

Original Article



Evaluation of Lower Urinary Tract Symptoms suggestive of Benign Enlargement of the Prostate by Uroflowmetry and American Urological Association Symptom Score

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Abstract

Background: Uroflowmetry study is a non-invasive, simple, and inexpensive preliminary the diagnostic tool of various lower urinary tract diseases like benign prostatic hyperplasia, stricture the urethra, neurogenic bladder, etc. American Urological Association Symptom Score is the single a most important tool used in the evaluation of patients with Benign prostatic hyperplasia (BPH) and is recommended for all patients before initiation of therapy. **Objectives:** To evaluate lower urinary tract symptoms suggestive of Benign Enlargement of Prostate by Uroflowmetry study, measuring American Urological Symptom Score, Quality of life, and to find out correlation among Uroflowmetry parameters, age. **Materials and Methods:** This is a prospective study to evaluate 13 patients with lower urinary tract symptoms suggestive of benign enlargement of the prostate by performing a Uroflowmetry test. We also measured the level of symptoms by American Urological Association Symptom Score and quality of life of age group 48 to 71 years. Selected patients have gone under Uroflowmetry study recorded American Urological Association Symptom Score and quality of life by few questionnaires. **Results:** The mean age of the patients was 58.92 \pm 6.93 SD year. The mean maximum flow rate and average flow rate were found to be 16.44 and 6.99 ml/sec respectively. Voiding time and voided volume of urine was 74.53 \pm 44.94 SD sec, and 412.38 \pm 255.66 SD ml respectively. The maximum flow rate and age were negatively correlated ($R=-0.551$). Time of maximum flow rate and amount of voided urine was strong positively correlated ($R=0.8717$, $p<0.05$). Voiding time and voided volume were positively correlated ($p<0.05$). Regarding American Urological Association Symptom Score, 53.85% of patients had severe symptoms. The mean American Urological Association Symptom Score of severe and moderate symptomatic patients were 25.14 \pm 3.48 SD, and 14.67 \pm 3.77 SD respectively. For patients of Uroflowmetry studied, 76.92% had prolonged voiding time, and 23% had normal voiding time in comparison with a normal nomogram. **Conclusions:** The uroflowmetry test and American Urological Association Symptom Score are helpful for preliminary evaluation of lower urinary tract symptoms suggestive of benign enlargement of the prostate and for further treatment. Prolong voiding time and decrease maximum flow rate can give clues for outflow obstruction for benign enlargement of the prostate.

Key words: Maximum flow rate, Non-invasive tool, Quality of life.

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Introduction

Benign prostatic hyperplasia (BPH) is a complex progressive disease common in many men aged 40 years and above, commonly associated with bothersome symptoms, can also result in complications.¹ Common complications are urinary retention, urinary tract infection (UTI), bladder stones, renal damage.² Men who are at risk of BPH disease progression are

older age (>60 years), moderate to severe symptoms (AUA symptom score >8), enlarged prostate (PV > 30 cc), low urinary flow rate (Qmax < 10.6 ml/s), increased PSA (>1.5 ng/ml).³ An easy and simple step for the BPH symptoms assessment instrument is the AUA symptom score. The AUA Symptom Score is the most accepted self-administered questionnaire both valid and reliable in evaluating and

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identifying the need to treat patients with BPH, and in monitoring the response to therapy. There are 7 questions relating to different symptoms of BPH and one question is related to the overall quality of life. The AUA questionnaire allows a better understanding of the severity of lower urinary tract symptoms (LUTS). It is used for men who are having problems related to an enlarged prostate. It is helpful in determining which treatment option is suitable and for monitoring any improvement. After scoring each question the values are added together to give an indication of the severity of symptoms. AUA Symptom Score 0-7 is mild symptoms; 8-19 score is moderate symptoms, 20-35 is severe symptoms. The severity of symptoms can be assessed by AUA Symptom Score, rather than the increase in the prostate volume during treatment of BPH. ^{3,4} Uroflowmetry has become a universal investigation which is a safe, inexpensive urodynamic tool and a non-invasive way of measuring and recording the urinary flow rate throughout micturition after the publication of the technique by American Surgeon Willard M. Drake JR.^{5,6} There are three steps of urodynamic tests. Uroflowmetry, essential urodynamic tests such as filling cystometry, pressure flow study, and complex urodynamic, such as urethral pressure profile, video urodynamic, neurophysiologic test.^{7,8}

The parameters of Uroflowmetry are maximum flow rate (Qmax), average flow rate (Qave), time to maximum flow rate (Qtmax), voided volume (Vvoid), flow time(Ft), voiding time(Vt), and delay time. By measuring the Qmax, Qave, voided volume, voiding time, and Ft, the test can estimate the severity of obstruction by benign enlargement of the prostate(BPH), bladder dysfunction and urethral stricture in the lower urinary tract.

Materials and Methods

This prospective study of AUA Symptom Score, QOL, and Uroflowmetry test were done in 13 patients with LUTS suggestive of BPH, conducted during the period of April 2018 December 2018 at Khwaja Yunus Ali Medical College Hospital in the Urology outpatient department. Only 13 patients with LUTS suggestive of BPH were included in this study. In the Uroflowmetry test, the Qave, Qmax, Qtmax, Vvoid of urine, Ft, and Vt were recorded automatically during the test. Inclusion criteria were patients age >40 years, having LUTS, those AUA Symptom Score more than 8 ml/s. Exclusion criteria were patients having indwelling catheterization, patients who could not void properly, patients who voided less than 150 ml, and neurological disorders. During urination Uroflowmetry graph plotted showing, Vvoid, Ft, Vt, Qtmax, Qmax, Qave. During AUA Symptom Score and QOL study, patients were asked seven questions in Bengali, so that all patients can understand the meaning of questions and can the answer according to symptoms of the disease. Uroflowmetry results, AUA Symptom Score, QOL the score was analyzed and interpreted for correlation and significant difference. Pearson's correlation formula was used for coordination, excel software was used for the analysis of data.

Results

Of the 13 patients, the mean age was 58.92 +/- 6.93 SD years, range 48-71 years. The parameters of Qave, Qmax, Qtmax,

Vvoid, Ft, Vt are shown in table- 1.

Table I: The statistical variables of different Uroflowmetry parameters.

Uroflowmetry variables	Mean	Max	Min	SD	Variance	CI
Qave	6.99	16.6	2	3.80	14.40	6.99
Qmax	16.44	34.7	3.5	8.78	77.17	16.44
Qtmax	12.7	31.1	0.4	8.06	64.95	12.7
Vvoid	412.38	955.2	171.9	255.66	65363	412.38
Ft	63.72	166.6	22.7	38.36	1471.54	63.72
Vt	74.53	192.5	24	44.94	2019.91	74.53

The mean Qmax, Qave were found to be 16.44 and 6.99 ml/s respectively. The mean Qtmax, Ft, Vt, and, Vvoid were 12.7+/-8.78 SD sec, 63.72 +/-38.36 SD sec, 74.53 +/- 44.94 SD sec and 412.38+/-255.66 ml respectively. The parameter Qmax was positively correlated with voided volume(R=0.263, p<0.05), and negatively correlated with age (-0.55). Qmax was strongly positive correlated with voided volume (R=0.8717, p<0.05). Qtmax vs Vt was moderate positively correlated, (R=0.5753, p<0.05). Ft vs Vvoid and Vt vs Vvoid were moderate positively correlated with the significant result(R=0.591, R=0.6517, respectively, p<0.05). Regarding AUA Symptom Score, and QOL, 53.85 %(7) patients had severe symptoms, while 46%(6) had moderate symptoms. Of the patients, the mean AUA Symptom Score of severe and moderate symptoms patients were 25.14 +/- 3.48 SD and 14.67 +/- 3.77 SD respectively (Table II).

Table II: Mean AUA Symptom Score and QOL score of severe and moderate symptoms patients

AUA Symptom Score	Severe symptoms	Moderate symptoms
Mean	25.14	14.67
SD	3.48	3.77
Variance	12.12	14.22
QOL	4	2.5
SD	0.76	0.5
Variance	0.57	0.25

The mean Qmax of the 3 groups of different voided urine volumes are shown in table III. The maximum flow rate was 24.5 ml/sec when the voided volume was 301-450 ml, whereas Qmax were 17.35+/-1.25 SD ml/sec, and 21.9 +/-9.32 SD ml/sec respectively when the voided volume was 451-600 ml and 601 – 700 ml respectively, representing decreased flow rate may be due to complications of BPH in bladder outflow obstruction(Table III). Here maximum flow rate was not related to the urine volume voided.

Table III: Urine flow rate in different voided volumes (13 pts)

V void	Flow rate (ml/s)
150 – 300 ml	Mean - 12.69 +/- -7.84 SD, Range -3.5 – 27.9, Variance = 61.41,
301 – 450 ml	Mean= 24.5,
451 – 600	Mean=17.35+/- -1.25 SD, variance= 1.563,
601 – 700 ml	Mean= 21.9 +/- -9.32 variance= 86.78

Among the patients of Uroflowmetry studied 76.92% had prolonged voiding time with a mean age 60.5 years and 23% had normal voiding time with a mean age of 64 years. Three studies with a healthy population showed a normal reference value of uroflowmetry parameters compared with our study of BPH patients. (Table VI).). One Thai study with healthy population showed reference value of Uroflowmetry as Qmax is 31.2+/- 9 SD ml /sec , voiding time 24.7 +/- 10.6 SD sec, and voided volume 412.38 +/- 2 ml.11,13,14 Patients having prolonged voiding time in our study are shown in table-IV with corresponding Qmax, voiding time, and voided volume.

Table IV: Patients having prolonged voiding time showing corresponding maximum flow rate and voided volume.

No	Vt(s)	Vvoid (ml)	Qmax (ml/sec)	Age (years)
1.	48.2	242	19.7	63
2.	72.6	570.9	16.1	56
3.	53.3	171.9	6.9	63
4.	106.9	215.8	3.5	63
5.	133.8	955.2	18.2	60
6.	192.5	856.9	12.8	51
7.	66.4	220.6	5.2	71
8.	86.6	264.4	8.9	61
9.	56	472.5	18.6	48
10.	61.1	324.4	24.5	65

In our study population, 30.77 % had large voided urine volume shown in table V.

Table V: Parameters of Uroflowmetry of the patients having large voided volume of urine with corresponding other Uroflowmetry parameters.

Sl. No.	Voided volume (ml)	Qmax (ml/sec)	Voiding time (sec)	Delay time (sec)	Age (yrs)
1.	570.9	16.1	72.6	1	56
2.	955.2	18.2	133.8	3	60
3.	856.9	12.8	192.5	5	51
4.	643	34.7	36.8	1	50

Table VI: Showing different parameters of Uroflowmetry test in different studies done by other countries with normal population and our study with BPH comparing with them.

	Qmax (ml/sec)	Qave (ml/sec)	Qtmax (sec)	Voiding time(sec)	Voided volume(ml)
Kumar V et al. ¹¹ study Patients age >50 years Healthy population	17+/- 7.16SD	8.9+/- 4.06 SD	10.94+/- 9.28 SD	37.68+/- 19.08 SD	
Deepak S et al. ¹³ Patients age >50yrs. Healthy population	17+/- 7 SD	9+/- 4 SD			300+/- 140 SD
Suebnuanwattana T ¹⁴ Patients age 50 - 60yrs. Healthy population	27.5+/- 9.2 SD	19.1+/- 6.2SD		24.4+/- 8.5 SD	310.3+/- 107.8 SD
Our study, Patients age >48yrs BPH patients.	16.44+/- 8.78 SD	6.99+/- 3.8 SD	12.7+/- 8.06 SD	74.53 +/- 44.94 SD	412.38 +/- 255.66 SD

Discussion

One healthy person first feels the desire of micturition when the bladder contains 100-200 ml of fluid and strongly feels micturition desire when the bladder is full at 400-500 ml. Urinary flow rate is the result of detrusor action against outlet resistance, any variation from the normal flow rate might reflect dysfunction of either. The normal flow rate from a full bladder is approximately 20-25 ml/sec in men. Any variations are directly related to the Void and the person's age. Obstruction should be suspected if the flow rate is less than 15 ml/s. If the flow rate is less than 10 ml/s is considered definitive obstruction.⁹ All the patients in this study who had symptoms of LUTS susceptible to BPH are in the age group of 48-71 years but in another study patients, the age group was 50-60 years.¹⁰ Male aged < 40 years usually have a Qmax of >25 ml/sec which is correlated with Vvoid and age, a significant decreased of Qmax is generally accepted as <15 ml/sec. Age 46 to 65 years, the Qave for males is 12 ml/s.^{11,12}

In our study all patients had LUTS susceptible to BPH. The mean Qmax, Qave, was 16.44 ml/s, and 6.99 ml/s respectively the latter is lower than that of normal, indicating obstructive symptoms. Despite the limitation, Qmax remains the single most non-invasive urodynamic test to detect possible lower urinary tract obstruction as was found in other studies and in our study.¹³

In a study with a healthy population aged 50-60 years, the Qmax was 31.2 +/-9 ml/sec, Qave 22.6 +/-7.4 ml/sec, voiding time 24.7 +/-10.6 sec, and Vvoid 310.3 +/- 107.8.¹⁴ In our study with BPH patients age ranged 45-70 years, the Qmax 16.44 +/-8.78 SD ml/sec, Qave 6.99 +/-3.80 SD ml/sec, Vt 74.53 +/-44.94 SD ml/sec, Vvoid 412.38 +/- 255.66 SD ml/sec. The relationship between Qmax and Vvoid was correlated without significance (R=0.263), that means if voided volume increase the peak flow also increases. Due to intravesical obstruction Qmax, and Qave both decreased to the normal value as found in this study with healthy people.¹⁴

The maximum flow rate was negatively correlated with age that means if age is advanced peak flow is decreased and vice versa. Qmax was 24.5 +/-2.54 SD ml/sec when voided volume was 301-450 ml, Qmax was 17.35 +/-1.25 SD ml/sec, and 21.9 +/-9.32 SD ml/sec when voided volume were 451-600 ml and 601-700 ml respectively. The Qmax was higher when voided volume was 301-450 ml than Qmax when voided volumes were 451-600 ml and 601-700 ml respectively. This difference may be due to bladder dysfunction for bladder outflow obstruction susceptible to BPH. Uroflowmetry can give preliminary information on BPH. These parameters of Uroflowmetry may vary with age and gender and are useful for the investigation of bladder functions in a urological setting.

Conclusion

In this study, we found and conclude that Uroflowmetry can give preliminary information regarding lower urinary tract obstruction suggestive of BPH of the age group 48 to 71 years. Among BPH patients, 76.92 % patients had prolonged voiding and flow time. Of the patients Studied, 54% of patients had severe symptoms that were detected by AUA Symptom Score.

AUA Symptom Score gave preliminary information for the further decision of BPH patients treatment.

So, Uroflowmetry, and AUA Symptom Score are useful to preliminary diagnosis and subsequent BPH treatment plan. However, differential diagnosis of stricture urethra, detrusor muscle overactivity, and neurogenic bladder require further more invasive urodynamic study for confirmation.

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