



A CLINICAL COMPARISON OF UROFLOW- DYNAMICS IN PATIENTS WITH LOWER URINARY TRACT SYMPTOMS AND THEIR PROSTATE SIZE USING SONOGRAPHY.

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ABSTRACT

Benign Prostatic hyperplasia (BPH) is a common entity among men over 40 years of age with significant disability. It is a condition that occurs when the enlarged prostate gland compresses the urethra leading to Bladder Outlet Obstruction (BOO). To compare the size of the prostate gland in patients with lower urinary tract symptoms with the extent of bladder outlet obstruction by uroflowmetry. 240 randomly selected male patients, between the age group of 41 to 70 years, with lower urinary tract symptoms, and underwent trans-abdominal sonogram and urine flowmetry. Based on the age group, the subjects were divided into 3 groups. In group 1 (41 to 50 years) there are totally 56 patients with LUTS, (over all 23%). Out of which 14 patients had BPH, indicating that about 5% of patients with LUTS have BPH. In Group 2 (51-60 years) there are totally 62 patients with LUTS, Out of which 20 patients had BPH, indicating that 9% of patients with LUTS have BPH. In Group 3 (61-70 years) there are totally 122 patients with LUTS, out of which 66 patients had BPH, indicating that 27% of patients with LUTS had BPH. The mean age of patients with lower urinary tract symptoms was 60 years with mean prostate size of 45 gms. 0 Enlarged prostate gland was observed in 41% of the patients with mean Q max of 14 ml/sec and post-voidal volume of 48ml. There was significant correlation between the age and the size of prostate gland. In elderly patients with lower urinary tract symptoms, can be due to benign prostatic hypertrophy. LUTS in early ages can be nonspecific to BPH and there was no significant correlation. Based on previous studies, atients between the ages of 41 to 60 years, with lower urinary tract symptoms, secondary to benign prostatic hypertrophy, are more likely to have increased post-voidal residual urine volume, following urine flowmetry.

KEYWORDS: *Benign prostatic hypertrophy, benign prostatic hyperplasia, uroflowmetry, Bladder outlet obstruction, lower urinary tract*



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INTRODUCTION

Prostate is one of the accessory glands of the male reproductive system that secretes fluid to form bulk of the semen along with the seminal vesicles and bulbo-urethral glands. In post pubescent male, the prostate gland has a volume of upto 20 to 30ml. The prostate gland comprises of apex, base with an anterior, medial, posterior and two lateral lobes. Zones of the prostate gland according to McNeal, are divided into: a) Peripheral zone (70%) of the gland, as they are more prone for prostatic cancer b) Central zone (20%) of the gland, is posterior to the lumen, and above the ejaculatory ducts c) Peri-urethral transition zone (10%), most common for benign prostatic hypertrophy. Structural zone of prostate is composed of concentric zones separated by an ill-defined irregular capsule. The inner zone is composed of sub-mucosal glands, opening to the prostatic sinuses which are more prone for benign prostatic hypertrophy. The outer zone has large branched glands and is more prone for prostatic cancer¹. Benign Prostatic hyperplasia (BPH) is a common entity among men over 40 years of age with significant disability. It is a condition that occurs when the enlarged prostate gland compresses the urethra leading to Bladder Outlet Obstruction (BOO). Benign prostatic hypertrophy can be a histological diagnosis that refers to proliferation of smooth muscle, fibrous tissue and glandular tissue within the prostatic transition zone. The clinical assessment of prostatic size by trans-abdominal sonogram has proven to be more accurate predictor of actual prostatic size, as studies show that trans-abdominal sonogram estimate of prostate size and surgical size shows good correlation². The enlarged gland has been proposed to contribute to the overall lower urinary tract symptoms complex via two routes: direct bladder outlet obstruction from enlarged tissue (static component) followed by increased smooth muscle tone and resistance (dynamic component). Detrusor over-activity is thought to be a contributor to the storage symptoms seen in lower urinary tract symptoms. Although lower urinary tract symptoms secondary to benign prostatic hyperplasia is not often a life-threatening condition, the impact of lower urinary tract symptoms on quality of life can be significant and should not be underestimated³. Urine flowmetry is the electronic recording of urine flow rate throughout the micturation. Abnormal urine flow may be caused by bladder outlet obstruction and bladder dysfunction resulting in significant post-voidal residual volume. Studies indicate post-voidal residual urine normally ranges from 0.09ml to 2.2ml with the mean being 0.53ml. Increasing Post-voidal residual urine volume denotes significant bladder dysfunction and risk of developing urinary tract infection. Thus, this concept favors common inclusion of post-voidal residual urine measurement in the evaluation of men with benign prostatic hypertrophy⁴. Thus male with lower urinary tract symptoms based on International prostatic symptoms scale, suggestive of benign prostatic hypertrophy should undergo clinical evaluation for prostatic size by trans-abdominal sonogram. They should further be evaluated by urine flowmetry for post-voidal residual urine to assess the severity of bladder outlet obstruction. Complications of BPH includes

bladder calculi, renal failure, infection, incontinence, retention, hematuria⁵. This study compares the size of the prostate gland in patients with lower urinary tract symptoms with extent of bladder outlet obstruction by uroflowmetry. The study may be useful to the urologist in terms of prevalence of prostate enlargement disorder in each decade of life after the age of 40 years and its significance with the uroflowmetry parameters.

METHODOLOGY AND DESIGN

Men between ages of 41 years to 70 years with lower urinary tract symptoms attending Saveetha Medical College and hospital, Thandalam, Chennai, Tamil Nadu, India, are included in this study. After structural clinical interview, a trans-abdominal sonogram is done for estimation of prostate gland size. Prior approval from institutional Human Ethical Committee was received for the study Total of 240 patients were selected randomly attending outpatient block. They were informed and included in this study. Then the patients were divided into three groups based on the age. Group 1 consisted of patients between 41 to 50 years, Group 2 - 51-60 years and Group 3 - 61-70 years. Obese patients with BMI: $>30\text{kg/m}^2$, or with comorbid conditions such as urinary tract infection, prostatitis, neurogenic bladder, cancer, bladder stone were excluded from the study. After trans-abdominal ultrasound, the patients were made to void urine, as this will be measured for uroflowmetry parameters. These parameters were statistically analyzed using Pearson Correlation test and Student's 't' test.

RESULTS

Out of 240 patients who came with lower urinary tract symptoms 56 were between 41-50 years, 62 were between 51 – 60 years and 122 were between 61-70 years. The mean age of patients with lower urinary tract symptoms was 60 years with mean prostate size of 45 gm. 41% of patients had enlarged prostate gland with mean Q max of 14 ml/sec and post-voidal volume of 48ml (Table:1).

Group 1

Out of 56 patients with lower urinary tract symptoms, 14 patients had enlarged prostate gland. Out of 240 patients only 5% of patients had prostate enlargement between 41-50 years. Statistical analysis of group 1 showed there is significant correlation between age and prostate gland size, age and post-voidal volume, post-voidal volume and prostate gland size (Table 2).

Group 2

Out of 62 patients in group 2 with lower urinary tract symptoms, 20 patients had enlarged prostate. Among the total subjects of 40, 20 patients (roughly 9%) of age between 51 – 60 years had prostate enlargement. Statistical analysis of group 2 showed significant correlation (p value 0.04) on the parameter between prostate size and post voidal volume (Table 3).

Group 3

Out of 122 patients with lower urinary symptoms in group 3, 66 had enlarged prostate gland with volume

ranging from 21 -175 gm. Out of 240 patients, 27% of patient between ages 61-70 had enlarged prostate. Statistical analysis in group 3 showed significant

correlation between age and prostate size, age and post voidal volume (Table 4).

Comparison of observation between three groups

Table 1
Showing comparison of results between three groups
Analysis of group 1

	Group 1	Group 2	Group 3	Total
No of Patients LUTS (%)	56 (23%)	62 (26%)	122 (51%)	240 (100%)
Mean age (years)(range)	45 (41-50)	56 (51-60)	67 (61-70)	60 (41-70)
Mean Prostate(gms)(range)	34 (15-76)	41 (20-98)	54 (21-175)	45 (15-175)
Patients with BPH(>40gms)(%)	14 (5%)	20 (9%)	66 (27%)	100 (41%)
Mean Qmax (ml/s)(range)	16 (4-30)	14 (5-29)	12 (2-37)	14(2-37)
Mean Qavg (ml/s)(range)	6 (2-17)	7.2 (2-15)	6.6 (1-14)	7(1-17)
Mean Postvoid(ml)(range)	22 (4-150)	56 (5-150)	56 (3-180)	49 (3-180)

Table 2
Statistical analysis of group 1 showing significant correlation between age, prostate gland size and post-voidal volume.
Analysis of group 2

Group I	Pearson Correlation t-test	Correlation Coefficient (r)	p value	Significance
	Age and Prostate	0.37	<0.00013	YES
	Age and Post-Voidal	0.13	<0.0002	YES
	Age and Qmax	0.15	1.2	NO
	Age and Qavg	0.11	3.1	NO
	Prostate and Post-Voidal	0.6	0.046	YES
	Prostate and Qmax	-0.4	6.4	NO
	Prostate and Qavg	-0.22	2.7	NO

Table 3
Statistical analysis of group 2 (51-60 years) showing significant correlation only between prostate size and post voidal volume
Analysis of group 3

Group II	Pearson Correlation t-test	Correlation Coefficient (r)	p value	Significance
	Age and Prostate	-0.042	3.8	NO
	Age and Post-Voidal	-0.072	0.44	NO
	Age and Qmax	-0.2	2.7	NO
	Age and Qavg	-0.38	7.4	NO
	Prostate and Post-Voidal	0.0	0.04	YES
	Prostate and Qmax	-0.005	3.3	NO
	Prostate and Qavg	-0.13	1.1	NO

Table 4
Statistical analysis of group 3 (61-70 years) showing significant correlation only between age, prostate size and post voidal volume.

Group III	Pearson Correlation t-test	Correlation Coefficient (r)	p value	Significance
	Age and Prostate	0.14	<0.0011	YES
	Age and Post-Voidal	0.15	0.016	YES
	Age and Qmax	-0.017	2.4	NO
	Age and Qavg	0.09	1.3	NO
	Prostate and Post-Voidal	0.29	0.45	NO
	Prostate and Qmax	-0.29	2.9	NO
	Prostate and Qavg	-0.38	1.4	NO

DISCUSSION

In this study, there were more than 50% patients with lower urinary tract symptoms aging between 61-70 years, clearly indicating the rise in the incidence of the lower urinary tract symptoms with age. Mostly the lower urinary tract symptoms occur due to problem in storage and micturition due to abnormalities in the prostate,

urethra and urinary sphincters⁶. Earlier it was considered that any lower urinary tract symptoms in elderly men were related to benign prostatic hypertrophy, but the latest knowledge suggests that not all bladder symptoms are necessarily linked to benign prostatic hypertrophy. The lower urinary tract symptoms are a major burden for aging men, since it affects the quality of life significantly. A study showed that

approximately 30% of population older than 50 years have moderate to severe LUTS requiring treatment. This is a very large group potentially requiring treatment and can reduce patient's quality of life leading to serious pathology of urogenital tract⁷. But in the present study, nearly 77% of patients with lower urinary tract symptoms were above 50 years of age, which was very significant compared to earlier studies. Also in this study more than 50% of patients with lower urinary tract symptoms were above 60 years of age, which was higher comparable to previous studies where they showed only 27% of patients above 60 years had symptoms. Increased frequency of urination was the most common symptom for the men aged less than 70 years and nocturia, for those more than 70 years⁸. Among all lower urinary tract symptoms, hesitancy, poor urine flow and interruption or intermittency were highly correlated with each other⁹. As a consequence of age-associated diminished renal-concentrating capacity, diminished sodium-conserving ability, loss of the circadian rhythm of antidiuretic hormone secretion, decreased secretion of renin-angiotensin-aldosterone, and increased secretion of atrial natriuretic hormone, leading to age-related alteration in the circadian rhythm of water excretion during night-time in older people^{10,11}. This study shows that as the age increases the size of the prostate gland also increases. Out of tot subjects of 240 patients, 100 patients (41%) had benign prostatic hypertrophy. In group 1, 2 and 3 showed significant correlation between age and prostate size. The incidence of benign prostatic hypertrophy and lower urinary tract symptoms rises markedly with increased age. Isaacs et al¹² proposed a theory regarding development of benign prostatic hypertrophy. There are three probable mechanisms in the development of BPH, (1) the dihydrotestosterone hypothesis: a shift in prostatic androgen metabolism occurs with aging, leading to an abnormal accumulation of dihydrotestosterone, (2) the embryonic reawakening theory: a change in the prostatic stromal-epithelial interaction occurs in aging, leading to induction of prostatic growth, and (3) the stem cell theory: an increase in the number of prostatic stem cell and / or an increase in the clonal expanding of the stem cells into amplifying and transit cells occur in aging. On a population level, there are five broad categories of risk factors for benign prostatic hypertrophy and lower urinary tract symptoms. Aside from age, the other categories are genetics, sex steroid hormones, modifiable lifestyle factors, and inflammation¹³. Transition zone volume measurement is more important in terms of surgery because if the transition zone volume more than the entire prostate volume indicates benign prostatic hyperplasia¹⁴. Various studies shows that the transition zone volume is directly associated with urodynamic obstruction of bladder and it is an important predictor of surgical outcome¹⁵. Uroflowmetry specifically Qmax, can predict the natural history of the disease and also response to the surgery. Men with lower urinary tract symptoms and normal Qmax is likely to have non BPH related cause for their symptoms. Men with Q max of less than 10 ml/s are more likely to have urodynamic obstruction and may improve after surgery. According to a literature, the most valuable parameter for prediction of obstruction is peak flow rate (Qmax). If the Qmax is more than 10 ml/s, the

obstruction is around 90% and if the Qmax is between 10-14 ml/s, then the obstruction is around 67% and if the Qmax is more than 15 ml/s there is only 30% of obstruction¹⁶. In this study, 40% of patients with enlarged prostate gland volume more than 40 gms (96 patients) had Q max range from 2-12ml/sec. Only 4 patients(1% approx) had Qmax more than 15ml/sec had enlarged prostate gland. Large post-residual volume of more than 350 ml, indicate bladder dysfunction and may slightly of less favorable response to treatment. Large post-void residual volume may aggravate the progression of disease and it is not a contraindication for medical treatment, so there is no clear cutoff value for decision making. In this study the post-void residual urine volume range from 3-180 ml indicating that none of them had bladder dysfunction due to benign prostatic hypertrophy. Patients who are in urinary retention tend to have a larger gland but no statistical significance could be established with the urinary retention and prostate gland size, signifying that the dynamic component of prostate obstruction could be important in the production of urinary retention¹⁷. In some studies high post-void residual volume had predicted high failure rates and it does not predict response to the medical treatment¹⁸. The International Consensus Committee on BPH recommended that uroflowmetry data with post-voidal volume of less than 150 ml should be regarded as unreliable¹⁹. It is important to consider the substantial adverse consequences of lower urinary tract symptoms and benign prostatic hypertrophy for the global health of older men. Although it may be tempting to dismiss lower urinary tract symptoms and benign prostatic hypertrophy as relatively harmless disorders representing more of an inexorable, inconvenient, effect of aging, this perception belies the substantial medical, psychological, and economic burdens of these conditions. Despite widespread use of medical therapy, benign prostatic hypertrophy remains associated with a substantial prevalence of urinary infections, bladder stones, urinary retention, and acute renal failure.

CONCLUSIONS

In The present study, it was found that The mean age of patients with lower urinary tract symptoms was 60 years with mean prostate size of 45 gms. 41% of patients had enlarged prostate gland with mean Q max of 14 ml/sec and post-voidal volume of 48ml. The size of the prostate is statistically significant to the post-voidal residual urine volume in group 1 and 2. Patients between the ages of 40 to 60 years, with lower urinary tract symptoms, secondary to benign prostatic hypertrophy, are more likely to have increased post-voidal residual urine volume, following uroflowmetry. From this study, 27% of the total 120 patients with lower urinary tract symptoms have benign prostatic hypertrophy belong to 61-70 years age group. Thus screening male patients with Lower urinary tract symptoms, at 40 years and above, is an ideal way to detect prostatic problems at an early stage.

CONFLICT OF INTEREST

Conflict of interest declared none.

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