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Original article

Prevalence of clinical benign prostatic hyperplasia amongst community-dwelling men in a South-Western Nigerian rural setting: A cross-sectional study

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KEYWORDS
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Abstract
Objectives: To determine the prevalence of benign prostatic hyperplasia (BPH) and correlates International Prostate Symptom Score (IPSS), peak/maximum flow rate (Qmax), quality of life (QoL) score and prostate volume (PV) amongst male adults in a rural setting in Nigeria.
Subjects and methods: This is a community-based cross-sectional survey conducted amongst 615 men. Subjects selected using multi-staged sampling technique were interviewed for presence of lower urinary tract symptoms (LUTS) in their houses. Severity of symptoms was assessed using International Prostate Symptom Score (IPSS) questionnaire. Digital rectal examination (DRE), uroflowmetry and prostate scan were carried out in nearby primary health centres. Criteria for diagnosis of BPH were prostatic volume $\geq 30\,cm^3$ with moderate/severe LUTS and/or Qmax < 15 mL. Relationships between variables were determined using Pearson's Chi-squared and Fisher's exact tests.

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Results: The overall prevalence of LUTS was 57.4% while 28.5% had moderate-to-severe IPSS with average score of 12.3 ± 5.2. More than half (56.1%) reported impaired QoL with average score of 3.4 ± 1.3. The DRE and ultrasound prevalences of enlarged prostate were 68.3% and 64.9% respectively. About 29% had abnormal Qmax. Both QoL and Qmax had significant relationship with IPSS ($p < 0.001$) while none exists between prostate size and IPSS ($p = 0.339$). The overall prevalence of BPH was 237 per 1000 men (23.7%). The age-specific prevalence rates increased from 104 per 1000 men in the fifth decade to 429 per 1000 in men >90 years.
Conclusion: The burden of clinical BPH is very high amongst Nigerian men and the prevalence increases with age. There is need for more public awareness because of the significant impairment in the QoL associated with BPH symptoms.

Introduction

Benign prostatic hyperplasia (BPH) is the most common neoplasm and a significant cause of urinary symptoms in the adult males [1]. Enlargement of the prostate occurs with age leading to bladder outlet obstruction, which manifests with symptoms of impaired urine voiding and/or storage referred to as lower urinary tract symptoms (LUTS). Although BPH is not life threatening, its clinical manifestation as LUTS reduces the patient's quality of life (QoL) [2].

The prevalence of BPH varies and depends on the criteria as well as research settings. Many individuals with histological BPH are asymptomatic making clinical BPH the appropriate terminology when conducting research on BPH in the community [3]. Several community-based epidemiological studies have documented the prevalence of BPH ranging from 30 to 50% and 18.1 to 25.3% in hospital-based and community-based settings, respectively [4–6]. However, such studies are relatively scarce in sub-Saharan Africans where almost all the existing reports are hospital-based settings. Secondly, there are differences in the reported prevalence of LUTS and BPH among countries, possibly arising from cultural or linguistic differences. Because this finding suggests that the results in one country might not be applicable to others, it is necessary to investigate the natural history of LUTS in each one [5]. As the population of ageing men increases, BPH has become an important topic of public health concern. The only community-based study in Nigeria utilized the International Prostate Symptom Score (IPSS) as the only tool to determine the prevalence of BPH [7]. Another study conducted amongst Ghanaian men utilized IPSS and prostatic enlargement by digital rectal examination (DRE) [8]. The data in these studies were not collected using standardized tools and clinical definitions; therefore the diagnostic and epidemiological values of these studies are limited. Therefore, the aim of this study was to determine the prevalence of BPH using standardized criteria of IPSS, peak/maximum flow rate (Qmax) and ultrasound measured prostate volume (PV) amongst community-dwelling men in a rural setting. It also aimed at establishing statistical associations between these variables and analyzed changes with age.

Subjects and methods

This was a population-based descriptive cross-sectional survey designed to assess the prevalence of clinical BPH amongst community-dwelling male adults in Ido/Osi Local Government Area (L.G.A.) of Ekiti state, Southwest, Nigeria. Approval for the study was obtained from the research and ethics committee of Lagos University Teaching Hospital, Lagos. Additional approvals were obtained from authority of the L.G.A. as well as the traditional chiefs of the towns selected for the study. The study population comprises of all male adults above the age of 40 years who provided written consent to participate. A multi-stage sampling technique was used. First, three of the eleven electoral wards were selected followed by selection of a town in each ward by simple random sampling. About 25–40 streets were selected in each town also by simple random sampling while about 3–8 houses were selected in each street by systematic sampling technique. Where more than one man lives in any selected house, one of them is selected by simple balloting. All selected men were interviewed in their houses for LUTS using a semi-structured questionnaire including the IPSS questionnaire. Subjects were then mobilized to nearby primary healthcare centre in each town where they had a DRE carried out by two urologists to document the presence of enlarged prostate. Physical examination was followed by prostate scan to determine the prostate volume performed by a radiologist using a portable SONOSCAPE A5 ultrasound machine with a 3.5 MHz abdominal probe. They all had uroflowmetry using UROCAP III (Laborie, Canada) uroflowmeter. Data collection took place on three consecutive weekends in the selected three communities. Data were analyzed with SPSS version 18. The diagnostic criteria for clinical BPH were prostatic volume of ≥30 mL with moderate/severe IPSS (IPSS ≥ 8) and/or Qmax <15 mL/s; without symptoms, physical signs and radiologic findings suggestive of prostate cancer. Subjects already on treatment for BPH were included irrespective of their symptom severity. Pearson's chi-squared and Fisher's exact tests were used to establish relationships between variables with level of significance (p) set at 0.05.

Results

A total of 658 adult males were recruited but 615 completed the study. Ages of the participants ranged from 41 to 93 years with a mean of 64.3 ± 12.6 years (Table 1).

Three hundred and fifty-three men (57.4%) had at least one LUTS while 256 (41.6%) were asymptomatic. Two hundred and ninety-three (47.6%) had at least one irritative symptom while 238 (38.7%) had at least one obstructive symptom. Of all the participants, 175 (28.5%) were highly symptomatic consisting of 172 (48.7%) with

Table 1 Age distribution of the participants.

Age range (years)	Frequency (*n*)	Per cent (%)
41–50	115	18.7
51–60	153	24.9
61–70	165	26.8
71–80	112	18.2
80–90	49	8.0
>90	21	3.4
Total	615	100.0

moderate/severe symptoms (IPSS ≥ 8) and 3 on indwelling catheter for acute urinary retention. Average symptom score was 12.3 ± 5.2. A statistically significant relationship was found between age and IPSS (Table 2). Twenty-two of the participants were already on medication(s) for BPH.

Four hundred and twenty (68.3%) had abnormally enlarged prostate while 195 (31.7%) had no prostate enlargement by DRE estimation. Five participants had hard, nodular and craggy prostates with obliterated median groove and/or fixed rectal mucosa suggestive of malignancy.

Table 3 shows the prevalence of prostatic enlargement defined as prostate volume ≥ 30 mL using trans-abdominal ultrasound estimation. There was a statistically significant association between increasing age and prostate volume ($p < 0.001$). Of the 399 with ultrasound finding of enlarged prostates, only 279 (69.9%) had at least one symptom constituting 79% of the symptomatic men. One hundred and twenty asymptomatic men had enlarged prostates.

Overall, 179 of the participants (29.1%) had abnormal Qmax with the cut off mark of 15 mL/s set for the study. All these men were symptomatic while the remaining 174 symptomatic participants had Qmax ≥15 mL/s (Table 4).

The QoL was significantly impaired among men with IPSS ≥ 8 (average score = 3.4 ± 1.3). The relationship between QoL score, PV, Qmax and IPSS amongst the symptomatic men is depicted in Table 5. Both QoL score and Qmax had significant relationship with IPSS ($p < 0.001$). There is also a positive relationship between prostate enlargement and presence or absence of symptoms ($p < 0.001$). However, further analysis of the PV and IPSS yielded no statistically significant association ($p = 0.339$).

Of the 615 men, 126 (20.5%) did not meet any of the criteria for the diagnosis of BPH while 489 (79.5%) had at least one. One hundred and fifty (24.4%) had combination of at least two criteria while 114 (18.5%) had combination of the three (Fig. 1). Based on the criteria for diagnosis of BPH, 143 men met these criteria in this study. However, five men with clinical features suggestive of malignancy were excluded. Eight of the 22 men on medication for BPH had mild IPSS and normal Qmax while 14 of them still met the criteria. With the inclusion of these eight men i.e. (143 − 5 + 8 = 146), the percentage of men with clinical BPH was 23.7% with an estimated prevalence of 237 per 1000 adult men.

The prevalence of BPH was 104 per 1000 men in the fifth decade of life and increased to the highest prevalence of 429 per 1000 men in the ninth decade (Fig. 2). There was a significant association between the prevalence and increasing age ($p < 0.030$).

Table 3 Distribution of prostate volume versus age groups.

Age (years)	PV (mL)			
	<30 mL *n* (%)	≥30 mL *n* (%)	Total *n* (%)	*p*-value
41–50	86 (74.8)	29 (25.2)	115 (100.0)	<0.001
51–60	61 (39.9)	92 (60.1)	153 (100.0)	
61–70	42 (25.5)	123 (74.5)	165 (100.0)	
71–80	23 (20.5)	89 (79.5)	112 (100.0)	
81–90	4 (8.2)	45 (91.8)	49 (100.0)	
>90	0 (0.0)	21 (100.0)	21 (100.0)	
Total	216 (35.1)	399 (64.9)	615 (100.0)	

Table 4 Distribution of Qmax amongst the participants.

Status	Qmax (mL/s)	Frequency (*n*)	Per cent (%)
Abnormal (0–14)	Not done (on catheter)	3	0.5
	0–4	23	3.7
	5–9	81	13.2
	10–14	72	11.7
		179	29.1
Normal (≥15)	15–19	161	26.2
	20–24	132	21.5
	25–29	99	16.1
	≥30	44	7.2
		436	70.9
Grand total		615	100.0

Table 2 Distribution of IPSS versus age range of participants.

Age group	No symptom	Mild IPSS (1–7)	Moderate IPSS (8–18)	Severe IPSS (19–35)	On indwelling catheter	Total (*n*/%)
41–50	94 (81.7)	17 (14.8)	4 (3.5)	0 (0.0)	0 (0.0)	115 (18.7)
51–60	90 (58.8)	35 (22.9)	22 (14.4)	6 (3.9)	0 (0.0)	153 (24.9)
61–70	53 (32.1)	66 (40.0)	33 (20.0)	12 (7.3)	1 (0.6)	165 (26.8)
71–80	19 (17.0)	39 (34.8)	40 (35.7)	12 (10.7)	2 (1.8)	112 (18.2)
81–90	6 (12.2)	21 (42.9)	14 (28.6)	8 (16.3)	0 (0.0)	49 (8.0)
>90	0 (0.0)	0 (0.0)	13 (61.9)	8 (38.1)	0 (0.0)	21 (3.4)
Total	262 (42.6)	178 (28.9)	126 (20.5)	46 (7.5)	3 (0.5)	615 (100)

$p < 0.001$.

Table 5 Association between QoL score, PV, Qmax and IPSS.

Variable		Severity of symptoms					*p*-value
		No symptom	Mild (0–7)	Moderate (8–19)	Severe (20–35)	Total	
Quality of life score	Good (0–2)	262 (100.0)	113 (63.5)	34 (27.0)	8 (16.3)	417 (67.8)	<0.001*
	Fair (3–4)	0.0 (0.0)	65 (36.5)	53 (42.0)	10 (20.4)	128 (20.8)	
	Poor (5–6)	0.0 (0.0)	0.0 (0.0)	39 (31.0)	31 (63.3)	70 (11.4)	
		262 (42.6)	178 (28.9)	126 (20.5)	49 (8.0)	615 (100.0)	
Prostate size	Normal	126 (26.7)	143 (64.0)	4 (13.5)	3 (30.6)	216 (35.1)	<0.001**
	Enlarged	136 (73.3)	35 (36.0)	122 (86.5)	46 (69.4)	399 (64.9)	
		262 (42.6)	178 (28.9)	126 (20.5)	49 (8.0)	615 (100.0)	
Qmax	Normal	262 (100.0)	136 (76.4)	34 (27.0)	4 (8.2)	436 (70.9)	<0.001*
	Abnormal	0.0 (0.0)	42 (23.6)	92 (73.0)	45 (91.8)	179 (29.1)	
		262 (42.6)	178 (28.9)	126 (20.5)	49 (8.0)	615 (100.0)	

* Fisher's exact test.
** Pearson's chi-squared test.

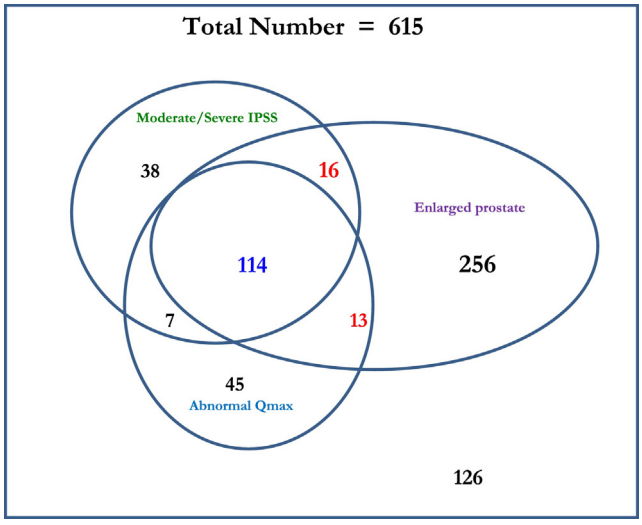

Figure 1 Diagnosis of clinical BPH using different diagnostic criteria.

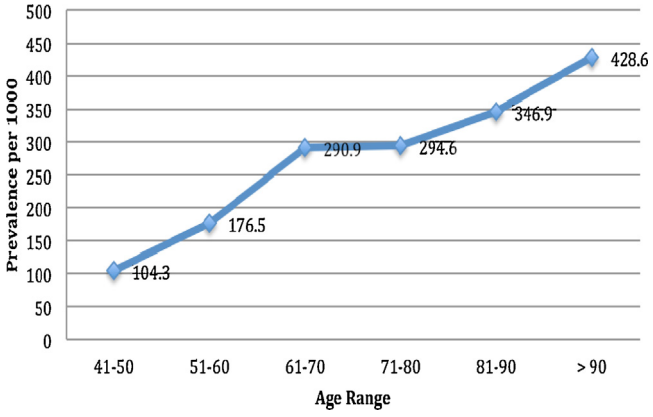

Figure 2 Age-specific prevalences of clinical BPH per 1000 men.

Discussion

Benign prostatic hyperplasia is the most common benign neoplasms in elderly men worldwide [1]. It is a significant health care problem due to its high prevalence and the cost associated with its treatment. Given the ageing of populations worldwide, the cost burden associated with the treatment of LUTS suggestive of BPH will increase substantially over the next few decades [9]. This present study is the first in Nigeria to determine the prevalence of BPH using other diagnostic criteria other than IPSS.

The prevalence of LUTS in middle-aged and elderly men has been documented to be high, ranging from 11 to 65% in many studies [4–6]. In our study, the overall prevalence of LUTS was 57.4%, which is similar to the prevalence reported in other studies [4,5]. Like other studies, the storage or irritative symptoms were more prevalent among the participants than obstructive or voiding symptoms [4–6]. A major criterion in the diagnosis of BPH is symptom severity assessed by the IPSS. Using this pre-defined cut-off score, 28.5% of all participants experienced moderate/severe symptoms regarded as significant LUTS corresponding to IPSS of ≥8. This includes the three men on indwelling urethral catheter at the time of the study. Though the prevalence of moderate/severe symptom was higher than documented in some studies which range between 16.6 and 24.4%, it however agrees with them in term of increasing prevalence with age [5]. When the association between age and IPSS was examined, there was a tendency for moderate/severe LUTS with increasing age.

Clinical BPH may not be life threatening; however, its manifestation as LUTS interferes with QoL [2]. More than half (56.1%) of the symptomatic men in this study reported impairment in their QoL due to symptoms of BPH while about one-fifth, 19.8%, had poor QoL. Like reported in other studies, the severity of BPH-related symptoms was significantly related to QoL. In fact, about 89.5% of those who had moderate/severe symptoms formed the population of the one-fifth with poor QoL while all men with severe symptoms and those on catheter had poor QoL scores. The severity of symptoms was significantly associated with QoL score. The higher the IPSS, the poorer the QoL and the lower the urine flow rate. Furthermore, the

I-PSS had no significant association with the prostate size. In fact, almost two-thirds of 399 men with radiological evidence of enlarged prostates had no or mild symptoms and normal Qmax values. These findings are in conformity with earlier reports [10,11].

The prevalence of prostate enlargement by DRE in this study was 68.3%. This is higher than 62.3% reported in a study conducted by Chokkalingam et al. [8] amongst Ghanaians. This may not be unconnected with the subjective error and inter-observer variability inherent in DRE. To minimize this, two urologists performed the DRE in our study. The prevalence of prostatic enlargement by trans-abdominal ultrasound was 64.9%. There was a great correlation between the DRE and ultrasound estimation of the prostatic size, however DRE seems to overestimate the prostate size as some men with DRE findings of enlarged prostate eventually had a normal prostatic volume of <30 mL with ultrasound estimation. This suggests that DRE provides a crude estimate of the prostatic size and a more accurate method is required for accurate determination of the PV [12]. The prevalence of prostatic enlargement increased with age in conformity with earlier reports [3,5]. Using the ultrasound findings, the prevalence of enlarged prostate increased steadily from 25.2% in the fifth decade to 91.8% ninth decade of life respectively. All the participants beyond ninth decade of life had enlarged prostates. There was a statistically significant increase in the proportion of men with a volume of ≥30 mL with increasing number of decades of life ($p < 0.001$). These findings conform to the natural history of benign prostatic enlargement (BPE) documented in other continents other than African communities [13–16].

The only way to determine objectively whether men are urodynamically obstructed is by performing detrusor pressure-uroflow studies, which unfortunately are too invasive for use in large population studies. Therefore, the determination of Qmax is generally used as screening test when bladder outflow obstruction is suspected. Like LUTS, other problems other than BPH can cause abnormal flow rate and this should be borne in mind when interpreting results of uroflowmetry. In this study, more than two thirds (70.9%) of all participants had a satisfactory Qmax of ≥15 mL/s while 28.1% had abnormally low Qmax (<15 mL/s). The percentage of men with abnormal Qmax increased significantly to 50.4% amongst the symptomatic men. The Qmax was found to correlate well with symptom severity and QoL scores ($p < 0.001$) but not with PV. Age factor, which has reciprocal or inverse relationship with Qmax and IPSS but direct relationship with prostatic size, may be the reasonable explanation for this finding. This is consistent with the findings of other researchers [17,18].

It is important to note that BPE is not synonymous with BPH as almost all men above middle age will have some degrees of prostatic enlargement [19]. However, not all of these men will have symptoms. In our study, only a third (32.6%) of men with enlarged prostate had moderate to severe symptoms. An additional fifth of this group of men had mild symptoms while the rest were purely asymptomatic. Even though men with enlarged prostate are more likely to have LUTS, the severity of their symptoms does not correlate with their prostate size. Several other studies have reported this [19,20]. In fact, about 18% of all the men who had enlarged prostates were completely asymptomatic. This has shown that BPE- a concept that emanated from this observation in earlier studies is clearly different from clinical BPH. In addition, five participants who reported mild symptom severity were found to have abnormally low Qmax. This confirms the widely believed subjective nature and limitation of the IPSS, which may be affected by method of questionnaire administration, culture, language and other factors [21–23]. This suggests that it may be better to incorporate uroflowmetry findings in the criteria for the diagnosis of BPH to avoid under- or over-estimation. Uroflowmetry is a relatively objective and simple way of demonstrating lower urinary tract obstruction. Altogether, ninety (14.6%) subjects had either moderate/severe LUTS or abnormal Qmax or both, but no prostatic enlargement. This observation points to the fact that BPH is not the only cause of LUTS in ageing men. These men require further investigations to rule out other possible causes of LUTS like urethral stricture disease, prostate cancer, urinary tract infection, neuropathic bladder and urolithiasis. This is also not surprising because women who do not have prostate have LUTS from non-prostatic causes [24].

Generally, the three criteria for diagnosing BPH overlap to varying degrees in different patients. The diagnosis of clinical BPH includes taking a medical history of the patient and recording the IPSS, DRE, Qmax and ultrasound results, but it is difficult to define BPH from these tests. Furthermore, it is impossible to choose any measure that is superior to the others in terms of efficacy [20]. Hence, researchers have reported data on the prevalence of BPH according to their own definitions. The prevalence of clinical BPH vary from a relatively low prevalence of 10.3% to a high prevalence of 43% depending on the criteria utilized, country and age range of the study [6,25]. Despite the abundance of information, prevalence of BPH using standard criteria has not been documented in Nigerian and Sub-Saharan African populations. Using the criteria, which took into consideration the acceptable values of these parameters, BPH is defined by finding of an enlarged prostate ≥30 mL with moderate-to-severe LUTS (I-PSS > 8) and/or decreased Qmax of <15 mL/s [5,26,27]. Of the 615 participants, only 146 were diagnosed to have clinical BPH based on the criteria stipulated above. From these data, the estimated prevalence of clinical BPH in this study was 23.7% or 237 per 1000 men. This is higher than the prevalence of 11.7% documented in a study amongst Spanish men [26] and 10.3% in another study in Netherlands [25]. It is also slightly higher than the reported prevalence 21.0% in Jeju Island, South Korea [5] and of 19.7% in Korea [28]. However, it is very similar to the prevalence of 23.5% in Pingliang, China [4]. These studies utilized the same criteria with ours [4,5,28]. On the other hand, the prevalence in our study is lower than the prevalence of 25.3% reported amongst Scottish men possibly due to use of 20 mL as the cut-off volume for prostatic enlargement in their own study [6]. The difference in the prevalence rates may also be attributable to differences in the study designs regarding sample selection and diagnostic criteria used for case definition to estimate disease prevalence. The prevalence rate in this study, though higher, was not significantly different from rates in the other countries using the same criteria and age range [4,5].

Benign prostatic hyperplasia is a disease of ageing men. There is hardly any study that reported contrary opinion on the positive association between age and occurrence of BPH. In our study, the age-specific prevalence rates increased from 104 per 1000 men in the fifth decade of life to 429 per 1000 men above ninety years. The increase was linear from the fifth to the seventh decade before it plateaus and increased in the eight decade of life again. This concurs with the findings in different parts of the world [25,29]. Although the absolute prevalence differs widely among studies, suggesting some possible cultural differences in reporting urinary symptoms, the strikingly consistent age-related increases among studies

parallel the age-related increase in prostate volume in autopsy studies [29].

Conclusions

The burden of LUTS and BPH amongst Nigerian men is very high and irritative symptoms were more prevalent than obstructive symptoms. The overall prevalence of BPH in this study was 23.7% or 237 per 1000 men and the age-adjusted prevalence increases with increasing age. Very few of the men diagnosed in this study were on medication for BPH suggesting the need for more public awareness about this benign disease with manifestations that can affect QoL adversely.

Ethical approval

This research and consent forms along with related materials were reviewed and given approval by the Health Research and Ethics Committee of Lagos University Teaching Hospital, Lagos, Nigeria.

Source of funding

Nil.

Conflicts of interest

None.

Authors' contributions

Having drafted the entire manuscript single-handedly, R.W. Ojewola endeavored every task along with fellow authors. The study concept and research design together with critical review of the manuscript works were shared among R.W. Ojewola, E.S. Oridota, K.H. Tijani, E.A. Jeje and M.A. Ogunjimi.

Data acquisition, collection, analysis and interpretation were shared among R.W. Ojewola, O.S. Balogun, T.O. Alabi, A.O. Ajayi, and T.O. Olajide. E.S. Oridota also contributed towards data analysis and interpretation works. In addition to making critical review of the manuscript, E.O. Ogundare participated in data acquisition/collection.

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