Volume 10, Issue 11, November 2024,
Publish Date: 22-11-2024
Doi https://doi.org/10.55640/ijmsdh-10-11-10

International Journal of Medical Science and Dental Health (Open Access)

COMPARATIVE STUDY OF TRANSRECTAL AND SUPRAPUBIC ULTRASONOGRAPHY IN THE ESTIMATION OF PROSTATE VOLUME: INITIAL EXPERIENCE

OZOEMENA S OBOKE[1], EMMANUEL A JEJE[2], ABRAHAM T OLADIMEJI[3], ADEWOLE ADEBOBOLA[4]

[1]Radiology Department, Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi, Nigeria.
[2]Department of Surgery, Lagos University Teaching Hospital/College of Medicine, University of Lagos, Lagos, Nigeria
[3]Urology Unit, Surgery Department, Federal Medical Centre, Ebute Metta, Lagos, Nigeria.
[4]Urology Unit, Surgery Department Marigold Critical Care centre Lagos, Nigeria.

ABSTRACT

Background: Prostate volume (PV) is a principal parameter used by clinicians to better manage patients with lower urinary tract symptoms (LUTS) due to prostate or prostate cancer. PV can be measured by digital rectal examination, transrectal or suprapubic ultrasonography, computed tomography, magnetic resonance imaging and in prostatic specimens after prostatectomy. This study aims at determining the correlation of PV measured by suprapubic ultrasound scan (SPUS) and transrectal ultrasound scan (TRUS). **Materials and Methods:** This prospective study involved patients that underwent evaluation for lower urinary tract symptoms. Participants had suprapubic ultrasound scan and transrectal ultrasound scan done by the same radiologist. Data was analyzed using Statistical Package for the Social Sciences Version 22.0. Pearson's correlation coefficient with the P <0.05 considered as significant was used. **Results:** A total of one hundred and seven patients were studied with age range of 24 – 84years and a mean age of 63.82±9.72years. The mean PV of all patients estimated by suprapubic sonography was 59.10±40.00 (cm3)/gram while mean PV measurement estimated by transrectal sonography was 70.60±45.40(cm3)/gram with positive correlation (r = 0.861 p-value = 0.0001). **Conclusion:** There is significant positive correlation between the suprapubic measured PV and transrectal measured PV. Therefore, SPUS can be a good substitute for TRUS where the latter cannot be done.

KEYWORDS: Prostate, Ultrasonography, Pearson coefficient.

INTRODUCTION

The prostate gland (prostate) is an unpaired parenchymal glandular organ, the shape and size of which resembles an edible chestnut. Its average dimensions in a healthy young man are: 3.75–4.00 × 2.5–3.00 × 3.1–3.8 cm (width x height x length) and its volume is 20–25 cm3. It belongs to the male genital system

– it produces the glycoprotein (prostate specific antigen, PSA) which is an ingredient of the semen and is responsible for its liquefication. It also has an endocrine properties visa viz production of prostaglandins (A, E and F), spermidine, spermine and conversion of testosterone into dihydrotestosterone under the influence of the 5-α-reductase enzyme.[1]

Symptomatic benign prostatic hyperplasia (BPH) is the most common neoplastic condition in men worldwide and constitutes a major public health problem in both developed and developing countries.[2] BPH is found in 50% of men in their 50s and 80% of men beyond 70 years.[3]

Lower urinary tract symptom (LUTS) is not, however, synonymous with BPH. However, accurate estimation of prostatic volume is an essential step in managing patients with BPH because it bears direct relevance to treatment options offered in each case like open prostatectomy, transurethral resection, and laser ablation.[4,5]

Therefore, it is quite important to accurately assess the dimensions of the prostate in patients with BPH.6 Digital rectal examination (DRE) and intravenous pyelography are inadequate for determining the prostate dimensions.7 Transrectal ultrasonography (TRUS) is considered superior to DRE, cystourethrography, and Urethrocystoscopy in the evaluation of PV.[6,7,8]

There is a strong correlation of PV between transrectal ultrasound measurement and cadavers.[9] Studies conducted have proven the sensitivity and specificity of TRUS in prostatic evaluation that some literatures refer to TRUS as an extension of the urologist finger. In spite of this, TRUS has remained an untapped tool and underutilized imaging modality for prostate evaluation in our environment.[10] Although, TRUS has assumed an important role in the evaluation of prostate gland pathologies worldwide, some controversies still exist with contrasting reports from various studies.[11,12,13] SPUS is a widely accepted method of imaging the prostate in our setting because the probe is readily available and the study is more convenient for the patient and the radiologist. TRUS on the other hand is associated with some level of resistance due to its invasiveness and associated discomfort.[14]

Transrectal ultrasonography (TRUS) is superior to suprapubic ultrasonography (SPUS) in the evaluation of the prostate but nevertheless it is not tolerated in all patients more especially in those with anal diseases. Suprapubic ultrasonography (SPUS) is more convenient, accessible and more patients friendly.

The aim of this study is to evaluate the correlation of prostate dimensions and volume measured by SPUS and TRUS and replaceability of TRUS by SPUS.

MATERIALS AND METHODS

In this study, 107 consecutive patients presented to our clinic with lower urinary tract symptoms were enrolled. Informed consent forms were obtained from all patients, and they underwent both TRUS and SPUS at a same session. The study was planned and conducted in compliance with Declaration of Helsinki and good clinical practice rules.

A Sonoscape ultrasound machine model S22 manufactured in Guangdong China in June 2018 with a probe 5-10-MHz multiplanar transrectal transducer/ curvilinear suprapubic transducer were used for all patients. The prostate was scanned in the transverse and sagittal planes. The prostate volumes were determined using the formula for a prolate ellipsoid (π/ 6 x width x length x height)

SPUS and TRUS measurements were performed with a fully distended bladder in the supine position and left decubitus position, respectively. The transverse (W = width), craniocaudal (L = length), and anteroposterior (H = height) dimensions of the prostates were subsequently measured. The craniocaudal dimension was measured in the sagittal plane, and the transverse and anteroposterior dimensions were measured in the transverse plane. The longest dimension from the base to apex of the prostate was considered as the craniocaudal dimension. The longest distance between the prostate anterior and posterior margins that crosses the trace of craniocaudal dimension at a right angle was considered as the anteroposterior dimension. The longest dimension between the right and left lateral margins was considered as the transverse dimension. All measurements were performed at the same session. The three dimensions and volume measurements performed by SPUS and TRUS were compared to determine the correlation using Pearson correlation coefficient. The data were analyzed with Statistical Package for the Social Sciences (SPSS) version 22.0 using Pearson's correlation coefficient with the P <0.05 considered as significant.

RESULT

A total of one hundred and seven patients were studied with age range of 24 – 84years and a mean age of 63.82±9.72years. The age groups from 50 – 79 years (i.e., the fifth to seventh decade of life) accounted for 90.6% of the study population with lower urinary tract symptoms (Table 1).

Table1 *(Showing the Age Distribution of Patients presenting with Lower Urinary Tract Symptoms (n=107))*

Variable	Frequency	Percent (%)
Age group (Years)		
20-29	1	0.9
30-39	1	0.9
40-49	5	4.7
50-59	24	22.4
60-69	47	43.9
70-79	26	24.3
80-89	3	2.8
Mean Age (Years)	63.82 ± 9.72	

The mean total PV of all patients estimated by transabdominal sonography was 59.10±40.00 (cm3)/gram while mean PV measurement estimated by transrectal sonography was 70.60±45.40(cm3)/gram. The mean volume of prostate measured transrectally was higher than that of suprapubic PV and this difference was statistically significant (p value <0.0001) (Table 2).

Table 2 *(Comparing the Mean Prostate Volumes Measured by SPUS and TRUS among Patients Presenting Lower Urinary Tract Symptoms.)*

Prostate Volumes (n=107)	Df	Mean ± SD	t-test value	(95% CI)	P value
Suprapubic Prostate Volume (cm3)/gram	106	59.1±40.0	-5.15	(- 15.9 to - 7.09)	0.0001*
Transrectal Prostate Volume	106	70.6±45.4			

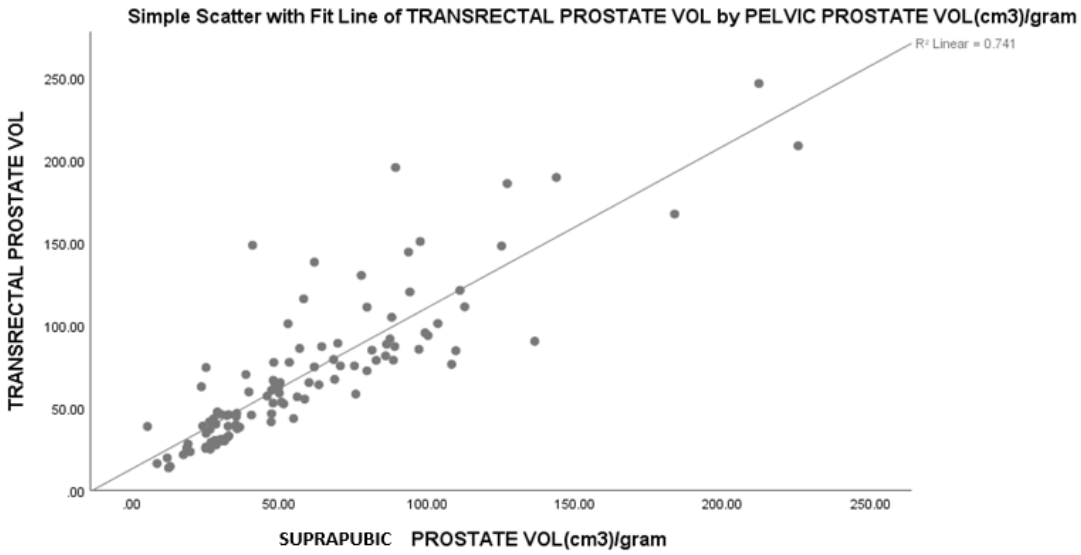
** Statistical significance, SD = standard deviation, df = degree of freedom, CI = confidence interval*

There is statically significant positive correlation between the suprapubic measured PV and transrectal measured PV (r = 0.861 p-value = 0.0001). Table 3. (Figure 1.)

Table 3 *(Showing Correlation between Suprapubic Prostate Volumes and Transrectal Prostate Volumes.)*

Prostate Parameters (n=107)	Mean ± SD	R	P-value
Suprapubic Prostate Volume (cm3)/gram	59.1±40.0	0.861	0.0001*
Transrectal Prostate Volume	70.6±45.4	0.861	0.0001*

** Statistical significance, SD = standard deviation, R= correlation coefficient*



DISCUSSION

Symptomatic benign prostatic hyperplasia (BPH) is the most common neoplastic condition in men worldwide and constitutes a major public health problem in both developed and developing countries.2

The current approach for diagnosing prostate volumes and visualization of the transitional/peripheral zone is through transrectal ultrasonography (TRUS).14,15 Although this approach is easy-to-use and less expensive than other imaging methods, but often it cause some discomfort for the patients.15 This study established that the mean age for symptoms of BPH is 63.82±9.72years which is comparable to the study by Babaei Jandaghi A et al.15 In the study done by Feng KK et al the mean age of the patients was 70 years.14 This goes further to affirm that age is a known risk factor in development of BPH.

In this study the mean total PV of all patients estimated by transabdominal sonography was 59.10±40.00 (cm3)/gram while mean PV measurement estimated by transrectal sonography was 70.60±45.40(cm3)/gram. The mean volume of prostate measured transrectally was higher than that of suprapubic (pelvic) PV with a mean value of difference of 16.3%. This finding is congruent with other studies that reported differences in mean volume for SPUS and TRUS respectively14,15 and at variance to study done by Doebler.16 The prostate volumes in Doebler study were measured higher by SPUS with a mean value of 12.4% than TRUS. He drew a conclusion that SPUS may slightly overestimate the PV.

At the volume of less than 50cm3 the estimated volume of the prostate on suprapubic and transrectal ultrasound is approximately the same however at above 50cm3 a factor of 1.63 of the volume of the prostate on suprapubic pelvic ultrasound will give the actual volume on transrectal ultrasound scan.

In agreement with our findings, Ozden E et al17 and Chung Feon Haung et al18 reported a strong correlation between TRUS and SPUS in the measurement of PV. The correlation coefficient of the two methods was 0.94 and 0.84 respectively for volume measurement ($P < 0.001$). Yuen et al19 also found that transabdominal measurement of PV had a good correlation with the measurements performed by TRUS, and thus, there was no need for the discomforting TRUS. This study showed a very strong correlation between volume measurements performed by SPUS and TRUS. The correlation coefficient of the two methods was 0.86 for volume measurement ($P < 0.0001$).

Even though there was a strong correlation between SPUS and TRUS in the measurements of PV with the (volsPUS - volTRUS) difference of -11.50±5.40 cm3/gram, this study did not establish the replaceability of TRUS with SPUS. Hence advocation of Bland and Altman statistical method becomes inevitable to achieve it.

CONCLUSION

There was a significant correlation of PV measurement between SPUS and TRUS. Based on the findings of the current study SPUS cannot replace TRUS for measuring PV however we believe that SPUS can be a reliable alternative for TRUS.

REFERENCE

1. Mc Neal JE: The zonal anatomy of the prostate. Prostate 1981; 2: 35–49
2. McVary KT. Clinical Evaluation of Benign Prostatic Hyperplasia. Rev Urol. 2003; 5 (suppl 4): S3-S11
3. Styles RA, Neal DE, Powell PH. Reproducibility of measurement of prostatic volume by ultrasound. Comparison of transrectal and transabdominal methods. Eur Urol. 1988; 14:266–269.

4. Garvey B, Turkbey B, Truong H, Bernardo M, Periaswamy S, Choyke PL. Clinical value of prostate segmentation and volume determination on MRI in benign prostatic hyperplasia. Diagn Interv Radiol 2014; 20:229e33.
5. Tahir A, Ahidjo A. Variation of prostatic volume with advancing age among adult Nigerians. Arch Nig Med. 2004; 1: 12- 14. PubMed | Google Scholar
6. Hendrikx AJ, Doesburg WH, Reintjes AG, van Helvoort-van Dommelen CA, Hofmans PA, Debruyne FM. Determination of prostatic volume by ultrasonography. A useful procedure in patients with prostatism? Urology. 1989; 33(4):336 – 339. Doi: 10.1016/0090-4295(89)90282-3.
7. Rathaus V, Richter S, Nissenkorn I, Goldberg E. Transperineal ultrasound examination in the evaluation of prostatic size. Clin Radiol. 1991; 44:383-385. Doi: 10.1016/s0009-9260(05)80654-3.
8. Vilman P, Hancke S, Strange-Vognsen HH, Nielsen K, Sorensen SM. The reliability of transabdominal ultrasound in the determination of prostatic volume. An autopsy study. Scand J Urol Neprol. 1987; 21:5-7.
9. Jones DR, Roberts EE, Griffiths GJ, Parkinson MC, Evans KT, Peeling WB. Assessment of volume measurement of the prostate using per-rectal ultrasonography Br J Urol 1989; 64:493e5.
10. Stravodimos KG, Petrolekas A, Kapetanakis T, Vourekas S, Koritsiadis G, et al. TRUS versus transabdominal ultrasound as a predictor of enucleated adenoma weight in patients with BPH: a tool for standard preoperative work-up? Int Urol Nephrol. 2009; 41(4): 767-771. Doi: 10.1007/s11255-009-9554-9.
11. Styles RA, Neal DE, Powell PH. Reproducibility of measurement of prostatic volume by ultrasound. Comparison of transrectal and transabdominal methods. Eur Urol. 1988;14(4):266-269. Doi: 10.1159/000472957.
12. Kim SH, Kim SH. Correlations between the various methods of estimating prostate volume: transabdominal, transrectal, and three-dimensional US. Korean J Radiol. 2008; 9(2): 134-139. Doi: 10.3348/kjr.2008.9.2.134.
13. Aarnink RG, de la Rosette JJ, Debruyne FM, Wijkstra H. Formula-derived prostate volume determination. Eur Urol 1996; 29(4):399-402. Doi:10.1159/000473786.
14. Feng KK, Chiang I.N, Huang CY, Pu YS. Analysis of transrectal and suprapubic ultrasonography for prostate size evaluation Urological Science 2017; 28(3): 166-168. Doi: 10.1016/j.urols.2016.10.004.
15. Babaei Jandaghi A, Shakiba M, Nasseh HR, Korouji Y, Esmaeili S, Khadem Maboudi AA, Khorshidi A. Application of Bland-Altman.Method in Comparing Transrectal and Transabdominal Ultrasonography for Estimating Prostate Volume. Iran J Med Sci. 2015;40(1):34-39.
16. Doebler RW. Transverse prostate measurement obtained using transabdominal ultrasound: possible role in transurethral needle ablation of the prostate. Urology. 2000; 55(4): 564-567. Doi: 10.1016/s0090-4295(99)00556-7.
17. Ozden E, Gogus C, Kilic O, Yaman O, Ozdiler E. Analysis of suprapubic and transrectal measurements in assessment of prostate dimensions and volume: is transrectal ultrasonography really necessary for prostate measurements? Urol J. 2009; 6(3): 208-213.
18. Huang Foen Chung JW, de Vries SH, Raaijmakers R, Postma R, Bosch JL, van Mastrigt R, Prostate Volume Ultrasonography: The Influence of Transabdominal versus Transrectal Approach, Device Type and Operator, Eur Urol. 2004; 46(3):352-356. 10.1016/j.eururo.2004.05.002.
19. Yuen JS, Ngiap JT, Cheng CW, Foo KT. Effects of bladder volume on transabdominal ultrasound measurements of intravesical prostatic protrusion and volume. Int J Urol. 2002; 9(4): 225-229. Doi: 10.1046/j.1442-2042.2002.00453. x.