

Original Research Article

Sonographic Evaluation of Prostate Size and its Correlation with Age and PMRV in Patients with Benign Prostatic Hyperplasia

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Abstract: Background: The enlargement of prostate is known as benign prostatic hypertrophy (BPH). It begins when the cells of the prostate gland begin to proliferate. BPH is caused by increased age and other factors associated with it. **Objective:** To determine the correlation of prostate volume with age and post-micturating residual (PMR) volume in patients with benign prostatic hyperplasia (BPH). **Methods:** This cross-sectional study was conducted on 100 patients of BPH that fulfilling inclusion criteria for 4 months, selected from Gondal Medical Complex Gujranwala during 14 January to 15 May 2022. Patients with prostate cancer, mild urinary tract or prostate surgery, and those with UTI or stone in bladder were excluded. Ultrasound was used to perform a transabdominal scan. Age, prostate volume (PV), and PMRV were the outcome parameters. **Results:** In this study hundred BPH positive patients were included. The mean age of patients with BPH, prostate weight, post-void residual volume of the participants was found to be 64.89±14.12 years, 54.68±29.42g, and 22.47±14.75ml respectively. In this study the correlation value of age of patients with BPH and prostate volume was 0.212 and P-value was 0.035 which was significant but the correlation between PV and PMRV was not significant because the correlation value of PV and PMRV was 0.032 and P-value was 0.751. **Conclusion:** This study concluded that there was significant correlation between Age and BPH but no significant correlation between BPH and PMRV.

Key words: BPH, PV, Bladder Outlet Obstruction, PMRV, LUTS, TAUS.

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INTRODUCTION

BPH, also known as benign prostatic hypertrophy, is a pathological disorder characterized by the uncontrolled growth of the prostate's cellular components. Some BPH drugs have been linked to the failure of this process (Zhang *et al.*, 2015). BPH is a hormonally dependent and therefore is considered a typical part of the ageing process in men (Seftel *et al.*, 2008). It generates between 20% and 30% of the seminal fluid (Gratzke *et al.*, 2015). In men with BPH, prostate volume may rise with time. Despite the fact that only 8% of men in their forties have clinical signs of BPH, the majority of men over 50 seem to have

LUTS due to BPH. The enlarge prostate accelerates in men over the age of 55, and by the seventh years of life, the incidence of BPH has increased to more than 70%, with approximately 90% of men in their eighties suffering from the condition (Zhang *et al.*, 2013). In addition, patients with untreated BPH, clinical findings may deteriorate by the passage of time. BPH symptoms are divided into two types: those that cause blockage during micturition and those that cause irritation. Obstructive symptoms are related with aberrant prostatic tissue development and inadequate prostatic muscle tone (dynamic component). Irritation is produced by a blockage of the bladder outflow caused by an enlarged prostate gland. Complications of BPH

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include bladder calculi, kidney failure, infection, incontinence, retention, and haematuria (Griffiths, 1988).

The overall amount of fluid detected in the urine bladder immediately after urination is known as PMRV, according to the International Continence Society. In the previously, the calculation of PMRV was the preferred method for diagnosing and monitoring individuals with benign prostate hyperplasia (Kim, 2013). For two reasons, the presence of leftover urine may be clinically relevant. First, it increases the likelihood of UTI, though additional research is needed to confirm this link; and second, it reduces functional extent of bladder, which may steer to clinical features such as frequency, urgency, and nocturia.

Abdomen ultrasonography is non-invasive, most urologists and their patients choose it to test PMR. Five modified Formulae are utilised to monographically measure PMR. The approaches were determined to be 93.6 percent comparable, making comparison impossible. A sophisticated volume estimation method based on the ellipsoid formula [$0.52 \times \text{width} \times \text{height} \times \text{length}$] shown a significant relationship with individuals observed in situ using foley's [$r = 0.982$; $P > 0$]. .001].²³ A prostate ultrasound is a diagnostic procedure performed to determine whether a man's prostate has any abnormalities. Ultrasound devices generate ultra high-frequency sound waves that pass through the human body. The pattern of echoes, or reflected sound waves, represents a sketch of the prostate. This test can determine whether your prostate is enlarged, either you have an abnormal growth that could suggest BPH, or if you have cancer (Rodríguez-Patrón, 2006). Trans abdominal ultrasound is simple to use and provides accurate prostate size and post-micturition residual volume, and also the ability to test the bladder and upper urinary system concurrently (Yuen *et al.*, 2002). Individuals with benign prostate hyperplasia (BPH) have clinical characteristics such as bladder outlet obstruction (BOO), frequent urination, weak flow, minor LUTS, and prostate enlargement on physical and sonographic testing (Wasserman, 2006). The prostate was first (and still is) examined using a transabdominal, trans-vesical method. The prostate and bladder benefit from the trans vesical approach (Littrup & Bailey, 2000). Early prostatic hypertrophy and associated problems can be detected with ultrasonography imaging. This study will create an awareness among men to diagnose timely to prevent complications (Mitterberger *et al.*, 2007).

MATERIALS AND METHODS

This cross-sectional research was completed during a period of 4 months from (Jan 14, 2022, to May 15, 2022) with sample size of 100. Eligible participants underwent sonographic examination at Gondal Medical Complex, Gujranwala. Male patients of all age with BPH were included in this study. Patients with the history of UTI, prostate cancer, stone in bladder, prostatitis, neurogenic bladder dysfunction, history of TURP or other surgical intervention associated with BPH were excluded in this study. The study was started after taking approval from the Institutional Review Board and Ethical committee of the University of Lahore, Gujrat Campus Pakistan. The procedure was described to the patients, as well as the study's outcomes, as they signed a permission letter. The information regarding history and age was taken. The information collecting slip was used to capture observed data, and patients were promised that their personal information would not be made public. Throughout the investigation, patient privacy was respected. Patients' age, prostate volume, and pre- and post-micturition residual volume were all studied factors. To measure the prostate volume (PV) of patients, Toshiba (Aplio 300) ultrasound machine with 3.5MHz curvilinear transducer was used. In the supine posture with a full bladder, participants were inspected. The transducer was angled 15 degrees towards the feet to produce transverse sections. After micturition, the PMRV was measured. The ellipsoid formula was used to determine the prostate size ($0.52 \times \text{width} \times \text{height} \times \text{length}$).

SPSS Version 26 was used to statistically analyse the gathered information. All descriptive variables were measured on the basis of mean and standard deviation, except for frequency, which was measured on the basis of terms of numbers and percentages. Pearson's correlation was used to assess correlation. P-values of less than 0.05 were considered significant.

RESULTS

The patients that participated in this study were of all age of men with BPH. The observed sample was statistically analysed for mean and standard deviation in this research study. The mean Age of patients with BPH, Prostate weight, post-void residual volume of the patients was found to be 64.89 ± 14.12 years, 54.68 ± 29.42 g, and 22.47 ± 14.75 ml respectively in this study presented in Table-1.

Table-1: Descriptive stats for total participants

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age of Patients with BPH	100	27.00	90.00	64.8100	14.12262
Prostate volume(g) of BPH patients	100	31.00	245.00	54.6830	29.42444
Post micturating residual volume(ml) (PMRV)	100	2.00	67.00	22.4700	14.75418
Correlations					
		Age of Patients with BPH		Prostate volume(g) of BPH patients	
Age of Patients with BPH	Pearson Correlation	1		.212 [*]	
	Sig. (2-tailed)			.035	
	N	100		100	
Prostate volume(g) of BPH patients	Pearson Correlation	.212 [*]		1	
	Sig. (2-tailed)	.035			
	N	100		100	

In this study the correlation value of age of patients with BPH and prostate volume was 0.212 and the P-value was 0.035, which was lower than 0.05 and was significant presented in Table 2. Scatter plot also

showed the significant relationship of age with prostate volume presented in Figure 1.

Table-2 Pearson correlation among age of patients with BPH and prostate volume.

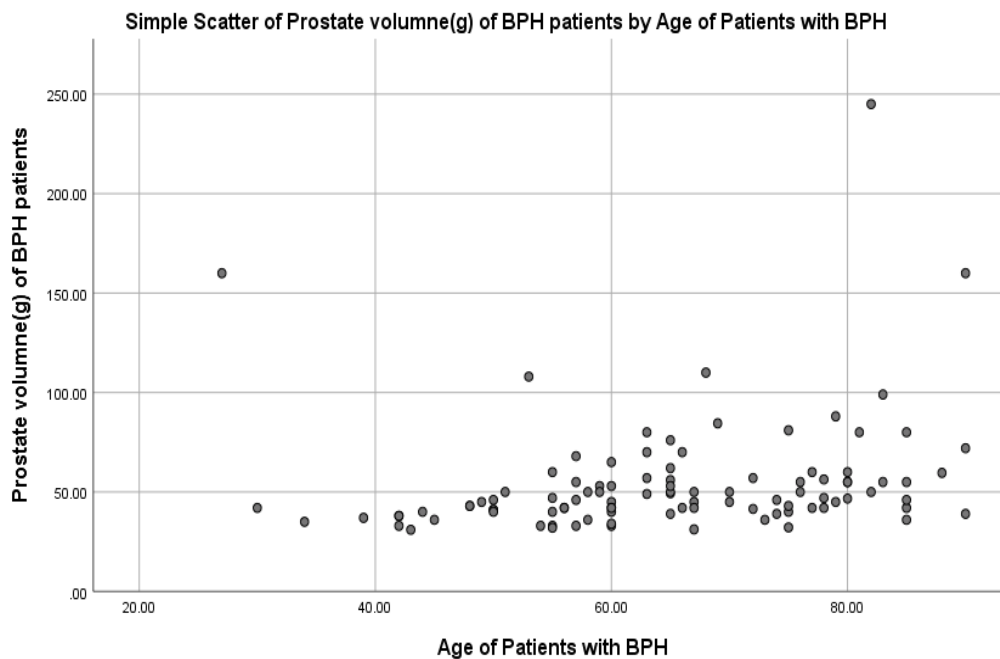


Figure 1: Scatterplot showing correlation of BPH with Age

Table-3: Pearson correlation among prostate volume of BPH patients and post-micturating residual volume

Correlations			
		Prostate volume(g) of BPH patients	Post micturating residual volume(ml) (PMRV)
Prostate volume(g) of BPH patients	Pearson Correlation	1	.032
	Sig. (2-tailed)		.751
	N	100	100
Post micturating residual volume(ml) (PMRV)	Pearson Correlation	.032	1
	Sig. (2-tailed)	.751	
	N	100	100

The correlation value of PV and PMRV was 0.032 and P-value was 0.751 which was more than 0.05 and it was insignificant presented in Table 3. Scatterplot

also showed the weak relation of PV with PMRV presented in Figure 2.

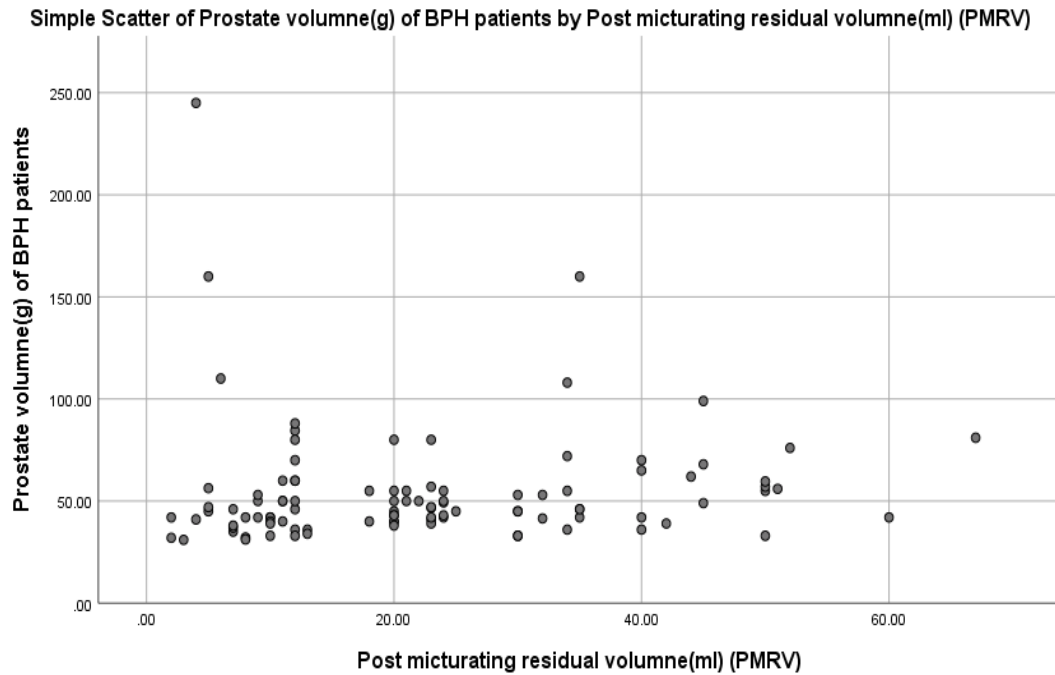


Figure 2: Scatterplot showing the correlation of BPH with PMRV

Table-4: Shows the frequency of clinical history in patients with BPH

Clinical history	Frequency	Percent (%)
Dysuria	40	40.0
Weak flow of urine	35	35.0
Frequent urination	47	47.0
Pain	29	29.0
Total	151	100.0

*Some patients were having more than 1 clinical symptoms

Out of 100 patients, 40 (40%) were presented with dysuria and 60(60%) patients had no dysuria Out of 100 patients, 35(35%) were presented with weak flow of urine and 65(65%) patients were without weak flow of urine. Out of 100 patients, 53(53%) were presented with frequent urination and 46(46%) patients had no frequent urination. Out of 100 patients, 29(29%) were presented with pain and 71(71%) patients were without pain.

DISCUSSION

There are many risk factors that influence the risk of developing BPH which includes aging, genetics, alcohol, smoking, and metabolic syndrome, such as obesity, cardiovascular disease and diabetes (Tabassum, 2021). In patients with benign prostatic hyperplasia, we believe that traditional transabdominal ultrasonography is a reliable, safe, and efficient way of determining the remaining urine volume (PMRV). Because pharmacological therapy for benign prostatic enlargement is more common, this assessment can be

performed as frequently as needed as an office-based procedure to assess treatment progress without causing urinary tract injury or infection. BPH is a source of increased morbidity and problems in old men due to LUTS, and LUTS can have a negative influence on quality of life. BPH is likewise a progressive illness, with LUTS deteriorating over time (Barry et al., 1993). In the diagnosis of BPH, it is more important to consider the severity of symptoms rather than the enlarged prostate volume. The American Urological Association and the European Urological Association both recommend using the IPSS to determine the seriousness of BPH. Not only can trans abdominal ultrasonography assist in the examination of the prostate, but it also assists in the evaluation of the urinary bladder, kidneys, and ureters. It's also essential to measure remaining urine before and after a void. The prostate volume, as well as the patient's clinical condition, are all factors to consider. In clinical practise, the sonographic findings of kidney, urinary bladder and ureters are essential choice making. According to a study of Basawaraj NG, et al., in 2015, prostate volume

and IPSS grading had a positive but limited relationship (Basawaraj *et al.*, 2015). In 2008, Agrawal *et al.*, observed that prostate size and IPSS score have no association. Many studies have found a strong association between age and prostate volume, but a negligible relationship between PV and PMRV (Agrawal *et al.*, 2008). In 2018, Saifullah et al, observed a significant relationship between PV and age, and insignificant relationship between PV and PMRV (Bacha *et al.*, 2018). Bladder dysfunction is indicated by a large PMRV of more than 350 millilitre, while a volume of less than 350 mL may respond to medication. The maximum PMRV might worsen the disease's severity. The major constituent of prostate blockage might be important in triggering urine retention (Caine, 1986). Trumbeckas et al. found that the correlation between prostate volume and remaining urine was negligible ($r = 0.198$, $p = 0.03$) in their study in 2011 (Trumbeckas *et al.*, 2011).

Volume of the prostate, texture, structure, and calcifications in the parenchyma of the median lobe of the prostate gland were all investigated. Their PMRV was assessed, and statistical analysis was performed. The p-value for prostate volume and PMRV was 0.751, that is more than 0.05. As a consequence, no significant correlation between prostate volume and postvoid residual volume was observed. A strong correlation between prostate volume and age was found, with a p-value of 0.035, which was less than 0.05. In my limited study, I observed that there is a significant correlation between age and prostate volume, but not between PV and PMRV.

CONCLUSION

This study concluded that there was significant correlation between Age and BPH but there was insignificant correlation between BPH and PMRV. The capability to diagnose early prostatic enlargement and related complications has improved because of ultrasonographic imaging. Transabdominal ultrasonography was used to determine prostate, urinary bladder, and PMRV. This study will create an awareness among men to diagnose timely to prevent complications.

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