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Assessment of Symptom Severity, Urinary Flow, and Prostate Volume in Men with Benign Prostatic Hyperplasia: A Cross-Sectional Correlation Study

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ABSTRACT

Benign prostatic hyperplasia (BPH) is a common cause of lower urinary tract symptoms (LUTS) in ageing men, yet patient-reported symptoms, urinary flow parameters, and prostate size often show inconsistent clinical relationships. Clarifying how these measures relate may improve diagnostic interpretation and clinical decision-making. **Objectives:** To evaluate the correlations among symptom severity (IPSS), peak urinary flow rate (Qmax), and prostate volume in men with BPH. **Methods:** A cross-sectional analytical study was conducted among 56 men aged ≥50 years with clinically diagnosed BPH. Symptom severity was assessed using the International Prostate Symptom Score (IPSS). Uroflowmetry provided Qmax values, and transabdominal ultrasonography measured prostate volume. Pearson correlation coefficients with 95% confidence intervals were calculated to assess associations among variables. **Results:** The mean age of participants was 62.79 ± 6.64 years, and most reported moderate to severe symptoms (mean IPSS 21.79 ± 6.22). No significant correlation was found between IPSS and Qmax (r = –0.064, p = 0.639; 95% CI –0.32 to 0.20) or between IPSS and prostate volume (r = 0.216, p = 0.110; 95% CI –0.03 to 0.45). Prostate volume showed a weak, nonsignificant inverse association with Qmax (r = –0.139, p = 0.306; 95% CI –0.37 to 0.13). **Conclusion:** The absence of significant correlations among IPSS, Qmax, and prostate volume confirms that symptom burden, flow limitation, and gland size represent different dimensions of BPH. Clinical decision-making should therefore integrate these measures collectively rather than interpreting them in isolation.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is among the most common urological disorders in older men, characterized by progressive enlargement of the prostate gland and resultant bladder outlet obstruction [1]. This enlargement often contributes to lower urinary tract symptoms (LUTS), including urinary frequency, nocturia, and voiding difficulty, all of which negatively impact quality of life [2]. With ageing populations and increasing life expectancy globally, the clinical and economic burden associated with BPH continues to grow [2, 3]. Assessment of BPH routinely involves symptom scoring using the International Prostate Symptom Score (IPSS), uroflowmetry, and ultrasound-based measurement of prostate size [4]. Although these tools are widely used, evidence consistently shows poor alignment between patient-reported symptoms, urinary flow parameters, and prostate size [5, 6]. Some men

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present with significant LUTS despite having normal flow rates and minimal prostatic enlargement, whereas others demonstrate large prostates with minimal subjective symptoms [7]. This inconsistency raises important questions about how well these commonly used measures reflect one another and whether they can reliably guide clinical decision-making. Despite widespread use of IPSS, uroflowmetry, and prostate volume in routine practice, the strength and direction of their interrelationships remain inconsistently reported, particularly within local populations. This lack of reproducible correlation represents a clinically relevant gap, as treatment decisions frequently rely on these measures. This study evaluates the correlations among IPSS, Qmax, and prostate volume, hypothesizing that these variables would demonstrate weak or nonsignificant associations, reflecting distinct pathological and perceptual components of benign prostatic hyperplasia.

This study aimed to evaluate the correlations among symptom severity (IPSS), peak urinary flow rate (Qmax), and prostate volume in men with Benign prostatic hyperplasia.

METHODS

This study was designed as a prospectively conducted cross-sectional analytical investigation aimed at determining whether symptom severity, urinary flow parameters, and prostate volume are correlated in men with benign prostatic hyperplasia. The research was carried out in the Department of Urology at Jinnah Postgraduate Medical Centre (JPMC), Karachi, over six months from April 2022 to September 2022. All information was collected prospectively, ensuring clarity of design and alignment with the study objective. Ethical approval for the study was obtained from the Institutional Ethical Review Committee (Ref: CPSP/REU/URO/2019-1861140). Each participant was briefed about the study's purpose and procedures, and written informed consent was secured. Confidentiality was maintained by avoiding personal identifiers, and all study procedures adhered to the Declaration of Helsinki. The sample size was calculated using a correlation-based formula, assuming an expected effect size of r = 0.368 derived from the reported correlation between IPSS and Qmax in a comparable population taken from the Oranusi *et al.* [8]. With a significance level of 0.05 and a statistical power of 80%, the minimum required sample size was 56 participants. Non-probability consecutive sampling was employed to include all eligible patients presenting during the study period, which is appropriate for exploratory correlation analysis in a clinical setting. Men aged 50 years or older with lower urinary tract symptoms and a clinical diagnosis of benign prostatic hyperplasia were included. Individuals with suspected or confirmed prostate cancer, prior prostate or urethral surgery, active urinary tract infection, or neurogenic bladder dysfunction were excluded to avoid confounding influences on urinary flow and symptom scores. Demographic variables and relevant medical history were documented through a structured proforma. Symptom severity was assessed using the International Prostate Symptom Score (IPSS), a validated tool widely used for evaluating LUTS in men with BPH [6]. The IPSS includes seven symptom questions scored 0–5 and one Quality-of-Life (QoL) question scored 0–6, producing a total score ranging from 0 to 35. Symptom severity categories were defined as mild (0–7), moderate (8–19), and severe (20–35). Uroflowmetry was performed using a calibrated electronic uroflow meter, operated by trained personnel. Devices underwent weekly calibration checks, and only voids with a minimum voided volume of ≥150 ml were accepted to ensure reproducibility. When the voided volume was insufficient, the test was repeated after adequate hydration. Measured parameters included Qmax, average flow rate, voided volume, and flow curve characteristics. Prostate volume and post-void residual urine were measured by transabdominal ultrasonography, performed by experienced radiology staff. Prostate volume was calculated using the ellipsoid formula. Data were entered into SPSS version 25.0. Continuous variables were summarized as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Normality of IPSS, Qmax, and prostate volume was assessed using the Kolmogorov–Smirnov test. Because distributions approximated normality and IPSS is commonly treated as a quasi-continuous variable in urological correlation studies, Pearson's correlation coefficient was applied. To strengthen interpretation, 95% confidence intervals for correlation coefficients were also calculated. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 56 men with benign prostatic hyperplasia were included. Normality testing using the Kolmogorov–Smirnov test showed no significant deviation from normal distribution for IPSS (p = 0.21), Qmax (p=0.18), and prostate volume (p=0.26). The mean age was 62.79 ± 6.64 years (range 50–77), and the mean BMI was 26.21 ± 2.79 kg/m^2. The mean duration of urinary symptoms was 15.27 ± 6.75 months. Diabetes was present in 42.9% of participants, hypertension in 37.5%, smoking history in 19.6%, and prior urinary retention in 17.9% (Table 1).

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Table 1: Baseline Characteristics of Participants (n=56)

Variables	n (%) or Mean ± SD	Range
Age (Years)	62.79 ± 6.64	50–77
BMI (kg/m^2)	26.21 ± 2.79	18.3–32.2
Symptom Duration (Months)	15.27 ± 6.75	4–31
Diabetes	24 (42.9%)	–
Hypertension	21 (37.5%)	–
Smoker	11 (19.6%)	–
History of Urinary Retention	10 (17.9%)	–

The study summarizes demographic and comorbidity distribution

The mean IPSS score was 21.79 ± 6.22, and most patients fell into the moderate or severe symptom categories. The mean QoL score was 3.95 ± 1.23. Uroflowmetry results showed a mean Qmax of 9.14 ± 2.75 ml/sec and a mean average flow rate of 5.04 ± 1.35 ml/sec. Mean post-void residual urine was 71.71 ± 23.94 ml, and mean prostate volume was 51.00 ± 15.59 ml (Table 2).

Table 2: Clinical Characteristics and Symptom Measures (n=56)

Variables	n (%) or Mean ± SD	Range
IPSS	21.79 ± 6.22	8–35
IPSS QoL	3.95 ± 1.23	2–6
Qmax (ml/sec)	9.14 ± 2.75	3.2–17.2
Average Flow (ml/sec)	5.04 ± 1.35	1.8–8.2
Post-Void Residual (ml)	71.71 ± 23.94	14–127
Prostate Volume (ml)	51.00 ± 15.59	15.2–88.5

The table summarizes symptom severity, flow parameters, and ultrasound measurements.

Regarding IPSS categorization, none of the participants fell into the mild range; 35.7% had moderate symptoms, and 64.3% had severe symptoms (Table 3).

Table 3: IPSS Severity Classification

Severity Category	n (%)
Mild (0–7)	0 (0%)
Moderate (8–19)	20 (35.7%)
Severe (20–35)	36 (64.3%)

Correlation analysis demonstrated weak and nonsignificant associations between symptom severity, urinary flow, and prostate volume. The correlation between IPSS and Qmax was weak (r = –0.064, p=0.639; 95% CI –0.32 to 0.20). IPSS showed a small, non-significant positive correlation with prostate volume (r = 0.216, p=0.110; 95% CI –0.03 to 0.45). The correlation between prostate volume and Qmax was also weak and non-significant (r = –0.139, p=0.306; 95% CI –0.37 to 0.13) (Table 4).

Table 4: Correlation Between IPSS, Qmax, and Prostate Volume (n=56)

Variable Comparisons	r	p-value	95% CI
IPSS vs Qmax	–0.064	0.639	–0.32 to 0.20
IPSS vs Prostate Volume	0.216	0.110	–0.03 to 0.45
Qmax vs Prostate Volume	–0.139	0.306	–0.37 to 0.13

A weak negative correlation was observed (r = –0.064), which was not statistically significant (p=0.639). The fitted trendline indicates minimal change in Qmax with increasing symptom score (R^2 = 0.0041) (Figure 1).

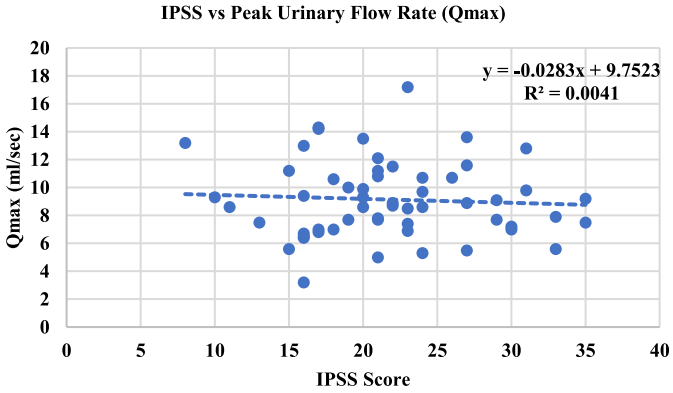

Figure 1: Scatter Plot Relationship Between IPSS and Qmax

A weak, non-significant positive correlation was observed (r = 0.216, p=0.110) (Figure 2).

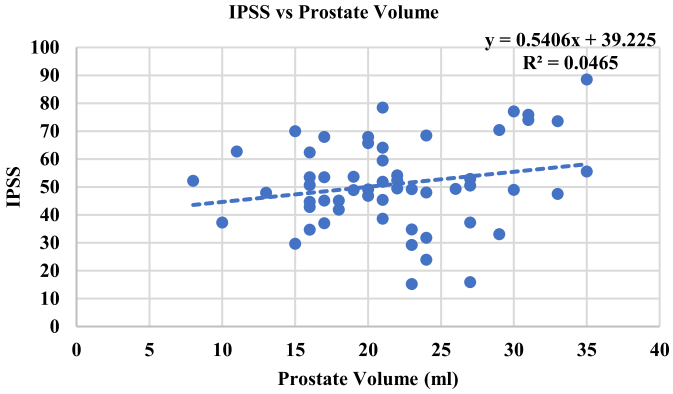

Figure 2: Scatter Plot Relationship Between IPSS and Prostate Volume

The correlation was weak and non-significant (r = –0.139, p=0.306) (Figure 3).

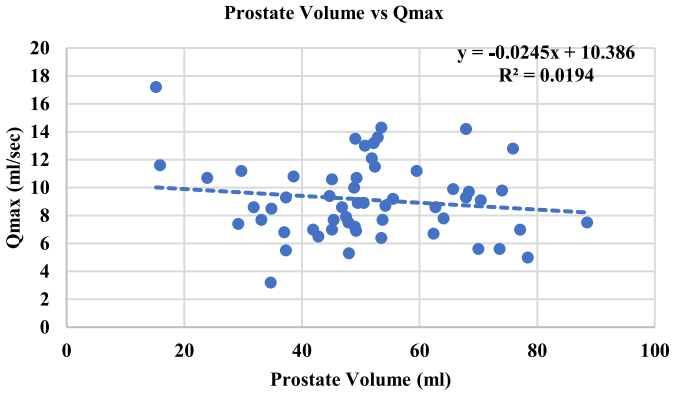

Figure 3: Scatter Plot Relationship Between Prostate Volume and Qmax

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DISCUSSION

This study demonstrated no significant correlations among symptom severity, urinary flow, and prostate volume in men with benign prostatic hyperplasia. From a clinical perspective, the weak associations observed suggest that symptom severity cannot be reliably inferred from either prostate size or urinary flow rate alone. This helps explain why patients with comparable prostate volumes may experience markedly different symptom burdens, and why uroflowmetry parameters often fail to predict perceived disease severity. These findings reinforce the importance of individualized clinical assessment rather than reliance on any single diagnostic indicator when managing men with benign prostatic hyperplasia. These findings reinforce the widely observed mismatch between subjective lower urinary tract symptoms and objective indicators of obstruction. Several studies have similarly reported that IPSS scores do not consistently reflect measured urinary flow rates, suggesting that patient-perceived symptom burden reflects a broader combination of sensory, behavioural, and functional factors rather than flow limitation alone [9, 10]. The weak and nonsignificant association between IPSS and prostate volume observed here follows the pattern described in previous research, where prostate size has shown only modest or clinically negligible relationships with symptom severity [11, 12]. This emphasizes that structural enlargement alone does not determine symptom intensity, as individual variations in bladder behaviour, detrusor activity, and symptom perception play a substantial role in shaping LUTS [13, 14]. Likewise, the small inverse trend between prostate volume and Qmax aligns with findings from larger multicenter datasets, where modest correlations have been reported but explain only a limited proportion of flow variability [15-17]. Flow performance ultimately reflects a combination of detrusor contractility and outlet resistance, and prostate size alone provides an incomplete picture of voiding efficiency. Interpretation of the nonsignificant relationships must consider the study's sample size, which was sufficient to detect moderate but not small effects a limitation shared by similar studies evaluating the interplay of symptoms, flow, and morphology [18-20]. Real-world clinical variability, including comorbidities and hydration status, may also diminish correlation strength. Overall, the findings highlight the multifactorial nature of LUTS in BPH and reinforce that no single parameter reliably captures the complexity of patient experience or obstruction severity. A combined approach using symptom scores, uroflowmetry, and imaging remains essential for comprehensive evaluation.

CONCLUSIONS

This study found no significant correlations among symptom severity, urinary flow, and prostate volume in men with benign prostatic hyperplasia. These results indicate that neither flow rate nor prostate size reliably reflects patient-reported symptoms, underscoring the need to interpret these measures collectively rather than in isolation. Clinical assessment should incorporate symptom scoring, uroflowmetry, and ultrasound findings to provide a balanced understanding of both subjective and objective aspects of BPH. Larger studies with additional functional parameters may help clarify the subtle interactions among symptoms, voiding dynamics, and prostate anatomy.

Authors Contribution

Conceptualization: AFP
Methodology: AFP, SAC, MZZK, MM
Formal analysis: MSR, A, MZZK
Writing review and editing: AFP, MSR, A, MM

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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