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Uroflowmetry Findings in Patients with Bladder Outlet Obstruction Symptoms in Standing and Crouching Positions

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ABSTRACT

Introduction: Bladder emptying in crouching position is a conventional way in many eastern countries. Our aim was to evaluate uroflowmetry parameters as an index of obstruction severity in standing and crouching positions and comparison of them in patients with bladder outlet obstruction symptoms.

Materials and Methods: Uroflowmetry in standing and crouching positions was done in 83 patients with bladder outlet obstruction symptoms due to benign prostatic hyperplasia (BPH). The patients were 50 years old or older and their maximum flow rate in standing position was less than 15 mL/s. The maximum flow rate, average flow rate, maximum flow time, and postvoid residual urine volume were measured and recorded. The results in standing and crouching positions were compared.

Results: The mean maximum flow rate and mean average flow rate in crouching position increased 86% and 51%, respectively ($P < .001$; $P = .012$), while mean maximum flow time and postvoid residual volume decreased 40% and 46%, respectively ($P < .001$; $P < .001$). These changes were also significant in patients with maximum flow rates of less than 10 mL/s and 10 mL/s to 15 mL/s in standing position, except for the maximum flow time in the latter group.

Conclusion: A more complete emptying of bladder in crouching position in patients with BPH can be attributed to the increased bladder pressure due to a good transmission of intra-abdominal pressure and a complete and coordinated relaxation of pelvic floor muscles. This position can help improve patients' symptoms.

KEY WORDS: voiding position, uroflowmetry, lower urinary tract symptoms

Introduction

Micturition is dependent on a synchronized interaction of the bladder and the urethra under control of the central nervous system.[1] There are many mechanical factors affecting micturition in different situations that may affect diagnosis and treatment of voiding dysfunctions. These factors include: pressure of abdominal muscles and viscera[2] and transmission of this pressure to the bladder and the urethra,[3] relaxation degree of pelvic floor muscles in different positions of micturition,[4] and relaxation degree of adductor and anterior muscles of the thigh which directly affects the relaxation of pelvic floor muscles.[5] Also, there are other factors which are expected to impact voiding such as the bladder position in the pelvis, the angle between the bladder neck and the urethra, patient's comfort in each voiding position, and anal sphincter tone during micturition.[4] Changes in voiding position may have a significant impact on the abovementioned factors and subsequently on micturition function. For instance, in crouching position, increased intra-abdominal pressure, its transmission to the bladder, and complete relaxation of anterior and adductor thigh muscles

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and the pelvic floor can affect urinary flow.

On the other hand, nowadays, there is a growing trend towards conservative treatment of benign prostatic hyperplasia (BPH),[6] and taking a proper voiding position is regarded as a helpful recommendation in patients. Moreover, increased severity of symptoms in patients with BPH makes them urinate in sitting or crouching positions, because these positions contribute a full relaxation of pelvic floor muscles and let the patients with hesitancy wait enough without exhaustion.[7]

Generally, among many people in eastern countries (especially among Muslims), bladder emptying is done in crouching position and according to religious recommendations, voiding in sitting or crouching position is preferred compared to standing position. But, the routine way of bladder emptying in western countries is standing position. In addition to the fact that presenting corroborative evidence for a religious suggestion is fascinating, achieving useful results from a simple recommendation for voiding position can help improve symptoms in patients with bladder outlet obstruction. Thus, we decided to evaluate uroflowmetry findings in patients with bladder outlet obstruction in standing and crouching positions.

Materials and Methods

In a cross-sectional study, 105 men, 50 years old or older, with lower urinary tract symptoms were selected from among those presented in urology clinics of Imam Khomeini and Sina hospitals in Tabriz, Iran, using a simple sequential sampling. All of the patients underwent complete history taking, and physical and rectal examination. The routine blood chemistry tests, urinalysis, urine culture, and measurement of prostate-specific antigen (PSA) serum level were performed. Then, upper and lower urinary tract system ultrasonography was carried out and the patients were examined with a 14-F catheter to rule out urethral obstruction. Patients with lesions other than BPH, such as prostate cancer, bladder stone, neurological dysfunction of the bladder, diabetes mellitus, meatal stenosis, and urinary tract infections were excluded from the study.

Patients with a diagnosis of BPH were instructed to the study and informed consent was obtained. They underwent uroflowmetry for 2 times with PUFS 2000 ambulatory urodynamic device (MMS, Enshede, the Netherlands). The first uroflowmetry was performed in standing position and the results were recorded. Immediately after the test, postvoid residual urine volume was measured with an 8-F Nelaton catheter and gentamycin, 80 mg, was injected intramuscularly as prophylaxis. If the maximum flow rate in the first uroflowmetry was more than 15 mL/s, the patient was considered nonobstructive and excluded from the study. Then, the second uroflowmetry was carried out the next day in crouching position. The second uroflowmetry was performed on a special chair which was designed and made for this purpose. This chair provided a completely similar situation to traditional Iranian toilets for crouching. There were two bars in front and lateral sides of the chair for balance maintenance. Postvoid residual urine volume was measured at the end of uroflowmetry. We made effort to keep the sum of voided urinary volume and postvoid residual volume between 150 mL/s and 300 mL/s in both uroflowmetries to prevent a significant impact on uroflowmetry results.

In all patients, maximum flow rate, average flow rate, maximum flow time, and postvoid residual urine volume were recorded in standing and crouching position and the results were compared. The results in standing and crouching positions were analyzed in all of the patients and separately in those with maximum flow rates of less than 10 mL/s and 10 mL/s to 15 mL/s in standing position.

For statistical analyses, paired *t* test and Wilcoxon signed rank test were used and a *P* value less than .05 was considered significant.

Results

Of 105 patients, 83 were eligible and completed the study. The mean age of the patients was 61.2 ± 8.4 years. The details of the results in all patients are shown in Table 1. Changing the position from standing to crouching increased the mean maximum and mean average flow rates ($P < .001$; $P = .012$) and decreased the mean maximum flow time and mean postvoid residual urine volume ($P < .001$; $P < .001$). The results were analyzed in 2 groups; patients with a maximum flow rate less than 10 mL/s in standing position (n = 66) and those with a maximum flow rate between 10 mL/s and 15 mL/s (n = 17). The same changes were seen in the uroflowmetry results and postvoid residual

Table 1. *Uroflowmetry findings in standing and crouching positions for all patients*

Parameter	Standing	Crouching	Percentage of difference	*P* value
Maximum flow rate (mL/s)	6.6	12.3	86%	< .001
Average flow rate (mL/s)	4.1	6.2	51%	.012
Maximum flow time (s)	22.4	13.4	40%	< .001
Postvoid residual urine volume (mL)	144.7	76.8	46%	< .001

Table 2. *Uroflowmetry findings in standing and crouching positions for patients with a maximum flow rate of 10 mL/s or less in standing position*

Parameter	Standing	Crouching	Percentage of difference	*P* value
Maximum flow rate (mL/s)	5	10.8	116%	< .001
Average flow rate (mL/s)	2.5	5.6	104%	< .001
Maximum flow time (s)	26.1	15.2	41%	< .001
Postvoid residual urine volume (mL)	160	86.8	45%	< .001

Table 3. *Uroflowmetry findings in standing and crouching positions for patients with a maximum flow rate of 10.1 mL/s to 15 mL/s in standing position*

Parameter	Standing	Crouching	Percentage of difference	*P* value
Maximum flow rate (mL/s)	12.6	17.8	41%	.019
Average flow rate (mL/s)	5.7	8.5	49%	.008
Maximum flow time (s)	7.9	6.5	17%	.091
Postvoid residual urine volume (mL)	85.3	37.9	55%	< .001

volume of the patients of the first group, all of which were significant (paired *t* test). In the patients of the second group, the increase in maximum and average flow rates and decrease in postvoid residual volume were significant, but the mean maximum flow time had an insignificant decrease (Wilcoxon signed rank test). The details of the results are presented in Tables 2 and 3.

Discussion

The present study showed that micturition in crouching position improved uroflowmetry findings in patients with severe bladder outlet obstruction (maximum flow rate of less than 10 mL/s) and in those with moderate obstruction (maximum flow rate of 10 to 15 mL/s). In crouching position, patients with severe obstruction (defined by maximum flow rate) moved into the group with moderate obstruction. In other words, maximum flow rate increased form less than 10 mL/s in standing position to more than 10 mL/s in crouching position. Furthermore, the mean average flow rate, maximum flow time, and postvoid residual volume changed significantly in favor of decrease in obstruction severity. Patients with a moderate obstruction (10 mL/s to 15 mL/s) based on the maximum flow rate in standing position were no longer classified in obstructive group while crouching; ie, maximum flow rate increased reaching a level higher than 15 mL/s. Other parameters in our investigation changed considerably in favor of decreased obstruction, too. The results showed that the more severe is the obstruction, the more significant is the improvement by position change. For example, in severe obstruction, increase in maximum flow rate in crouching position was 116%, while in moderate obstruction, this value was 41%.

Unsal and Cimentepe have studied the urodynamic parameters of 44 men with symptomatic BPH in sitting and standing positions. They have found no significant differences in the maximum flow rate, average

flow rate, and postvoid residual urine volume values.[8] However, in this study, increase in average flow rate and decrease in postvoid residual volume were 51% and 46%, respectively, from standing to crouching position. On the other hand, a study on 80 women performed by Moore and colleagues has shown that patients who micturate in crouching position have a 21% decrease in the average flow rate and a 149% increase in postvoid residual urine volume compared with complete sitting position.[9] The results reported by Moore and colleagues are related to the posture that women take over public toilet seats; thus, they have concluded that patients may benefit from a comfortable position while undergoing uroflowmetry. We provided a special chair for our patients and found that their uroflowmetry parameters improved significantly. Controversial results urge more studies on all voiding positions, with special attention to the subject's health status, sex, habits, and convenience at voiding. To our knowledge, our study is the first comparison of crouching position with standing position in BPH patients.

Increased severity of BPH makes patients micturate in sitting position. Because of hesitancy in patients, sitting position enables them to stay longer in toilet without exhaustion, which means a more complete micturition. In addition, more relaxation of the pelvic floor muscles leads to decreased resistance of the bladder outlet and better micturition.[7,9] Below are some possible mechanisms which result in increased flow rate and decreased residue in crouching and sitting positions:

The first mechanism is that in crouching, abdominal muscles act appropriately, completely and symmetrically to help micturition. Moreover, pressure from abdominal contents and their interposition, and transmission of pressure to the lower part of abdomen and the bladder is an important factor in micturition that increases the flow rate. Measuring the pressures at the mea and detrusor muscles simultaneously, Sorensen has shown that postural changes from supine to sitting position changess in increased pressure of bladder and mea, but the bladder pressure increase is more than that of meatal pressure, due to the increased passive pressure of abdominal contents and activity of pelvic floor muscles.[3] Natural micturition entails a raise in forward-moving forces to the urine and a reduction in forces causing bladder outlet obstruction. Intravesical pressure is the sum of detrusor pressure and intra-abdominal pressure. In a normal state, micturition is met by detrusor contraction without any increase in intra-abdominal pressure. But if detrusor contractility is not sufficient for emptying, or high pressure is required (in men with BPH), an increase in intra-abdominal pressure can be helpful.[2] Hence, crouching increases vesical pressure by increasing intra-abdominal pressure for a more complete emptying.

A second mechanism could be explained; the urine flow rate correlates directly with detrusor pressure and inversely with outlet resistance. Thus, when outlet resistance decreases, flow rate increases.[2] There are 2 reasons for relaxation of pelvic floor musculature and eventual decrease in bladder outlet resistance in crouching positing. First, muscles of the medial and anterior part of the thigh are relaxed in this position. It has been shown that contraction of these muscles inhibits the bladder contraction and leads to insufficient relaxation of pelvic floor muscles. The relaxation of the previously mentioned muscles has opposite effect.[10] Second, while crouching, the knees and the head of femur are in complete flexion which causes symmetry and a good fixation of pelvis to facilitate relaxation and finally the relaxation of pelvic floor muscles.[4] Wennergren and colleagues have shown that supporting legs during micturition (by putting a pillow under the feet) in various situations leads to a better relaxation of pelvic floor musculature. They studied 20 healthy girls in 3 positions: supine, sitting, and crouching. They found that supporting legs in supine and sitting positions, improves pelvic floor relaxation, but in crouching position it has no effect on relaxation degree. They demonstrated that the most relaxation of pelvic floor is achieved by crouching per se.[4]

We can speculate a third mechanism; innervations of anal sphincter and urethra have the same origin (S2 to S4) and these two sphincters act coordinately and simultaneously. Therefore, synchronously relaxing one and contracting another is a partially difficult task. In standing position and especially in public conveniences, in order to prevent intestinal gas passing and maybe stool, one should contract anal sphincter and relax urethral sphincter for voiding. This causes incoordination in pelvic floor muscles, and then complete relaxation of pelvis and the resultant bladder emptying does not

happen; subsequently, urinary flow rate is decreased. In crouching, the patient uses an isolated toilet and is not obligated to keep anal sphincter tone, there is no incoordination in musculature, and complete relaxation is met. This per se makes a decrease in bladder outlet obstruction and a better emptying.

Apart from cases of BPH, patients with low functional capacity of the bladder (eg, urgency, detrusor instability) benefit from relaxation of pelvic floor musculature and complete bladder emptying. An increase in postvoid residual urine volume equals increased susceptibility to infection, especially in women. Thus, crouching seems to be the recommended voiding position in those at the risk of cystitis. The position of bladder in pelvic floor and the change in the angle between the bladder neck and the urethra may have a role in emptying improvement in crouching position. These concerns should be more investigated by videourodynamics, pressure flow study, and simultaneous recording of electromyography from pelvic floor and adjacent muscles.

Conclusion

Bladder emptying in crouching position is a simple solution for cases with bladder outlet obstruction symptoms and dysfunctional voiding, without any complication. The effects appear immediately and may last for a long time. Obstruction improvement following increased intravesical pressure originates from a good transmission of abdominal pressure to the bladder and coordinated complete relaxation of the pelvic floor in crouching. Other factors contributing to decrease in bladder outlet resistance such as bladder position in pelvic floor and change of the angle between the bladder and the urethra in crouching should be studied with more complete and precise methods such as videourodynamics and pressure flow study. However, there is fair evidence that makes this voiding position recommendable to patients with BPH and dysfunctional voiding to increase flow rate and decrease residue.

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