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Original Research Article **Surgery**

Correlation between Prostate Volume Estimated by Digital Rectal Examination and Trans-Rectal Ultrasound Measurements in Patients Diagnosed with Benign Prostatic Hyperplasia

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Abstract

Background: Measurement of Prostate Volume (PV) is fundamental in the proper management of patients with benign prostatic hyperplasia (BPH). Although a crude way of assessing PV, digital rectal examination (DRE) has been used in various centres and then objectified by the use of Transrectal Ultrasound Scan (TRUS) measurement for reasons of accuracy. Prostate volume measurement together with the use of international prostate symptom score (IPSS) is central in choosing treatment modalities whether medical or surgical. In this study, we aimed at correlating PV measured by DRE and TRUS. ***Patients and Methods:*** This is a prospective study of seventy four (74) patients being managed for BPH in our facility between September 2019 and December 2020 who met inclusion criteria. Full clinical history was obtained together with physical examination and well-focused DRE of the prostate to estimate PV based on Romero *et al.*, technique combined with the sliding scale technique. Subsequently patients were sent for TRUS measurements of the prostate which is also a routine procedure in BPH managements. Data were collated and analysed using statistical package for social sciences (SPSS) version 20.0 ***Results:*** A total of 74 patients were studied with a mean age of 63.05±9.89 years ranging from 43 to 90 years. Mean PV estimated by DRE was 47.91±14.16 mls and that by TRUS was 53.42±25.33 mls. There was a statistically significant correlation in PV measurements between the two modalities (P v=.750, PV < .05). ***Conclusion:*** PV measured by DRE closely approximates TRUS measurements.

Keywords: Correlation. Prostate Volume, Digital rectal examination, transrectal ultrasound scan.

INTRODUCTION

In BPH patients, estimation of PV is fundamental in choosing treatment modalities either surgical or medical [1]. In patients that may require medical treatment, and in combination with IPSS, PV is useful in determining those that will benefit from mono- or combination therapy with α- adrenergic blocker and 5α-reductase inhibitor [2]. AUS G *et al.*, [3] in their study reported that PV can predict the duration of surgery and blood loss with more bleeding occurring in larger prostates by reason of a wider cavity and area of oozing after enucleation. When surgery is indicated, PV helps determine the technique, either minimally invasive or open surgery. Alschibaja [4] noted that prostate volumes in excess of 75mls should be treated with open surgery and those less than 75 mls reserved for transurethral resection of the prostate (TURP) and other minimally invasive procedures to limit surgery time and associated complications. Estimation of PV can be done with DRE, Trans-abdominal Ultrasound Scan (TAUS), TRUS and magnetic Resonance imaging (MRI). Studies have long documented the supremacy of imaging studies in PV estimations over DRE [5]. However, in some rural settings especially in Sub-Saharan Africa, these imaging studies are unavailable and expensive and surgeons rely on DRE for PV estimation [6].

It is a simple, non-invasive and cost effective means of assessing patients with lower urinary tract symptoms (LUTS) which can also detect other ano-rectal conditions. Despite its usefulness, DRE has a high inter-observer variability [7, 8]. Again DRE only assesses the posterior surface of a 3-dimensional prostate and in those with predominant median lobe enlargements; DRE assessments may indicate a normal prostate [9]. Therefore, TRUS has been adopted as the

criterion standard for measurements of prostate size where available [10]. In some studies, DRE had been shown to underestimate large prostates and over-estimate small prostates compared with TRUS measurements [11, 12]. In this study, we set out to compare PV estimated by DRE and TRUS measurements.

MATERIALS AND METHODS

Study Design

This is a prospective study conducted in the urology clinic of our facility from September 2019 to December 2020.

Inclusion and Exclusion Criteria

A total of 74 men with clinical diagnosis of BPH who met the inclusion criteria were studied. Detailed clinical history and physical examination with focused DRE of the prostate was done. Thereafter patients were sent for TRUS measurement of PV and other prostate features. Exclusion criteria included known or suspected prostate cancer patients on DRE and TRUS assessments, obese patients with a BMI > 30kg/m^2, patients with anal fissures and thrombosed haemorrhoids. Bed ridden patients and those with bony abnormalities that restrict proper positioning.

Data Collection and Statistical Analysis

A single urologist with more than 10 years of practice physically examined the patients with detailed DRE and grading of the prostates. Informed consent was taken from each patient. DRE was done in the standard left lateral position where the dependent lower limb is extended and the right lower limb is flexed at both the hip and the knee joints. Each step of the procedure was first explained to the patient and cooperation was optimal. The buttock was parted and the peri-anal region fully inspected for hygiene, protrusions, fissures and mucoid or bloody discharge. Then a well- lubricated gloved right index finger was introduced gently noting the tone of the anal sphincter, the degree of prostatic protrusion into the rectum, and other features such as consistency, tenderness, the presence of the median groove and lateral sulci, mobility of rectal mucosa and the remaining part of the rectum not occupied by the prostate were examined. The examining finger was inspected for blood, mucus or normal stool colour. Features consistent with suspected BPH were; an enlarged prostate with preservation of the median groove and both lateral sulci, firm consistency with a freely mobile rectal mucosa over the prostate. I used the Romero *et al.,* [13] technique which utilizes the ability of the right index finger to access the upper limit of the prostate. This technique grades prostate enlargement from 1 to 4 as follows: grade 1 is accessibility of the upper limit of the prostate with ease; grade 2 is accessibility with little effort, grade 3 is accessibility with marked difficulty and grade 4 is inability to access the upper limit even with great effort. The other aspects of Romero *et al.,* technique could not be followed because not all prostates in the same grade may have all the features since prostates enlarge and elongate in different directions. This technique was combined with the sliding scale [14] which has long been practiced. It is based on the level of rectal encroachment by the prostate. In grade 1, prostate occupies <1/4 of the rectum, grade 2 it occupies > ½ of the rectum, grade 3 > ¾ of the rectum is occupied and grade 4, prostate fills so much of the rectal lumen that adequate examination is difficult.

A search was made on the ultrasound scan grading of benign prostates whose reliability had been tested and used in clinical practice [15]. It is graded as follows: Grade 1 corresponds to a PV < 30g, while grade 2 is PV between 30 – 50g, grade 3 is PV > 50gm – 85gm and grade 4 is PV > 85gm. This system was used to clinically match the DRE PV estimation with the numerical values in USS grading. PV ultrasound scan measurements are calculated using the formular $V= \alpha \times \beta \times \gamma \times {}^{\pi}/_{6}$ (α= transverse diameter, β = A-P diameter, γ = longitudinal diameter, ${}^{\pi}/_{6}$ = 0.52 [16]. Prostate volume was categorized as non-significant when PV was < 50gm and significant when it was ≥ 50gm in both DRE and TRUS measurements. Mean, median and range of continuous variables were calculated. Frequency of categorical variables were obtained and Pearson correlation was used to assess the level of association while statistical significance was set at $P<0.05$.

RESULTS

In table 1; The Mean age of the patients was 63.05±9.89 years, ranging from 43 to 90 years. The mean DRE and TRUS prostate volumes were 47.91±14.16mls and 53.42±25.33mls respectively. Mean serum PSA was 4.44±6.25ng/ml. Table 2 shows prostate volume classification into significant and non-significant values. For DRE, 40.5% and 59.5% were considered significant and non-significant volumes respectively while for TRUS measurements, 41.9% and 58.1% were respectively considered significant and non-significant prostate volumes. In table 3; Prostate volume estimated by DRE correlated significantly with Prostate volume measured with TRUS (r=.750, P=.000), and PSA correlated significantly with both DRE and TRUS measurements (r=.348, P=.002 / r=.367, P=.001 respectively).

Table 1: Table of means

Variables	Mean ± Std	Range
Age	63.05±9.89 years	43-90 (years)
DRE Pv	47.91±14.16mls	25-100mls
TRUS Pv	53.42±25.33mls	15.58-135.50mls
PSA	4.44±6.25ng/ml	0.1-4410ng/ml

Table 2: Prostate volume classifications

DRE Pv	Frequency(n)	Percent (%)	Cumulative (%)
Significant	30	40.5	40.5
Not significant	44	59.5	100.0
Total	**74**	**100.0**	
Ultra-sound Pv:			
Significant	31	41.9	41.9
Not significant	43	58.1	100.0
Total	**74**	**100**	

Table 3: Correlations

		USS Pv	DRE Pv	PSA
USS PV	Pearson correlation	1	.750	.367
	Sig (2-tailed)		.000*	.001*
DRE PV	**N.**	**74**	**74**	**74**
	Pearson correlation	.750	1	.348
	Sig.(2-tailed)	.000*	74	.002*
	N	**74**	**74**	**74**
PSA	Pearson correlation	.367	.348	1
	Sig (2-tailed)	.001*	.002*	
	N.	**74**	**74**	**74**

*Statistical significance set at P value <.05s

DISCUSSION

Assessment of prostate enlargement and even volume estimation can be done with DRE, TAUS, TRUS and MRI even though studies have shown supremacy of imaging studies over DRE estimation [5]. In some rural settings especially in Sub-Saharan Africa, these imaging studies are not readily available and expensive and so surgeons rely on DRE for PV estimation [6]. DRE of the prostate has been shown to have a high diagnostic value [17]. Despite this, it is for a large part subjective and for proper clinical use should be objectified by comparison with TRUS examination [18]. Other inherent flaws of DRE include its high inter-observer variability and underestimation of PV compared to TRUS [7, 8]. In clinical practice, the need for PV estimation cannot be over-emphasized as it enables determination of significantly enlarged prostate employed in medical and surgical management of BPH patients. Boyle P *et al.,* [19] noted that patients with significantly enlarged prostates (>50mls) have better clinical improvements when treated with combination therapy using α-adrenergic blocker and 5α-reductase inhibitor.

In this study, significantly enlarged prostate was noted in 40.5% and 41.9% using DRE and TRUS measurements respectively giving a predictive value of 96.7%. With this in mind, one will not be too far from normal if DRE is used solely to choose medical treatment options for BPH patients where conventional imaging tools are not available. Measurements of PV by DRE had been pioneered by researchers like Romero *et al.,* [13] and Graylack JT [14]. For the purpose of reproducibility, attempts have been made to standardize the outcome of the results [20]. In our work, PV measured by DRE had a statistically significant correlation with TRUS measurements (r=.750, P=0.000). Same result was also recorded in a study by Udeh E I *et al.,* [21] with a relatively lower correlation coefficient (r=.593, P=0.000). The slightly wide disparity in the strength of the association between the two studies may be accounted for by the population studied, the method employed and in particular patients morphometric variable and the length of the examiner's right index finger.

Two researchers noted independently that DRE done by a Urologist had a higher predictive value and even so when considering prostate volume estimation than a urology junior trainee [7, 22]. It therefore follows that PV estimation done by DRE although closely approximates TRUS measurements should be interpreted with caution and details the examiner. This underscores the importance of a long learning curve that arrives at excellence in this seemingly simple but important procedure. Its reproducibility will enhance urological practice

elsewhere where conventional imaging studies are not readily available or expensive.

It is also important to note that PV measurements with both modalities correlated positively with patient's prostate specific antigen (PSA) levels (Table 3). Similar result was also noted by Udoh EA *et al.,* [23] in their study of 71 men with BPH. This also suggests that, with DRE estimation of PV, it is possible to arrive at a prostate specific antigen density (PSAD) with some level of certainty that could help discriminate between BPH and prostate cancer (Pca) especially in the PSA gray zone (0 – 4ng/ml). The current guideline documents a PSAD of 0.15ng/ml/cc in the diagnosis and treatment of Pca [24]. With DRE estimation of PV and serum PSA assay, PSAD value arrived at could eliminate to some extent unnecessary prostate biopsies with its attendant complications and also reduce over-treatments of prostate cancer. The above deductions are so useful in the rural settings that lack appropriate equipments in managing prostate diseases and further strengthen the skills of urologists irrespective of where their practice is located that DRE is an indispensable tool in their hands to manage prostate pathologies.

Studies have noted that DRE underestimates prostate volumes compared to TRUS [7, 8]. While this is also observed in this work, Smith *et al.,* [12] had a contrary result although they used TAUS which could have affected their report. Some authors have noted that TRUS is more accurate in predicting PV than TAUS in BPH patients [25, 26]. This statement is dependable considering the anatomical location of the prostate being an intra-pelvic organ and just anterior to the rectum.

The limitation of this study is that patients were evaluated by a single Urologist in a single centre precluding inter-observer reliability where many hands are involved. The effectiveness of this report could also be better appreciated when different cadre of clinicians are involved ranging from attending urologists to the junior urology trainees.

CONCLUSION

DRE PV estimation correlates strongly with TRUS measurements in this study. Although underestimation was observed, as was also noted in other studies, its use in resource poor settings without conventional imaging modalities may not be misleading in BPH evaluation and treatments.

Authors Contribution

EAU: Substantial contributions to conception and design, Acquisition of data, Drafting the article, revising it critically for important intellectual content, data analysis and Final approval of the version to be published.

IUE: Substantial contributions to conception and design, revising it critically for important intellectual content and final approval of the version to be published.

PDE: Substantial contributions to conception and design, revising it critically for important intellectual content and final approval of the version to be published.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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