

SONOGRAPHIC ASSESSMENT OF PROSTATE VOLUME IN MEN WITH RAISED PROSTATE-SPECIFIC ANTIGEN (PSA) IN ONITSHA METROPOLIS

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Abstract

The prostate-specific antigen (PSA) level is a useful indicator of prostate volume and may inform the choice between treatment options for benign prostatic hyperplasia and other benign conditions. The observation of greater testing of men living in more affluent areas is consistent with previous studies. Therefore, this study was aimed at evaluating the actual volume of the prostate gland in different age groups, in men with raised PSA value. This cross-sectional study was conducted sonographically among men aged 40-89 years in Onitsha Anambra State of Nigeria with clinical indication of raised prostate specific antigen (PSA). Both laboratory and ultrasound procedures were carried out following the standard procedures after obtaining ethical approval from Anambra State of Nigeria Ministry of Health. Data such as age, prostate volume (PV), PSA, total PSA and free PSA were obtained using data capture sheet. The statistical package for social sciences (SPSS) version 20.0. (SPSS Incorporated, Chicago, Illinois), descriptive (mean, standard deviation, percentage, frequency, and charts) and inferential (Pearson correlation test) statistical tools were adopted for statistical data analysis. The level of statistical significance was set at $p < 0.05$. The mean and standard deviation for prostate volume were $26.6 \pm 7.576 \text{ cm}^3$. The mean and standard deviation values for prostate volume at different age group are $24.47 \pm 5.438 \text{ cm}^3$, $25.06 \pm 5.94132 \text{ cm}^3$, $28.76 \text{ cm}^3 \pm 9.814 \text{ cm}^3$ and $27.22 \pm 8.0638 \text{ cm}^3$ for age group 40-49years, 50-59years, 70-79years and 80-89years of age respectively. There were no statistically significant correlations between TPSA and PV ($r=0.003$, $p=0.96$), and between FPSA and PV ($r=0.031$, $p=0.66$). There were no statistically significant correlations between TPSA and age ($r=0.04$, $p=0.56$), and between FPSA and age ($r=0.02$, $p=0.72$). There was a positive statistically significant correlation between prostate volume and age ($r=0.21$, $p=0.002$). The study population has normal value of prostate volume. The prostate volume was not significantly influenced by the TPSA and FPSA values. However, the subject's age has significant positive correlation with the prostate volume. Therefore, in assessing the prostate volume, the age of the individual should be taken highly into consideration.

INTRODUCTION

The National Cancer Institute (NCI) defines Prostate-specific antigen (PSA) as a protein made by the prostate gland and found in the blood. Prostate-specific antigen level can be used as a screening test with prostate biopsy in men with a raised PSA level allowing histopathological confirmation of the diagnosis of prostate cancer (Schroder, Hugosson and Roobol 2014). In almost 30 years of PSA testing, the balance of benefits and harms of the test has not been established and, perhaps consequently, there are varying rates of testing around the world (Schroder *et al.*, 2014).

In many studies, high PSA level may be a sign of prostate cancer, but high PSA levels can also mean noncancerous prostate condition, such as infection a noncancerous enlargement of the prostate (Leissner and Tisell 2010). It has been reported that the elevation of PSA in the blood was due to its release into the circulation because of a breakdown of the prostate cellular architecture (Pinsky *et al.*, 2017). The average lifetime risk of prostate cancer was 11.7% for whites and 16.7% for blacks, based on 2016–2018 Surveillance, Epidemiology, and End Results (SEER) data (Howlander *et al.*, 2020). Average lifetime risk of dying from prostate cancer was 2.3% for whites and 3.8% for blacks (Howlander *et al.*, 2020). The World Health Organization (WHO) PSA level in blood was measured in units called nanograms per milliliter (ng/mL).

After 13 years of follow-up, the cumulative mortality rates from prostate cancer in the intervention and control groups were 3.7 and 3.4 deaths per 10,000 person-years, respectively, meaning that there was no significant difference between the two groups (Tang and Xie 2012). Prostate diseases are fairly very prevalent in Nigeria. Prostate cancer accounts for 46% of malignancies in Nigerian men while benign prostatic hypertrophy affects 30% of them annually (Young *et al.*, 2000). There other prostate diseases such as corpora amylacea and prostatitis as well affected them. All these prostate diseases lead to elevation of serum PSA and are thus diagnosed partly by conducting a PSA test.

Ultrasonography was also conducted as an adjunct to PSA test for a firm diagnosis. There was a litany of the tests conducted on these patients and PSA test, ultrasonography, and these other tests impose a heavy financial burden on the poor. Benign prostatic hypertrophy (BPH) was quite common among elderly Nigerian men and those around middle ages. These groups of men usually undergo ultrasonography and PSA test regularly to screen for prostate enlargement and prostate cancer. Those with the symptoms of BPH and cancer are also required to undergo the same tests. It is important to note that serum PSA level was also related to age. A relationship between prostate size, age and PSA value was yet to be formulated to help predict either prostate size or PSA value.

This study aimed to establish the relationship between prostate size and serum PSA value and age. The objectives are to: Sonographically determine the size of the prostate gland in men with signs and symptoms of prostate enlargement and volunteers with apparently normal prostate gland in a selected population. Determine the serum PSA level in men with signs of prostate enlargement and volunteers with sonographically normal prostate gland in a selected population. Compare the prostate size and serum PSA values in normal volunteers and men with enlarged prostate and determine the relationship between prostate size, serum PSA value, and age in normal volunteers and men with enlarged prostate.

MATERIALS AND METHODS

Research Design

A cross-sectional study design that involved the collection of data at one point in time only from each patient was adopted for the research.

Study Area

The research was conducted in the ultrasound suite of the Sun Medical Diagnostics, Onitsha, Anambra State, Nigeria. It was a private owned medical diagnostic outfit, licensed and registered by the Anambra State Ministry of Health. The radio-diagnostic centre was located in a densely populated part of Onitsha North Local Government Area. The radio-diagnostic center receives an average of 30 patients per day for different kinds of ultrasound studies. The Centre has a consultant radiologist, a radiographer, and medical laboratory scientists in its work force.

Study Population

The population size of people living in the part of Onitsha North Local Government Area of Nigeria was estimated. The estimated population number of people in Onitsha North was 2,000 000.

Sample Size

The sample size was determined using Cochran’s formula 1975 (cited in Singh and Masuku, 2014).

$$n = \frac{Z^2 pq}{e^2} \quad n = \frac{1.96^2 \times 0.09 \times 0.91}{0.05^2} \quad n = 200 \text{ Male participants}$$

Sampling Technique

Ethical consideration

Ethical Clearance was obtained from Anambra State of Nigeria Ministry of Health. Informed consent was obtained from participants.

Instruments for Data Collection

Ultrasound scans results of the participants prostate gland and blood samples for PSA laboratory test.

Method of data analysis

Data was analyzed using the statistical package for social science-SPSS software version 20.0. Descriptive (mean, standard deviation, percentage, frequency and charts) and inferential (Pearson correlation test) statistical tools were adopted for statistical data analysis. The level of statistical significance was set at $p < 0.05$.

RESULTS

Table 1 showed that out of 200 subjects, the greater number 57(28.5%) were within the age group of 70-79years, followed by age group 60-69years 46(23%) and the least 11(5.5%) of the subjects were in the age bracket of 80-89years of age. The majority 147(73.5%) of the subjects had normal prostate volume ($< 30\text{cc}$) and the least 1(0.5%) had prostate volume ($>60\text{cc}$).

Table 1 showing the mean volume of the prostate gland.

The actual volume of the prostate gland in men leaving in Onitsha. The mean and standard deviation values for the prostate volume in table are $26.6 \pm 7.576\text{cm}^3$.

N	Minimum	Maximum	Mean	Std deviation
200	16.60	81.00	26.60	7.576

Table 2, showing the prostate volume for different age groups.

The mean and standard deviation values for prostate volume at different age group are $24.47 \pm 5.438\text{cm}^3$, $25.06 \pm 5.94132\text{cm}^3$, $28.76\text{cm}^3 \pm 9.814\text{cm}^3$ and $27.22 \pm 8.0638\text{cm}^3$ for age group 40-49years, 50-59years, 70-79years and 80-89years of age respectively.

Age Group	N	Minimum	Maximum	Mean	Std. Deviation
40-49 Years	44	18.00	42.19	24.47	5.43828
50-59 Years	42	16.60	46.76	25.06	5.94132
60-69 Years	46	18.00	51.63	27.25	6.78545
70-79 Years	57	17.67	81.00	28.76	9.81427
80-89 Years	11	18.11	45.42	27.22	8.06381

Table 3 showing correlation between TPSA, FPSA, Prostate volume and Age. There were no statistically significant correlations between TPSA and age ($r=0.04$, $p=0.56$), FPSA and age ($r=0.02$, $p= 0.72$). There was a positive statistically significant correlation between prostate volume and age ($r=0.21$, $p=0.002$).

Variables	N	r	p-value	Remark
TPSA	200	0.04	0.56	N/S
FPSA	200	0.02	0.72	N/S
Volume	200	0.21	0.002	Significant

Discussions

From the result of this research, the obtained value for the prostate volume in the study population is within the normal value. This implies that elevated PSA does not actually translate into high prostate volume. This may be so because several factors influence the volume of the prostate.

It was found in this study that the prostate volume varies with individual’s age. This implies that the prostate volume increases as the individual advances in age and vice versa. This may be so because many men with high prostate volume are those that are advanced in age (elderly) and commonly prone to prostate cancer. This finding is consistent with the finding of the study conducted by Zhang *et al.*, (2013), who also reported that the prostate volume increases with an increase in the individual’s age. According to Ablin *et al.*, (2015), due to the age-related growth of the prostate, the concept of adjusting the cutoff values based on age has helped reduce unnecessary prostate biopsies in older men to improve early prostate cancer detection. According to Berry *et al.*, (2014) the size of the prostate typically increases throughout a man’s lifetime. Different growth characteristics in each prostate zone may contribute to differences in the overall growth rate with age.

The correlation between TPSA and FPSA with prostate volume revealed that there were no statistically significant correlations between TPSA and FPSA with the prostate volume each respectively. This means that increase either of TPSA or FPSA will not also increase the prostate volume statistically. Nevertheless, the significance of TPSA and FPSA as tumor marker in evaluation of prostate cancer and also patient at risk was adequately documented (Seabury *et al.*, 2002; Coric, *et al.*, 2015).

The correlation between TPSA, FPSA, PV and age were assessed and the results revealed that there were no statistically significant correlations of TPSA with age and FPSA with age. However, there was a positive statistically significant

correlation between prostate volume and age. These findings imply that the age of an individual has no significant influence on the level of TPSA and FPSA, meaning that increase in age will not translate to increase in TPSA and FPSA each respectively. This could be true since TPSA and FPSA are disease specific biomarkers and not age-related. Nevertheless, prostate volume and age of an individual have significant influence on each other, which mean that as the age increases, the prostate volume will also increase and vice versa. This finding is in agreement with the findings of the studies carried by Han, Shan and Jin (2010) and Zhang *et al.*, (2013) and which equally reported that prostate volume has significant positive correlations with an individual age. This also in consonant with the statement by Berry *et al.*, (2014) and Xia *et al.*, (2002), they stated that the size of the prostate typically increases throughout a man's lifetime. Different growth characteristics in each prostate zone may contribute to differences in the overall growth rate with age.

Summary of findings

The mean prostate volume of $26.6 \pm 7.576 \text{cm}^3$ was within the normal value.

The mean and standard deviation values for prostate volume at different age group shows that participants within the age group of 70-79years has the highest value of $28.76 \text{cm}^3 \pm 9.814 \text{cm}^3$.

The research findings had a positive statistically significant correlation between prostate volume and age ($r=0.21$, $p=0.002$). There were no statistically significant correlations between TPSA and PV, FPSA and PV, TPSA and age and FPSA and age.

Conclusion

Age has a significant positive impact in prostate volume and should be taking highly into consideration when always assessing the prostate volume.

Recommendation

The findings of this study should be considered when assessing the prostate volume across different age groups especially for health-policy decisions making.

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