**Original Research Article**

**UTILITIES OF INTRAVESICAL PROSTATIC PROTRUSION AND PEAK FLOW RATE MEASUREMENTS AS CLINICAL TOOLS IN DIAGNOSIS OF BLADDER OUTLET OBSTRUCTION IN A COMMUNITY SETTING**.

ABSTRACT:

BACKGROUND:

Clinical diagnosis of cause of bladder outlet obstruction (BOO) is often difficult and decision on who and when to treat intriguing. Pressure flow studies are the main stay diagnostic tool but they are cumbersome, not readily available and expensive. Use of simpler modalities like ultrasound determination of intravesical prostatic protrusion (IPP) and uroflow-metric measurement of Peak flow rate (PFR), if found to correlate with clinical index of BOO such as International Prostate Symptom Score (IPSS) could make diagnosis of BOO easier in a community setting.

AIM:

To determine if IPP measured with transabdominal USS and PFR measured with uroflow-meter correlate with International Prostate Symptom Score (IPSS) which is a clinical marker of bladder outlet obstruction.

METHOD:

In a community setting we evaluated apparently normal males 40years and above with no previous history of lower urinary tract symptoms. Using IPSS questionnaire we obtained IPSS score for each participant. We determined the IPP when bladder was fully distended using 3.5MHx Mindray DP2200 transabdominal ultrasound. We asked each participant to void into the uroflow-meter machine and recorded the PFR. Using Spearman’s correlation coefficient, we corelated IPSS with IPP and PFR. Statistical significance was determined at p value <0.05.

Results: Pearsons correlation coefficient showed IPSS scores exhibited a statistically significant negative correlation with peak flow rate [r = -0.257, p = 0.001] and significant positive correlation with IPP[r = 0.22, p = 0.030] There was negative relationship between IPP and peak flow rate but this was not significant [r = -0.15, p = 0.124].

Conclusion: USS measurement of IPP and uroflow measurement of PFR are useful tools in accessing BOO especially in settings where pressure flow studies are not readily available.

Keywords: BOO, IPSS, PFR, IPP, Community-study.

INTRODUCTION

The prostate increases significantly in size as men age, and so do prostatic disease.1,2 An enlarged prostate may cause bladder outlet obstruction (BOO) which often presents with lower urinary tract symptoms (LUTS). The size of the prostate does not directly correlate with the severity of LUTS.3 As the prostate enlarges it grows in the direction of least resistance and may enlarge into the bladder which is the intravesical prostatic protrusion (IPP). The IPP creates a ball valve effect thus causing a mechanical obstruction to the flow of urine.4 The ideal modality for evaluating BOO are pressure flow studies. These are invasive because a urethral catheter needs to be inserted. Pressure flow studies also require expensive equipment which are not readily available in developing countries like Nigeria.5-7

The need to decide who, when, how to treat, follow up and prognosticate patients with BOO has been the objective of studies. The challenges in the availability and use of pressure flow studies which are the main stay for evaluating BOO have necessitated the use of other modalities like bladder wall thickness, post void residual urine volume, maximum flow rate and IPP in determining treatment of BOO.8-10

Peak flow rate determined by a uroflow meter is a component of the urodynamic studies. Peak flow rate is an important tool in accessing patients with BOO, it has also been used as tool in determining disease severity, the need for treatment or surgical intervention and accessing treatment outcomes.11-13 Variabilities in flow rate may however necessitate multiple measurements. Studies have also shown that IPP determined by ultrasound scan can be a useful tool in the care of patients with BOO.14,15

Most of these studies were done in the hospital setting. In this community-based study we determined IPP and maximum flow rate and correlated them with international prostate symptom score. The aim is to determine if these variables can measure BOO in a community setting.

PATIENTS AND METHOD

We studied adult males, 40 years and above, living freely in a community in the Niger Delta region of Nigeria, apparently without knowledge of having any disease of the prostate. Using the International Prostatic Symptom Score (IPSS), we elicited symptoms of bladder outlet obstruction and classified them according severity into mild, moderate and severe. The symptoms considered were 4 voiding symptoms- intermittency, poor stream, straining and feeling of incomplete emptying of the bladder, and 3 storage symptoms-frequency, nocturia and urgency. Each of these were assigned values 0 to 5 depending on their severity. A total of 35 points were assigned; scores <7 was mild, 8-19 moderate and 20-35 severe.

We determined IPP using 3.5MHx Mindray DP2200 transabdominal ultrasound probe from the tip of the prostate in the bladder to the bladder neck. We graded IPP as mild(<5mm), moderate (5-10cm), severe (>10cm). We determined peak flow rate using uroflowmetry machine by asking participants to void into the uroflow meter after ensuring bladder capacity was at least 150mls and respondents had urge to pass urine.

We then asked the respondents to empty their bladder after determining the IPP and using the same 3.5MHx Mindray DP2200 transabdominal ultrasound probe determined post void residual urine volume using the equation length(cm) x width(cm) x height (cm) x 0.52.

We did spearman’s correlation studies for IPSS versus measures for uroflowmetry such as peak flow, flow time and flow volume. We then did spearman’s correlation study for Intravesical prostatic extension versus international prostate symptom score and peak flow rate. We drew inferences from the results of the correlation studies.

Data were presented in tables and pie chart. Test of significance was done at p value <0.05.

RESULTS

A total of 377 participants were recruited with age ranging between 40years and 81years. 181 (48%) had mild LUTS, 155 (41.1%) had moderate LUTS and 41 (10.9%) had severe LUTS. 287(78.1%) had intravesical prostatic protrusion less than 5mm, 29(7.7%) had IPP between 5-10mm, and 61(11.2%) had IPP greater than 10mm. Majority of participants (44%) had flow rate between 5 and 10ml/s, 13% had flow rate less than 5ml/s, 4% had flow rate 20-25ml/s and only 1.1% has flow rate greater than 25ml/s.

Pearsons correlation between IPSS scores and variables of uroflowmetry showed that IPSS exhibited a significantly negative correlation with peak flow rate (r = -0.257, p = 0.001); flow volume also showed a negative correlation (r = -0.197, p = 0.001), indicating that higher IPSS scores were associated with lower peak flow rates and flow volumes. However, flow time displayed a significant positive correlation (r = 0.146, p = 0.006).

The relationships between intravesical prostatic protrusion(IPP) and international prostate symptoms score(IPSS) showed that there was a significant positive correlation between intravesical prostatic protrusion and IPSS scores (r = 0.22, p = 0.030). There was however a negative correlation between intravesical prostatic protrusion and peak flow rate that was not statistically significant (r = -0.15, p = 0.124).

Table 1: Age group distribution of the study subjects

|  |  |  |
| --- | --- | --- |
|  | **Frequency (n=377)** | **Percent**  **(%)** |
| **Age Groups (years)** |  |  |
|  |  |  |
| 40-49 | 61 | 16.2 |
| 50-59 | 147 | 39.0 |
| 60-69 | 127 | 33.7 |
| 70-79 | 38 | 10.1 |
| 80-89 | 4 | 1.1 |

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Fig 1: The distribution of severity of Lower Urinary Tract Symptoms in the respondents.

Table 2. Distribution of Intravesical Prostatic Protrusion(IPP)

|  |  |  |
| --- | --- | --- |
| **IPP (mm)** | **Frequency** | **Percent** |
| <5 | 287 | 76.1 |
| 5 – 10 | 29 | 7.7 |
| >10 | 61 | 11.2% |
|  |  |  |
|  |  |  |
| **Total** | **377** | **100.0** |

Mean IPP = 13.6 ±7.8

Table 3. Distribution of flow rate.

|  |  |  |
| --- | --- | --- |
| **Flow rate** | **Frequency** | **Percent** |
| <5 | 49 | 13.0 |
| 5 to 10 | 166 | 44.0 |
| 11 to 15 | 119 | 31.6 |
| 16 to 20 | 24 | 6.4 |
| 21 to 25 | 15 | 4.0 |
| >25 | 4 | 1.1 |
| **Total** | **377** | **100.0** |

Table 4: Correlation between international prostate symptoms score (IPSS) and variables of uroflowmeter

|  |  |  |
| --- | --- | --- |
| I-PSS vs | Pearson's coefficient (r) | P-value |
| Peak flow rate | -0.257 | 0.001 |
| Flow Time | 0.146 | 0.006 |
| Flow Volume | -0.197 | 0.001 |
|  |  |  |
|  |  |  |

Table 5: Correlation of intravesical prostatic protrusion with IPSS and peak flow rate

|  |  |  |
| --- | --- | --- |
| **IPP vs** | **Pearson's coefficient (r)** | **P-value** |
| IPSS | 0.22 | 0.030 |
|  |  |  |
| PFR | -0.15 | 0.124 |

statistically significant (p<0.05)

Based on the table above, in exploring the relationships between intravesical prostatic protrusion and various parameters, it was discovered that there was a significant positive correlation between intravesical prostatic protrusion and IPSS scores (r = 0.22, p = 0.030), indicating that greater protrusion was associated with higher IPSS scores.

DISCUSSION:

Bladder outlet obstruction in men with LUTS is usually evaluated using pressure flow studies and peak flow rates[10] however, non-invasive tool such as ultrasound scan can measure parameters like intravesical prostatic protrusion, a vertical distance from the tip of the intra vesical portion of the prostate to the bladder base has been used [16]

In this community-based study, 377 respondents participated with the mean age group with the highest frequency being 50-59 (Table 1). In the studies by Abhulimen et al15 and lee et al16 which were hospital-based, the age group with the highest frequency was 60-69 age group. This difference may be because their study was hospital-based with the study population being patients with BPH whose average age of presentation falls between 60-59 age group.

Majority of the patient in this study (48%) had mild symptoms. 155 (41.1%) and 41(10.9%) had moderate and severe symptoms respectively (Figure 1). Bock-Oruma et al16 also recorded that most of their patients had mild symptoms, this was different from Oranusi et al17 and Amu et al18 report that majority had moderate symptoms, and further different from the finding of Abhulimen et al15 in which most of the patients had severe LUTS. Our findings may have been due to the fact that ours is a population-based study among apparently normal people. Moderate and severe LUTS are markers of late presentation and are characteristics of Hospital-based studies in Nigeria15,17,18.

Intravesical prostate protrusion is an important parameter accessed in patients with BPE, and it could be important in the diagnosis. In this study we accessed IPP by doing a trans abdominal ultrasound scan. Several studies have shown that IPP can be accessed using a transabdominal ultrasound scan15,19.

In this study we categorized IPP into 3 groups- less than 5mm, 5-10mm and greater than 10mm (Table 2) as did Chai et al20 credited as one of the first to report IPP as a tool in accessing and following up patients with BPE. In our study the group with IPP less than 5mm had the highest frequency of 76.1%, followed by those greater than 10mm (11.2%) and the lowest was those between 5 -10mm. The mean IPP in our study was 13.6 ±7.8 (Table 2). This corroborates with the findings of Oshagbemi et al21, Agbo et al 22 and Sigdel et al 23 who recorded mean IPP of 13.04mm, 12.9mm and 14.6mm respectively. The finding of mean IPP in a population study like ours that is similar to hospital- based studies 21,22,23 means that apparently normal persons in the population could have high IPP and considerably high LUTS and this justifies routine IPP investigation in assessment of patients with BOO. Lee et al24 in their study found IPP correlated positively with prostate volume. It was how ever found to have a better correlation with BOO than prostate volume. They also concluded that men with good flow and high IPP were more likely to have BOO later in life.

In correlating I-PSS scores with measures for urine flow, Pearson's coefficients showed that IPSS exhibited a significant negative correlation with peak flow rate (r = -0.257, p = 0.001)( Table 4). The significant negative correlation between IPSS and peak flow in our study was similar to the findings by Okedere et al25 and Abhulimen et al15 and may probably be as a result of higher voiding symptoms among the population we studied. Other studies have shown that IPSS did not correlate with IPP. 23,26-28 but this was attributed to volume of urine in the bladder; higher bladder volumes have been associated with lower IPP23,29.

In further exploring the relationships between intravesical prostatic protrusion and various parameters, it was discovered that there was a significant positive correlation between intravesical prostatic protrusion and IPSS scores (r=0.22,p=0.030)(Table 5), indicating that greater protrusion was associated with higher IPSS scores. This is similar to the findings from other studies 15,19,20.

IPP like IPSS exhibited a statically significant negative correlation with peak flow rate( Table 5). Peak low rate as well as other pressure flow studies is one of the standard modalities used to access BOO 27,28 IPP is cheap, readily available and non-invasive. 26 Abhulimen et al15 in their hospital-based study reported a negative correlation between IPP and peak flow rate. This was also the outcome of this study. IPP has also been shown to correlate positively with other pressure flow studies 20. In their study Cumpanas et al29 showed IPP can be used to predict outcome of medical treatment of patients with BPE. Higher IPP is associated with worse symptoms29

CONCLUSION

IPP measurement by ultrasound scan is a simple and readily available tool may be used to access patients with BPE especially in settings where complex, expensive and invasive pressure flow studies are not readily available. IPP is a ready too in assessing BOO in a community setting where pressure flow studies may be elusive.

CONFLICT OF INTEREST.

The authors declare there is no conflict of interest in this study.

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