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Relationship between prostate volume for age and urological abnormalities

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ABSTRACT

Prostate disorders such as benign prostate hyperplasia (BPH) and prostate cancer are most common in older men, others such as prostatitis occur more in younger men following infections in most cases.

This study aimed to investigate the relationship between prostate volumes for age and some abnormal consequential urological parameters such as intravesical prostatic protrusion (IVPP), post voidal residue (PVR), urinary bladder wall thickness (UBWT) due to urothelial remodeling after longstanding obstruction or urolithiasis from abnormal calcifications in the urogenital organs.

The cross-sectional study was conducted over a span of 6 months to gather this data with written consent obtained from the subjects in form of questionnaire. The estimation of prostate volume and other urological parameters involved 538 healthy divided into 2 age groups of younger adults (<60 years) and older adults (>60 years). This was achieved through trans-abdominal suprapubic ultrasonographic examinations carried out at TAK radio-diagnostic center, Kwara state. Data was analyzed using the Statistical Package for Social Sciences, version 27. A significance level of p-value (< 0.05) was adopted to determine statistical significance.

The correlation between age, prostate volume and other urological abnormalities was statistically significant.

The study established that there was a significant relationship between age and urological abnormalities.

Keywords: Prostate gland, benign prostate hyperplasia, intravesical prostatic protrusion, Post voidal residue

INTRODUCTION

Prostate disorders such as benign prostate hyperplasia (BPH) and prostate cancer are commoner in older men, others such as prostatitis occur more in younger men following infections in most cases. These diseases commonly manifests with increased prostate gland volume and extra-luminal constriction of the proximal urethral lumen resulting in urinary bladder outlet obstruction (BOO), this can then lead to backpressure effects on the upper urinary tract collecting system such as hydro-nephro-ureters as well as lower urinary tract symptoms (LUTS) (Ezeanyika, 2006). Other causes of urinary BOO includes urinary bladder stones or intraluminal urethral masses such as tumors and chronic inflammatory scars as in urethral strictures.

While prostate enlargement and urinary bladder outlet obstruction are generally not directly life-threatening, they can substantially impair a man's quality of life. Among these conditions, benign prostatic hyperplasia (BPH) is the most prevalent. However, in older men with compromised immune systems due to other factors, infections such as urosepsis arising from lower urinary tract symptoms (LUTS) can pose a significant threat to life (Platz *et al*., 1999).

The risk factors associated with BPH includes increasing body mass index (BMI) and age which also coexists with other non-communicable degenerative diseases like hypertension, dietary as well as hormonal factors have also been incriminated in these etiopathogenesis (Wang *et al*., 2022). According to recent research conducted at the Department of Anatomy, Mymensingh Medical College in Bangladesh, benign prostatic hyperplasia (BPH) and prostate carcinoma have emerged as prevalent disorders among Bangladeshi males. The results from this study indicated a notable increase in prostate gland volume with advancing age (Epsi *et al.,* 2016).

Intravesical prostatic protrusion (IVPP) has been identified as a morphometric parameter used to determine the presence of BPH (Liu *et al.,* 2017), it is characterized by upward displacement of the urinary bladder floor by the enlarged median lobe of the prostate gland corresponding to the transitional zone (Gandhi *et al.,* 2018) and IVPP is quantified into three grades as follows: – grade 1: ≤ 5mm; grade 2: 5-10mm; grade 3: > 10mm (Topazio *et al*., 2018). Post void residue (PVR) is the amount of urine left in the bladder after voluntary micturition which serves as a diagnostic tool in evaluating degree of urinary bladder obstruction or neuromuscular competence thus <50mls is termed adequate and >200mls is termed inadequate voiding in adults (Sakakibara, *et al.,* 2005)

while in the elderly 50–100mls can be considered normal (Kolman, *et al*., 1999). The clinico-epidemiologic analysis of patients with bladder outlet obstruction (BOO) in the southwest region of the Nigerian population revealed a prevailing trend of delayed presentation, leading to heightened morbidity. Notably, benign prostatic hyperplasia (BPH) emerged as the primary cause of BOO in adult men, while neurogenic bladder dysfunction was predominant among women. (Idowu *et al.,* 2023). This study aimed to investigate the relationship between prostate volumes for age and some abnormal consequential urological parameters such as IVPP, PVR, urinary bladder wall thickness (UBWT) due to urothelial remodeling after longstanding obstruction or urolithiasis from abnormal calcifications in the urogenital organs.

MATERIALS AND METHOD

This cross-sectional study for this data was carried out over a period of 6 months, estimation of the prostate volume, post-voidal residue, and intravesical prostatic protrusion of 538 subjects divided into two age groups of younger adults <60 years and older adults >60 years was performed via a trans-abdominal suprapubic ultrasonographic examination under the supervision of a professor of Radiology and urologist using a 3.5Mhz curvilinear probe of a Mindray DP 2200 digital ultrasound imaging system machine at TAK radio-diagnostic center, Ilorin, Kwara state. Informed written consent in the form of questionnaire was obtained from each subject; subjects had their age recorded.

Men with a prostate volume ≥25ml were considered to have an enlarged gland. The prostate volume was categorized as follows: ≤25ml (normal volume), and ≥25ml (abnormal volume).

Men with IVPP greater than 5mm and PVR over 200ml were considered as being susceptible to having BPH.

Statistical analysis was carried out using SPSS version 27. The collected data encompassing age, intravesical prostatic protrusion, urinary bladder wall thickness, post voidal residue and prostate volume underwent comprehensive analysis using the Statistical Package for the Social Sciences (SPSS) version 27. A significance level of p-value (< 0.05) was adopted to determine statistical significance. It is acknowledged that despite meticulous methodological practices, the possibility of inadvertent errors remains. Any such errors that may have occurred are considered unbiased and random in nature.

Ethical consideration

Informed written consent in form of questionnaire was obtained from the subjects and the study protocol approved by the ethical review committee of the University of Ilorin (ethical number: UERC/ASN/2017/1054).

RESULTS

Data obtained from 538 male participants who satisfied the inclusion criteria was studied, the mean age of younger men was 44.08±5.53 years and 66.80±6.63years for older men respectively.

From the analysis all of the abnormal urological parameters were significantly lower in younger men in comparison to their older counterparts; IVPP (t=10.660, P<0.001) VOL (t=10.352, P<0.001), UBWT (t=4.391, P<0.001) PVR (t=3.863, P<0.001) as seen in table 1.

Studies has shown that IVPP exceeding 5 mm is significantly associated with BOO (Shin *et al.,* 2013) while a prostate volume exceeding 25ml is deemed abnormal, (Mitterberger *et al.,* 2010), urinary bladder wall thickness normal value ranges from 1.55mm-2.76mm for a distended and almost empty bladder. (Jequier & Rousseau 1987). The urological parameters were graded into normal and abnormal, analysis showed that the urological status between the two groups of adults were significantly different with the older men having more percentage of abnormal urological parameters. This is shown in table 2.

Table 1. Summary statistics and t-test of mean difference in urological parameters of younger and older men

Variable	Age class	Mean	T-value	P-value
IVPP (mm)	**Younger men**	1.50±3.78	-10.660	<0.001
	Older men	7.84±7.53		
Vol (ml)	**Younger men**	30.29±31.82	-10.352	<0.001
	Older men	88.83±72.40		
UBWT (mm)	**Younger men**	2.96±1.10	-4.391	<0.001
	Older men	5.07±6.36		
PVR (ml)	**Younger men**	8.78±78.18	-3.863	<0.001
	Older men	69.06±201.45		

Table 2: **Summary statistics and chi-square analysis of distributional difference in urological status of younger and older men**

Urological parameters			Normal (%)	Abnormal (%)		P-value
IVPP (mm)	Younger men		397 (92.5)	32 (7.5)	132.56	< 0.01
	Older men		91 (51.4)	86 (48.6)		
	Total		488 (80.5)	118 (19.5)		
Vol (ml)	Younger men		249 (58.0)	180 (42.0)	111.777	< 0.01
	Older men		19 (10.7)	158 (89.3)		
	Total		268 (44.2)	118 (55.8)		
UBWT (mm)	Younger men		239 (55.7)	190 (44.3)	107.292	< 0.01
	Older men		17 (9.6)	160 (90.4)		
	Total		256 (42.2)	118 (57.8)		
PVR (ml)	Younger men		426 (99.3)	3 (0.7)	23.655	< 0.01
	Older men		162 (91.5)	15 (8.5)		
	Total		588 (97.0)	118 (3.0)		

DISCUSSION

The primary objective of this study was to investigate the potential relationship between age and urological abnormalities susceptible to benign prostatic hyperplasia (BPH) in Ilorin, Kwara State, Nigeria. The study findings indicate a noteworthy association between age and urological abnormalities.

A significant positive correlation was observed between clinical presentation features and BOO etiology, suggesting that these features could serve as reliable indicators. Although full urodynamic studies are considered the gold standard for diagnosing BOO, this correlation underscores the potential of clinical features in predicting BOO accurately. The substantial burden of BOO in this context underscores the urgent need for enhanced health education and awareness campaigns to encourage early diagnosis, thus alleviating this burden on the population (Idowu *et al.,* 2023).

Furthermore, a notable observation was made regarding urological parameters relevant to BPH, revealing a more pronounced trend in older adults compared to middle-aged adults, aligning with the findings of Lee et al. (2017) whose analysis revealed a combined prevalence of 26.2% (95% CI: 22.8–29.6%), while acknowledging variations in prevalence due to diverse BPH definitions, survey methods, response options, geographical distributions, and participant demographics.

Despite these variations, a consistent trend emerged: BPH prevalence increases with advancing age.

Conclusion

It is concluded that there is a significant correlation between age and urological abnormalities associated with BPH.

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