

The Accuracy of Bladder Voiding Efficiency to Predict the Severity of Lower Urinary Tract Symptoms in Benign Prostatic Enlargement Patients at Ndola Teaching Hospital, Ndola , Zambia

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Research Article

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Abstract

Background

The management of Benign Prostatic Enlargement (BPE) in low resource settings poses a major challenge in Africa. The objective of the study was to investigate the accuracy of Bladder Voiding Efficiency (BVE) to assess lower Urinary Tract Symptoms (LUTS) among BPE patients in a low resource setting.

Methods

From December 2017 to March 2018, patients with Benign Prostatic Enlargement (BPE) and Lower Urinary Tract Symptoms (LUTS) were recruited into the study. The study was a prospective cross-sectional study. Participants had the International Prostate Symptom Score (IPSS) recorded followed by evaluation of their Bladder Voiding Efficiency (BVE). The BVE was calculated as the ratio of the volume of Urine voided over total volume of Urine in the bladder at the time of the void. The data was analysed to show the Sensitivity and Specificity of BVE in symptomatic LUTS. The Pearson correlation co-efficient between IPSS and BVE was analysed.

Results

The study recruited 94 participants. The age range was 45 to 85 year. The mean age was 68.1 years. The sensitivity of BVE to detect severe LUTS was 97.97%, while the specificity of BVE to detect mild to moderate disease was 97.78%. The correlation coefficient between IPSS and BVE was negatively correlated at 0.89 and this was statistically significant ($P < 0.001$).

Conclusion

The Bladder Voiding Efficiency (BVE) is a highly sensitive and specific test in our population to detect LUTS. It is well correlated to the International Prostate Severity Score (IPSS) in this study population.

Background

There has been an increase in the prevalence of BPE in Africa in the last 10 years because of life-style changes (1, 2). The prevalence of BPE ranges from 40–60% among men over 50 years of age in Africa(3). The increase in metabolic syndromes and the related changes in diet as well as life-style has also been linked to this increase in BPE/LUTS in Africa (4).

The evaluation of BPE/LUTS in low-resource setting poses a challenge because of the low utilization of the IPSS score and the sparsity of Urological services in Africa (5, 6) .

The use of BVE as an objective tool to determine the severity of BPE/LUTS in low-resource settings has been minimal (7).

The simple BVE technique is easy to use, minimally invasive and can be done by non-Physicians. This makes it very suitable for use in low-resource setting where other urological diagnostic services may not be available (8).

The objective of this study was to determine the acceptability and accuracy of using BVE to determine the severity of BPH/LUTS using the IPSS score as a gold standard.

Methods

The study was performed at the Ndola Teaching Hospital Urology Outpatient Clinic from December 2017 to March 2018. This study was approved by the Ethics Review Board of our hospital. Prior to recruitment, it was ensured that all patients included in the study had provided appropriate informed consent. A research questionnaire was administered to each patient to obtain all vital epidemiological data from the patient.

The case definition of a participant was any patient aged 45 to 85 years with clinical evidence of BPE and evidence of LUTS attributable to BPE. Patients with urethral disease, neurological disease, Prostate or Bladder malignancies or complicated BPE were excluded from the study.

The standard IPSS was administered to each patient by a trained nurse and the total score computed. The patient was asked to do an initial void, the voided volume (V) as well as the post-void residual urine (PVR) were measured. These were recorded as V1 and PVR1. The bladder was emptied completely thereafter. Once the bladder was emptied, it was filled passively with 200mls of Saline at room temperature. The patient was then instructed to void a second time. The volumes obtained were recorded as V2 (voided urine volume) and PVR2 (post void urine volume) respectively. The average of V1 and V2 as well as PVR1 and PVR2 were used to obtain mean void and mean PVR volumes respectively. The Bladder Voiding Efficiency (BVE) was then computed as the ratio of mean void to Total Bladder Capacity (mean void + mean post-void urine volume).

Each participant recruited had an IPSS administered them. The IPSS scores were grouped into two categories. Those with a score of ≤ 18 were Group 1, which was mild to moderate symptoms. Those with a score of ≥ 19 were Group 2, which was classed as severe symptoms.

The BVE results were also grouped into two. The participants with a BVE $\geq 75\%$ were in Group 1 and were said to have good voiding efficiency. Those with a BVE $\leq 74\%$ were Group 2, with poor voiding efficiency. The cut-off used was based on recently published literature on BVE measure of good bladder function (9).

The participants were also asked about the acceptability of BVE as a method of assessing severity of LUTS. The results were analysed to provide an acceptability rate of the technique among the participants.

The data were coded and then entered into the Excel 2013 software with double entry verification. The IPSS was used as the Gold Standard. Sensitivity was defined as the ability of the BVE to detect severe IPSS while Specificity was defined as the ability of BVE to detect mild and moderate IPSS. These ratios were computed as percentages. The correlation coefficient was the extent and direction of the relationship between the BVE and the IPSS in this data set. The Pearson coefficients and the specificity/sensitivity were analysed using SPSS version 20 software.

Results

The study recruited a total of 102 patients. However, 8 were not enrolled because they had confounding co-morbidities. The study had 94 participants who were enrolled into the study and for whom a complete data set was collected. The age-range was between 49 and 85 years with a mean age of 68.1 (standard deviation [SD] \pm 7.49 years). (Figure 1).

The mean IPSS score was 18.81 ± 10.7 SD with a minimum score of 1 and a maximum score of 31. Of the 94 enrolled, 49 (52%) had severe symptoms, 21 (22%) had moderate symptoms and 24 (26%) showed scores mild symptoms (Figure 2).

In assessment of the acceptability of the procedure by participants, 86 (91.5%) found it acceptable and 8 (8.5%) did not find it acceptable.

The BVE was used as the test and the IPSS as the gold standard. Table 1 shows the sensitivity, specificity, as well as the positive and negative predictive values. The sensitivity of the BVE was 97.96%. The specificity was calculated as 97.78%. The positive predictive value was 97.96% and negative predictive values were both 97.78% (Figure 4).

The Pearson correlation coefficient was 0.89 (Figure 4). This was a negative correlation with a P value of <0.001 .

Discussion

There is a rising prevalence of BPE/LUTS in Africa due to increasing lifestyle change and an increase in life expectancy (1, 2). The study found the mean age at presentation to be 68.1 years (Figure 1). The IPSS pattern found in the study is similar to what other studies in this region have shown (11, 12). The mean IPSS score of 18.8 did not differ significantly from that found in previous studies at the site as well as other regional studies (4, 13). The pattern of presentation in the study of 53% with severe symptoms (figure 2) was high compared to other studies which have shown mainly predominance of moderate symptoms (4, 13). Ogwuche et al. in their study of 120 patients at the Jos University Teaching Hospital showed that most patients (59%) had moderate symptoms. Strother et al in their study of 473 patients in Uganda showed increasing severity of symptoms score in the specialist clinics relative to those in the community-based studies (14). This suggests that patients present late due to difficulty of access to urology services in Africa, which is well documented (4, 13, 14, 15). The study found a high acceptability

for the use of the BVE for evaluation of severity of LUTS at 91.5%(figure 3).Other studies have shown high acceptability for this tool in accessing LUTS in BPH and other Bladder Outflow Obstruction (BOO) patients (7, 9, 15).

The Sensitivity and Specificity of BVE was very high at 97.96% and 97.87% respectively. This was much higher than that found at the same site using the Single Question Nocturia Score (SQNS) where the Sensitivity and Specificity of this tool was 87% and 91% respectively (4). Other tools have demonstrated higher correlation with IPSS score such as the Visual IPSS Score and the UWIN score with a correlation coefficient of 0.72 and 0.913 respectively (17, 18, 19, 20).The study found the BVE had a high correlation with IPSS though the correlation was negative. This meant the higher the voiding efficiency, the lower the IPSS score. The correlation coefficient was 0.89 (P<0.001) (Figure 4).

The BVE parameter has also been used successfully to measure post-operation LUTS as well as to measure LUTS in women with BOO(8, 9).This study finding shows that simple BVE evaluation can be used to accurately assess LUTS, in low-resource settings. This tool also has a high acceptability in this study population.

Declarations

Ethics Approval and Consent to participate

All the research methods in this study were carried out in accordance with relevant guidelines and regulations. Research approval was obtained from the Bio-medical Ethics Review Committee of Tropical Diseases Research Centre (TDRC), IRB registration number: 00002911, FWA number: 00003729 and research number TRC/C4/09/2017. Informed consent was obtained from all participants in the study or their legal guardian where appropriate.

Consent for Publication: Not applicable

Availability of Data Materials: The data set is provided as a supplementary file in MS excel as BVE Dataset

Competing interest: The authors declare that they have no competing interests

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Authors' contribution: The author KB provided the concept, supervised the research and contributed to the final write up. The author PK designed, supervised and executed the study. He contributed to the final edits and write up of the research report and publications

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Tables

Table 1 **Sensitivity and Specificity**

	IPSS			
		Severe	Mild/Moderate	Total
BVE	Poor	48	1	49
	Good	1	44	45
	Total	49	45	94

Sensitivity = 97.96%

Positive Predictive Value = 97.96%

Specificity = 97.78%

Negative Predictive Value = 97.78%

Abbreviations:

IPSS: International Prostate Symptom Score

BVE: Bladder Voiding Efficiency

Figures

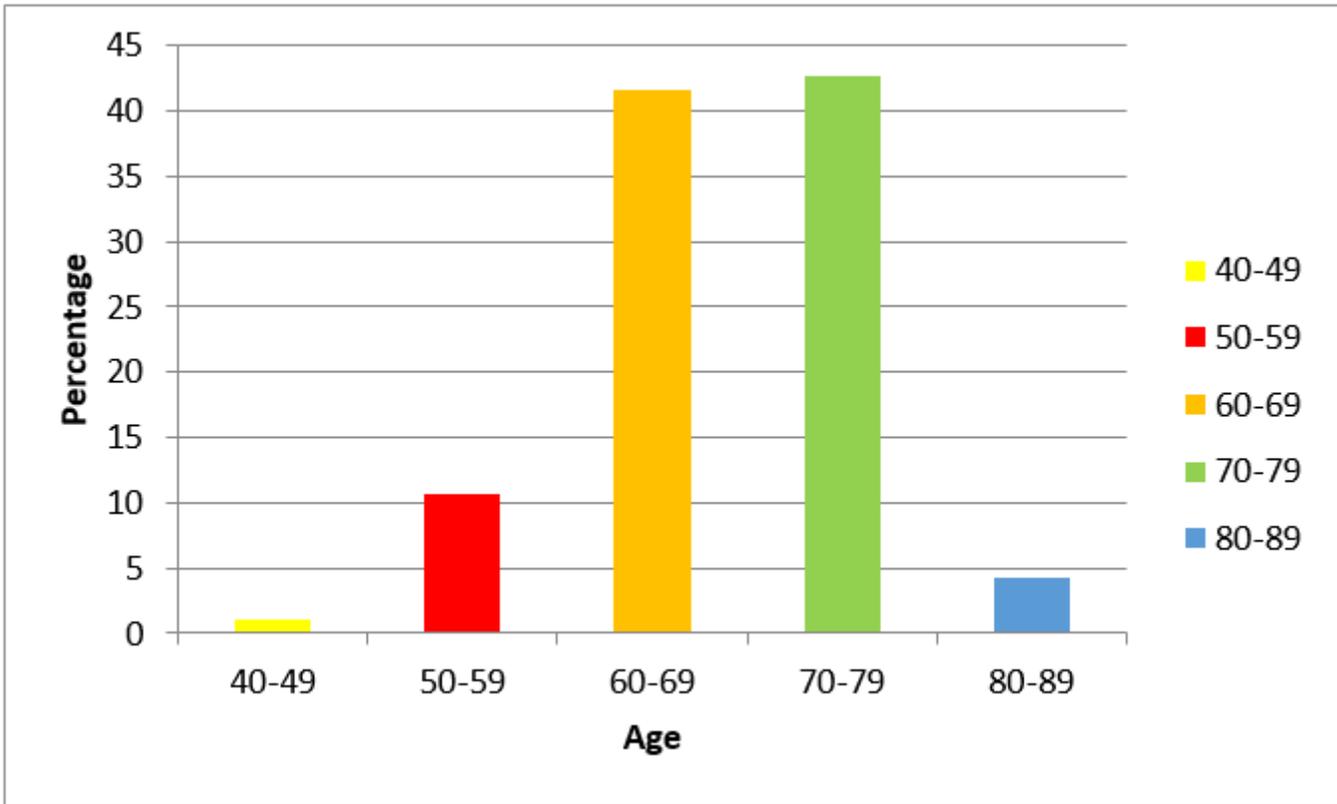


Figure 1

Age of Study Population

The mean age of the population was 68.1 years (SD: 7.49). The highest incidence was observed in the 7th and 6th decades of life respectively.

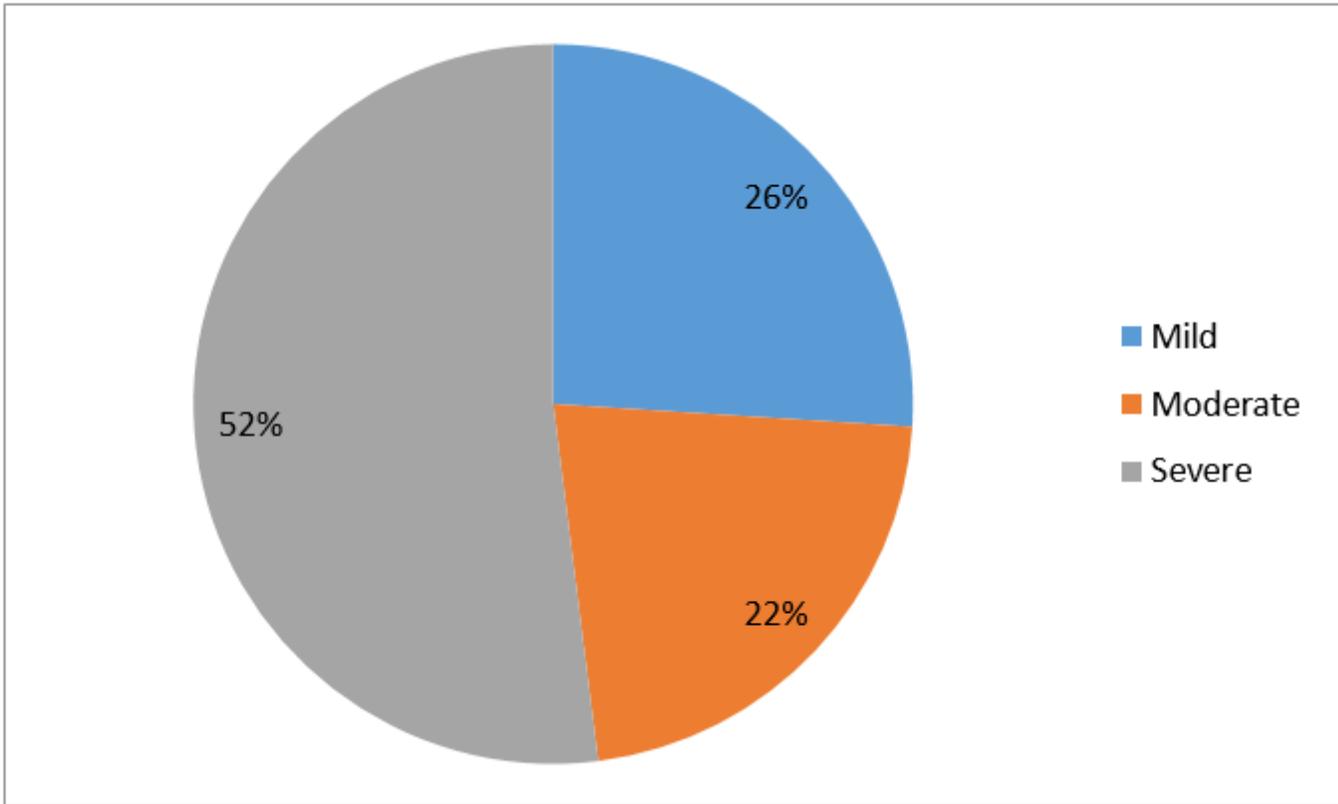


Figure 2

IPSS Score at Presentation

The majority of the BPE/LUTS patients presented with severe symptoms (52%) compared to mild (26%) and moderate (22%) symptoms respectively.

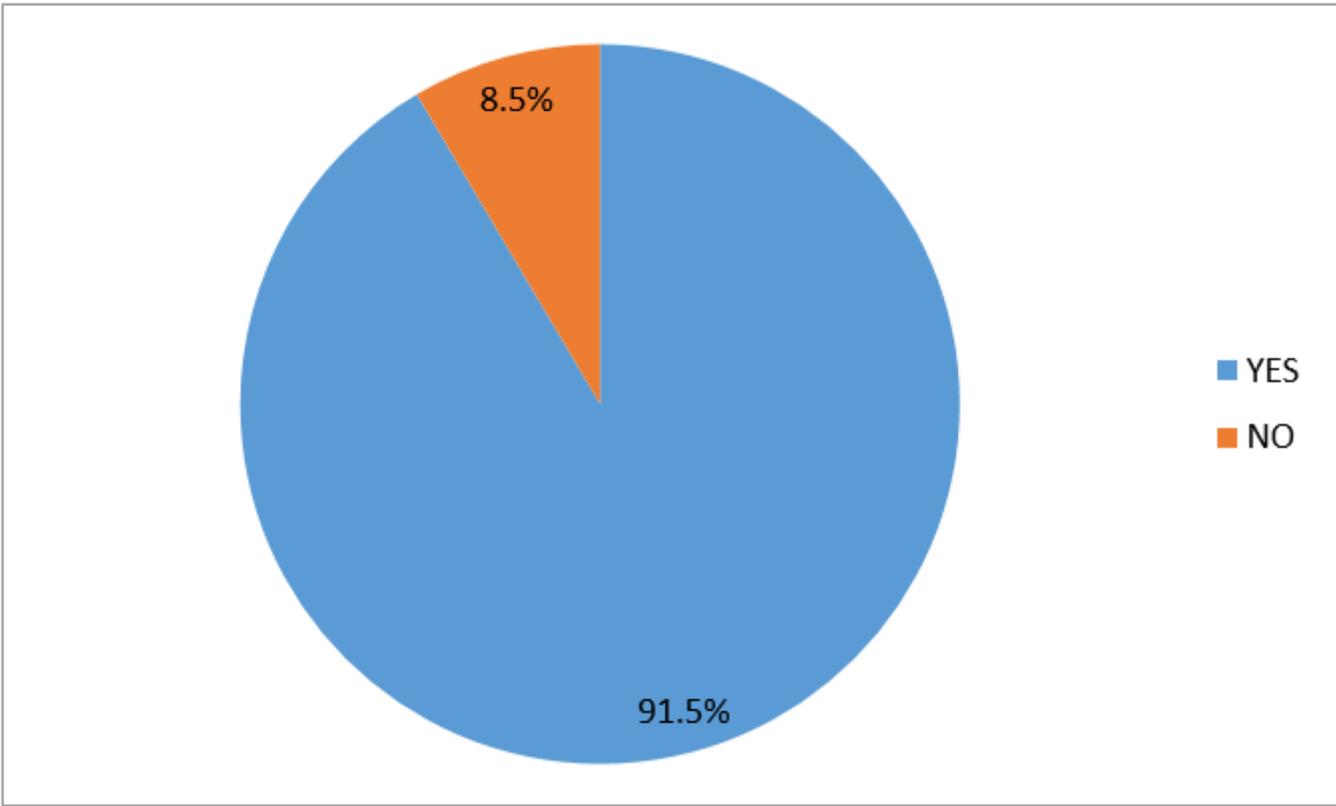
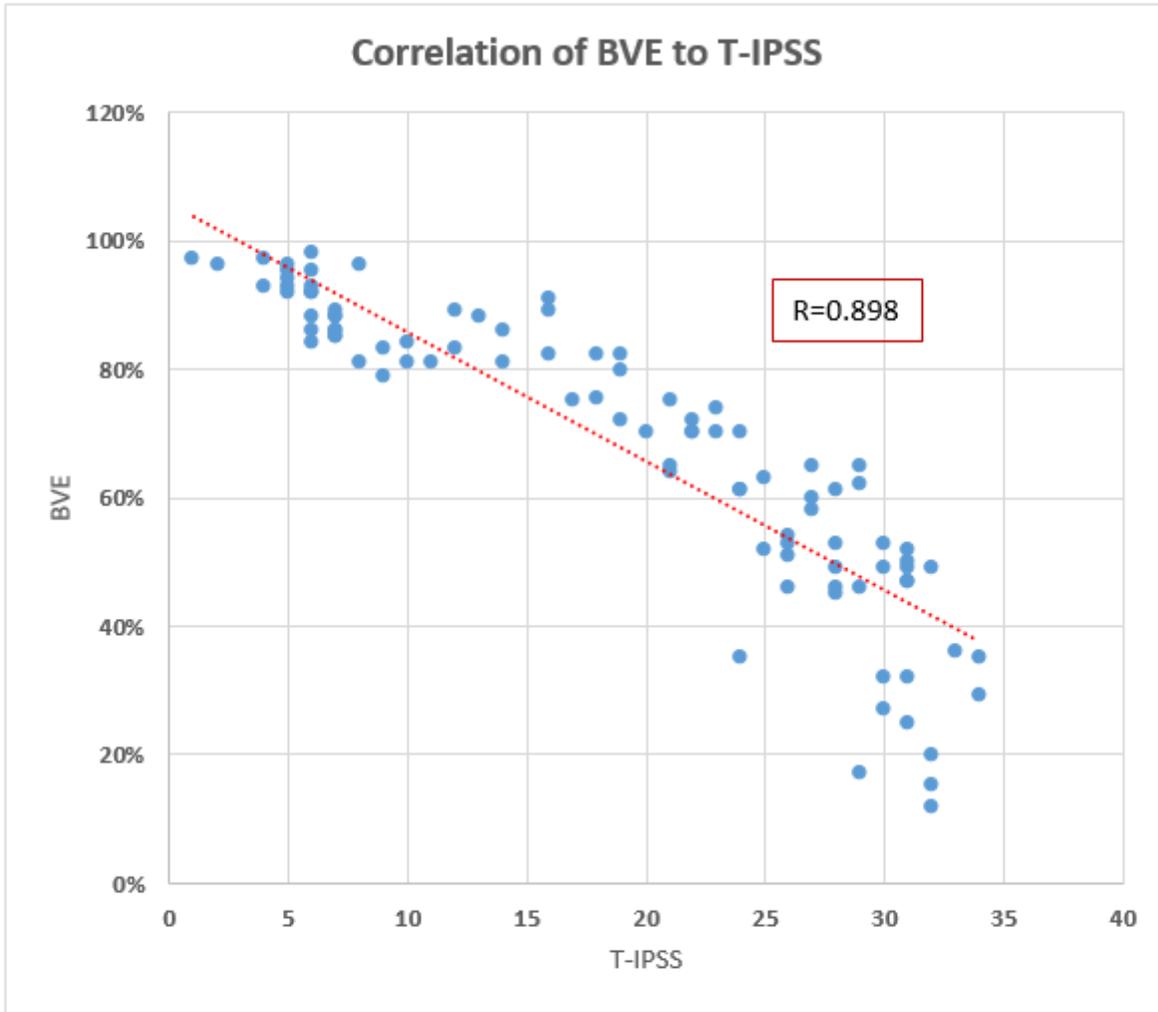


Figure 3

Acceptability Rates

The results showed an acceptability rate of the BVE test of 91.5%.



BVE=Bladder Voiding Efficiency T-IPSS =Total IPSS

Figure 4

The Pearson's Correlation Coefficient (R) for this relationship as shown by the Scatter Plot was -0.89 at $P < 0.001$.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [BVEdatasetclean.xlsx](#)