

USING TRANSRECTAL ULTRASONOGRAPHY IN THE ASSESSMENT OF PROSTATE VOLUME IN ADULT MALES IN THE CAPITAL CITY OF IMO STATE, NIGERIA

ADUEMA W^{1*}, VIDONA WB², AKUNNEH-WARISO C³, AMAH AK⁴

¹Department of Human Physiology, PAMO University of Medical Sciences, Port Harcourt, Rivers, Nigeria. ²Department of Human Anatomy, Edo State University, Iyamho, Nigeria. ³Department of Human Physiology, Abia State University, Uturu, Nigeria. ⁴Department of Human Physiology, Imo State University, Owerri, Imo, Nigeria. Email: wadioniaduema@gmail.com

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ABSTRACT

Objective: Prostate gland is a compound tubuloalveolar exocrine gland of male reproductive system in human. Morphometric analyses of an organ with the use of radiologic technique have been shown to be imperative in the evaluation of radiologic or systemic disease. The radiologic anatomist has described inaccuracy with physical examination of organs morphometry as it provides misleading results involving a particular organ for prognostic and diagnostic purpose in our region. This work is aimed at establishing the normal prostatic volume in adult males in Imo State, Nigeria. It also dealt on relationship between prostate volumes (PVs) with age.

Methods: The investigation was carried out in adult male between the ages of 21 and 80 years and the research tool used was an ultrasound machine. Subjects were subjected to transrectal scanning as they were lying on this left lateral position. PV was evaluated using the ellipsoidal formula: $PV=0.524 \times L \times H \times W$. A total of 200 individuals were studied.

Results: The result of this study gave a mean of 28.72 ml which tallied closely with similar work on prostate size in adult males in Nigeria with a mean value of 20.93 ml. The prostate size had statistically significant relationship ($p < 0.05$) with the individual age, with male subjects in the age group of 71–80 years showing the highest volume of 36.1 ± 1.81 ml which corresponds with the previous studies done in Nigeria.

Conclusion: A normogram for PV has been established for adult male in Owerri, Imo State, Nigeria, to be 28.72 ml and correlation between the PV and age is significantly positive ($p < 0.05$).

Keywords: Prostate, Normogram, Male subjects, Volume, Size.

INTRODUCTION

Among the various advances in medical imaging, ultrasonography has been shown to give accurate detail in normal prostate volume (PV) [1,2]. Ultrasonography has been described as a non-invasive technique that uses sound waves in medical imaging of soft tissues [3,4]. The prostate is a tubular gland present in the male reproductive system [4]. It secretes a slightly alkaline fluid, milky in appearance that constitutes roughly 30% of the volume of the ejaculate containing spermatozoa. The prostate also contains some smooth muscle that helps expel semen during ejaculation and has a mean weight of about 11 g in normal adult male [5]. Researchers have shown that PV among patients with negative biopsy is related significantly, with weight and height (body mass index), so it is necessary to the control of weight [6]. Prostate can be divided into two categories: By zone or lobe [7,8]. A research to establish a normogram of PV in normal adult Nigerians as guide to determine the mean PV was carried out using 200 men whose ages ranged from 25 to 45 years (men aged 35 years) with no symptoms of prostate enlargement agreed to be screened using transrectal ultrasound (TRUS). The result showed that the mean prostatic volume for a normal adult Nigerian was about 20.93 ± 1.79 cm³ compared with 19.80 cm³ for the Caucasians. This shows that there is a strong positive correlation between PV and age ($r = 0.734$, $p < 0.05$) [9]. Furthermore, studies on 200 Nigeria adults at the Radiology Department of University of Benin Teaching Hospital were also carried out to determine the normal volume of the prostate gland and a mean PV of 19.620 cm³ was reported [10]. Therefore, due to the dearth of literature on relationship of PV estimation among Ibo ethnic ground in Imo State of Nigeria. This study will provide baseline data in the assessment of PV in our locality. This study is aimed at establishing normal PV in adult males (20–80 years) in Owerri, Imo State, Nigeria.

METHODS

Types of study and study population

Approval for this study was sought from the Department of Human Anatomy, College of Basic Medical and Health Science, Abia State University, Uturu, Abia State. The study is a clinically based: Research on establishing the PV of adult males within Imo State was done over 12 months period between May 2017 and June 2018. The study population is 200 adult males from the age of 20 to 80 years.

The place of study

The study was carried out in the Radiological Department of St Vincent's Specialist Hospital, New Owerri, where 200 adult males were randomly selected.

Sample of the study

The study was carried out with some diagnostic bias, only healthy subjects were selected, i.e those with no history or apparent urinary disease symptoms or changes related to malignancy of neoplasm. Males from Ibo ethnic group between the age of 20 and 80 years without renal disorder or any other like diabetes passed through TRUS.

Sample size

Based on the above-mentioned criteria for eligibility for data collection, sample size of 200 subjects was randomly selected.

Ethical approval

Approval was obtained from the ethical committee of the Imo State teaching hospital of the university.

Data collection

Participant's biodata such as age which ranges from 20 to 80 years, sex, and weight was obtained before ultrasound examination. The participants

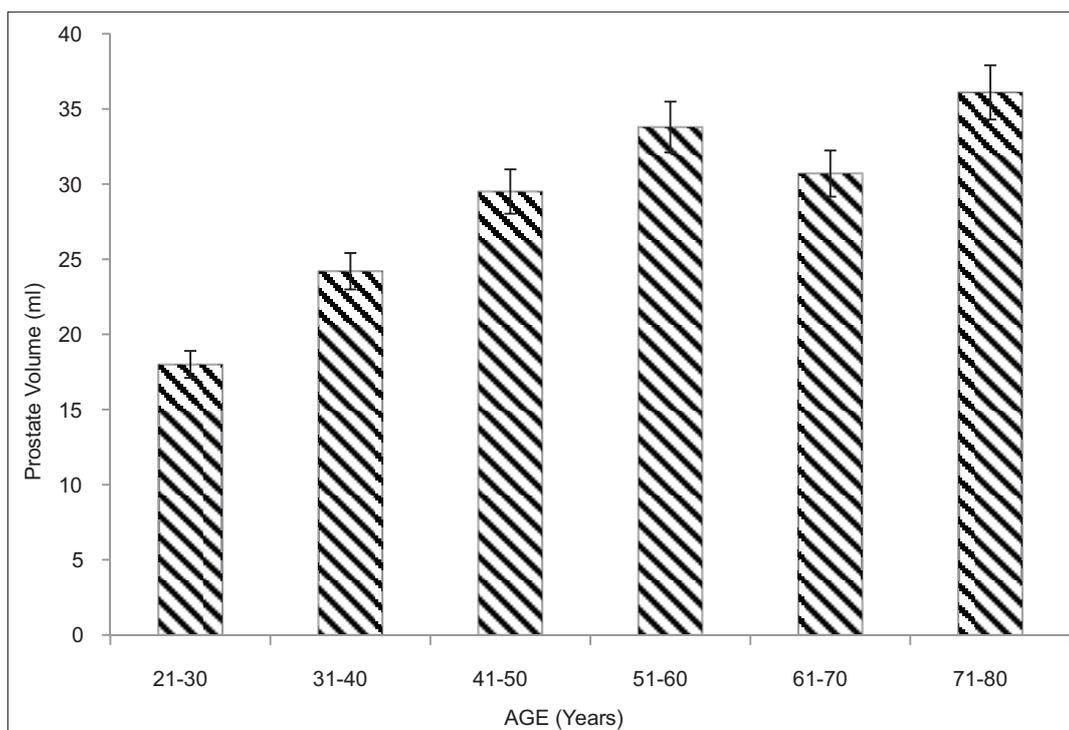


Fig. 1: Prostate volume subject to age groups

were asked to fill their urinary bladder by taking a lot of water so as to increase the echogenicity of the prostate. A transabdominal scanning method was used to visualize the prostate. The prostatic dimensions such as cephalocaudal length (L), anteroposterior height (H), and transverse width (W) were evaluated while the PV was computed using the ellipsoid formula [11,12]. Obtained image was processed using MATLAB software and was passed through a median filter, which was used to smoothen, sharpen the image and reduce noise effect. PV was evaluated using the ellipsoidal formula: $PV=0.24 \times L \times H \times W$.

Data processing

- ANOVA with respect age-related differences in PV
- Correction with respect to the relationship of age and volume
- Create chart for age/PV.

RESULTS

General data analysis

The study was conducted using 200 male individuals. The individual's age and PV were measured. The PV was calculated and correlation between age and PV was done.

The result presented in Table 1 shows the correlation analysis of PV of adult male subjects with age.

Result obtained showed a significant ($p < 0.05$) positive correlation between PV with age. Correlation coefficient (r) of the analysis was $r = 0.921$. This result indicates a strong association of age and PV.

DISCUSSION

Age-related changes in prostate size

The study was conducted using 200 male individuals. The individual's age and PV were measured Table 2. The PV was calculated and correlation between age and PV was done. Fig. 1 shows the mean PV of male subjects according to age range. The result obtained showed that the mean PV was 18 ± 0.9 , 24.2 ± 1.21 , 29.2 ± 1.48 , 33.8 ± 1.69 , 30.7 ± 1.54 , and 36.1 ± 1.81 ml in male subjects of age ranges 21–30, 31–40, 41–50, 51–60, 61–70, and 71–80, respectively. This study confirms the age-related changes in the size of the prostate as there was gradual increase

Table 2: Correlations analysis between prostate volume and age of adult male subjects. Descriptive statistics

Correlations	Mean	Standard deviation	n
Age	50.0000	18.70829	6
Prostrate volume	28.7167	6.63549	6

Correlations		Age	Prostate volume
Age	Pearson correlation	1	0.921**
	Sig. (two tailed)		0.009
Prostate volume	Pearson correlation	0.921**	1
	Sig. (two tailed)	0.009	0.009
	n	6	6

***Correlation is significant at the 0.01 level (two tailed)

Table 1: Chart between age and prostate volume

Age	Prostate volume
20-30	18
31-40	24.2
41-50	29.5
51-60	33.8
61-70	30.7
71-80	36.1

in the prostate size as the age increased [9,10]. Statistical analysis of the result showed a significant difference ($p < 0.05$) in the mean PV among male subjects compared across all the age groups of 21–30, 31–40, 41–50, 51–60, 61–70, and 71–80. PV was found to increase with age as stated above, with male subjects in the age group of 71–80 showing the highest volume of 36.1 ± 1.81 ml [9,10]. The mean PV for adult male in Imo State was noted to be 28.72 ml. This is different from the value of similar study on normal PV in adult Nigerian males, value of this 20.93 ml [9], 19.62 ml [13], and Caucasian value of 19.80 ml.

This study further confirms the age-related changes in the size of the prostate as there was gradual increase in the prostate size as the age increased which corresponds with studies by Okeji *et al.*, Ogbeide and Ebubedike, and Hoo *et al.* [9,13,14]. A level of statistical significance was established between the prostate size and age ($p < 0.05$).

CONCLUSION

A normogram from PV has been established for adult male within Imo State, Nigeria, to be 28.72 ml. A direct relationship between age and PV has been established and confirmed in this research to be positively associated with increase age. Correction between PV with age is significantly ($p < 0.05$) positive.

REFERENCES

- Zhang B, Lewis SM. A study of the reliability of clinical palpation of the spleen. *Clin Lab Haematol* 1989;11:7-10.
- Park SB, Kim JK, Choi SH, Noh HN, Ji EK, Cho KS, *et al.* Prostate volume measurement by TRUS using heights obtained by transaxial and midsagittal scanning: Comparison with specimen volume following radical prostatectomy. *Korean J Radiol* 2000;1:110-3.
- Nathan MS, Seenivasagam K, Mei Q, Wickham JE, Miller RA. Transrectal ultrasonography: Why are estimates of prostate volume and dimension so inaccurate? *Br J Urol* 1996;77:401-7.
- Harper D. *Online Etymology Dictionary*. New Jersey: Campbell; 2013. p. 34-6.
- Leissner KH, Tisell LE. The weight of the human prostate. *Scand J Urol Nephrol* 1979;13:137-42.
- Fowke JH, Motley SS, Cookson MS, Concepcion R, Chang SS, Wills ML, *et al.* The association between body size, prostate volume and prostate-specific antigen. *Prostate Cancer Prostatic Dis* 2007;10:137-42.
- Rifkin MD, Sudakoff GS, Alexander AA. Prostate: Techniques, results, and potential applications of color Doppler US scanning. *Radiology* 1993;186:509-13.
- Pinsky PF, Kramer BS, Crawford ED, Grubb RL, Urban DA, Andriole GL, *et al.* Prostate volume and prostate-specific antigen levels in men enrolled in a large screening trial. *Urology* 2006;68:352-6.
- Okeji MC, Okeye IJ, Nwobi IC, Okpalaek MC. Transrectal ultrasonography assessment of prostate volume in normal adult Nigerian. *West Afr J Ultrasound* 2007;6:21-31.
- Eze CU, Ohagwu CC, Okaro OA, Nwobi IC. Sonographic assessment of normal prostate size within age groups among Benue people of Nigeria. *J Exp Clin Anat* 2006;5:13-7.
- Bakker J, Olree M, Kaatee R, de Lange EE, Moons KG, Beutler JJ, *et al.* Renal volume measurements: Accuracy and repeatability of US compared with that of MR imaging. *Radiology* 1999;211:623-8.
- Walz J, Graefen M, Chun FK, Erbersdobler A, Haese A, Steuber T, *et al.* High incidence of prostate cancer detected by saturation biopsy after previous negative biopsy series. *Eur Urol* 2006;50:498-505.
- Ogbeide OU, Ebubedike UR. Study of tranabdominal ultrasonographic evaluation of prostate volume for a symptomatic adult Nigerians at the radiology department of the University of Benin teaching hospital. *Ann Biomed Sci* 2012;11:102-8.
- Hoo NK, Pahl MS, Abduljabbar HN, Supriyan E. Prostate volume ultrasonography: The relationship of body weight, height, body mass index and ethnicity. *Int J Biol Biochem Eng* 2010;4:1-3.