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Original Article

Anatomy Section

Correlation of Prostate Gland Size and Uroflowmetry in Patients with Lower Urinary Tract Symptoms

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ABSTRACT

Introduction: 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).

Aim: To correlate the size of the prostate gland and uroflowmetry parameters in patients with Lower Urinary Tract Symptoms (LUTS).

Materials and Methods: One hundred and twenty randomly selected male patients, from the ages of 41 to 70 years, with LUTS, and underwent trans abdominal sonogram and uroflowmetry were included in the study. The samples were divided into three groups according to the age; Group 1: 41 to 50 years, Group 2: 51 to 60 years, Group 3: 61 to 70 years.

Results: In Group 1 (41 to 50 years), there were totally 28 patients with LUTS, out of which seven patients had BPH, indicating that about 5% of patients with LUTS have BPH. In Group 2 (51-60 years) there were totally 31 patients with LUTS, out of which 10 patients had BPH, indicating that 8% of patients with LUTS have BPH. In Group 3 (61-70 years) there were totally 61 patients with LUTS, out of which 33 patients had BPH, indicating that 27% of patients with LUTS had BPH. The mean age of patients with LUTS was 60 years with mean prostate size of 45 cm^3. Enlarged prostate gland was present in 41% of patients with mean Q max of 14 ml/sec and post voidal volume of 48 ml.

Conclusion: This study concludes that the LUTS in older patients are mostly due to BPH leading to BOO. Also, patients with BPH in early ages can lead to increased Post voidal Residual Volume (PVR) following uroflowmetry. Thus, screening male patients with LUTS, at 40 years and above, is an ideal way to detect prostatic problems at an early stage.

Keywords: Benign prostatic hyperplasia, Benign prostatic hypertrophy, Bladder outlet obstruction

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 30 ml. The prostate gland comprises of apex, base with an anterior, median, posterior and two lateral lobes. Zones of the prostate gland according to McNeal, are divided into: a) Peripheral zone (70%) of the gland, which 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 BPH. Structural zone of prostate is composed of concentric zones separated by an ill-defined irregular capsule. The inner zone of prostate gland near the urethra is composed of submucosal glands that open directly into prostatic sinuses which are more prone for BPH. The outer zone has large branched glands and is more prone for prostatic cancer [1].

In men above 40 years of age, BPH is a common entity with significant disability. It is a condition that occurs when the enlarged prostate gland compresses the urethra leading to BOO. BPH 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 a more accurate predictor of actual prostatic size, as studies show that trans-abdominal sonogram estimate of prostate size and surgical size shows good correlation [2].

The enlarged gland contributes to the lower urinary tract symptoms through two routes by direct BOO from enlarged tissue (static component) and by increased smooth muscle tone and resistance (dynamic component). The over activity of detrusor is thought to be a contributor to the storage symptoms seen in lower urinary tract symptoms. The symptoms of lower urinary tract caused secondary to BPH are usually not life threatening but can impact the quality of life and should not be underestimated [3]. Urine flowmetry is the electronic recording of urine flow rate throughout the micturation. Abnormal urine flow may be caused by BOO and bladder dysfunction resulting in significant PVR volume. Increasing PVR urine volume denotes significant bladder dysfunction and risk of developing urinary tract infection. Thus, this concept favours inclusion of PVR urine volume measurement in the evaluation of men with BPH [4].

Thus men with lower urinary tract symptoms based on International prostatic symptoms scale, suggestive of BPH should undergo clinical evaluation for prostatic size by trans-abdominal sonogram. They should further be evaluated by urine flowmetry for PVR urine to assess the severity of BOO. Complication of BPH includes bladder calculi, renal failure, infection, incontinence, retention, haematuria [5]. So the purpose of this study was to assess the size of the prostate gland in patients with lower urinary tract symptoms and to compare it with uroflometry. This study may be useful to the urologist in terms of prevalence of prostate enlargement in each decade after 40 years and its significance with the uroflowmetry parameters.

MATERIALS AND METHODS

A prospective study was done in men between ages of 41 years to 70 years with LUTS attending Saveetha Medical College and Hospital, Chennai, Tamil Nadu, India from June 2015 to July 2016 were included in this study. After obtaining Institutional Human Ethical Clearance (IHEC), the total sample size of 120 patients were se-

lected randomly from patients attending outpatient block during the study period. The written informed consent was taken from each patient who was included in the study. After structural clinical interview, a trans abdominal sonogram was done for estimation of prostate gland size. The patients were then divided into three groups according to the age group: Group 1: 41 to 50 years, Group 2: 51-60 years and Group 3: 61-70 years. Patients with obesity (BMI: >30kg/m^2), urinary tract infection, prostatitis, neurogenic bladder, cancer, bladder stone were excluded from the study. After transabdominal ultrasound, the patient was made to void urine that was measured for uroflowmetry parameters like Qmax, Qavg and post void residual volume.

STATISTICAL ANALYSIS

The uroflowmetry parameters were statistically analysed using Pearson Correlation test and Student's t-test with SPSS software version 22.0. A p-value less than 0.05 were taken as significant.

RESULTS

Out of 120 patients who came with LUTS, 28 were between 41-50 years, 31 were between 51-60 years and 61 were between 61-70 years. The mean age of patients with lower urinary tract symptoms was 60 years with mean prostate size of 45 cm^3. 41% of patients had enlarged prostate gland with mean Q max of 14 ml/sec and post voidal volume of 48 ml [Table/Fig-1]. The mean prostate sizes in Group 2 and 3 patients were more than 40 cm^3 which was an indication for surgical intervention.

Parameters	Group 1	Group 2	Group 3	Total sample
No of Patients LUTS (%)	28 (23%)	31 (26%)	61 (51%)	120 (100%)
Mean age (years)(range)	45 (41-50)	56 (51-60)	67 (61-70)	60 (40-70)
Mean Prostate cm^3 (range)	34 (15-76)	41 (20-98)	54 (21-175)	45 (15-175)
No of Patients with BPH (>40cm^3) (%)	7 (25%)	10 (32%)	33 (54%)	50 (41%)
Mean Qmax (ml/s)(range)	15 (4-30)	15 (5-29)	13 (2-37)	14(2-37)
Mean Qavg (ml/s)(range)	7 (2-17)	8 (2-15)	6.6 (1-14)	7(1-17)
Mean Post void(ml) (range)	23 (4-150)	55 (5-150)	55 (3-180)	48 (3-180)

[Table/Fig-1]: Showing comparison of mean age, prostate size, Qmax, Q avg and PVR between three groups.

Comparison of Observation between Three Groups

Group 1

Out of 28 patients with LUTS only seven patients had enlarged prostate gland. Out of 120 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/Fig-2].

Group 2

Out of 31 patients in Group 2 with LUTS only 10 patients had enlarged prostate. Among the total sample of 120, roughly 8% of age between 51-60 years had prostate enlargement with mean prostate size more than 40 cm^3. Statistical analysis of Group 2 showed significant correlations only between prostate size and post voidal volume [Table/Fig-3].

Group 3

Out of 61 patients with LUTS in Group 3, only 33 had enlarged prostate gland of volume range from 21-175 cm^3. Out of 120 patients, 27% of patient between ages 61-70 had enlarged prostate. Statistical analysis of Group 3 showed significant correlation between age and prostate gland size, age and post voidal volume [Table/Fig-4].

Group I			
Pearson Correlation t-test	Correlation Coeffficient (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/Fig-2]: Statistical analysis of Group 1 (41-50 years) done by Pearson correlation test showing significant correlation between age, prostate gland size and post voidal volume.

Group II			
Pearson Correlation t-test	Correlation Coeffficient (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	0.01	0.04	YES
Prostate and Qmax	-0.005	3.3	NO
Prostate and Qavg	-0.13	1.1	NO

[Table/Fig-3]: Statistical analysis of Group 2 (51-60 years) done by Pearson correlation test showing significant correlation only between prostate size and post voidal volume.

Group III			
Pearson Correlation t-test	Correlation Coeffficient (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

[Table/Fig-4]: Statistical analysis of Group 3 (61-70 years) done by Pearson correlation test showing significant correlation only between age, prostate size and post voidal volume.

DISCUSSION

In this study, there were more than 50% patients with LUTS aged from 61-70 years indicating rise in the incidence of the LUTS with age. LUTS occur due to problem during voiding, storage and micturition due to abnormalities in the prostate, urethra and urinary sphincters [6]. Earlier it was considered that any LUTS in elderly men were related to BPH, but the latest knowledge suggests that not all bladder symptoms are necessarily linked to BPH [7]. The LUTS 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 tract [8]. Frequency was the most common symptom for the men aged less than 70 years and nocturia for those more than 70 years [8].

Among all LUTS, hesitancy, poor urine flow and interruption or intermittency were highly correlated with each other [9]. 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, leads to age-related alteration in the circadian rhythm of water excretion during night time in older people [2,10].

This study shows that as the age increases, the size of the prostate gland also increases. Out of total samples of 120 patients, 50 patients (41%) had BPH. In Group 1, seven patients, in Group 2, 10 patients and in Group 3, 33 patients showed significant correlation between age and the size of the prostate gland. The prevalence of BPH and LUTS rises markedly with increased age. Patients of more than 50 years of age had mean prostate size of more than 40cm^3 which is a main indication for surgical treatment.

Wei JT et al., proposed a theory regarding development of BPH. There are three probable mechanisms in the development of BPH: i) due to shift in prostatic androgen metabolism occurs with aging, leading to an abnormal accumulation of dihydrotestostereone; ii) due to change in the prostatic stromal-epithelial interaction leading to induction of prostatic growth; iii) increase in the number of prostatic stem cell and/or an increase in the clonal expanding of the stem cells [11]. On a population level, there are five broad categories of risk factors i.e., age, genetics, sex steroid hormones, modifiable lifestyle factors and inflammation for BPH and LUTS [12]. Transition zone volumes measurement is more important in terms of surgery because if the transition zone volume is more than the entire prostate volume indicates BPH [13]. Various studies shows that the transition zone volume is directly associated with urodynamic obstruction of bladder and it is an important predictor of surgical outcome [14].

Uroflowmetry specifically Qmax, can predict the natural history of the disease and also response to the surgery. Men with LUTS and normal Qmax is likely to have non BPH related cause for their symptoms [15]. Men with Qmax of less than 10 ml/sec 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/sec, the obstruction is around 90% and if the Qmax is between 10-14 ml/sec then the obstruction is around 67% obstruction and if the Qmax is more than 15 ml/sec there is only 30% of obstruction [16]. In this study, the 40% of patients with enlarged prostate gland volume more than 40 cm^3 (48 patients) had Qmax range from 2-12 ml/sec. Only two patients (1% approx) had Qmax more than 15 ml/sec had enlarged prostate gland.

Large post residual volume of more than 350 ml indicates bladder dysfunction and slightly less may response to favourable treatment. Large post void residual volume may aggravate the progession of disease and it is not a contraindication for medical treatment. So there is no clear cut off value for decision making. In this study, the PVR range from 3-180 ml indicating that none of them had bladder dysfuction due to BPH. Patients with 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 retention [17]. In some studies, high PVR volume had predicted high failure rates and it does not predict response to the medical treatment [18]. Any uroflowmetry data in BPH patients with post voidal volume of less than 150 ml should be regarded as unreliable [19].

For the global health of older men, it is important to consider the substantial adverse consequences of LUTS and BPH. Although, LUTS and BPH are considered 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, BPH remains associated with a substantial prevalence of urinary infections, bladder stones, urinary retention, and acute renal failure.

LIMITATION

This study didn't comment on international prostatic symptom score with LUTS, since this study was done to assess the prostate size and to compare with uroflowmetry parameters. Also this study didn't follow up the patients after surgery to correlate the prostatic size found in the ultrasonogram.

CONCLUSION

This study concludes that the LUTS in elderly patients are mostly due to BPH leading to BOO. The mean prostate size was more than 40 cm^3 in patients more than 50 years of age which is an indication for surgical intervention. Also, patients with BPH in early ages can lead to increased PVR following uroflowmetry. There was no significant correlation between LUTS and mean Qmax, Qavg in all the groups. Hence, BPH should be considered in patients with LUTS.

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