Role of Uroflowmetry in Lower Urinary Tract Symptoms Evaluation due to Benign Prostatic Hyperplasia (BPH)

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Objective: Objective of the study was to evaluate the lower urinary tract symptoms (LUTS) due to benign prostatic hyperplasia (BPH) by measuring the maximum flow of urine, flow time, voided volume and voided time by uroflowmetry and post void residual urine with the help of ultrasound.

Method: There were 20 patients in our study age was 49-77 years with mean age 66.35 ± 7.77 years.

Results: Our study data results show. The mean flow, maximum flow and flow time. It was also disturbed in all these patients with their means 5.21 ± 2.006, 9.67 ± 3.2 ml/sec and 34.94 ± 14.65/sec respectively. The residual volume showed increase in the range of 30-230 ml with the mean of 114-65 ± 94.97 ml.

Conclusion: We conclude from this study that uroflowmetry plays key role to evaluate obstructive lower urinary tract symptoms (LUTS) due to benign prostatic hyperplasia by measuring the maximum flow of urine, voided volume, voided time and post void residual volume of urine.

Key Words: Benign Prostatic Hyperplasia (BPH), uroflowmetry, urine flow rate, ultrasound.

Introduction

Uroflowmetry is one of the simplest and noninsive urodynamic investigation in the measurement of urinary flow rate using a flowmeter for evaluation of obstructive lower urinary tract symptoms. in 1979 Turner Warwick et al[21] first described how the intravenous urogram might be converted to an urodynamic study by incorporating the measurement of flow rate while the bladder is empty at the end of the examination the correlation of flow rate with post micturation bladder residual volume adds useful information about bladder obstruction. Flow rate measurements are used now in a similar manner during ultrasonography of the lower urinary tract.

Lower urinary tract symptoms are one of the commonest presentation in urology clinics. BPH has been known as a cause of urinary obstruction and the most common disease effecting the aging men. 50% of the men aged 51-60 years and 90% of men over aged 80 years have histological evidence of BPH. Clinical diagnosis of BPH is made by the assessment of the IPSS, prostate size or volume and reduced urinary flow rate. Histopathologicaly BPH characterized by an increased number of epithelial and stromal cell in the periurethral transition zones of the prostate.

Ultrasound of the prostate is the investigation that enables us to visualize the prostate gland directly and is one of the commonest diagnostic modalities performed nowadays it can be done using the supra pubic abdominal approach as well as transrectal approach. Among several methods the diameter method is the most commonly used for determination of prostate volume it comprises measurement of height (H),width(W),and length(L),and volume(V) is calculated using the formula ½ (H x L x W).

Urodynamic studies in patient with lower urinary tract symptoms are used for objective assessment of urinary bladder outlet behaviour. However to decide what is abnormal it seams mandatory to agree on what can be considered normal.[22] Although urodynamic studies are frequently used to evaluate voiding disorders in an elderly man with lower urinary tract symptoms suggestive of BPH only a few studies have included sufficient age matched controlled.[23]

The measuring instrument calculate the amount of urine, flow rate in second and length of time until completion of void. This information is converted into a graph and interpreted by physician[1,2] Abdul Mohammad, and Omid Rouhi on 16th March 2005 recommended the normogram of the maximum and average flow rate of girls and boys[3] and which can help the physicians to evaluate the response to medical or surgical treatment and be useful for the screening of lower urinary tract disturbing in children for a wide range of voided volume. Christopher G, and Wood on March 2006 suggested that a uroflowmetry test called pressure flow study when used with a pressure recording catheter in the urinary bladder.

Material and Methods

In Department of Urology KEMU/Mayo Hospital, uroflowmetery is a routine test to evaluate the obstructive lower urinary tract symptoms due to benign prostatic hyperplasia and other infravesical diseases. There were only 20 patients with LUTS mainly due to benign prostatic hyperplasia (BPH) inducted in our study. All these patients included in this study were subjected to standard diagnostic criteria including detailed history, physical examination, International prostatic symptom score (IPSS), digital rectal exami-

nation (DRE), prostatic specific antigen (PSA), renal biochemistry, complete urine analysis, culture and sensitivity (C/S), uroflowmetry and ultrasonography.

In uroflowmetry focus was on **flow rate, flow time, maximum flow, voided volume, residual volume and post void residual urine** measurement with ultrasonography.

Uroflowmetry is a simple diagnostic screening procedure used to calculate the flow rate of urine over time. Uroflowmetry is performed by having a person urinate into a special funnel that is connected to a measuring instrument.

How the Test is Performed

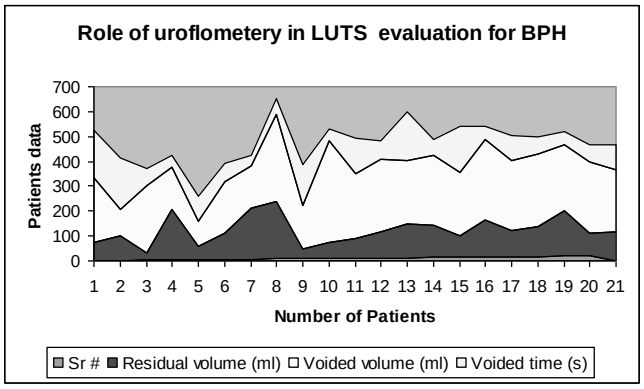
Patient will urinate in a special urinal in toilet equipped with a machine which has a measuring device. Patients are asked to press a button shortly before starting the urination. The machine will give the results.[4,5] Uroflowmetry is performed with a full bladder, they should not urinate for 02 hours prior to test.

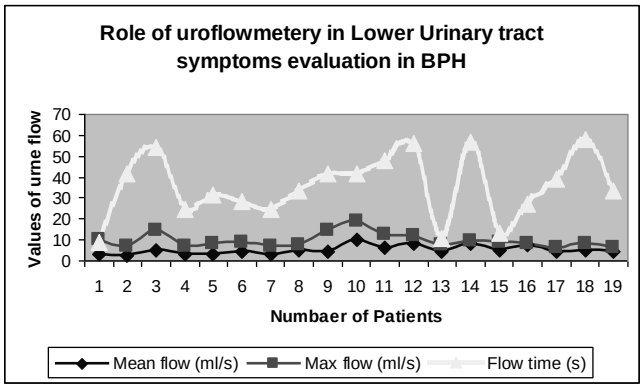
Aim and Objects

1. To evaluate obstructive lower urinary tract symptoms due to BPH, with the help of uroflowmetry.

Table 1: *Evaluation of residual volume, voided volume and voided time in BPH patients.*

Sr #	Residual volume (ml) (normal =nil)	Voided volume (ml) (normal =300-500)	Voided time (s) (normal =)
1.	73	260	191.6
2.	100	106	203.2
3.	30	268	68.5
4.	203	170	46
5.	54	101	98.1
6.	105	207	75.2
7.	203	170	46
8.	230	350	65.2
9.	40	174	166.2
10.	64	411	47.3
11.	80	257	147.2
12.	107	290	72.1
13.	138	250	195.7
14.	130	280	63.8
15.	88	250	185.3
16.	150	320	55.2
17.	106	280	99.1
18.	122	287	72.3
19.	180	268	54.8
20.	90	289	69.8
Mean	**114.65**	**249.4**	**101.13**
SD ±	**94.97462212**	**76.52409321**	**57.8682371**





Results

As mentioned above total 20 patients included in this study. The results of statistical analysis are tabulated in tables and graphs.

In this study a younger patient age was 49 year and older patient age was 77 year the mean age of the patients was 66.35 ± 7.77 years. The minimum residual urine in one patient was 30ml and maximum residual urine was 230 ml. The mean residual urine of all patients was 114.65ml ± 94.97ml.

Mean voided volume was 249.4 ml ± 76.52 ml. In all these patients minimum voided volume was 101 ml and maximum voided volume was 320ml.

During the uroflometery study the mean voided time was 101.13/ sec ± 57.868 sec. The maximum time taken by a patient of benign prostatic hyperplasia (BPH) was 203.2 sec. The minimum time for voiding was 46.00 sec.

The detail of residual urine, voided volume and voided time are shown in table and graph 1.

From this study we conclude, the patients international prostatic symptom score (IPSS) on higher side residual volume, with increased voiding time, but voided volume decreased.

The mean of maximum flow of all patient was 9.67 ml ± 3.26 ml/ sec. In all these patients maximum flow was below normal standard except one patient whose maximum flow was 18.8ml/sec and minimum flow was 6.1ml.

The mean flow was 5.21ml/sec ± 2.006ml/sec. Which was also disturbed in all patients except one patient. The minimum flow was 2.6 ml/sec and maximum mean flow in one was 9.9ml/sec.

All these statistical analysis indicates decreased mean flow. The mean flow time was 34.945 sec ± 14.65 sec which indicate the disturbed value then standard normal values.

In flowmetry test in one patient minimum flow time was 9 sec and in other patient maximum flow time was 57.9 sec.

It clears from this data the flow time is on higher side than normal. The statistical analysis shown in table and graph 2.

Table 2: *Evaluation of BPH in LUTS for mean flow, Maximum flow and flow time by Uroflowmetery.*

Sr #	Age	Mean flow (ml/s)	Max flow (ml/S)	Flow time (s)
1.	65	3	10.1	9
2.	70	206	6.9	41.9
3.	59	5	14.5	54
4.	49	2.9	6.9	24.4
5.	59	3.2	7.9	31.5
6.	65	4.5	8.7	28.6
7.	60	2.9	6.9	24.4
8.	68	4.9	7.3	33.2
9.	69	4.2	14.5	41.9
10.	57	9.9	18.8	41.6
11.	73	6.3	12.5	47.9
12.	68	8.3	12.2	56.3
13.	75	4.5	7.4	11
14.	63	8.1	9.3	57
15.	70	5.3	8.7	13
16.	76	7.3	8.5	27.1
17.	72	4.7	6.3	38.9
18.	76	4.8	8.5	57.9
19.	77	4.3	6.1	33.3
20.	56	7.5	11.5	26.3
Mean	**66.35**	**5.21**	**9.675**	**34.945**
SD ±	**7.77496**	**2.006713731**	**3.269078616**	**14.65869964**

Discussion

Russel[1] et al 2004; claimed that the uroflowmetry proves about the dysfunctional voiding symptoms score and external urinary syphincter.

G Mauro[2], Walter and Andrea proves that maximum flow rate, average flow rate, flow time, and voiding time are properly assessed by the large part of urodynamic flow curves from healthy men or from patients with urethral stricture or BPH.

Neyas[3] M MD, Mukhtar Alam et al in 2007 they did the comparative study on the prostate volume and uroflowmeter in benign prostatic hyperplasia in lower urinary tract symptoms. From their study they give valuable information about the diagnosis of lower urinary tract symptoms LUTS.

Neil D, Sharma[4] 2006 they described how to perform uroflowmetry to evaluate lower urinary tract symptoms due to infravesical diseases.

Brian A,[5] Bander Bring and Lane S Palmer described that flow rate measured by non invasive uroflowmetry showed significant increases following meatoplasty for meatal stenosis uroflowmetrey represent an objective method to assessive outcome following meatoplasty compared to subjective visualization of urinary stream during voiding.

In healthy males normal flow rate is 20-25 ml/sec. According to Abram PH and Grffiths[6] is maximum flow rate is above 15ml/sec generally indicate unobstructed micturation, where as value below 10ml/sec indicates infravesical obstruction mainly due to enlarge prostate, condition is that the detrusor muscle function normally.

Our study data shows that the overall symptoms severity corelates with the result of uroflowmetry and post void residual urine measurement.

Barry et. al,[7] in 1993 proves the corelation between symptoms,voided volume and urinery flow rate.

Kaplan[8,9] and Jensen KME;in 1995 by their research work on lower urinery tract symptom due to BPH with the help of uroflowmetry and urodynamic proves that in BPH patients flow rate is decreased, flow time is increased with increased post void residual urine.

Measurement of urine flow with uroflowmetry and post voiding residual urine provides one of the most effective method of evaluation of patients during a period of watchful waiting and monitoring response to the treatment.

Neal DE,[10] and Ramsden PD, also studies on uroflowmetry and urodynamics results of surgical treatment BPH have shown that improvement in flow rate and significantly decrease in post void residual urine.

Schafer W,[11] 1993, urodynamics in BPH; in 1993 in their research work on the urodynamic and uroflowmetry they proved the flow rate, flow time and post void residual urine helps to differentiate the LUTS due to BPH.

Tanakay, Masumori N,[12] Itoh N et al; in 2001 ; in their study on flow rate by flowmetry and post void residual urine proves measurements are now used in the evaluation lower urinary tract symptoms due to BPH.

Schafer W;[13] in 1995; the gold standard to evaluate grade of lower urinary tract symptoms is urodynamic study with pressure flow analysis.

Matzkin H;[14] Van der Z Waagr; Chen Y et al; How reliable is single measurement of urinary flow in diagnosis of bostruction in BPH ; in 1993, De La Rosette JJ;[15] Witses WP; Debruyne FM etal; in 1996; they all says uroflowmetry is regarded one of the most useful urodynamic techniques for objective assesment of obstructive uropathy. For decades uroflowmetry has played a major role in the evaluation of voiding complaints and helps in making decision about the need for theraputic intervention to relieve lower urinary tract symptoms.

Golomb J;[16] Linder A; Siegel Y et al; in 1992; according to them single episode of uroflowmetry may not be sufficiently reliable for determination of lower urinary tract symptoms due to BPH because many patients are unable to relax and void in the normal fashion while at clinic moreover, since variability between consecutive flow measurements and cicardian changes may be found in various voidnig parameters and specifically in flow rate, any decision based on single flow measurement is not sufficient.

El-Diin KE;[17] Kiemeney LA; De Wildt Ms et al; the say that to minimize the effect a homely and real life sitaution should be provided to the patient so that free uroflow values are obtained under normal condition. Also as we move into modern era when alternative to surgery are increasingly used to treat BPH, the time has come to consider the minimum diagnostic criteria that should be established before any medical or surgical treatment is recommended.

Boormans JL;[18] Van Venrojj GE; Boon TA ; in 2007, Delke M:[19] Hofner K; Jonasu; De LA Rosett JJ; Ubbink DT; Wijkstra H: in 2007, in their study for the diagnostic accuracy of non invasive bladder outlet obstruction uroflowmetry, post void residual urine and prostate volume are the important for the treatment of lower urinary tract symptom (LUTS).

Choks;[20] Kim JH; Kim DJ:Choi YD; Kim JH; in 2008; have a study on lower urinary tract symptom(LUTS) and they prove the relationship between prostate urethral angle and urniary flow rate. They explain the decreased flow rate due to change in prostatic urethral angle after benign enlargement of prostate flow time is increased with increase in post void residual urine.

Conclusion

After the completion of this study we prove that uroflowmetry and urodynamic are non invasive, easy and cheap investigation for evaluation of lower urinary tract symptoms (LUTS), mainly due to BPH.

In our study we proved infravesical obstruction due to BPH urinary flow decreased, voiding time is increased, voided volume is decreased and post void residaul urine is increased.

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