CORRELATION BETWEEN INTRAVESICAL PROSTATIC PROTRUSION AND INTERNATIONAL PROSTATE SYMPTOM SCORE (IPSS) IN MEN WITH BENIGN PROSTATIC HYPERPLASIA AT NNAMDI AZIKIWE UNIVERSITY TEACHING HOSPITAL, NNEWI.

A DISSERTATION

BY

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(MBBS, NIGERIA)

SUBMITTED TO THE NATIONAL POSTGRADUATE MEDICAL COLLEGE OF NIGERIA
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CORRELATION BETWEEN INTRAVESICAL PROSTATIC PROTRUSION AND INTERNATIONAL PROSTATE SYMPTOM SCORE (IPSS) IN MEN WITH BENIGN PROSTATIC HYPERPLASIA AT NNAMDI AZIKIWE UNIVERSITY TEACHING HOSPITAL, NNEWI.
CANDIDATE’S DECLARATION

I attest that the dissertation ‘Correlation between Intravesical Prostatic Protrusion and International Prostate Symptom Score (IPSS) in Men with Benign Prostatic Hyperplasia at Nnamdi Azikiwe University Teaching Hospital, Nnewi’ is my original work and has not been done previously by another researcher at Nnamdi Azikiwe University Teaching Hospital, Nnewi. It has not been published elsewhere. I observed ethical standards in carrying out the study.

[Signature]

Date: [Signature]

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<tr>
<td>AUA</td>
<td>American Urological Association</td>
</tr>
<tr>
<td>BPH</td>
<td>Benign prostatic hyperplasia</td>
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<tr>
<td>BOO</td>
<td>Bladder outlet obstruction</td>
</tr>
<tr>
<td>IPP</td>
<td>Intravesical prostatic protrusion</td>
</tr>
<tr>
<td>IPSS</td>
<td>International prostate symptom score</td>
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<td>IPSS-s</td>
<td>IPSS storage symptoms</td>
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<td>IPSS-v</td>
<td>IPSS voiding symptoms</td>
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<tr>
<td>LUTS</td>
<td>Lower urinary tract symptoms</td>
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<tr>
<td>N.A.U.T.H.</td>
<td>Nnamdi Azikiwe University Teaching Hospital, Nnewi.</td>
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<tr>
<td>QoL</td>
<td>Quality of Life</td>
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<td>TPV</td>
<td>Total prostate volume</td>
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ABSTRACT

**Background:** Urinary problems in elderly men are often caused by prostate disorders of which BPH is the commonest. BPH presents with BOO; urodynamic study is the gold standard for diagnosis of BOO but is invasive. IPP is a non-invasive test that can predict BOO. IPSS is an objective assessment of BOO symptom severity.

**Objective:** The objective of the study is to study the correlation between IPP and IPSS.

**Patients and Methods:** A hospital based cross-sectional prospective study of new symptomatic BPH patients who presented to the urology clinics of Nnamdi Azikiwe University Teaching Hospital, Nnewi. Ethical approval was obtained from the ethical committee of the hospital and informed consent from patients. After evaluation (including IPSS, PSA and prostate biopsy when PSA > 4ng/ml), participants had abdominal ultrasonography measurement of IPP from midline sagittal image of the prostate (at bladder volume ≥ 100mls) using Prosound SSD3500 (Aloka Co Ltd, Tokyo, Japan) with abdominal probe frequency of 3.5 MHz. IPP was divided into three grades (grade I: 0-4.9mm; grade II:5.0-9.9 mm; grade III: 10.0 mm and above). Data was analyzed using SPSS version 20 (IBM, SPSS, Chicago, IL, USA). The data was subjected to ANOVA (to compare mean parameters among
different grades of IPP) and Pearson’s correlation was used to assess correlation where necessary. P-Value < 0.05 was considered significant.

Results: Hundred and one men with a mean age of 67.09±10.93 years were included in the study. The mean BMI was 25.80±3.92 kg/m². Most of the participants had highest educational level of primary education (50.5%) while 82.2% were married. The average IPSS, IPSS-S, IPSS-V, QoL index, TPV, IPP and PSA were 17.05±7.62, 7.81±5.17, 9.24±3.16, 4.75±1.59, 68.33±46.53 mls, 13.50±7.47mm and 7.35±12.49 ng/ml respectively. There was significant differences between the mean IPSS (p = 0.000), mean IPSS-S (p = 0.000), mean IPSS-V (p = 0.002), mean TPV (p = 0.000) and mean PSA (p = 0.015) among the three grades of IPP. There were a significant positive correlations between IPP and IPSS (p = 0.000); IPSS-S (p = 0.000); IPSS-V (p = 0.000); IPSS QoL index (p = 0.000).

Conclusion: There were significant positive correlations between IPP and IPSS, IPSS-S, IPSS-V, and IPSS QoL index. There were also significantly higher IPSS, IPSS-S, IPSS-V, and IPSS QoL index in BPH patients with IPP of 10.0 mm or more.

Key Words: Intravesical prostatic protrusion, IPSS, IPSS QoL index, BPH.
CHAPTER ONE- INTRODUCTION

Background

Urinary problems in ageing men are often caused by prostate disorders. The most common of these disorders is benign prostatic hyperplasia (BPH)\textsuperscript{1, 2}. BPH is characterised by an excessive but non-malignant increase in the number of cells in the prostate associated with overgrowth of prostatic tissue surrounding the urethra. This ultimately leads to constriction of the urethral lumen and gives rise to lower urinary tract symptoms (LUTS)\textsuperscript{1, 3, 4}.

LUTS comprise storage symptoms (daytime urinary frequency, nocturia, urgency, urinary incontinence), voiding symptoms (slow stream, spraying, intermittency, hesitancy, straining, terminal dribbling), and post micturition symptoms (sensation of incomplete emptying, post micturition dribble). BPH is often associated with LUTS, but LUTS generally cannot be used to make definitive diagnosis of BPH\textsuperscript{5}. The initial diagnostic challenge in patients presenting with LUTS is to establish that the symptoms are due to BPH\textsuperscript{6}.

BPH can be defined as enlargement of the prostate gland of equivalent weight $\geq 20$ grams in the presence of symptoms of urinary dysfunction and/ or a urinary peak flow rate $< 15$mls/ second, without evidence of malignancy. Men with BPH have a higher level of bother attributed to urinary symptoms than men without BPH. Patients’ feeling of well-being should be taken into account in the
clinical management of BPH. BPH may cause bladder outlet obstruction (BOO) which is characterised by increased detrusor pressure and reduced urine flow rate. BOO caused by BPH has both static (increased tissue mass) and dynamic (increased smooth muscle tone) components of the prostate.

Intravesical prostatic protrusion (IPP) is a morphological change due to overgrowth of prostatic median and lateral lobes into the bladder. Some studies have shown a statistically significant relationship between IPP and bladder outlet obstruction (BOO). IPP measured via trans-abdominal ultrasonography is a non-invasive and accessible method that significantly correlates with BOO in men with BPH more than prostate volume.

1.1 STATEMENT OF PROBLEM.

Worldwide, BPH affects more than 70 % of men 70 years or older with or without LUTS. BPH is the most common cause of LUTS in male adults in their 50s or older. BPH is a progressive disease and symptoms tend to worsen with time. Identifying those patients at risk of BPH progression is crucial to the optimisation of their treatment.

Worldwide prevalence of moderate-to-severe LUTS due to BPH is 37%. Six and a half million of 27 million Caucasian men aged 50 to 79 years in USA have BPH. In Nigeria, the population based incidence of symptoms suggestive of BPH
is 25.35%\textsuperscript{1}. The severity of symptoms increases with age and storage symptoms are more troublesome than voiding symptoms.

In USA, in the year 2000, approximately 4.5 million visits were made to physicians’ offices for a primary diagnosis of BPH. The number of visits rises to a staggering 8 million if patients with secondary diagnosis of BPH are included. The economic burden of BPH can be divided into three broad groups: direct medical costs associated with treatment; indirect costs associated with absenteeism, work limitations, and premature mortality; and intangible costs associated with pain, suffering, and grief. In USA, the direct cost of BPH treatment in the year 2000 was estimated to be $1.1 billion, excluding outpatient pharmaceuticals\textsuperscript{4}.

Symptoms severity and obstruction in patients with BPH do not depend entirely on prostate size. Some studies have suggested that it is not BPH alone that causes LUTS, but rather the extent to which the prostate protrudes into the bladder and ultrasonographic measurement of IPP may be a promising non-invasive method of assessing BOO.

Urologists need a non-invasive method to predict the presence of significant BOO and to be able to tailor the treatment towards relieving the obstruction, particularly the need for prostatectomy. IPP has been suggested to be a non-invasive predictor of urodynamically ascertained BOO\textsuperscript{13, 21 - 25}. 
Although BPH is not usually a life-threatening condition, the impact of BPH on quality of life can be significant and should not be underestimated. Its negative impact of sleep deprivation, loss of leisure, impaired activities of daily living, and ill-effects on sexual activities should be considered when considering its effects on quality of life. An inverse relationship exists between the intensity of urinary symptoms and quality of life\textsuperscript{26, 27}.

1.2 STUDY JUSTIFICATION.

Considering the burden of BPH in our environment, there is a need for a non-invasive and available investigative modality for objective and yet reliable assessment of BOO. Most studies done on the correlation between IPP and IPSS are in non-Africans. Most previous studies on IPP studied mostly the relationship between IPP and urodynamic parameters of BOO\textsuperscript{28-31}. To my knowledge, no local study has been carried out to assess the correlation between IPP and IPSS and IPP is not yet routinely used in the evaluation of patients with BPH at Nnamdi Azikiwe University Teaching Hospital, Nnewi (N.A.U.T.H). Hence, there is need for this study.

Many men with LUTS due to BPH are subjected to unnecessary medications or surgical interventions because their symptoms have not been correctly evaluated\textsuperscript{32}. The primary objective of the diagnostic evaluation of men with LUTS is to exclude other urologic and non-urologic conditions that may masquerade as
BPH. A secondary objective is to determine the severity of LUTS. The proper selection of patients is essential for adequate management of LUTS due to BPH-associated BOO.

Evaluation of and treatment selection criteria for BPH include IPSS, uroflowmetry and urodynamic studies. Urodynamic studies are known to be the most sensitive tests in the diagnosis of BOO. Men who were proved to have obstruction on the basis of pressure-flow measurements applied to a normogram have better outcomes after transurethral resection of prostate. Hence, there is a growing need to accurately define bladder outlet obstruction.

Though pressure-flow studies are at present the gold standard for diagnosing BOO and differentiating BOO from detrusor hypo-contractility, these tests have some limitations in clinical application owing to their invasiveness, complications, non cost effectiveness and non availability in most third world hospitals.

An ideal assessment tool to detect severity of LUTS must be non-invasive, quick, inexpensive, and reproducible with high diagnostic accuracy. Ultrasonography has all of these criteria with additional advantages (no contrast material and no ionizing radiation). IPP assessed by ultrasonography can be used as a potent predictor of BOO as it has a significant correlation with severity of LUTS and bladder outlet obstruction index (BOOI).
Studies examining the correlation between total prostate volume (TPV) and IPSS have shown mixed results. Some have shown a positive and statistically significant correlation between prostate volume and severity of symptoms measured by IPSS. Conversely, no correlation was found between TPV and IPSS in other studies. Prostate volume can be used to select treatment option (open versus transurethral prostatectomy) but it is not reasonable to decide whether to treat a patient on the basis of prostate size alone.

On the other hand, some studies have demonstrated significant relationship among IPP, severity of symptoms, and parameters of pressure-flow studies. Studies have also shown that there is a higher risk of medical treatment failure in patients with significant IPP and severe IPSS. Hence, IPP can be a useful parameter in determining BPH patients that would likely respond to medical treatment and those that will require surgery. Early treatment, including surgery, is recommended for patients with significant IPP.

There is need to use patient’s reported bother assessment in the evaluation of BPH treatment benefits as clinical parameters are weakly associated with patient’s perception of LUTS. International guidelines for BPH management emphasise that the degree to which patient is bothered is more important than symptom score. The American Urological Association (AUA) developed the IPSS as an objective assessment of symptom severity and impact of LUTS suggestive
of BPH on patients’ health and functioning. They also developed the BPH Impact Index (BII)\(^51\). The IPSS questionnaire is accepted as a critical component in BPH – LUTS research. BII is less frequently used\(^24\). The IPSS is widely used to assess the severity of LUTS in men with BOO and to evaluate the response to medical or surgical therapy for BPH\(^52\). IPSS is used in evaluating BPH and worsening score may warrant intervention\(^33\). However, its poor correlation with BOO is a major drawback\(^53,\,54\). A more objective evaluation of BOO, which is exclusively due to BPH, should include, not only TPV but also IPP\(^32\).

IPP can be used to direct the appropriate patients to more aggressive treatment strategies such as surgery. The final decision for management can be tailored and individualised to achieve cost-effectiveness\(^17\). IPP is a cost-effective way to stratify patients with LUTS due to BPH for further management\(^13,\,55\).

**1.3 SCOPE AND STUDY LIMITATIONS.**

The scope of this study was to determine the correlation between IPP and IPSS among adult Nigerian male patients who will present with LUTS caused by BPH at the urology clinics of Nnamdi Azikiwe University Teaching Hospital, Nnewi.

The IPSS was designed to be self administered. An important problem with IPSS is that some patients find the questions difficult to understand (and may require translation to local dialect), especially men with a lower level of education\(^56,\,57,\,58\). Because of this, the researcher in some cases helped to fill the questionnaire.
and this might introduce bias. The IPP was assessed by a particular consultant radiologist and the researcher. The particular radiologist was not available all the time.

In this study, the co-morbidities that constituted the exclusion criteria were self reported. No attempts were made to verify patients’ medical records from the hospital he was referred from, when applicable.
CHAPTER TWO- LITERATURE REVIEW

2.1 ANATOMY OF PROSTATE.

The prostate develops as multiple solid outgrowths of the urethral epithelium both above and below the entrance of the mesonephric duct. These simple tubular outgrowths begin to develop in 5 distinct groups at the end of the 11th week and are complete by the 16th week. From the 5 groups of epithelial buds, 5 lobes are eventually formed: anterior, median, posterior, and 2 lateral lobes. Initially, these lobes are widely separated, but later they meet, with no definite septa dividing them.

The prostate gland lies behind the pubic symphysis. To its posterosuperior surface are the vasa deferentia and seminal vesicles. Posteriorly, the prostate is separated from the rectum by the 2 layers of Denonvilliers’ fascia, serosal rudiments of the pouch of Douglas. The prostate is a fibromuscular and glandular organ lying just inferior to the bladder (figure 1). It is composed of approximately 70% glandular elements and 30% fibromuscular stroma. The normal prostate weighs about 20 g and is transversed by the prostatic urethra which is about 2.5 cm in length. It is supported anteriorly by the puboprostatic ligament and inferiorly by the urogenital diaphgram. The prostate is perforated posteriorly by the ejaculatory ducts, which pass obliquely to empty through the verumontanum on
the floor of the prostatic urethra just proximal to the striated external urethral sphincter \(^{59}\).

The prostate, according to Lowsley\(^{60}\), consists of 5 lobes: anterior, posterior, median, right lateral and left lateral. According to McNeal\(^{61}\), the prostate has four zones: a peripheral zone (consists of over 70% of glandular prostate), a central zone, a transitional zone (surrounds the urethra, the zone in which BPH mainly occur), and an anterior fibromuscular zone. Embedded within the prostate is an abundant amount of smooth musculature derived primarily from the external longitudinal bladder musculature. This bladder musculature represents the true smooth involuntary sphincter of the posterior urethra in males.

On histology, the prostate consists of a thin fibrous capsule under which is circularly oriented smooth muscle fibres and collagenous tissue that surrounds the urethra. Deep in this layer lies the prostatic stroma composed of connective and elastic tissues and smooth muscle fibres in which are embedded the epithelial glands. These glands drain into the major excretory ducts (\(\approx\) 25 in number) which open chiefly on the floor of the prostatic urethral between the verumontanum and the bladder neck.

The blood supply of the prostate is derived mainly from the inferior vesical artery with minor contributions from the internal pudendal and middle rectal arteries (figure II). As the prostatic artery approaches the gland, it divides into two
(2) main branches: the urethral group of arteries (they penetrate the prostatovesical junction posterolaterally and approach the bladder neck in the 1 o’clock to 5 o’clock and 7 o’clock to 11 o’clock positions) and the capsular branches. The veins from the prostate drain into the periprostatic plexus, which has connections with the deep dorsal veins of the penis and internal iliac veins. The lymphatic vessels from the prostate drain into the internal iliac, sacral, vesical, and external iliac lymph nodes. The prostate receives a rich nerve supply from the sympathetic and parasympathetic nerve plexuses\textsuperscript{59}. 
2.2 PHYSIOLOGY OF MICTURITION.
The lower urinary tract is a functionally integrated unit comprising of the uretero-vesical junction, bladder, urinary sphincters, urethra and neurologic control mechanisms. The functions of the lower urinary tract include the storage of adequate volumes of urine (at low pressure and with no leakage) and emptying of urine (which should be voluntary, efficient, complete and at low pressure). Urine flow from the ureters to the bladder is propelled by contractions of the ureteric wall smooth muscle. The urine is stored in the bladder and intermittently ejected during micturition.

The bladder has whorls of smooth muscle collectively called detrusor muscle whose contraction on the urine in the lumen of the bladder produces urination. Internal urethral sphincter is the part of the detrusor muscle near the beginning of the urethra. Just below this, a ring of skeletal muscle (external sphincter) surrounds the urethra.

Parasympathetic innervation, with preganglionic neurones located in sacral parasympathetic nucleus (S2-S4), stimulates the detrusor and inhibits the internal and external urethral sphincters during micturition. Sympathetic innervations, from the inferior mesenteric ganglia (T10-L2), have opposite effects on these three structures and inhibit micturition while encouraging filling of bladder and relaxation of detrusor muscle.
During micturition, as the bladder fills with urine, the pressure within it increases, and this stimulates stretch receptors in the bladder wall. Afferent fibres from these receptors enter the spinal cord and stimulate the parasympathetic neurons. Simultaneously, the afferent input from the stretch receptors inhibits the sympathetic neurons to the internal sphincter and somatic motor neurons to the external sphincter. These cause contraction of the detrusor and relaxation of both the internal and external sphincters (with funnelling of the bladder neck and proximal urethra) which initiates micturition.

The local spinal reflex described above can be influenced by descending pathways from the brain. This accounts for the ability to prevent or initiate micturition voluntarily. Loss of these descending pathways eliminates one’s ability to voluntarily control micturition and leads to the development of incontinence.62

2.3 PATHOPHYSIOLOGY OF BENIGN PROSTATIC HYPERPLASIA.

The Pathophysiology of BPH is complex. One of the unique features of the human prostate is the presence of the prostatic capsule. It plays a role in the development of LUTS. Presumably, the capsule transmits the pressure of tissue expansion to the urethra and leads to an increase in urethral resistance. Thus the clinical symptoms of BPH in man may be due not only to age-related increase in prostatic size but also to the unique anatomic structure.63
Pathophysiological mechanisms that have been proposed as being involved in BOO due to BPH include changes in detrusor morphology and innervations, intercellular communication and electrical properties, detrusor receptors, urothelial mechanoafferent signalling and central nervous regulation. Prostatic hyperplasia increases urethral resistance, resulting in compensatory changes in bladder function. However, the elevated detrusor pressure required to maintain urinary flow in the presence of increased outflow resistance occurs at the expense of normal bladder storage functions.\textsuperscript{64}

The presence of BOO is initially compensated for by detrusor hypertrophy. Over the course of time, pathological deposition and replacement of detrusor fibres with collagen occurs. In addition to abnormal increase of connective tissue, smooth muscle hyperplasia could contribute to advanced hypertrophy. Despite detrusor smooth muscle hypertrophy, some bladders become severely dysfunctional. Subsequently, there can be trabeculation, sacculation and diverticular formation.\textsuperscript{65}

Obstruction-induced changes in bladder are of two basic types. The first type leads to detrusor instability or decreased compliance and is clinically associated with symptoms of frequency and urgency. On the other hand, the second type is associated with decreased detrusor contractility and with further deterioration in the force of urine stream, hesitancy, intermittency and increased residual urine.\textsuperscript{63}
Active smooth muscle tone in human prostate is regulated by the adrenergic nervous system. The $\alpha_{1A}$ receptor mediates active tension in human prostatic smooth muscle. Also, there is a statistically significant increase in the $\alpha_1$ adrenergic receptor in the obstructed bladder. During prostate obstruction, $\alpha_{1d}$ is the predominant sub-population in the bladder. The action of $\alpha_1$ adrenergic receptor antagonists in ameliorating irritation and obstruction in patients with BOO due to BPH has been demonstrated\textsuperscript{66}.

Apart from the morphological changes of the bladder, chronic urinary tract obstruction can lead to permanent damage to the urinary tract. Progressive back pressure on the ureters and kidneys can lead to hydroureter and hydronephrosis. The ureters become dilated and tortuous, with the inability to adequately propel urine forward. Hydronephrosis can cause nephron damage and renal failure. Urine stasis increases the risk of infection and calculus formation\textsuperscript{67}.

2.4 BENIGN PROSTATIC HYPERPLASIA AND INTRAVESICAL PROSTATIC PROTRUSION.

Lower urinary tract symptoms in ageing men are often associated with BPH\textsuperscript{39}. BPH is a benign prostate disorder characterised by an excessive increase in the number of cells in the prostate leading to prostatic enlargement\textsuperscript{1}. This arises from uncontrolled prostatic epithelial and stromal cell proliferation and delayed cell
death\textsuperscript{68}. BPH predominantly involves the stromal compartment of the gland but also involves the epithelial elements. The exact aetiology of BPH is not known\textsuperscript{15,68}.

These changes in the prostate usually begin histologically in the third decade of life and clinically in the fifth decade of life. They are mediated primarily by tissue levels of dihydrotestosterone, within the prostate, and results in the gland’s continued growth throughout life. When prostatic enlargement occurs, increased resistance in the proximal urethra may limit urinary flow during micturition, often resulting in pathophysiological changes in the bladder (hypertrophy, trabeculation, sacculation and diverticular formation).

Clinically, BPH presents as LUTS. The symptoms are variable and range from nocturia to development of acute urinary retention\textsuperscript{4,69}. The mechanical compression of the prostatic urethra by the enlarged prostate causes a static obstruction. There is also a dynamic component to BPH. This can show substantive variation between individuals and relates to the neuronal control over prostatic smooth muscle tone by alpha-1 adrenergic receptors\textsuperscript{70}. The inter-individual differences in the static and dynamic components of BPH will determine which men are affected by LUTS and the degree of symptom bother.

IPP is a gross structural morphologic change due to the development of prostatic adenoma\textsuperscript{71}. It is a morphological change due to the overgrowth of prostatic median and lateral lobes (as described by Lowsley\textsuperscript{60}) into the bladder. IPP
may cause dyskinetic movements of bladder during micturition due to the inhibition of the funnel effect of bladder neck at urination \(^{17,24,72}\). Because of these dyskinetic movements, IPP would cause more obstruction than if there were no protrusion and just enlargement of lateral lobes, as the strong bladder contraction could force open a channel between the lateral lobes \(^{10,11,13}\).

IPP may cause either more voiding symptoms due to ball-valve phenomenon or elongation of the prostatic urethra \(^{73}\); or more storage symptoms due to increased bladder neck irritation \(^{10}\). It usually affects storage symptoms more than voiding symptoms \(^{73}\). Assessment of IPP has been reported to be a non-invasive method to evaluate bladder outlet obstruction (BOO) and has been found to be an independent factor for predicting better post-operative outcomes in patients with BPH \(^{74}\).

**2.5 ASSESSMENT OF INTRAVESICAL PROSTATIC PROTRUSION.**

Transabdominal ultrasonographic assessment of the lower urinary tract in a non-invasive manner allows clinicians to assess LUTS in men without any morbidity. The technique is accurate, simple, reliable, quick and intra- and inter-observer variability is low \(^{38}\). Ultrasonography has been used widely for the assessment of the prostate gland owing to its safety, availability and non-invasiveness \(^{75}\).

Intravesical prostatic protrusion can be measured by transabdominal ultrasonography and it is able to detect BOO in BPH patients quickly and non-
invasively \textsuperscript{14, 76}. IPP is measured from images of the prostate obtained using the midline sagittal image by drawing a line from the anterior to the posterior intersections of the bladder base and the tip of the Intravesical prostatic protrusion \textsuperscript{23, 77} (figure III).

Intravesical prostatic protrusion (IPP) can be graded according to IPP vertical distance in millimetres:

Grade I: 0 – 4.9 mm

Grade II: 5.0 – 9.9 mm

Grade III: = or > 10.0 mm\textsuperscript{13, 25, 50, 78}.

A filled bladder acts as an acoustic window for transabdominal ultrasound measurement of IPP. The IPP is the protrusion of the prostate seen in the sagittal plane measured best in comfortably filled bladder between 100 ml to 400 ml. When the bladder is over distended (> 400 ml), the prostate recedes below the pubic symphysis and is difficult to be imaged correctly, giving a lower value. In contrast, too little urine in the bladder (<100ml) might cause overestimation of the IPP \textsuperscript{79}. 
2.6 INTERNATIONAL PROSTATE SYMPTOM SCORE (IPSS).

Several validated questionnaires have been developed in collaboration with The American Urological Association (AUA) to assess the severity and treatment effect in men with BPH. One of such instruments is the international prostate symptom score (IPSS) \(^{80,81}\) (appendix III). It requires little skill and no laboratory equipment and this makes IPSS a useful tool in third world countries where equipments for tests like uroflowmetry may not be available \(^1\).

The IPSS index consists of seven questions on the symptoms of BPH (frequency, nocturia, urgency, straining, weak urinary stream, intermittency, and incomplete bladder emptying) and the patient’s perception of his quality of life. 

Figure III: IPP measurement on transabdominal ultrasonography. Source: Lieber et al\(^{77}\).
IPSS can be divided into storage (IPSS-s) and voiding (IPSS-v) symptoms. Storage symptoms appear to be due to secondary bladder dysfunctions (bladder wall hypertrophy and collagen deposition in the bladder) while voiding symptoms result from direct urinary flow obstruction. The difference between the AUA symptom score and the IPSS is that IPSS incorporates a question capturing the global impact of LUTS on quality of life. The IPSS quality of life index (IPSS QoL) is an additional question usually included at the end of the IPSS questionnaire and should not be part of the total IPSS score.

This self administered instrument includes seven questions rated 0 to 5. Scores can range from 0 to 35 points. The total scores are graded as mild (1 – 7), moderate (8 – 19), and severe (20 – 35). The IPSS QoL ranges from 0 (if patient feels delighted to spend the rest of his life with his urinary condition just as it currently is) to 6, if patient feels terrible about his urinary condition as it is now (see appendix III).

IPSS discriminates BPH patients from control patients better than Maine Medical Assessment Programme index and equivalently to the Madsen-Iversen and Boyarsk indexes, despite having fewer items. The IPSS alone cannot be used to establish the diagnosis of BPH, as men (and women) with a variety of lower urinary tract disorders (infection, tumour, neurogenic bladder e.t.c) will also have high IPSS. The IPSS is the ideal instrument to grade baseline symptoms, assess response
to therapy, and detect symptom progression. It could be used to guide choice of treatment modality.

**2.7 RELATIONSHIP BETWEEN INTRAVESICAL PROSTATIC PROTRUSION AND INTERNATIONAL PROSTATE SYMPTOM SCORE.**

Some studies have found that patients with significant Intravesical prostatic protrusion had significantly higher prostate volume and IPSS than patients without IPP. There is also a significant positive correlation between IPP and IPSS.

There have been conflicting reports in literatures of the correlation between IPP and IPSS. In studies using transabdominal ultrasound probes and a study by Tjahjodjati et al using transrectal ultrasound probe, significant positive correlations have found between IPP and total IPSS Score. On the other hand, using transabdominal ultrasound probes and transrectal ultrasound probes no significant correlations have also been found between IPP and total IPSS score.

Furthermore, significant positive correlations have been found between IPP and IPSS-\(v\), between IPP and IPSS-\(s\), and between IPP and IPSS QoL index. In contrast, some studies have found no significant correlation between IPP and IPSS-\(v\), between IPP and IPSS-\(s\), and between IPP and IPSS QoL index.

Lee et al in their work to compare the post-operative changes in IPSS, IPSS-\(v\), IPSS-\(s\) and quality of life in patients with significant IPP (IPP> 5mm) and those
without significant IPP found that the changes were significant in the group of patients with significant IPP. They concluded that significant IPP is an independent factor for predicting better operative outcomes of IPSS. Significant IPP has been associated with severe IPSS and failure of non-operative management. Studies have linked significant IPP with severe IPSS and increased odds of failure of medical treatment in patients with BPH \(^{47-49}\).

IPSS is a measure of the severity of symptoms of BOO. Though some studies did not directly assess the correlation between IPP and IPSS, they found a statistically significant relationship between IPP and bladder outlet obstruction (BOO) \(^{10,12,13}\).

Though no local study on correlation of IPP with IPSS was found in the course of literature search, Udeh et al\(^ {31}\) in their study in Enugu among adult males with BPH did not find any significant relationship between prostate volume and international prostate symptom score in Africans.
CHAPTER THREE- AIM AND OBJECTIVES

The aim of the study was to determine the correlation between IPP and IPSS in adult Nigerian male patients with symptomatic BPH.

Specific objectives included:

1. To determine the relationship between IPP and total IPSS score.
2. To determine the relationship between IPP and storage IPSS sub-score.
3. To know the relationship between IPP and voiding IPSS sub-score.
4. To determine the correlation between IPP and IPSS Quality of Life (QoL).
CHAPTER FOUR- PATIENTS AND METHOD

4.1 STUDY DESIGN AND SETTING.

This was a hospital based cross sectional prospective study to determine the correlation between IPP and IPSS among adult male patients who presented with symptomatic BPH at the urology clinics of Nnamdi Azikiwe University Teaching Hospital, Nnewi (N.A.U.T.H)

N.A.U.T.H is a federal government owned tertiary health institution in Nnewi. Nnewi is a major trading/ manufacturing city in Anambra State, South East Region of Nigeria. The hospital is a 320 bed capacity health facility. The male surgical ward has 48 beds while the female surgical ward has 32 beds. A wide range of urological (both open and endoscopic) services are offered in the hospital. There are no dedicated bed spaces to urology division (spaces are used by all surgical units). The surgical bed occupancy rate is almost always hundred percent.

The study centre mainly receives referrals for health related conditions and its catchment includes all corners of the state and the neighbouring states of Abia, Delta, Ebonyi, Enugu, Imo and Kogi States. Sometimes, farther areas may be involved because of high numbers of people on business trips.

4.2 STUDY POPULATION AND SAMPLE SIZE.
This was a hospital based study of new patients seen in the urology outpatient clinic. The population comprised all new patients > 40 years seen in the urology clinic with symptomatic BPH. The sample size was calculated thus:

\[ nf = \frac{n}{1 + \frac{n}{N}} \]

Where:

- \( nf \) = the desired sample size when population is less than 10,000
- \( n \) = the desired sample size when population is more than 10,000
- \( N \) = the estimate of the population size which is 156 (3 new patients/week [from the clinic register] \( \times \) 52 weeks).

But:

\[ n = \frac{z^2 p q}{d^2} \]

\( Z \) = area under normal curve at corresponding confidence level. At 95% confidence level, \( z = 1.96 \)

\( p \) = prevalence of BPH which is 25% or 0.25. Ezeanyika et al.¹

\( q \) = remaining proportion not likely to have BPH which is 0.75

\( d \) = maximum difference tolerated between the sample mean and the population mean. Which is 5% or 0.05
Hence, \( n = (1.96)^2 (0.25) (0.75) (0.05)^2 \)

\[ = 288.12 \approx 288. \]

Thus, \( n_f = \frac{288}{1+288/156} \)

\[ = 101.05 \approx 101. \]

Hence, a total of 101 participants were used for this study.

**4.3 SUBJECT SELECTION**

Subject selection was by quota/ survey sampling method. Included in this study were new patients that attended the urology clinic of N.A.U.T.H with symptomatic BPH and who gave a written informed consent and did not have the exclusion criteria for the study.

**EXCLUSION CRITERIA:**

1. Patients with LUTS due to non prostatic disorders.
2. Patients with carcinoma of prostate.
3. Patients with previous pelvic or urethral surgeries.
4. Patients with bladder calculi or carcinoma of the bladder.
5. Patients with neurological deficit(s).
6. Patients using 5α reductase inhibitors.
7. Patients using anticholinergic medications.

4.4 STUDY PERIOD.

This study was conducted over a period of fifteen months (July, 2014-September, 2015).

4.5 ETHICAL CONSIDERATIONS.

All study protocols and informed consent procedures were approved by the research and ethical committee of N.A.U.T.H (appendix II).

Written informed consent (see appendix I) was obtained from any potential subject and he was then included in the study if inclusion criteria were met and exclusion criteria were absent.

4.6 DATA COLLECTION AND QUALITY CONTROL.

Patients who consented and met the inclusion criteria participated in the study. Each subject was interviewed by the researcher using a standard proforma (appendix IV) which contained the patient’s personal data, anthropometric measurements, IPSS, IPSS Quality of Life, associated symptoms, co-morbidities, family history and social history, prostate assessment including IPP, other investigations and results.
Patient evaluation included a detailed history with IPSS. Physical examination was carried out. This included a digital rectal examination and neurological examination to exclude neurological deficit(s) and neurologically related bladder dysfunction. Urinalysis and urine microscopy and culture were carried out to screen for urinary tract infection, diabetes mellitus and microscopic haematuria. Serum prostate specific antigen (total, free and percentage free) was done. Transrectal digitally guided prostate biopsy was done for patients with total PSA > 4 ng/ml to rule out carcinoma of the prostate. Transabdominal ultrasonography measurement of prostate volume, IPP and post void urine were done.

IPP was assessed using transabdominal ultrasonography. The ultrasound machine that was used is *Prosound* model SSD 3500 with an abdominal probe frequency of 3.5 MHz (Aloka co Ltd, Tokyo, Japan). 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: 0 - 4.9 mm; grade II: 5.0 – 9.9 mm; grade III: 10.0 mm and above) as done by other researchers\textsuperscript{13,25,50,78}. The bladder was allowed to fill passively with at least 100ml of urine by asking the patient, after voiding, to ingest
one (1) litre of water and performing the abdominal ultrasonography about two
hours later. This is to allow enough time for urine to accumulate in the bladder.

To ensure quality control, only the researcher interviewed the patients and
this was done in an enclosure to ensure confidentiality and free flow of
information. Furthermore, abdominal ultrasound assessment was done by the
same consultant radiologist and the researcher.

4.7 DATA PROCESSING AND ANALYSIS.

Before data analysis, all completed questionnaires were coded. Data collected
was analysed with a multi-purpose computer analysis programme: Statistical
Package for Social Sciences version 20 (IBM; SPSS, Chicago, IL, USA). This was done
with the help of a statistician.

Results obtained were presented using tables and figures where applicable.
The data was subjected to ANOVA (to compare mean parameters among different
grades of IPP) and Pearson’s correlation was used to assess correlation where
necessary. P < 0.05 was considered significant.
CHAPTER FIVE - RESULTS

Demographic Characteristics

A total of 101 men who met the inclusion criteria, and signed the consent form were recruited into the study. The mean age was 67.09 ± 10.93 years and age range of the subjects was 42 – 90 years. The age distribution of the participants was as shown in table 1. The mean weight was 72.75 ± 12.80 kilograms. The mean height was 1.68 ± 0.06 meters and the mean BMI was 25.80 ± 3.92 kilograms/meter².

Table 1. Age distribution of participants.

<table>
<thead>
<tr>
<th>Age Range(years)</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49</td>
<td>7</td>
<td>6.9</td>
</tr>
<tr>
<td>50-59</td>
<td>18</td>
<td>17.8</td>
</tr>
<tr>
<td>60-69</td>
<td>32</td>
<td>31.7</td>
</tr>
<tr>
<td>70-79</td>
<td>31</td>
<td>30.7</td>
</tr>
<tr>
<td>80-89</td>
<td>12</td>
<td>11.9</td>
</tr>
<tr>
<td>90-99</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>101</td>
<td>100</td>
</tr>
</tbody>
</table>
Eighty three participants (82.2%) were married while 9 (8.9%), 7 (6.9%), 2 (2%) were widowers, divorced and single respectively. Ninety five of the participants (94.0%) were Christians while 3 (3.0%), 2(2.0%), 1 (1.0%) were Muslims, atheist, and other religion respectively. The highest educational level of most of the participants [51 (50.5%)] was primary followed by secondary [21 (20.8%)], post-secondary [20 (19.8%)] and no formal education [9 (8.9%)] as shown in fig. 1

![Pie chart showing educational level of participants.](image)

Figure . Pie chart showing educational level of participants.
IPSS and Quality of Life Characteristics of Participants

The mean total IPSS was $17.05 \pm 7.62/35$. The mean storage symptom IPSS sub-score (IPSS$_S$) was $7.81 \pm 5.17/15$. The mean voiding symptom IPSS (IPSS$_V$) sub-score was $9.24 \pm 3.16/20$. The mean Quality of Life index was $4.75 \pm 1.59/6$.

Using total IPSS, 8 participants (7.9%) had mild grade symptoms (total IPSS 0-7), 61 (60.4%) had moderate grade symptoms (total IPSS 8-19) and 32 (31.7%) had severe grade symptoms (total IPSS 20-35). This is shown in fig. 2.

![Pie chart showing percentage of participants with mild, moderate and severe IPSS grade.](chart.png)
Eighty six participants (85.1%) were worried about their urinary problem while 15 (14.9%) were not worried. Nine (8.9%), 6 (5.9%), 1 (1%), 13 (12.9%), 28 (27.7%) and 44 (43.6%) participants felt pleased, mostly satisfied, mixed, mostly dissatisfied, unhappy and terrible, respectively, if they were to spend the rest of their lives with their urinary condition just the way it was. This is shown in fig. 3.

![Figure 3. Quality of life of participants](image)

**Associated Conditions**

Ninety four (93.1%) participants had dysuria while 7 (6.9%) had no dysuria. Eighty nine (88.1%) had haematuria and 12 (11.9%) did not. Thirty six (35.6%)
participants have had surgical operations in the past as against 65 (64.4%) who had none. The commonest past surgery was inguinal herniorrhaphe in 15 (15.0%) of participants. As regards family history of prostate disease, 78 participants (77.2%) had no family history of prostate disease while 23 (22.8%) had positive family history of prostate disease.

**Prostate Characteristics**

The mean total prostate volume (TPV) was 68.33 ± 46.53 millilitres while the mean intravesical prostatic protrusion (IPP) was 13.50 ± 7.47 millimetres. The mean total prostate specific antigen (PSA), free PSA and percentage free PSA were 7.35 ± 12.49 ng/ ml, 2.21 ± 3.75 ng/ml and 40.93 ± 11.23 % respectively.

**Comparison of IPP Grades**

Eight (7.9%) participants had IPP of 0 – 4.9mm (grade I), 33 (32.7%) had IPP of 5 – 9.9 mm (grade II) and 60 (59.4%) had IPP of 10.0 mm and above (grade III)

The mean TPV was 32.29 ± 3.90 mls; mean IPP was 4.47 ± 0.37 mm; mean PSA was 2.12 ± 1.52 ng/ml; mean IPSS was 8.75 ± 3.34; mean IPSS-V was 2.88 ± 1.96; and mean IPSS-S of was 5.88 ± 1.96 for participants with IPP of 0 – 4.9 mm.

For those with IPP of 5.0 – 9.9 mm, the mean TPV was 39.66 ± 13.36 mls; mean IPP was 7.91 ± 1.52 mm; mean PSA was 3.26 ± 4.28 ng/ml; mean IPSS was 15.15 ± 7.49; mean IPSS-V was 6.75 ± 5.37; and mean IPSS-S of was 8.39 ± 2.82.

Furthermore, the mean TPV was 88.91 ± 50.05 mls; mean IPP was 17.77 ± 6.79 mm; mean PSA was 10.29 ± 15.26 ng/ml; mean IPSS was 19.20 ± 7.11; mean
IPSS\textsubscript{V} was 9.05 ± 4.88; and mean IPSS\textsubscript{S} was 10.15 ± 3.06 for participants with IPP of 10.0 mm and above.

The differences in mean TPV (p = 0.000), mean IPP (p = 0.000), mean PSA (p = 0.015), mean IPSS (p = 0.000), mean IPSS\textsubscript{V} (p = 0.002), mean IPSS\textsubscript{S} (p = 0.000) among the three groups of IPP were statistically significant as shown in table 2.

Table 2. Comparison of mean parameters of participants with different intravesical prostatic protrusion grades.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>0.0 – 4.9 mm</th>
<th>5.0 – 9.9 mm</th>
<th>10.0 mm and above</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean TPV (mls)</td>
<td>32.29 ± 3.90</td>
<td>39.66 ± 13.36</td>
<td>88.91 ± 50.05</td>
<td>0.000*</td>
</tr>
<tr>
<td>Mean IPP (mm)</td>
<td>4.47 ± 0.37</td>
<td>7.91 ± 1.52</td>
<td>17.77 ± 6.79</td>
<td>0.000*</td>
</tr>
<tr>
<td>Mean PSA (ng/ml)</td>
<td>2.12 ± 1.52</td>
<td>3.26 ± 4.28</td>
<td>10.29 ± 15.26</td>
<td>0.015*</td>
</tr>
<tr>
<td>Mean IPSS</td>
<td>8.75 ± 3.34</td>
<td>15.15 ± 7.49</td>
<td>19.20 ± 7.11</td>
<td>0.000*</td>
</tr>
<tr>
<td>Mean IPSS\textsubscript{V}</td>
<td>2.88 ± 1.96</td>
<td>6.75 ± 5.37</td>
<td>9.05 ± 4.88</td>
<td>0.002*</td>
</tr>
<tr>
<td>Mean IPSS\textsubscript{S}</td>
<td>5.88 ± 1.96</td>
<td>8.39 ± 2.82</td>
<td>10.15 ± 3.06</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

TPV = total prostate volume, IPP = intravesical prostatic protrusion, PSA = prostate specific antigen, IPSS = international prostate symptom score, IPSS\textsubscript{V} = voiding symptoms IPSS, IPSS\textsubscript{S} = storage symptoms IPSS, * = p-value < 0.05.
Using Post-hoc test, the differences in mean parameters were in participants with grade III IPP (IPP 10.0mm or more). The p-values of the differences in the mean values of TPV between grade III IPP and grade I IPP was 0.000; and between grade III IPP and grade II IPP was 0.001. The p-values of the differences in the mean values of PSA between grade III IPP and grade I IPP was 0.000; and between grade III IPP and grade II IPP was 0.023. The p-values of the differences in the mean values of IPSS between grade III IPP and grade I IPP was 0.000; and between grade III and grade II IPP was 0.025. Furthermore, the p-values of the differences between the mean values of IPSS\textsubscript{V} between grade III IPP and grade I IPP was 0.003; and between grade III IPP and grade II IPP was 0.084. Finally, the p-values of the differences between the mean values of IPSS\textsubscript{S} of grade III IPP and grade I IPP was 0.01; and between grade III IPP and grade II IPP was 0.018.
Correlation between IPP and IPSS

There were significant positive correlation between IPP and total IPSS (Pearson correlation coefficient = 0.406, \( p = 0.000 \)). Scatter plot of IPP and IPSS is shown in fig. 4.

Figure 4. Scatter plot of relationship between Intravesical Prostatic Protrusion and total IPSS.
Correlation between IPP and IPSS$_S$

There was also a statistically significant positive correlation between IPP and Storage IPSS sub-score (Pearson correlation coefficient = 0.398, p = 0.000). The scatter plot of IPP and storage IPSS sub-score is shown in fig. 5.

Figure 5. Scatter plot of relationship between Intravesical Prostatic Protrusion and storage IPSS sub-score.
Correlation between IPP and IPSS-V

Moreover, there is also a significant positive correlation between IPP and voiding IPSS sub-score (Pearson correlation coefficient = 0.356, p = 0.000). The scatter plot of IPP and voiding IPSS sub-score is shown in fig. 6.

Figure 6. Scatter plot of relationship between Intravesical Prostatic Protrusion and voiding IPSS sub-score.
Correlation between IPP and IPSS QoL

Furthermore, there is a significant positive correlation between IPP and IPSS Quality of Life (QoL) index (Pearson correlation coefficient = 0.457, p = 0.000). Higher IPSS Quality of Life score corresponds to deteriorating quality of life. Hence, there is a significant positive correlation between IPP and poor quality of life. The scatter plot of IPP and IPSS QoL score is shown in fig. 7.

Figure 7. Scatter plot of relationship between Intravesical Prostatic Protrusion and IPSS Quality of Life index.
CHAPTER SIX- DISCUSSION

IPP is a protrusion of the lateral and/or median prostatic lobes into the bladder lumen and can be estimated by suprapubic ultrasound. IPP can be a useful marker for the management of LUTS/BPH and a higher IPP grade is associated with a higher risk of clinical progression in LUTS. Significant IPP is an unfavourable predictor of successful medical treatment with alpha-blockers for male LUTS caused by BPH. IPP assessed by transabdominal ultrasonography has been reported to be a better and more reliable predictor of BOO than prostate volume.

The mean age of 67.09 years of the participants of this study is similar to the mean age of 68.3 years in the study by Sigdel et al in their investigation of IPP among men with BPH in Nepal. It also conforms with a mean age of above 65 years demonstrated in other studies. The mean age is above the mean age of less than 65 years by some other studies. One of the studies with mean age less than 65 years, excluded men with prostate volume greater than 40 mls.

The mean body mass index of 25.08 is similar to the body mass index of 24.91 found by Hou et al among a population of men with BPH. This is not surprising as BMI is calculated from height and weight which is normally distributed in a population.

Majority (59.4%) of the participants in this study had either no formal or only primary education. Only 19.8% of participants had post-secondary education. This
low level of education might have been responsible for some of the participants not being able to fill the IPSS questionnaire themselves. Inability to complete the IPSS questionnaire without assistance due to low educational level has also been demonstrated in other studies\textsuperscript{56,57,58}.

The mean total IPSS 17.05 in the present study falls within the moderate IPSS range. Hou et al\textsuperscript{92} also found a mean total IPSS of 17.05 among participants in their study. Most other studies also found mean IPSS within the moderate IPSS range\textsuperscript{14,85,87,88,93}. Puthenveetil et al\textsuperscript{98}, among Indian men with BPH, found a mean IPSS of 20, which is in severe IPSS range. This may be due to the fact that they excluded men with prostate volume of less than 40 mls.

The percentage of participants with mild, moderate and severe grade total IPSS scores were 7.9%, 60.4%, and 31.7% respectively. This is similar to the 9.8% (for mild), 56.6% (for moderate) and 33.6% (for severe) obtained by LU et al\textsuperscript{85} among a subset of men with BPH from a population of 122 elderly men with overactive bladder. Gyawali et al\textsuperscript{88}, in investigating IPP and TPV in predicting symptom severity in BPH, found more men (45%) in severe IPSS category. This may be due to a smaller sample size of 60 participants.

The mean IPSS\textsubscript{V} of 9.24 is more than the mean IPSS\textsubscript{S} of 7.81. These are similar to the mean IPSS\textsubscript{V} of 9.25 and mean IPSS\textsubscript{S} of 7.78 obtained by Hou et al\textsuperscript{92}. Some other studies have also shown mean IPSS\textsubscript{V} greater than IPSS\textsubscript{S}\textsuperscript{87,93}. Lue et al\textsuperscript{85} found mean IPSS\textsubscript{V} (7.2) less than mean IPSS\textsubscript{S} (9.7). This reverse finding is not
surprising as their study population was a group of men with overactive bladder (though 51.6% of them also had BPH).

The mean TPV of 68.33 ml found in this study is similar to the mean TPV of 72.79 ml found in Jos by Udeh et al\textsuperscript{31} while investigating the relationship between TPV and IPSS. In addition, it is more than TPV of less than 50mls found in studies in other regions of the world\textsuperscript{14,85,89,90,92,93,99}. This may be due to geographical / racial differences or late presentation of patients in our climate.

Majority (59.4\%) of the participants had grade III intravesical prostatic protrusion. This is similar to the work done (also using transabdominal ultrasound probe and similar bladder volume) by Aganovic et al\textsuperscript{10} in which they found 57.7\% of participants with grade III intravesical prostatic protrusion. Other studies have found preponderance of IPP grade I and II\textsuperscript{85,91,93}. This may be due to smaller average TPV in those studies.

The mean IPP of 13.5 mm lies within IPP grade III. Aganovic et al\textsuperscript{10} and Sigdel and Belokar\textsuperscript{90} also found mean IPP of 11.8 mm and 14.6 mm respectively. On the other hand, some studies found mean IPP within grade I\textsuperscript{92,98} and grade II\textsuperscript{14}.

The significant differences found between the various grades of IPP in TPV (p = 0.000), PSA (p = 0.015), IPSS (p = 0.000), IPSS-V (p = 0.002), IPSS-S (p = 0.000) has also been found in earlier studies\textsuperscript{86,91}. This differences lies mostly in IPP grade III showing that patients with IPP 10.0 mm or more have more severe symptoms.
The significant positive correlation between IPP and IPSS (p = 0.000) is in agreement with other studies\textsuperscript{85-88}. Although other studies\textsuperscript{89-94} have shown no significant correlation between IPP and IPSS, some of those studies used different bladder volume for measurement of IPP\textsuperscript{92,98} or did not state the bladder volume at which IPP was measured\textsuperscript{90,93,94}. Too little urine in bladder (volume < 100mls) have been shown to overestimate IPP while a bladder volume > 400mls have been shown to underestimate IPP\textsuperscript{79}.

This work found a positive significant correlation between IPP and IPSS\textsubscript{−v}. This is in agreement with the studies done by Tjahjodjati et al\textsuperscript{89} in Indonesia and Park et al\textsuperscript{87} in Korea. On the other hand, other studies have shown no significant correlation between IPP and IPSS\textsubscript{−v}\textsuperscript{92-94}.

Furthermore, the current study demonstrated a significant positive correlation between IPP and IPSS\textsubscript{−s}. Several studies have made a similar observation\textsuperscript{85,87,89,92,94}. Kuei and co-workers\textsuperscript{93} using a transrectal probe of 6.5 MHz (at an unspecified bladder volume for measurement of IPP) in a sample of 112 men in Taiwan found no significant correlation between IPP and IPSS\textsubscript{−s}.

A significant positive correlation was found between IPP and IPSS QoL index in this study. Gyawali et al\textsuperscript{88} found a similar significant positive correlation while Lee and co-wokers\textsuperscript{94} found an insignificant (though positive) correlation between IPP and IPSS QoL index.
Finally, the positive correlation between IPP and IPSS; and between IPP and IPSS QoL index in this and other previous studies may make IPP an important non-invasive tool in the assessment of men with symptomatic BPH.
CHAPTER SEVEN - CONCLUSION

The findings of this study show significant positive correlations between IPP and IPSS, IPP and IPSS-S, IPP and IPSS-V, and IPP and IPSS QoL index. Hence IPP can help assess severity of symptoms in men with BPH. The significant positive correlation between IPP and IPSS QoL index found in this study suggests a worse quality of life for patients with increasing IPP.

Moreover, a significantly higher IPSS, IPSS-S, IPSS-V, and IPSS QoL index in BPH patients with IPP of 10.0 mm or more was found. Therefore, patients with IPP grade III have more severe BPH symptoms (as measured with IPSS) and worse quality of life (as measured by IPSS QoL index).
CHAPTER EIGHT- RECOMMENDATIONS

From this study, the following recommendations are being made:

1. IPP measurement should be included in the request for routine abdominopelvic ultrasonography of patients with BPH. It is non-invasive and can provide valuable information at no additional cost.

2. Urologists and radiologist should be trained in the correct procedure for measuring IPP.

3. Approximate bladder volume at which IPP should be measured should be standardized to enable comparison between studies.

4. A standardized route of measurement (transabdominal versus transrectal routes) and ultrasound probe frequencies should also be established.
REFERENCES


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44. Ezzel Din K, Kiemeney LA, de Wildt MJ, Debruyne FM, de la Rosette JJ. Correlation between uroflowmetry, prostate volume, postvoid residue, and lower urinary tract symptoms as measured by the international prostate symptom score. Urology. 1996; 48: 393-397.


85. Lu SY, Yang CM, Fan YH, Lin AT, Chen KK. Intravesical prostatic protrusion correlates well with storage symptoms in elderly male patients with non-neurogenic overactive bladder. *Urological Science* 2015 Jul 6. Available from: [http://dx.doi.org/10.1016/j.urols.2015.05.006](http://dx.doi.org/10.1016/j.urols.2015.05.006)


88. Gyawali PR, Shrestha GK, Joshi BR, Chalise PR, Sharma UK. Intravesical Prostatic Protrusion is better than Prostate Volume in Predicting Symptom


100. Aganovic D, Hasanbegovic M, Prcic A, Kulovac B, Hadziosmanovic O. Which is a better indicator of bladder outlet obstruction in patients with benign
APPENDIX I

CONSENT FORM

INTRODUCTION

I am Dr. Eze Balantine of Department of Surgery, N.A.U.T.H, Nnewi. I intend to carry out a research that relates to urinary problems in patients with benign prostatic hyperplasia (BPH). The prostate is a gland that is located below the bladder around the channel through which urine flows out. It is present in every man and usually undergoes a non cancerous increase in size (called BPH) with ageing. Intravesical prostatic protrusion (IPP) is the extent to which the prostate enlarges into the bladder. International prostate symptom score (IPSS) is a standard questionnaire used to assess the severity of urinary problems. I intend to carry out a research that relates to IPP and IPSS in adult Nigerian men with BPH.

BPH is common among ageing men and it is important to determine which group of patients that would benefit from one form of treatment or other. IPP and IPSS can help make a decision on treatment. No study has been done to explore the relationship between them in our locality and this makes this study important.

BENEFITS OF STUDY

This study will add to medical knowledge and help in better evaluation and treatment of patients with BPH.

PROCEDURE

This study will not involve any invasive procedure. Participation in this study is voluntary. Participants will be required to fill out a questionnaire and carry out an abdominal ultrasound scan.

You are not going to be exposed to any risk in participating in this study and you may withdraw from the study at any time without needing to give an explanation and without any detriment to the usual care you are entitled to.

Throughout the study, privacy will be assured and information given will be treated with confidentiality. Participants will not be paid.

I ……………………………………………………………………………. accept to participate in this study.

Signature/ Thumbprint…………………………………………..        Date ……………………………………………

Witness ……………………………………………       Signature/ Thumbprint ………………………. Date……………..

For enquires/complaints, please contact   Dr. Eze B.U.  Department of Surgery, N.A.U.T.H, Nnewi.

Phone number: 08035001763       email: buneze@rocketmail.com
APPENDIX II

ETHICAL COMMITTEE APPROVAL

NNAMDI AZIKIWE UNIVERSITY TEACHING HOSPITAL
P.M.B. 5025, NNEWI, ANAMBRA STATE, NIGERIA

Professor Anthony O. Igwegbe
MBBS, FWACS, FICS, FISS
Chief Medical Director/Chieft Executive

Dr. E.A. E. Affadigwe
B.Sc (Hons) Nig. MBBS (NAU), FWACS, FICS
Ag. Chairman
Medical Advisory Committee

E-mail: naauthcmnd@yahoo.co.uk
nauthnnewi@hotmail.com
Telegram: TEACHOS NNEWI

Date: 13th January, 2014

Dr. Eze Balantine Ugochukwu
Department of Surgery,
Nnamdi Azikiwe University Teaching Hospital,
Nnewi.

ETHICS COMMITTEE APPROVAL

RE: CORRELATION BETWEEN INTRAVESICAL POSTATIC PROTRUSION AND INTERNATIONAL PROSTATE SYMPTOM SCORE (IPSS) IN MEN WITH BENIGN POSTATIC HYPERPLASIA IN NNAMDI AZIKIWE UNIVERSITY TEACHING HOSPITAL, NNEWI.

We write to inform you that after due consideration of your revised research proposal, approval is hereby conveyed for you to commence the study.

The principal investigator is required to send a progress report to the Ethical Committee at the expiration of three(3) months after ethical clearance to enable the Committee carry out its oversight function.

Please note that this approval is subject to revocation if you fail to obtain proper authorization from your study site/unit.

Prof: P.U. Ele
Chairman, NAUTH Ethical Committee

Udemezue N.O. (Mrs)
Sec., NAUTH Ethical Committee
APPENDIX III

INTERNATIONAL PROSTATE SYMPTOM SCORE

<table>
<thead>
<tr>
<th>IN THE PAST MONTH</th>
<th>Not At All</th>
<th>Less than 1 in 5 times</th>
<th>Less than half the time</th>
<th>About half the time</th>
<th>More than half the time</th>
<th>Almost always</th>
<th>score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Incomplete Emptying: How often have you had the sensation of not emptying your bladder?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2. Frequency: How often have you had to urinate less than every two hours?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>3. Intermittency: How often have you found you stopped and started again when you urinated?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4 URGency: How often have you found it difficult to postpone urination?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>5 Weak Stream: How often have you had a weak urinary stream?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6 Straining: How often have you had to strain to start urination?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>7 Nocturia: How many times did you typically get up at night to urinate?</td>
<td>None</td>
<td>1 time</td>
<td>2 times</td>
<td>3 times</td>
<td>4 times</td>
<td>5 times</td>
<td></td>
</tr>
</tbody>
</table>

Total Score ..........................................................

Mild: 1 – 7    Moderate: 8 – 19    Severe: 20 – 35.

Quality of Life (QoL)

If you were to spend the rest of your life with your urinary condition just the way it is now, how would you feel about that?

<table>
<thead>
<tr>
<th>Delighted</th>
<th>Pleased</th>
<th>Mostly satisfied</th>
<th>Mixed</th>
<th>Mostly Dissatisfied</th>
<th>Unhappy</th>
<th>Terrible</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
APPENDIX IV
STUDY PROFOMA

Date ……………………………………………………………………………………………………………………………………..

Research Number …………………………………………………………………………………………………………………..

Hospital Number …………………………………………………………………………………………………………………..

Personal Data

Age last birthday …………………

Contact Address …………………………………………………………………………………………………………………..

Phone Number …………………………………………………………

Marital Status:  
☐ Married  ☐ Divorced  ☐ Widower  ☐ Single

Religion:  
☐ Christian  ☐ Muslim  ☐ Others  ☐ Atheist

Highest Level of Education:
☐ No formal education  ☐ Primary  ☐ Secondary  ☐ Post-Secondary

Anthropometric Measurements:

Height (metres) ……………

Weight (kilograms) ………

Body mass index (kg/m²)………..

International Prostate Symptom Score (IPSS):

<table>
<thead>
<tr>
<th>IN THE PAST MONTH</th>
<th>Not At All</th>
<th>Less than 1 in 5 times</th>
<th>Less than half the time</th>
<th>About half the time</th>
<th>More than half the time</th>
<th>Almost always</th>
<th>score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Incomplete Emptying: How often have you had the sensation of not emptying your bladder?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Frequency: How often have you had to urinate less than every two hours?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
### Intermittency:
How often have you found you stopped and started again when you urinated?

<table>
<thead>
<tr>
<th>None</th>
<th>1 time</th>
<th>2 times</th>
<th>3 times</th>
<th>4 times</th>
<th>5 times</th>
</tr>
</thead>
</table>

### Urgency:
How often have you found it difficult to postpone urination?

### Weak Stream:
How often have you had a weak urinary stream?

### Straining:
How often have you had to strain to start urination?

### Nocturia:
How many times did you typically get up at night to urinate?

<table>
<thead>
<tr>
<th>None</th>
<th>1 time</th>
<th>2 times</th>
<th>3 times</th>
<th>4 times</th>
<th>5 times</th>
</tr>
</thead>
</table>

**Total Score ……………………………………………………..**

**IPSS-v ………………………………………………………**

**IPSS-s ………………………………………………………**

### Quality of Life (QoL).

Are you worried about your urinary problem?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If you were to spend the rest of your life with your urinary condition just the way it is now, how would you feel about that?

<table>
<thead>
<tr>
<th>Delighted</th>
<th>Pleased</th>
<th>Mostly satisfied</th>
<th>Mixed</th>
<th>Mostly Dissatisfied</th>
<th>Unhappy</th>
<th>Terrible</th>
</tr>
</thead>
</table>

### Other Associated Symptoms.

Do you feel pain when you urinate?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If yes, for how long?  

<table>
<thead>
<tr>
<th>≤ 1 month</th>
<th>2 – 3 months</th>
<th>&gt; 3 months</th>
</tr>
</thead>
</table>

Do you pass blood in urine?  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
If yes, how many episodes?  1  2 – 3  4 -5  > 5

Do you pass excess amount of urine compared with the amount of water/ fluid you take?
Yes  No

Co-Morbidities.

Have you been previously diagnosed with?

Hypertension:  yes  no  Duration

Diabetes:  yes  no  Duration

Tuberculosis:

Over the last 6 months, have you had cough > 2 weeks, coughed out blood or stayed with a person coughing for long or being treated for tuberculosis? Yes  No

Schistosomiasis:

In your childhood, did you pass blood in urine or did you live in an area where your neighbours pass blood in their urine? Yes  No

Prostatitis:

In last 3 months, have you had pains deep in your perineum or during ejaculation?
Yes  No

Have you had surgeries in the past?  Yes  No

If yes, specify ……………………………………………………………………………………………

Drug Use.

Have you been taking any of these drugs?

5α- reductase inhibitors  Yes  No

Anticholinergics  Yes  No

Family History.

Has anyone in your family suffered from

Diabetes?  Yes  No

Hypertension?  Yes  No

Prostate diseases?  Yes  No

Other diseases? Specify …………………………………………………………………………………
Social History.

Do you smoke?       Yes ☐       No ☐
If yes, how many sticks/day? …… for how long?………………
Do you drink alcohol?     Yes ☐       No ☐
If yes, what type? ……….. Quantity/week…………….. duration …………

Prostate Assessment.

Extent of prostate enlargement on digital examination: mild ☐   moderate ☐   gross ☐
Total prostate volume (abdominal ultrasound) ……………………..mls
IPP (abdominal ultrasound) …………………………………..millimetres
Post void urine (abdominal ultrasound)….…………………millilitres

Investigations/ Results.

urinalysis

Glucose………..
Nitrites………..
WBC…………../hpf
RBC…………../hpf
Pus cells……../hpf

Urine Culture. ………………………………………………………………………………………………..(culture growth)

PSA
Total…….. ng/ml
Free……..ng/ml
% free………. %.