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Correlation between the severity of erectile dysfunction and prostate size in patients with benign prostatic enlargement

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Abstract

Background: Erectile dysfunction (ED) is persistent inability to achieve and maintain an erection for sufficient satisfactory intercourse. Lower urinary tract symptoms (LUTS) are defined as a constellation of storage, voiding and post-micturition symptoms following bladder outlet obstruction. Preservation of sexual function remains an important component of quality of life and should be considered in the management of patients with benign prostatic enlargement (BPE), and many data report evidence of a link between ED and BPE. This study aimed to evaluate the link between ED, size of the prostate and symptom in patients with BPE.

Methods: By simple random sampling, patients who presented at the Urology Clinic of the University of Abuja Teaching Hospital, Gwagwalada, with BPE were assessed for the presence of ED. Three questionnaires (a proforma, the IIEF-5 and the IPSS) were administered to all the patients that met the inclusion criteria to objectively assess ED and LUTS due to BPE without bias. Data obtained were analyzed using Statistical Package for Social Sciences version 20.0. *P* value of less than 0.05 shall be considered statistically significant.

Results: One hundred and seventeen male patients with BPE were enrolled for the study. Ninety patients (76.9%) had ED while twenty-seven patients (23.1%) had no ED. Mean age of patients with severe ED was 64.00 years \pm 7.07 while the mean age of patients with moderate ED was 64.13 years \pm 7.26. Mean age of patients with mild to moderate ED, mild ED and no ED was 64.62 years, 59.90 years and 57.96 years, respectively. Patients with severe ED had the highest mean prostate volume of 122.95 cm³ \pm 40.16. Mean prostate volume of 85.24 cm³ \pm 40.23 was noted in patients who had moderate ED while a mean prostate volume of 76.42 cm³ \pm 26.45 and 60.35 cm³ \pm 21.39 was noted in patients with mild to moderate ED and mild ED, respectively. Patients with no ED had a mean prostate volume of 49.75 cm³ \pm 15.55. *P* value (0.001) was significant.

Conclusion: This study shows that erectile function has a direct relationship with prostate size. There was a positive correlation between ED and prostate size. Adopting a holistic approach in the management of ED and BPE will have laudable impact on patients' performance.

Keywords: Erectile dysfunction, Benign prostatic enlargement, Prostate volume, Lower urinary tract symptoms

1 Background

Erectile dysfunction (ED) is defined as persistent inability to achieve and maintain an erection sufficient for satisfactory intercourse [1]. Sexuality is an essential aspect of a couple's relationship and has a significant impact on quality of life (QoL) [2]. Prevalence of ED increases as men grow older. In men older than 70 years, the

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prevalence is as high as 71% compared to 9% prevalence in men younger than 40 years [3]. ED affects sexual performance and can cause significant relationship problems among couples impacting negatively on QoL [4, 5].

The National Institute of Health and Clinical Excellence (NICE) guidelines define LUTS as comprising storage, voiding and post-micturition symptoms affecting the lower urinary tract due to bladder outlet obstruction [6]. Voiding symptoms include weak or intermittent stream, straining, hesitancy, terminal dribbling and incomplete emptying while storage symptoms include urgency, increased frequency, urge incontinence and nocturia. The major post-micturition symptom is post-micturition dribbling which is bothersome [6]. In the Boston Area Community Health Survey, BPE prevalence increased from 8% in men aged 30–39 years to 35% in men aged 60–69 years [7]. Many epidemiological analyses provide overwhelming evidence of link between ED and BPE and possible etiopathogenic mechanisms [8]. Owing to the strong link between ED and BPE, patients presenting with one of these conditions should be routinely screened for the other condition [9]. Recent data found that for every decade, the percentage of men with moderate (IPSS = 8–19) or severe (IPSS \geq 20) LUTS increased and for each IPSS grouping, the frequency of sexual activity declined with age, with increased prevalence of ED [10]. A study carried out in Nigeria supports the link between ED and prostatic enlargement and further attributes the high prevalence of ED to the obstructive urinary symptoms from the bulk of the adenoma with ED occurring in 71% of the patients [11]. More so, recognition of possible link between ED and prostate size will improve patient and partners quality of life (QoL).

Medical and surgical treatment of symptomatic BPE can affect sexual function resulting in loss of libido and ED including ejaculatory disorders. A recent clinical trial found that Silodosin (a newer alpha blocker) is associated with higher incidence of sexual side effects including retrograde ejaculation [12]. ED remains the most volunteered side effect in most patients on treatment with finasteride and doxazosin [13, 14]. Many men with ED and/or symptomatic BPE may also have other health problems and may be receiving treatment with drugs such as antipsychotic agents, antihypertensive, antidepressants, beta blockers, antihistamine, Parkinson disease medications and muscle relaxants that have associated sexual adverse events [15, 16].

With the increasing life expectancy and population of elderly in Nigeria, it becomes a concern to consistently evaluate patients in a holistic manner. In clinical practice, International Prostate Symptom Score (IPSS) remains a vital tool for assessing LUTS due to BPE. International Index of Erectile Function (IIEF-5) is a validated tool for

assessing ED. The worse the voiding symptoms due to the bulk of the adenoma with increase in prostate size, the worse the impaired erectile function in men aged 40 and above [17, 18].

In Calabar, South-South Nigeria, BPE was noted in 74.3% with prostatic pathology, occurring in men greater than 40 years [19]. Similar study in Benin City showed that BPE was the most common tumor among aging men [20]. Patients greater than 45 years have three times more likelihood to have ED compared to patients less than 45 years [21]. In Lagos, South West Nigeria, 74.2% of patients with prostatic pathology had BPE [22]. This study is focused to establish the correlation between ED and prostate size in patients with symptomatic BPE and act as a stimulant to other researchers to explore in Nigeria.

2 Methods

This study was carried out in the Urology Division of the Department of Surgery (BLINDED FOR PEER REVIEW). This was a prospective study over a period of 1 year beginning from October 2016 to September 2017. During this period, patients seen in the urology clinic with BPE were assessed for erectile dysfunction and those that fulfilled the inclusion criteria were recruited for the study.

3 Inclusion criterion

1. Patients with symptomatic BPE.

4 Exclusion criteria

1. Patients with BPE coexisting with other causes of LUTS (example: prostate cancer, urethral stricture, bladder pathologies).
2. Paraplegic patients.
3. Chronic pelvic pain.
4. Patients on psycho-tropics, antiandrogens, antihypertensives and diuretics especially thiazide medications.
5. All patients that smoke cigarette or take alcohol.
6. Patients with past history of major pelvic injury.
7. Patients with past history of poorly treated priapism.
8. Patients with co-morbid conditions like hypertension and diabetes mellitus.
9. Patients on urethral catheter.

Informed consent was obtained. Approval for the study was granted by the hospital ethical committee. Two structured questionnaires (IPSS and IIEF-5) were utilized. A proforma was designed to obtain the relevant information, viz. biodata, prostate size/volume, risk

factors such as hypertension, diabetes mellitus, coronary heart disease, myocardial infarction and obesity. The 3 questionnaires were administered to those that met the inclusion criteria. Those who could not read English language were assigned an interpreter.

The transrectal ultrasound was performed in left lateral position. The bladder was full with the patient feeling the urge to void. A properly lubricated 7.5 MHz rectal probe was used, and all TRUS was performed with the Mindray M5 hand-carried color Doppler diagnostic ultrasound system which is available in the unit. TRUS also aided in confirming diagnosis, especially for new patients. Those with hypoechoic, isoechoic and nodular prostatic features suggesting malignancy were excluded from the study. The prostate volume was calculated using the ellipse shape formula ($0.523 \times \text{transverse diameter} \times \text{anterior posterior diameter} \times \text{longitudinal diameter}$). The prostate volume was measured in cm^3 which is equivalent to the weight in grams. Patients were asked for the history of diabetes, and both fasting blood sugar and 2-hour post-prandial blood sugar were carried out to exclude diabetes in the patients.

Completed questionnaires/proforma of all eligible patients with BPE were collated and the data analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0 and *P* values less than 0.05 were considered to be statistically significant. Student’s paired T test and Chi-square were used to compare means where appropriate. Correlation between ED (IIEF-5), LUTS (IPSS) and prostate size was determined using the Spearman rank and Pearson’s correlation. The result is represented in the form of tables and charts.

5 Results

One hundred and seventeen male patients with BPE who met the inclusion criteria were enrolled for the study. The patients fell within the age ranges of 43 to 75 years with a mean age of 61.48 years \pm 7.24. Majority of the patients

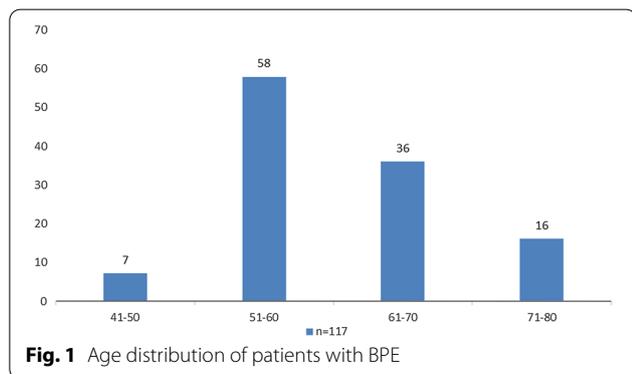


Fig. 1 Age distribution of patients with BPE

fell within the age range of 51–60 years with only seven patients below 50 years of age as shown in Fig. 1.

Ninety patients (76.9%) had erectile dysfunction (ED) while twenty-seven patients (23.1%) had no ED. Among patients that had ED, 2 (2.2%) patients had severe ED, 15 (16.7%) patients had moderate ED, 35 (38.9%) patients had mild to moderate ED and mild ED was seen in 38 (42.2%) of patients as shown in Fig. 2.

Mean age of patients with severe ED was 64.00 years \pm 7.07 while the mean age of patients with moderate ED was 64.13 years \pm 7.26. Mean age of patients with mild to moderate ED, mild ED and no ED was 64.62 years, 59.90 years and 57.96 years, respectively, as shown in Table 1. The *P* value was 0.001. This was statistically significant and shows strong evidence against the null hypothesis.

The two patients with severe (ED IIEF-5 score of 5) were aged 59 years and 69 years. The patients who had the highest IIEF-5 score of 25 were within the age range of 54–60 years. The severity of ED increased with age. Seven patients were between the ages of 41–50 years and 71.4% of them had ED while 65.5% of patients that were between the age range of 51–60 years had ED. 88.9% and 93.7% of patients between the age range

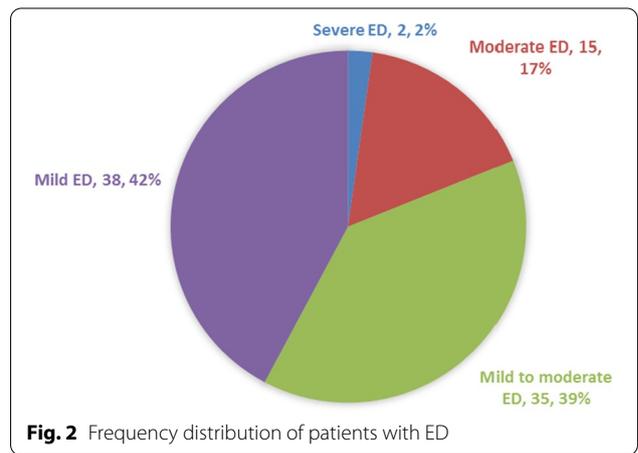


Fig. 2 Frequency distribution of patients with ED

Table 1 Mean age versus severity of ED in 117 patients with BPE

Category of ED	Frequency (n = 117)	Mean age in years	Standard deviation
Severe ED	2	64.00	7.07
Moderate ED	15	64.13	7.26
Mild to moderate ED	35	64.63	7.40
Mild ED	38	59.90	7.05
No ED	27	57.96	5.16

P value = 0.001

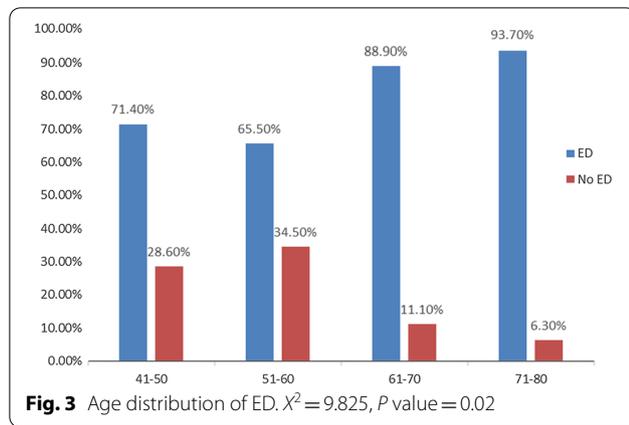


Fig. 3 Age distribution of ED. $\chi^2 = 9.825$, P value = 0.02

Table 2 Correlation between age and ED

	Spearman's r value	P value	Interpretation
Age versus ED	0.269	0.013	Weak positive correlation

Table 3 Mean prostate volume by age in 117 patients with BPE

Age grouping (years)	Frequency (n = 117)	Mean prostate volume (cm ³)	Standard deviation
41–50	7	47.99	12.71
51–60	58	61.18	24.44
61–70	36	77.06	30.16
71–80	16	73.57	36.19

P value = 0.012

of 61–70 years and 71–80 years, respectively, had ED as shown in Fig. 3. The P value (0.02) was statistically significant.

There was a weak direct correlation between age and ED. The P value (0.013) was statistically significant as shown in Table 2.

The smallest prostate volume observed was 30.36 cm³ equivalent to 30.36 g while the largest prostate volume was 158.00 cm³ which was also equivalent to 158.00 g. Mean prostate volume increased with advancing age, and prostate volume of 77.06 cm³ ± 30.16 was observed in patients between the ages of 61–70 years as shown in Table 3. The P value (0.012) was also statistically significant as depicted in Table 3.

Patients with severe ED had the highest mean prostate volume of 122.95 cm³ ± 40.16. Mean prostate volume of 85.24 cm³ ± 40.23 was noted in patients who had moderate ED while a mean prostate volume of 76.42 cm³ ± 26.45 and 60.35 cm³ ± 21.39 was noted in patients with mild to moderate ED and mild ED,

Table 4 Severity of ED and mean prostate volume in 117 patients with BPE

Category of ED	Frequency (n = 117)	Mean prostate volume (cm ³)	Standard deviation
Severe ED	2	122.95	40.16
Moderate ED	15	85.24	40.23
Mild to moderate ED	35	76.42	26.45
Mild ED	38	60.35	21.39
No ED	27	49.75	15.55

P value = 0.001

Table 5 Correlation between LUTS/IPSS and prostate volume

IPSS	Frequency (n = 117)	Mean prostate volume (cm ³)	Standard deviation
Mild	24	59.18	30.94
Moderate	63	67.18	28.45
Severe	30	72.77	26.68

P value = 0.224

respectively. Patients with no ED had a mean prostate volume of 49.75 cm³ ± 15.55. P value (0.001) was significant as depicted in Table 4.

The prostate volumes of the two patients with severe ED were 151.34 cm³ and 94.55 cm³. Five patients had IIEF-5 score of 25, and the prostate volumes of these patients were 32.60 cm³, 34.23 cm³, 39.55 cm³, 40.50 cm³ and 60.25 cm³. The patient with the smallest prostate volume of 30.36 cm³ had mild ED (IIEF-5 = 17) while the patient with the largest prostate volume of 158.00 cm³ had moderate ED (IIEF-5 = 8).

LUTS was evaluated using IPSS. Twenty-four patients (20.5%) had mild IPSS, 63 patients (53.8%) had moderate IPSS while severe IPSS was observed in 30 patients (25.6%). The P value (0.224) was not statistically significant and indicates a weak evidence against the null hypothesis as depicted in Table 5.

IPSS correlation with mean prostate volume showed that patient with mild symptoms had a mean prostate volume of 59.18 cm³ ± 30.94 compared to patients with severe symptoms who had a higher mean prostate volume of 72.77 cm³ ± 26.68 as depicted in Table 5. However, IPSS had no direct correlation with individual prostate size. The patient with the highest IPSS score of 35 had a low prostate volume of 33.60 cm³ while the patient with the lowest IPSS of 3 had a higher prostate volume of 34.50 cm³.

Severity of ED was also correlated with IPSS. Patients with severe ED had a higher mean IPSS of 23.00 ± 12.73 while patients with no ED had the lowest mean IPSS of

13.19 ± 8.05 as shown in Table 6. The *P* value was 0.211 and not statistically significant as depicted in Table 6.

Quality of life has a weak inverse relationship with erectile function with a *P* value of 0.112 which was not statistically significant. QoL has a weak direct relationship with prostate volume with a *P* value of 0.116 which indicates weak evidence against the null hypothesis as shown in Table 7.

6 Discussion

6.1 Prevalence of erectile dysfunction

The prevalence of ED among men with symptomatic BPE in this study was high (76.9%) generally, and in men older than 70 years the prevalence was 93.7%. This was similar to a high prevalence obtained in other studies [3, 21]. The incidence of ED per age distribution in this study was 71.4% for patients aged 41–50 years and 88.9% of patients aged 61–70 years. This means that the prevalence of ED is higher in older patients with symptomatic BPE which is in keeping with several similar studies [2, 3]. Kinsey et al. [23] noted that the prevalence of ED was age related, being less than 2% until the age of 40 years, increased with aging and correlates with LUTS due to BPE. This was similar to the observation made in this study which noted more severe forms of ED with increasing age, suggesting that there may be link between ED and symptomatic BPE since the latter is commoner with advancing age. Majority of patients (76.9%) with symptomatic BPE without other etiological causes of ED had ED. This finding is similar to a study carried out in Nigeria by Ikuero et al. [11] that supports the link between ED and prostatic enlargement, and probably linking the high prevalence of ED to the obstructive urinary symptoms from the bulk of the adenoma with ED occurring

in 71% of the patients. Vallancien et al. [24] also noted a high prevalence of sexual dysfunction in men with symptomatic BPE (41–71%) which is similar to the high prevalence noted in this study. This finding shows that there is a positive correlation between ED and symptomatic BPE and supports the need to screen all patients with symptomatic BPE for ED. This will also have a positive impact on the QoL and sexual performance.

On the contrary, the prevalence of ED in this study is higher than the finding obtained in a population-based multinational study in regions of the UK (Birmingham), Netherland (Boxmeer), France (Auxerre), Korea (Seoul) linking ED and LUTS due to BPE in 4800 men aged 40 to 70 years. The study observed a prevalence of 21.1%. The difference in this observation may be due to the fact that larger group of patients with LUTS due to BPE were enrolled compared to the 117 patients with symptomatic BPE enrolled in this study [25]. However, the consistent observation is that ED and symptomatic BPE were significantly associated with increasing age [8, 22, 25].

6.2 Correlation between erectile dysfunction and symptomatic benign prostatic enlargement

The severity of ED was directly related to prostate size and men with larger prostate had ED compared to those with smaller prostate. Braun et al. [26] noted that the prevalence of ED in men with BPE was 72% in their Cologne Male Survey involving approximately 5000 German men and this was similar to the high prevalence of 76.9% in men with BPE observed in this study. This shows that ED is common in men with BPE and further supports the need to consider ED in managing patients with symptomatic BPE. Raymond et al. [2] in another clinic-based population study in Western countries observed that the prevalence of ED in patients with LUTS ranged from 41 to 71% with statistical significance (*P* < 0.05). This finding was similar to that noted in this study with a *P* value of 0.001 which was statistically significant.

Ngai et al. [27] noted a statistically significant correlation between ED and symptomatic BPE. This was similar to the observation made in this study which shows positive correlation between ED and symptomatic BPE with statistical significance (*P* value = 0.001). BPE may be an indicator of ED, and patients should be evaluated holistically due to the high prevalence of ED in men with

Table 6 Correlation between severity of ED and mean IPSS

Category of ED	Frequency (n = 117)	Mean IPSS score	Standard deviation
Severe ED	2	23.00	12.73
Moderate ED	15	17.93	9.20
Mild to moderate ED	35	15.14	7.46
Mild ED	38	14.39	7.08
No ED	27	13.19	8.05

P value = 0.211

Table 7 Summary of correlation between QoL versus IIEF and prostate volume

	Pearson's <i>r</i> value	<i>P</i> value	Interpretation
QoL versus IIEF	−0.148	0.112	Weak negative correlation
QoL versus prostate volume	0.146	0.116	Weak positive correlation

symptomatic BPE and positive correlation between both pathologies [24].

Olugbenga-Bello et al. [28] noted that the overall prevalence of ED in Nigerian was 46%. This study observed a high prevalence (76.9%). The probable reason for the high prevalence noted in this study may be due to the fact that all the patients enrolled in this study had symptomatic BPE. This shows that there is a link between ED and symptomatic BPE accounting for the higher prevalence of ED. This supports the need for establishing coexistence ED in men with symptomatic BPE.

6.3 Erectile dysfunction and lower urinary tract symptom severity

The severity of ED was directly related to LUTS severity, and majority of patients with high severity score had ED. This finding was similar to the study carried out by Darab et al. [29] using IPSS and IIEF questionnaires to assess LUTS caused by BPE and ED, respectively, and showed that sexual function can be severely affected by LUTS severity.

The point prevalence of ED in this study was 32.5% for mild ED, 29.9% for mild to moderate ED, 12.8% for moderate ED and 1.7% for severe ED. This is dissimilar and higher to the values obtained by Ngai et al. [27] among Chinese men. The difference in the findings may be due to environmental factors and genetic make-up which differs between Africans and Orientals. The point prevalence of mild, moderate and severe LUTS in this study was 20.5%, 53.8% and 25.6%, respectively. Schiff et al. [10] found that for every decade, the percentage of men with moderate (IPSS = 8–19) or severe (IPSS \geq 20) LUTS increased and for each IPSS grouping there was increased prevalence of ED. This was similar to the observation made in this study, and the severity of ED was associated with higher IPSS and a mean IPSS of 18 and 23 was noted in patients with moderate and severe ED, respectively (although not statistically significant, $P=0.211$). This may be due to the voiding symptoms from the bulk of the adenoma as reported by Ikerowo et al. [11].

This shows that ED and symptomatic BPE are common health issues in Nigerian men with statistical significant correlation and awareness of the link between both ED and symptomatic BPE should always be emphasized and patients evaluated holistically.

6.4 Impact of erectile dysfunction on QoL

Preservation of sexual function should be considered in the management of patients with symptomatic BPE. With increase in elderly population, it is expected that more men will experience ED and symptomatic BPE. There was positive correlation between the severity of ED and prostate size in this study, and patients with severe ED had

higher mean prostate size of 122.94 g. This further supports the need to screen patients with symptomatic BPE for ED. Sexual and urinary functions have a direct impact on QoL. This present study shows that QoL has a weak negative correlation with ED (Pearson's r value = -0.148 , P value = 0.112) and a weak positive correlation with prostate size (Pearson's r value = 0.146 , P value = 0.116). This is because patients' impression on quality of life varies. While a patient with a huge prostate and severe ED may be satisfied with the symptoms, another patient with milder form may feel terrible with his symptoms [30].

7 Conclusion

This study shows that the erectile function has a direct relationship with prostate size as there was a positive correlation between erectile dysfunction and prostate size. Adopting a holistic approach in the management of ED and symptomatic BPE will have laudable impact on patients' sexual performance and QoL.

8 Recommendation

1. All patients presenting with symptomatic BPE should also be evaluated for the presence of ED.
2. Further study on severity of erectile dysfunction and prostate size with a larger sample size will further strengthen these findings.

Abbreviations

BOO: bladder outlet obstruction; BPE: benign prostatic enlargement; cAMP: cyclic adenosine monophosphate; cGMP: cyclic guanosine monophosphate; CVD: cardiovascular disease; ED: erectile dysfunction; IIEF-5: International Index of Erectile Function-5; IPSS: International Prostate Symptoms Score; LUTS: lower urinary tract symptoms; NICE: National Institute of Health and Clinical Excellence; NO: nitric oxide; QoL: quality of life; REM: rapid eye movement; SPSS: Statistical Package for Social Sciences; TRUS: transrectal ultrasound of the prostate.

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The corresponding author was a guest participant at the 21st Congress of the European Society for Sexual Medicine held in Slovenia in 2019 and presented the abstract of this work but not the full manuscript.

Author contributions

OK, AT and AS participated equally in patient's counseling and enrolment, data collection, performing trans-rectal ultrasound guided biopsy (TRUS), review of literature and data analysis. AO and DN offered professional supervision of the entire work. The corresponding author OK compiled the entire manuscript. All authors have read and approved the final manuscript.

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Availability of data and materials

Data and materials including questionnaires and proforma are available.

Ethics approval and consent to participate

The informed consent obtained from study participants was written and available. Ethical clearance was secured from the University of Abuja Teaching Hospital Research and Ethical Committee. The reference number is UATH/HREC/448 as uploaded in the next page. See Appendix I for certificate of approval. No other reference number is applicable or available.

Consent for publication

A written informed consent to publish was obtained from all the participants.

Competing interests

Nil competing interest.

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References

- Hatzimouratidis K, Amar E, Eardley I et al (2010) Guidelines on male sexual dysfunction: erectile dysfunction and premature ejaculation. *EurUrol* 57(5):804–814
- Raymond C, Francois G, Culley C (2005) Sexual dysfunction and lower urinary tract symptoms associated benign prostatic hyperplasia. *EurUrol* 47(6):824–837
- Morant S, Bloomfield G, Vat V et al (2009) Increased sexual dysfunction in men with storage and voiding lower urinary tract symptoms. *J Sex Med* 6(4):1103–1110
- Kirby M, Chappel C, Jackson G et al (2013) Erectile dysfunction and lower urinary tract symptoms: a consensus on the importance of co-diagnosis. *Int J ClinPract* 67(7):606–618
- Klotz T, Mathers MJ, Braun M et al (1999) Effectiveness of oral L-arginine in first line treatment of erectile dysfunction in a controlled crossover study. *UrolInt* 63(4):220–223
- NICE clinical guidelines 97. Lower urinary tract symptoms. Management of lower urinary tract symptoms in men. <http://www.nice.org.uk/guidance/CG97/FullGuidance>
- Kupelian V, Wei JT, Kusek JW et al (2006) Prevalence of lower urinary tract symptoms and effect on quality of life in a racially and ethnically diverse random sample: the Boston Area Community Health (BACH) Survey. *Arch Intern Med* 166(21):2381–2387
- Seftel AD, Birt J, Porter V et al (2013) Co-existing lower urinary tract symptoms and erectile dysfunction: a systematic review of epidemiological data. *Int J ClinPract* 67(1):32–45
- Rosen RC (2006) Update on the relationship between sexual dysfunction and lower urinary tract symptoms/benign prostatic hyperplasia. *Curr OpinUrol* 16(1):11–19
- Schiff JD, Mulhall JP (2004) The link between lower urinary tract symptoms and erectile dysfunction: clinical and basic science evidence. *Am SocAndrol* 25(4):470–478
- Ikuerowo SO, Akindiji YO, Akinoso OA et al (2008) Association between erectile dysfunction and lower urinary tract symptoms due to benign prostatic hyperplasia in Nigerian men. *UrolInt* 80(3):296–299
- Gacci M, Eardley L, Giuliano F et al (2011) Critical analysis of the relationship between sexual dysfunction and lower urinary tract symptoms due to benign prostatic hyperplasia. *EurUrol* 60(4):809–825
- Mirole M, Sessa A, Giuliano F et al (2011) Current benign prostatic hyperplasia treatment: impact on sexual function and management of related sexual adverse event. *Int J ClinPract* 65(9):1005–1013
- Bieri S, Iselin C, Rohner S et al (1997) Capsular perforation localization and adenoma size as prognostic indicator of erectile dysfunction after transurethral prostatectomy. *Scand J UrolNephrol* 31(6):545–548
- Ferrario CM, Levy P (2002) Sexual dysfunction in patients with hypertension: implication for the therapy. *J Clin Hypertension* 4(6):424–432
- Web MD Erectile Dysfunction Health Center (2012). <http://www.webmd.com/erectile-dysfunction/guide/drugs-linked-erectile-dysfunction>. Accessed 20 Apr 2012
- Glina S, Santana AW, Azank F et al (2006) Lower urinary tract symptoms and erectile dysfunction are highly prevalent in ageing men. *BJU Int* 97(4):763–765
- Nasir AR, Zehn AA, Abbas F et al (2001) The correlation between International Prostate Symptom Score and sexual health inventory in men with lower urinary tract symptoms. *IntUrolNephrol* 43(3):625–629
- Umezurike BI, Ekanem TB, Eluwa MA et al (2006) The frequency of benign prostatic hypertrophy in Calabar. *Niger Postgrad Med J* 13(3):236–239
- Aligbe JU, Forae GD (2013) Prostatic tumors among Nigerian males: a private practice experience in Benin-City, South-South, Nigeria. *Niger Postgrad Med J* 20(3):193–196
- Fafolu AS, Adebayo AM, Akande TO et al (2014) Erectile dysfunction among male hypertensive in tertiary health facility in South-west Nigeria. *Glob J Health Sci* 7(1):154–160
- Erinomo OO, Anunobi CC, Orah NO (2013) Autopsy study of prostatic weight and lesion in Lagos State University Teaching Hospital: a 12month prospective study. *Nig Q J Hosp Med* 23(2):85–89
- Sudhir B (1988) Sexual dysfunction in hypertensive men: a critical review of the literature. *Am Heart Assoc J* 12:1–10
- Vallancien G, Emberton M, Harring N et al (2003) Sexual dysfunction in 1,274 European men suffering from lower urinary tract symptoms. *J Urol* 169(6):2257–2261
- Boyle P, Robertson C, Mazzetta C et al (2003) The association between lower urinary tract symptoms and erectile dysfunction in four centers: the Ur Epik study. *BJU Int* 92(7):719–725
- Braun M, Wassmer G, Klotz T et al (2000) Epidemiology of erectile dysfunction: results of the Cologne male survey. *Int J Impot Res* 12(6):305–311
- Ngai KH, Kwong AS, Wong AS et al (2013) Erectile dysfunction and lower urinary tract symptoms. Prevalence and risk factors in a Hong Kong primary care setting. *Hong Kong Med J* 19(4):311–316
- Olugbenga-Bello AI, Adeoye OA, Adeomi AA et al (2013) Prevalence of erectile dysfunction and its risk factors among adult men in Nigeria community. *Niger Postgrad Med J* 20(2):130–135
- Darab M, Gholam HN, Seyed RY et al (2008) Sexual dysfunction in aging men with lower urinary tract symptoms. *J Urol* 5(4):260–264
- Udeh EI, Ozoemena OF, Ogwuche E (2012) The relationship between prostate volume and IPSS in Africans with benign prostatic hyperplasia. *Niger J Med* 21(3):290–295

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