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Comparison of Prostatic Volume Estimates by Transrectal and Suprapubic Ultrsonography in A Nigerian Population

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ABSTRACT

The aim of this study is to establish prostatic volumes in normal adult Nigerians using Transrectal Ultrasonography (TRUS) and suprapubic Ultrasonography (SPUS). It will also compare the volume of significant difference in the values of the two methods. 200 men (mean age 35 years) whose age ranged between 25 and 45 years with no symptoms or history of prostatic enlargement consented to undergo TRUS and SPUS screening. Their prostate volumes were calculated using the three dimensional method. The prostatic volumes obtained by TRUS and SPUS were $20.932 \pm 1.785 cm^3$ and $21.138 \pm 1.714 cm^3$ respectively. Although there was difference in the values of prostatic volume by TRUS and SPUS, this was not statistically significant. There was good correlation between prostate volume and age ($r = 0.734$). This study shows that SPUS gives a fairly good volume estimate of the prostate and can be used when volume estimate is of primary concern. Difficulties experienced in visualizing the echotexture of the cranio-caudal part of the prostate during the course of the study suggest that SPUS is limited in its ability to appreciate echotextural changes in some part of the organ.

Keywords: prostate volume, Trans-rectal Ultrasonography, Suprapubic Ultrasonography.

Accurate prostate volume assessment is a useful parameter to the urologist. The estimation of prostatic volume is important for evaluation of the efficacy of new drugs (for benign prostatic hyperplassia (BPH) and in radiation therapy planning. These therapies are often assessed by estimating changes in size and volume of the prostate gland. (Tempany et al, 1993, saitoh et al, 1994) Also accurate estimation of the amount of benign prostatic hyperplasia (BPH) would help to decide upon the appropriate surgical option and equally assist in the interpretation of serum prostate specific antigen (PSA) levels for the presence of cancer. (Lee et al, 1992, Traficante et al, 1997)

There have been several studies which aimed to accurately estimate the prostate volume. (Hastak et al, 1982, Rahmouni et al, 1992) Earlier authors used suprapubic ultrasonogrphy to measure prostate size. (Stone et al, 1991) although some reported accurate result with it, others felt that the method has an inherent problem. It is accepted that TRUS using the step section planimetric method gives the most accurate volume, but it is tedious and time consuming and requires sophisticated software to compute the volume. (Stone et al, 1991, Aarnink et al 1995)

This study aims to compare prostate volumes by TRUS and SPUS and to find out if there is any significant difference between the two methods since SPUS is more available in our Nigerian environment.

MATERIALS AND METHODS

Within the period of this study a total of two hundred male subjects whose ages range from 25 to 45 years (mean age 35 years) with no history or symptoms of prostatic enlargement consented to be screened by transrectal ultrasound (TRUS) and suprapubic ultrasound (SPUS). The subjects were drawn from major ethnic groups in Nigeria.

Digital rectal examination (DRE) was earlier performed by a clinician to exclude palpable rectal mass. Prostate glands with abnormal echotexture during sonography were also excluded.

The prostate dimensions were determined sonographically using Kretz Combison 310A Ultrasound scanner it has a combination system for 3.5MHz mechanical sector probe and a 7.5MHz transcrectal biplane transducer. The system has digital frame freeze capability.

The techniques were explained to each subject prior to investigation. The suprapubic prostatic measurement was performed with the

Table 1: Values of mean Prostatic Volume for TRUS and SPUS

Parameter	No. of Subjects	Mean age (years)	Mean (x) Prostate Volume	Standard Deviation (SD)
TRUS^{y1} (cm^3)	200	35	20.932	1.785
SPUS^{y2} (cm^3)	200	35	21.138	1.714

The statistical test of significance was carried out using the student's t-ratio since we are comparing two sample means presumed to be drawn from the same population with equal variances.

The formula for $t = \frac{(x_1 - x_2) - (u_1 - u_2)}{Sx_1 - x_2}$ (Rayon and Haber 1977)

The standard error of the difference between means or $S\ x_1 - x_2$ was got from the formular

$$S x_1 - x_2 = \frac{\sum x_1^2 + \sum x_2^2}{n(n-1)}$$

Significant level: $\alpha = 0.05$

Degree of Freedom, $df = n - 1 = 21 - 1 = 20$

Critical region $t \geq 2.086$

Null Hypothesis (H_0): There is no difference between prostatic volume estimated through TRUS and that by SPUS.

Alternative Hypothesis (H_1): There is a difference between prostatic volume estimated through TRUS and that by SPUS.

Table 2:

Variables	No of Pairs	Mean (cm^3)	SD	SE of mean
y^1	21	20.932	1.785	0.389
y^2	21	21.138	1.714	0.374

t value = - 0.382

Since the obtained t does not fall within the critical region (that is - 0.382<t 0.05) we accepted H_0.

subject having full bladder and lying in supine position on a couch. The transducer was angled inferiorly to direct the bean under the public symphysis until the longest longitudinal image was obtained. The transverse section was obtained with caudal angulation of about 15 degrees . The full bladder afforded an acoustic window for proper visualization of the prostate. Measurements were taken for length, width and height.

For the transrectal approach, each patient was asked to void. Anacoustic gel was first applied on the probe before it was covered with the commercially available disposable latex condom. The gel ensures that air is excluded between the probe and latex whilst the latex ensures protection against infection. The subjects were examined in left lateral decubitis (right side up). The prostate was examined systematically from bladder neck to the apex in the axial plane. The largest AP (height) and transverse width diameters were measured. In the sagittal plane, the longest cranio caudal (length) diameter from the bladder neck to the apex of the prostate was measured. The axial section allows assessment of symmetry, size and shape of the prostate while the sagittal section allows better imaging of the seminal vesicle, the base and apex of the gland. The prostate volume was calculated for SPUS and TRUS using the three dimensional formular according to Teris and Stamey (1991).

RESULTS

The mean prostatic volume for TRUS and SPUS measurements for each age group was obtained by taking the average prostatic volumes from subjects in that age bracket. The population mean of prostate volumes from TRUS and SPUS were then calculated and shown in Tables 1 & 2.

TABLE 1:Volues of mean prostatic volume for TRUS and SPUS

DISCUSSION

The examination of the prostate gland using TRUS has gained widespread acceptance in urological practice it displays the echotextural changes and clearly delineates the boundaries of the gland. Despite these features, methods for prostatic volume estimate are still controversial. Accurate and reproducible prostatic volume estimate is important to assess the efficiency of drugs for management of BPH, to derive PSA density and PSA divergence in predicting the probability of carcinoma of the prostate, to help decide on the appropriate surgical option. Being that TRUS are currently not widely available in Nigeria, this study welcomes with relief the finding that prostate volume measurement by TRUS has no statistically significant advantage over the use of SPUS for the same purpose.

This study also showed that the prostate volume has significant positive correlation with the age of the subjects (r = 0.73) which is agreement with Witjes et al (1997) that, the prostate gland enlarges as men age.

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