UIJ UroToday International Journal®

www.urotodayinternationaljournal.com
Volume 4 - June 2011

The Effect of Voiding Position on Uroflowmetric Parameters in Healthy Young Men

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Submitted February 7, 2011 - Accepted for Publication March 10, 2011

ABSTRACT

INTRODUCTION: Voiding quality can theoretically be affected by voiding position. It is important to know the effect of voiding position on urometric parameters in order to obtain optimal diagnostic test results, compare data across research investigations, and make recommendations about voiding position for the management of voiding problems. This prospective study was designed to evaluate the effect of changes in voiding position on uroflowmetric findings of young, healthy men.

METHODS: The participants were 31 male volunteers who were asymptomatic of urological disorder. They had an average age of 29.2 years (range, 23-39 years). In each of standing, sitting, and squatting positions, 2 measurements were done (6 separate measurements for each case) and the mean of each pair was determined. Outcome measures were peak flow rate (Qmax), average flow rate, time to peak flow, flow time, and voided volume. A one-way ANOVA was used to compare the voiding positions; a probability value $< .05$ was considered statistically significant.

RESULTS: The results for the standing, sitting and squatting positions were: mean Qmax of 23.4, 24.4, and 25.8 mL/s, respectively ($P = .618$); mean for average flow rates of 13.4, 13.0, and 13.9 mL/s, respectively ($P = .813$); mean flow times of 23.9, 22.1, and 22.9 seconds, respectively ($P = .822$); mean time to peak flow of 7.8, 8.0, and 6.0 seconds, respectively ($P = .119$); and mean voided volume of 300, 275, and 290 mL, respectively ($P = .631$).

CONCLUSION: The present study revealed no statistically significant differences between the standing, sitting, or squatting voiding positions for any of the measured urodynamic parameters. A precise judgment about the effect of voiding position on the uroflowmetric measures of healthy young males needs more investigation using a large number of cases, preferably with heterogeneous typical voiding positions.

KEYWORDS: Urodynamics; Uroflowmetry; Voiding position

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CITATION: *UroToday Int J*. 2011 Jun;4(3):art 35. doi:10.3834/uij.1944-5784.2011.06.06

Abbreviations and Acronyms
AFR, average flow rate
Qmax, peak flow rate

INTRODUCTION

Voiding is a phenomenon that results from the interaction between the bladder and urethra under central nervous system control. Different factors are proven or believed to affect voiding in normal men. Among these factors are bladder contractility, the degree of mechanical and/or functional obstruction, relaxation of the pelvic floor muscles related to voiding position [1,2], and relaxation of the adductor and anterior muscles of the thigh, which affect relaxation of the pelvic floor [1,3]. The bladder position in the pelvis, the angle between the bladder neck and the urethra, the patient's comfort in the selected voiding posture, and anal sphincter tone during micturition [1] have also been suggested as having an impact on voiding quality.

Many men in the Middle East choose the sitting or squatting posture during bladder emptying due to religious beliefs. The routine way of voiding in Western countries is in the standing position. Intraabdominal pressure changes and alterations in pelvic floor muscle tone seem possible in the standing, sitting, and squatting voiding positions.

It is important to know the effect of voiding position on urometric parameters in order to obtain optimal diagnostic test results, compare data across research investigations, and make recommendations about voiding position for the management of voiding problems. A definitive answer is not available in the current literature. The aim of the present study was to examine the effect of voiding position on uroflowmetric parameters in young men who were asymptomatic of urological disorder.

METHODS

This is a prospective study of men from Tabriz, Iran. The protocol was approved by the ethics committee of Tabriz University of Medical Sciences. It was conducted between December 2008 and May 2009. All volunteers were informed about the purpose, design, and preparations for the study. The noninvasive procedures were described and they were assured of privacy. All participants provided their informed consent.

Participants

The participants were 31 male volunteers who were asymptomatic of urological disorder. They had an average age of 29.2 years (range, 23-39 years). A complete medical history was taken, with an emphasis on urinary symptoms and any change in voiding habits. None of the volunteers had a significant medical history and all were considered healthy. The participants were not asked about their typical voiding position.

Procedures

Uroflowmetric measurements were obtained during 6 different sessions; 2 measurements were obtained for each of the standing, sitting, and squatting positions. All participants were advised to start the test with a *normally full* rather than an *extremely full* bladder. The first measurement was made with the participants in the standing position because of its simplicity. For measurements in the sitting position, we used a usual toilet seat with a space under it for the uroflowmeter. For the squatting position, we made a special seat that resembled a typical Iranian toilet.

All of the participants were alone in the room during the voiding phase. They held a remote control and pressed start and stop buttons at the times described for them before the evaluation. Participants had to provide at least 125 mL of urine. We excluded measurements from voided urine volumes greater than 450 mL to prevent a significant impact of volume on results.

Any participant whose flow pattern was not obviously typical (eg, interruptions in flow; a maximum flow rate lower than 15 mL/s; unusual peaks in flow) was asked to repeat the measurement. If more than 1 atypical test was detected, he was excluded and referred to the urology clinic for further evaluation.

Data Recording and Analysis

Measurements were recorded on the Delphis IP urodynamic system (Laborie; Toronto, Canada). We calculated the average of each pair of measurements in each voiding position. The outcome measures were peak flow rate (Qmax), average flow rate (AFR), time to peak flow (TPF), flow time (FT), and voided volume (VV) in each position. A one-way analysis of variance (ANOVA) was calculated using SPSS 13.0 software (IBM Corp; Somers, NY). A probability value $< .05$ was considered statistically significant. A power analysis was not conducted, so the possibility of a type 2 error exists.

RESULTS

A total of 33 participants entered the study, based on the inclusion criteria. One participant was excluded because of unusual fluctuations in flow rate in 3 voiding graphs from 2 different positions. A second participant showed at least 3 peak flow rates < 15 mL/s in different postures. He was referred to the clinic and ultrasonography showed a bladder diverticulum. The remaining 31 volunteers finished their measurements. Only 4 measurements of the total 186 tests were repeated because of low or high urine volumes.

Table 1 contains the mean, standard error, 95% confidence interval, and probability of significant differences in voiding position for the outcome measures. The measures of Qmax, flow time, and time to peak flow are also depicted in Figure 1, Figure 2, and Figure 3, respectively. There were no significant differences in any of the outcomes for any of the positions ($P > .05$).

DISCUSSION

Study of the effect of voiding position on uroflowmetric parameters has been facilitated by the emergence of uroflowmetry in recent decades and by our current ability to analyze voiding dynamics. However, it is essential to remember that the uroflowmetric parameters have been

Table 1. Mean, Standard Error, 95% Confidence Interval, and Probability of Significant Differences in Voiding Position for the Outcome Measures (N = 31).
doi: 10.3834/uij.1944-5784.2011.06.06t1

Outcome Measure	Position	Mean	Standard Error	95% Confidence Interval	*P*
Maximum flow rate, mL/s	Stand	23.4	1.5	20.2-26.6	.618
	Sit	24.4	1.7	20.8-28.0	
	Squat	25.8	1.9	21.9-29.7	
Average flow rate, mL/s	Stand	13.4	0.9	11.5-15.4	.813
	Sit	13.0	0.9	11.1-14.9	
	Squat	13.9	0.9	12.1-15.7	
Flow time, s	Stand	23.9	2.2	19.3-28.4	.822
	Sit	22.1	1.6	18.7-25.4	
	Squat	22.9	2.2	18.4-27.4	
Time to peak flow, s	Stand	7.8	0.6	6.6-8.9	.119
	Sit	8.0	1.0	5.9-10.0	
	Squat	6.0	0.4	5.3-6.9	
Voided volume, mL	Stand	300	23	253-348	.631
	Sit	275	17	241-309	
	Squat	291	16	257-324	

Figure 1. Maximum flow rate (Qmax) in 3 different voiding positions.
doi: 10.3834/uij.1944-5784.2011.06.06f1

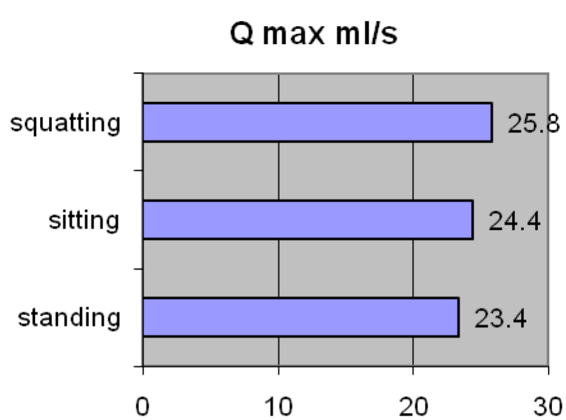


Figure 2. Flow time in 3 different voiding positions.
doi: 10.3834/uij.1944-5784.2011.06.06f2

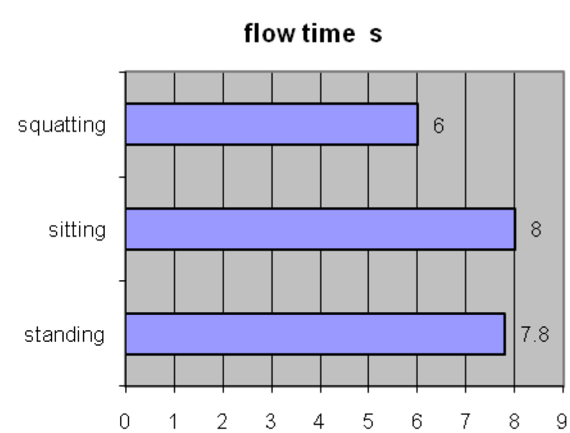
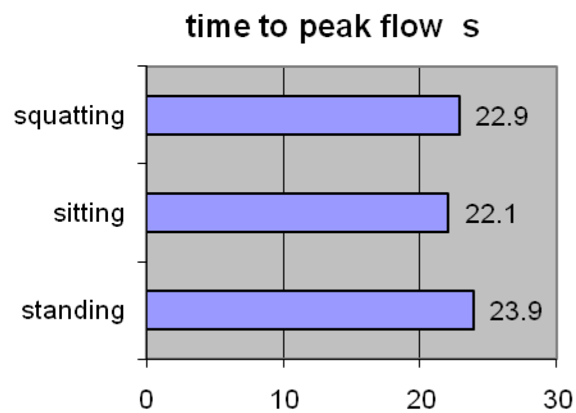


Figure 3. Time to peak flow in 3 different voiding positions.
doi: 10.3834/uij.1944-5784.2011.06.06f3



standardized only in recent years [4] and there has been no differentiation in the standards for voiding position. If there are differences in uroflowmetric measures according to voiding position, the standards may need to be adjusted. Furthermore, uroflowmetric information is mainly directed at differentiating *abnormal* voiding from *normal* and there have been insufficient comparative studies between people without urological disorder from different races, ages, or cultures.

A number of studies are available in the literature with specific aims that are completely like ours [5-9] or relatively similar to ours [2,3,10-13]. Many studies have reported differences in voiding parameters with different positions [1,3,5-8,10,12,13]. However, some of these studies were designed for patients with symptomatic benign prostatic hyperplasia [1,7] or for women [2,3,12,13]. Additionally, some of the studies compared usual voiding positions with unusual ones like recumbent [10] and supine or lateral positions [6]. Of those articles comparing at least 2 of our selected positions in normal males, 2 studies found differences in uroflowmetric findings [5,8] and 2 studies did not [7,9].

One previous study of 200 males in Saudi Arabia showed statistically proven differences for the standing versus sitting position [8]. All participants routinely used the seated voiding position. Therefore, the standing position could have been uncomfortable for them and this may have affected the results. In the present study, we did not inquire about routine voiding positions, although some assumptions could be made based on the fact that all participants were from the Middle East. We knew that routine voiding position could be regarded as both advantageous and disadvantageous information. It is a logical concern that indifference about the patient's usual voiding position could have created biases in our measurements. However, we did not feel that we had a sufficient number of participants to divide them into categories.

It is interesting to note that even in the studies with no statistically significant differences in the results of different voiding positions, Qmax has shown a tendency to increase when the participant moves from standing to sitting or squatting. A restricted number of cases is a shared limitation among the majority of these studies (including ours) and may be a reasonable cause for this variability. However, there are acceptable explanations in the literature for the possible positive effect of the sitting and crouching positions. Muscles of medial and anterior parts of the thigh are relaxed in these positions and it has been shown that contraction of these muscles inhibits bladder contraction and leads to insufficient relaxation of pelvic floor musculature [14].

Another important point to be discussed is the possibility of bladder neck angle variation with different positions, which can affect voiding quality. Moreover, increased intraabdominal pressure in the sitting and squatting positions can (theoretically) positively affect the flow rate. This point was postulated in a previous study from our center using patients with benign prostatic hyperplasia [1]. However, we found no specific data addressing the importance of the increased abdominal pressure in *normal* voiding.

We made one important observation after our initial experience in taking measurements in the sitting and squatting positions. Because these postures are usually used for simultaneous defecation and voiding, the participants may not have experienced voiding while contracting the anal sphincter (ie, voiding with voluntary inhibition of defecation). If they found this position uncomfortable, it could have affected the results. This has been emphasized in our previous study of patients with bladder outlet obstruction. In the standing position (especially in public conveniences), contraction of the anal sphincter while relaxing the urethral sphincter can lead to pelvic floor muscle discoordination; these actions have common innervations from S2 to S4 [1].

The present study did not show statistically significant differences between 3 voiding positions for any of the measured uroflowmetric parameters. In the most similar research to our study, Eryildirim et al [5] evaluated 30 healthy young men who voided in 3 positions. They concluded that Qmax and AFR were affected by sitting and squatting positions when compared with the standing position, but they did not find differences in voided volume, voiding time, or postvoid residual urine.

CONCLUSION

The present study revealed no statistically significant differences between the standing, sitting, or squatting voiding positions for any of the measured urodynamic parameters. A precise judgment about the effect of voiding position on the uroflowmetric measures of healthy young males needs more investigation using a large number of cases, preferably with heterogeneous typical voiding positions. Randomized position order for data collection would also avoid any order effect. Additional information may be obtained from meta-analysis of homogenous available data or videourodynamic studies.

Conflict of Interest: none declared.

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