference in uroflowmetry parameters and PVRU volume between sitting and standing voiding position among healthy individuals (Ünsal & Cimentepe, 2004a, 2004b; Yazici et al., 2014). Aghamir et al. (2005) reported that uroflowmetry parameters in healthy individuals are not affected by the voiding positions. Similarly, Unsal and Cimentepe (2004a, 2004b) reported that the urinary flow rate and PVRU volume do not seem to be affected by the voiding position of healthy men and women. In contrast, some authors reported that voiding position significantly impacts on PVRU and uroflowmetry parameters of healthy individuals (Choudhury et al., 2010; Eryıldırım et al., 2006). In our study, we did not find any significant statistical differences in uroflowmetry parameters and PVRU at standing and sitting position on healthy individuals.

Some studies evaluated the effect of voiding position on uroflowmetry parameters and PVRU in patients with BPH. Yazici et al. (2014) studied uroflowmetry parameters in 198 men with BPH and healthy individuals, in sitting and standing positions. They concluded that there were no clinical significant uroflowmetry differences between voiding in sitting and standing positions and the optimal voiding position may be left to personal preferences during uroflowmetry evaluation (Yazici et al., 2014). (Unsal & Cimentepe, 2004a, 2004b) studied the effect of voiding position on BPH patients and reported that the urinary flow rate and PVRU volume are not affected by voiding position, in patients with BPH and healthy men (Ünsal & Cimentepe, 2004a, 2004b).

Additionally, Goel et al. (2017) conducted a study to evaluate the impact of voiding position on uroflowmetry parameters and PVRU on healthy volunteers and patients with BPH in different age groups. He reported that voiding in the sitting position was reported to be the optimal position for elderly men; however, the significant changes

Table 2. Uroflowmetry Parameters and Post Void Residual Urine for Group 1 and Group 2 in Standing and Sitting Position. Reported as Medians (Interquartile Ranges).

	Group 1 (case) $n = 118$			Group 2 (control) $n = 78$		
Parameters	Standing median (IQR)	Sitting median (IQR)	*p*	Standing median (IQR)	Sitting median (IQR)	*p*
Qmax (ml/s)	14.7 (11.7–17.5)	11 (8.9–13.3)	<.0001	26 (23–31)	26 (23–31)	.2509
VV (ml)	340 (276–455)	266.5 (194–390)	<.0001	422 (595–552)	423 (307–551)	.9351
VT (s)	56 (39–74)	61 (46–85)	.0073	36 (26–58)	37 (26–56)	.7563
TQ (s)	47 (34–63)	55 (40–72)	.1489	32 (24–49)	34 (22–52)	.5498
Qave (ml/s)	5.9 (4.5–7.5)	5 (3.2–6.4)	<.0001	12 (10–15.4)	13 (10–16)	.2737
TQmax (s)	9 (6–18)	11 (6–21)	.2894	8 (5–10)	8 (5–10)	.1825
PVRU (ml)	51.5 (30–95)	85.5 (50–134)	<.0001	10 (6–25)	10 (6–25)	.9345

IQR = interquartile ranges; Qmax = maximum flow rate; VV = voided volume; VT = voided time; TQ = flow time; Qave = average flow rate; TQmax = time to maximum flow rate; PVRU = post void residual.

Table 3. Comparison of Uroflowmetry Parameters and Post Void Residual Urine Between Group 1 and Group 2 in Standing and Sitting Position. Reported as Medians (Interquartile Ranges).

Voiding position	Parameters median (IQR)	Group 1 (cases) $n = 118$ median (IQR)	Group 2 (control) $n = 78$ median (IQR)	*p*
Standing	Qmax (ml/s)	14.7 (12,18)	26 (23,31)	<.0001
	VV (ml)	340 (276,455)	422 (295,552)	.0093
	VT (s)	56 (39,74)	36 (26,58)	<.0001
	TQ (s)	47 (34,63)	32 (24,49)	<.0001
	Qave (ml/s)	5.9 (5,8)	12 (10,15)	<.0001
	TQmax (s)	9 (6,18)	8 (5,10)	.0314
	PVRU (ml)	52 (30,95)	10 (6,25)	<.0001
Sitting	Qmax (ml/s)	11 (9,13)	26 (23,31)	<.0001
	VV (ml)	267 (194,390)	423 (307,551)	<.0001
	VT (s)	61 (46,85)	37 (26,56)	<.0001
	TQ (s)	55 (40,72)	34 (22,52)	<.0001
	Qave (ml/s)	5 (3,6)	13 (10,16)	<.0001
	TQmax (s)	11 (6,21)	8 (5,10)	.0003
	PVRU (ml)	86 (50,134)	10 (6,25)	<.0001

Note. IQR = interquartile ranges; Qmax = maximum flow rate; VV = voided volume; VT = voided time; TQ = flow time; Qave = average flow rate; TQmax = time to maximum flow rate; PVRU = post void residual urine.

are there only on PVRU volume and voiding time (Goel et al., 2017). In contrast to the above mentioned studies, we found that almost all uroflowmetry parameters and PVRU volume in BPH patients showed statistically significant differences in favor of standing over sitting position.

Several studies were conducted in order to evaluate different voiding position other than standing and sitting position and the results were variable and conflicting (Choudhury et al., 2010; Dueñas-Garcia et al., 2019; Eryıldırım et al., 2006; Salem et al., 2009). Aghamir et al. (2005) reported that PVRU volume was significantly lower in the sitting position compared to squatting and standing position, whereas Choudhury et al. (2010) reported better uroflowmetry parameters while standing and squatting position compared to sitting position.

De Jong et al. conducted meta-analysis in 2014 and reported that voiding position had no significant impacts on uroflowmetry parameters in healthy individuals, but the voiding while sitting displayed an improved uroflowmetry profile for patients with LUTS. This meta-analysis included only 11 full-text articles after an extensive database search, with a total study population of 800 participants. The majority of studies had a small sample size of less than 50. In addition to variations in sample size, these studies were heterogeneous in terms of age and the inclusion of volunteers or patients with LUTS (De Jong et al., 2014).

There are no available guidelines on the ideal voiding position for patients with BPH. However, our results suggest that voiding in the standing position could be recommended as an optimal lifestyle modification during the management of these patients.

The limitations of this study included the relatively small sample size, particularly of healthy individuals. This can be attributed to conducting our study in a hospital, which made it difficult to recruit healthy men.

In conclusion, for patients with LUTS due to BPH, voiding while standing position showed better uroflowmetry parameters and significantly less PVRU volume. On the other hand, uroflowmetry parameters and PVRU are not significantly affected by voiding position in healthy men.

Declaration of Conflicting Interests

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Compliance with Medical Ethics

Written informed consent was obtained from all patients before participating in this study

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