African Journal of Urology (2018) **24**, 342–346

African Journal of Urology

Official journal of the Pan African Urological Surgeon's Association
web page of the journal

www.ees.elsevier.com/afju
www.sciencedirect.com

BPH and Prostate Diseases
Original article

The value of intravesical prostatic protrusion in evaluation of bladder outlet obstruction from benign prostatic enlargement in Nigeria

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Received 28 August 2018; received in revised form 4 November 2018; accepted 19 November 2018; Available online 12 December 2018

KEYWORDS
Intravesical prostatic protrusion;
IPSS;
Qmax;
BPE

Absract

Objective: To determine the significance of intravesical prostatic protrusion in evaluation of bladder outlet obstruction from benign prostatic enlargement in Jos, Nigeria.

Patients and Method: A hospital based cross-sectional prospective study that included patients who presented to the Urology clinic of Jos University Teaching Hospital, Jos, Nigeria with clinical features of BPE. Each had IPSS, Qmax, IPP, PV, PVR and PSA measured. IPP was measured through transabdominal ultrasound scan along mid sagittal view in millimetre using a curvilinear probe 3.5 MHz. IPP was divided into three grades (grade I: <5 mm; grade II: 5–10 mm; grade III: >10 mm). Statistical analysis was done using SPSS® version 20 (SPSS, IBM, Chicago, IL, USA). Appropriate test statistics were used with p-value < 0.05 considered as significant.

Results: Eighty-seven patients aged 40–86 years were enrolled in the study. The means of age, IPSS, IPSS-v, IPSS-s, Qmax, IPP, PV, PVR and PSA – were 64.6 ± 10.2 years, 16.7 ± 7.6, 9.8 ± 3.5, 6.9 ± 3.3, 8.2 ± 3.8 ml/s, 12.9 ± 7.0 mm, 70.1 ± 50.3 mls, 78.3 ± 69.3 mls and 7.2 ± 1.9 ng/ml respectively. IPP correlated positively with IPSS (r = 0.808, p = 0.000), IPSS-$_S$ (r = 0.799, p = 0.000), IPSS-$_V$ (r = 0.717, p = 0.000), and PVR (r = 0.306, p = 0.004) but negatively with Qmax (r = −0.519, p = 0.000).

Conclusion: The IPP correlates significantly with IPSS, Qmax and PVR. Therefore, it is a valuable parameter – for evaluation of patients with BOO due to BPE.

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Peer review under responsibility of Pan African Urological Surgeons' Association.

https://doi.org/10.1016/j.afju.2018.11.007

Introduction

The intravesical prostatic protrusion (IPP) is a morphological change due to overgrowth of prostatic median and/or lateral lobes into the bladder and may lead to dyskinetic movement of bladder during voiding [1]. IPP is a novel and non-invasive predictor of clinical progression in BPE for patients receiving non-surgical treatment [1–3]. The IPP is measured as the distance from the tip of the prostate's protrusion into the vesical lumen to the bladder neck measured in millimetres. The measurement is perpendicular to an imaginary line linking the bladder mucosae. The measurement is categorized into three (3) grades as recommended [1,2] – grade I – <5 mm, grade II – 5–10 mm, and grade III – >10 mm. Measurement of IPP is taken in the sagittal view, using the transabdominal ultrasound. It is the vertical height from the tip of the protrusion to the base of the prostate [11]. The sagittal view has been studied to give accuracy, high positive predictive value and clinical use of IPP as compared to coronal view [2,3]. Intravesical prostatic protrusion (IPP) has been shown to predict the extent of bladder outlet obstruction in pressure flow studies, and also predicts the success of a trial without catheter after acute urinary retention [4,5].

The gold standard of assessing BOO is pressure flow study which is invasive with potential complications of dysuria, UTI, fever, bleeding and acute urinary retention [6,7]. There have been patients who died after pressure flow studies because of urosepsis due to contaminated catheter [7].

The available parameter like international prostate symptom score (IPSS) has its short comings in interpretation by the patients. Incorporation of IPP into current stratification strategies for BPH would enhance the clinical assessment by the urologist and refine treatment efficacy of this common urological disease in a more holistic and cost-effective manner [5].

Considering the burden of BOO from BPH in our environment, there is a need for a non-invasive, cheap and available investigative modality for objective and yet reliable assessment of BOO. The measurement of intravesical prostatic protrusion appears to offer such promise. Studies have shown the need for greater emphasis on IPP measurement in the evaluation of BPH and decision-making in offering surgical options [8]. The IPP has recently become a very significant component in predicting BOO, as well as its progression and the need for surgical treatment [9,10].

This study seeks to establish a case for IPP measurement in addition to PVR, bladder wall thickness and prostate volume measured during ultrasound scan study.

Patients and methods

This study was conducted in the department of Urology, Jos University Teaching Hospital, Jos, Nigeria between April 2016–June 2017 after an approval from the ethical committee of the hospital. All patients with clinical assessment of BPH were included in the study while those who had co-morbid conditions that affected lower urinary tract symptoms e.g. diabetes mellitus, urethral stricture, bladder calculi, prostate cancer were excluded. A written informed consent was taken from patients before enrolling them for the study. Each subject had clinical evaluation, IPSS, Qmax, IPP, PVR and PSA assessed. A curvilinear probe of 3.5 MHz was used to measure the IPP along the mid sagittal view [2,3]. IPP was measured from images of the prostate obtained using the midline sagittal image by drawing a line from the anterior to posterior intersections of the bladder base and the tip of the intravesical prostatic protrusion. This was measured in millimetres and divided into three grades- grade I: less than 5 mm, grade II: 5–10 mm, grade III: > 10 mm [11–13]. The prostate volume and post-void residual urine were also measured during the transabdominal ultrasound scanning by the same radiologist.

The data was collected through a structured proforma. Data was analyzed on the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) version 20.

Results

A total of eighty-seven (87) patients were included in the study with a mean age of 64.6 years. (as shown in Table 1 below)

There was statistically significant positive correlation between IPP and -IPSS, -IPP-s, -IPSS-v, -QoL, -PV, -PVR and -PSA. A negative correlation was seen between IPP and Qmax. (Tables 2 and 3).

Table 1 Demographic and clinical characteristics of the Study Population.

Variables	Minimum	Maximum	Mean	Standard deviation
Age (years)	40	86	64.6	10.2
IPSS	3	34	16.7	7.6
IPSS-v	1	19	9.8	3.5
IPSS-s	3	13	6.9	3.3
QoL	1	6	5.2	1.1
Qmax (ml/s)	2	15	8.2	3.8
Voided volume (ml)	152	704	185	141
IPP (mm)	2	24	12.9	7.0
PV (ml)	14	254	70.1	50.3
PVR (ml)	3	398	78.3	69.3
PSA (ng/ml)	0.6	10	7.2	1.9
Urea (mmol/l)	2.4	83	8.3	16.1
Creatinine (umol/l)	72	278	97.5	41.4

Table 2 Comparison of IPP with Clinical Variables.

	IPP			Total (n = 87)	P value
	<5	5–10	>10		
IPSS					
0–7	1	2	1	4	0.000
8–19	9	14	30	53	
20–35	6	6	18	30	
Qmax (ml/s)					0.000
<10	5	13	38	46	
≥10	11	9	11	41	
PV (ml)					0.002
<40	6	1	10	17	
≥40	10	21	39	70	
PVR (ml)					
<50	2	4	8	14	0.004
≥50	14	18	41	73	
PSA (ng/ml)					
≤4	7	10	20	19	0.02
>4	9	12	29	68	

There was statistically significant positive correlation between IPP and -IPSS, -IPP-s, -IPSS-v, -QoL, -PV, -PVR and -PSA. A negative correlation was seen between IPP and Qmax. (Table 3).

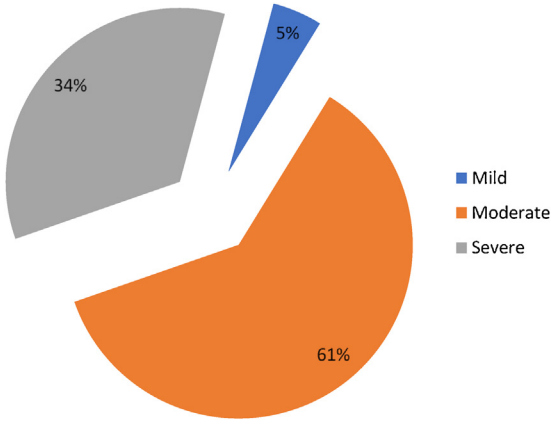

Fig. 1 Distribution of study population according to IPSS grading.

Table 3 The correlation of IPP with age, IPPS, IPP, Qmax, PVR, QOL.

Variable	Correlation coefficient rp	P value
Age	0.07	0.512
IPSS	0.808	0.000
IPSS-s	0.799	0.000
IPSS-v	0.717	0.000
QoL	0.710	0.008
Qmax	−0.519	0.000
PV	0.332	0.002
PVR	0.306	0.004
PSA	0.348	0.02

A significant negative correlation between IPP and Qmax (Pearson correlation coefficient = −0.519, p = 0.000) was observed in this study. Scatter plot of IPP and Qmax is shown in Fig. 1 below.

A significant negative correlation between IPP and Qmax (Pearson correlation coefficient = −0.519, p = 0.000) was observed in this study. Scatter plot of IPP and Qmax is shown in Fig. 1.

Discussion

This study was designed to determine the significance of IPP in the evaluation of BOO due to BPE and to determine its correlation with Qmax.

In this study, eighty-seven (87) patients with BOO due to BPE were studied. Most of the patients presented in the seventh decade of life with mean age of 65.4 years. This is comparable to reports by Reis et al. [4] and Eze et al. [14] with mean ages of 64.8 and 67 years respectively. Similarly, Mohammed et al. [15] reported a mean of 63.4 years in Kano, Nigeria; confirming that BPH is a disease of the older men.

The proportion of patients with grade III IPP was 56.3%. This is comparable to the work done by Aganovic et al. [16] in which they found 57.7% of participants with grade III intravesical prostatic protrusion. However other studies have found preponderance of IPP grade I and II [17,18]. The relative smaller prostate volume in those studies is likely the reason for the reported lower IPP grades.

The present study showed that the mean IPP was 12.9 mm which lies within the grade III IPP. Sigdel et al. [19] and Eze et al. [14] reported mean IPP of 11.8 mm and 13.5 mm respectively. On the other hand, Lin et al. [20] reported a mean IPP of 6.6 mm among 122 Taiwan patients. The lower mean IPP found may be attributed to the relatively smaller size prostate as compared to African men [21].

It was observed in the present study that 44.7% of the patients with maximum flow rate of less than 10 ml/s had IPP more than 10 mm. A similar finding was found among Latin American patients by Reis et al. [4] which showed that 47% of the obstructed patients had IPP more than 10 mm. This gives credence to IPP in its relationship with BOO. However, a higher value was reported in other studies. Hossain et al. [22] reported 69.2% of the patients with obstruction had IPP more than 10 mm. Lim et al. [23] – reported that—66%

of obstructed patients had IPP more than 10 mm. The lower value seen in this study may be due to parameter that was used to measure degree of obstruction which was Qmax as compared to the bladder outlet obstruction index (pressure flow study) that was used in their studies.

A significant positive correlation was observed between IPP and IPSS ($p = 0.000$). This is similar to findings in other studies [14,20]. On the contrary, some studies have shown no significant correlation between IPP and IPSS [17,24,25]. This may be attributed to the different bladder volume for measurement of IPP [24]. Too little urine in bladder (volume < 100 mls) has been shown to overestimate IPP while a bladder volume > 400 mls has been shown to underestimate IPP [13].

This work found a significant positive correlation between IPP and IPSS sub scores- (voiding and storage). This is similar to studies done by Park et al. [26] in Korea, Tjahjodjati et al. [24] in Indonesia and Eze at al in Nigeria [24]. However, other studies have shown no significant correlation between IPP and IPSS subscores [18,25]. Kuei et al. [18] in Taiwan found no significant correlation between IPP and IPSS-s. The subjectivity of IPSS may have been responsible for the null relationship between IPP and IPSS reported in these studies thus adding evidence to the value of IPP in evaluation of men with BOO.

The present study showed a strong negative correlation between IPP and Qmax ($r = -0.519$, $p = 0.000$), implicating that the higher the grade of IPP, – the lower the Qmax. A lower Qmax has been – interpreted as obstruction as most men (90%) with BOO have low Qmax. In addition, Qmax has been found to correlate well with bladder outlet obstruction index (BOOI) as defined by the gold standard of BOO which is pressure flow study [27,28]. Therefore, patients with a higher IPP can be predicted to have BOO. Lee et al. [28] gave credence to this in their report which stated that high grades of IPP were more likely to have BOO and hence, may be a useful adjunct to predict BOO.

The finding of a negative correlation between IPP and Qmax as seen in this study is similar to previous reports [12,16,19]. Moon et al. [29] found a strong negative correlation between IPP and Qmax ($= -0.551$, $p = 0.000$) and concluded that an IPP exceeding 5.5 mm was significantly associated with BOO. Wang and Keqin et al. [17,30] also reported negative correlation between IPP and Qmax but of a lower correlation coefficient of -0.300 and -0.284 respectively. The different criteria used for parameter measurement, regional and racial variations were possible reasons for the difference in correlation coefficient reported. Similarly, Lieber et al. [12] in their study of IPP measurement – among 322 white men residing in Olmsted County, Minnesota, – reported a significant negative correlation between IPP and peak flow rate ($r = -0.18$, $p < 0.001$) and suggested the clinical usefulness of IPP in predicting the need for treatment.

There have been reports on good correlation between IPP and other parameters of BOO [16,19]. This was confirmed in the present study. In the analysis of correlation between IPP and prostate volume, a positive correlation was observed. Studies have reported similar finding of positive correlation between IPP and prostate volume [23,27]. Lee et al. [27] found a good positive correlation between IPP and PV ($r = 0.747$, $p < 0.001$). This study also showed a positive correlation between IPP and PVR as seen in other previous studies [24,27]. Agranovic et al. [16] reported while analysing the correlation of IPP with other clinical and radiological factors, a very good correlation was observed between intravesical prostatic protrusion and prostate volume ($r = 0.53$, $p < 0.0001$). Chia et al. [11] reported that the IPP was a better and more reliable predictor of BOO than the other variables assessed (IPSS, PV, PVR).

Conclusion

Intravesical prostatic protrusion measurement, which is non-invasive, easily accessible, reproducible and more cost effective, showed a significant correlation between IPP and -IPSS, -IPSS-v, -IPSS-s, -Qmax and -PVR.

Conflict of interest

None.

Authors' contributions

C.A AGBO: Project development, manuscript writing, data collection, data analysis, editing.

V.M RAMYIL: Project development, editing.

N.K DAKUM: Project development, editing.

S.I SHUAIBU: Project development, editing.

V.E ONOWA: Data collection, editing.

L.E NABASU: Data collection, editing.

Z.Z GALAM: Data collection, editing.

Source of funding

None.

Ethical committee approval

Obtained.

Consent from the patients

Obtained.

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