

**COMPARISON OF MEASUREMENT OF POST-VOID RESIDUAL VOLUME BY  
ULTRASOUND AND URETHRAL CATHETERIZATION IN OKINNIN COMMUNITY,  
SOUTH WEST NIGERIA**

Ayomide Olajide Olufemi\*, Eziyi Amogu Kalu, Ojewuyi Olufemi Olayide and Oyeniya Ganiyu Adebukola

Urology Unit, Department of Surgery of LAUTECH Teaching Hospital Osogbo, Osun State. Nigeria.

**\*Corresponding Author: Ayomide Olajide Olufemi**

Urology Unit, Department of Surgery of LAUTECH Teaching Hospital Osogbo, Osun State. Nigeria.

Article Received on 17/05/2021

Article Revised on 07/06/2021

Article Accepted on 28/06/2021

**ABSTRACT**

**Background:** Measurement of post-void residual volume of urine is part of assessment of patients presenting with lower urinary tract symptoms. Post-void Residual urine is defined as the volume of urine remaining in the bladder immediately after voluntary void. There are several means of measuring the PVR; the most common methods are urethral catheterization and abdominal ultrasound. There are controversies about accuracy of ultrasound in measurement of PVR, while urethral catheterization is considered to be the gold standard method; it is considered invasive and associated with increased risk of urinary tract infection. **Materials and Method:** The study was a community based study conducted over a period of six weeks in 2018. The study population were men, 40 years and above who consented to participate in the study. Multi-stage sampling technique was used to select the respondents and the study was done at the health centre within the community. Ethical approval was obtained from ETHIC committee of LAUTECH Teaching Hospital Osogbo and permission to carry out the study in the community was granted by the Traditional Ruler of the community. Informed consent was taken from all participants and data including sociodemographic data, lower urinary tract symptoms captured in the international prostate symptoms score and post void residual volume were obtained with questionnaire, ultrasound and urethral catheterization. **Results:** A total of 236 men participated in the study, mean age was 60.81 (Range 40 to 80 years). The mean post void residual volume by catheterization was 35.74 while the mean PVR by abdominal ultrasound was slightly less at 33.74. **Conclusion:** Transabdominal ultrasound is an accurate, reproducible and a less invasive means of measuring post void residual volume of urine. The difference between the value obtained by the two methods were not statistically significant ( $p=0.06$ ). It is safe, more acceptable by patients and it is therefore recommended as routine method of assessing post void Residual volume.

**INTRODUCTION**

Post-void Residual urine is defined as the volume of urine remaining in the bladder immediately after voluntary void.<sup>[1]</sup> Post-void residual volume of urine is often used to assess patients presenting with LUTS, although the pathophysiology of elevated PVR volume of urine is not well understood and its interaction with BOO and detrusor underactivity is complex. A significant post-void Residual could be due to detrusor underactivity or bladder outlet obstruction or a combination of both. There is no agreed-upon standard definition of exactly what constitutes an elevated PVR and different values were reported by various studies. Sakakibara et al.<sup>[2]</sup> considered PVR less than 50ml as adequate bladder emptying and PVR greater than 200mls as significant residual. Kolman et al.<sup>[3]</sup> on the other hand put normal post-void residual volume in adults at 50-100mls

PVR can be assessed by abdominal Ultrasound, Portable bladder scanner and urethral catheterization. The most

accurate method is said to be by urethral catheterization, it is reported to have 100% sensitivity and specificity<sup>[4,5]</sup> however it carries the risk of urethral injury, urinary tract infection and it is less acceptable by patients.

Various studies have compared the accuracy of residual urine volume measurement using abdominal ultrasound and urethral catheterization and found that ultrasound method is an acceptable way of doing this but it is not as accurate as urethral catheterization.<sup>[1,6]</sup> While some advocate caution when interpreting PVR measurements made by abdominal US, others consider it to be too inaccurate<sup>[7,8]</sup> This study aims to revisit how accurate ultrasound is in measuring PVR

**MATERIALS AND METHOD**

The study was a community based study carried out at Primary Health Centre Okinin; ward 10, Egbedore Local government area of Osun State in September 2018 with approval of Ethics committee of LAUTECH Teaching Hospital Osogbo and written approval from the

Traditional Ruler of Okinni. The study population were men 40years and older in the community who consented to participate in the study. Multi-stage sampling method was used to select 236 men in the community which was already stratified to 8 district by traditional landmarks, thus, the total number of the respondents was divided into eight equal parts. Simple random sampling technique was used to select 10 street/compound from each district, thus, each street had a minimum of 3 participants. A number of household were selected from each street using systematic sampling technique. The selected men were given serial number and were told to report at the community Health centre for assessment. At the health centre, the procedure was explained to the participants, written informed consent taken and IPSS questionnaire was administered to each person in completely private settings. Information obtained were sociodemographic biodata and lower urinary tract symptoms as captured in the International Prostate Symptoms Score. Thereafter, each respondent was told to void, abdominal ultrasound was done immediately after voiding using SONOACE X4 (MEDISON CO. LTD; Seoul, Korea) ultrasound machine to estimate the post void residual urine volume and size 14 urethral catheter passed with adequate lubrication with Lidocaine gel to drain and measure the post void residual urine. Ultrasound volume was calculated using prolate ellipsoid formula (Length (cm) X Width (cm) X Height (cm) X 0.52). The data was analyzed using Statistical Package for Social Sciences Version 22. The calculated Post Void Residual Volume using Transabdominal Ultrasound was

correlated with volume gotten from urethral catheterization.

## RESULTS

A total of 236 men above 40 years of age participated in the study, the mean age of the respondent was 60.81 (range 40 to 80 years). Sociodemographic characteristic is shown in table 1 below. The mean post void residual volume by catheterization was 35.74 while the mean PVR by abdominal ultrasound was slightly less at 33.74. Among the respondent 52.54% had mild IPSS score (IPSS 1-7) while 47.46 had moderate IPSS score (IPSS 8-19). In the category of respondent with mild IPSS score the mean PVR by Ultrasound was 26.30 while PVR by catheterization was 28.39. On the other hand, those with moderate IPSS score had mean PVR of 41.96 by ultrasound and 43.88 by catheterization.

**Table 1: Sociodemographic characteristics of the Respondents.**

Variable	Frequency (n=236)	Percentage (%)
Age (years)		
41-50	44	18.6
51-60	64	27.1
61-70	80	33.9
71-80	48	20.3
Total	236	100.0
Mean age =60.81		

**Table 2: Distribution of respondents by IPSS score.**

Variable	Frequency (n=236)	Percentage (%)
Mildly symptomatic ( IPSS 0-7)	124	52.5
Moderate symptomatic ( IPSS 8-19)	112	47.5
Total	236	100.0

**Table 3: Post-Void residual volume cross tabulated with IPSS.**

Variable	IPSS scores		P value
	Mildly symptomatic	moderate symptomatic	
PVR by Catheter	28.39	43.87	.000
PVR by USS	26.30	41.96	.000

**Table 4: Correlation between IPSS score and some parameters.**

Correlations		Age	PVR by Catheter	PVR by USS
IPSS core	Pearson Correlation	.368**	.471**	.475**
	Pvalue	0.000	0.06	0.06
	N	236	236	236

## DISCUSSION

Measurement of post-void Residual urine volume is part of assessment of patients presenting with Lower Urinary Tract Symptoms. While there are controversies about what constitutes an elevated PVR, some authors considered post-void residual volume less than 50 mL to be normal, and volumes greater than 100 mL is considered abnormal. The gold standard method of

measuring PVR is urethral catheterization, this is invasive, less acceptable by patients and increases risk of urinary tract infection.<sup>[10,11]</sup>

The mean age of the respondent was 60.81, this is comparable to the mean age of the patients enrolled in the study done by Amole et al<sup>[7]</sup> on patients with BPH where the mean age was 63.8. The mean PVR were

35.74 and 33.74 for urethral catheterization and ultrasonography respectively.

Previous studies on accuracy of ultrasound in measuring PVR have given conflicting results. Many studies demonstrated high accuracy of post-void residual using transabdominal ultrasound and bladder scanner<sup>[12,13]</sup>, others however considered ultrasound inaccurate way of estimating PVR.<sup>[1]</sup> In our study, the calculated PVR from Ultrasound measurement has shown to be about 96% accurate. A high correlation was found between the ultrasound volume and catheter volume. This is similar to a systematic overview by Nwosu *et al.*<sup>[14]</sup> and some other studies<sup>[7], [15]</sup> which showed ultrasound to be an accurate means of estimating PVR. In our study, postvoid residual volume increases with age as well as severity of IPSS. The Calculated PVR using ultrasound correlated well with PVR by catheterization with correlation coefficient of 0.475 and the difference in the measured volume is not statistically significant ( $p=0.06$ ) The difference in measurement between the two volumes was not related to age or IPSS score.

In the present study, there was no incidence of urethral injury as the catheterization was done by Urology trainee, however, the risk of urinary tract infection was unknown because the participants were not followed up. In spite of this findings, urethral catheterization is still associated with risk of infection, trauma and patient discomfort. There is therefore a need for a less invasive way of measuring PVR that is as accurate but less invasive

## CONCLUSION

Transabdominal ultrasound is an accurate, reproducible and a less invasive means of measuring post void residual volume of urine. The difference between the value obtained by the two methods were not statistically significant It is safe, more acceptable by patients and it is therefore recommended as routine method of assessing post void Residual volume.

## REFERENCES

1. Simforoosh N, Dadkhah F., Hosseini S.Y., Asgari M.A, Nasser A., Safarinejad M.R Accuracy of residual urine measurement in men: comparison between real-time ultrasonography and catheterization J Urol, 1997; 158: 59-61.
2. Sakakibara R, Yamamoto T, Uchiyama T, Liu Z, Ito T, Yamazaki M, Awa Y, Yamanishi T, Hattori T. Is lumbar spondylosis a cause of urinary retention in elderly women? J. Neurol, Aug, 2005; 252(8): 953-7.
3. Kolman C, Girman CJ, Jacobsen SJ, Lieber MM. Distribution of post-void residual urine volume in randomly selected men. J. Urol., Jan, 1999; 161(1): 122-7.
4. Richter S., Hag'ag R., Shalev M., Nissenkorn I. Measuring residual urine by portable ultrasound scanner Harefuah, 1999; 137: 93-95.
5. Alivizatos G., Skolarikos A, Albanis S., Ferakis N, Mitropoulos D. Unreliable residual volume measurement after increased water load diuresis Int J Urol, 2007; 11: 1078-1081.
6. Hassan A. Abdelwahab, Housseini M. Abdalla, Mahmoud H. Shereif, Mohamed B. Ibrahim, Mostafa A. Shamaa. The reliability and reproducibility of ultrasound for measuring the residual urine volume in men with Lower Urinary tract symptoms. Arab Journal of Urology, 2014; 12: 285-289.
7. Amole A.O., Kuranga S.A, Oyejola B.A. Sonographic assessment of postvoid residual urine volumes in patients with benign prostatic hyperplasia, J Nat Med Assoc, 2004; 96: 234-239.
8. Bent AE, Nahhas DE, McLennan MT. Portable ultrasound determination of urinary residual volume. Int Urogynecol J Pelvic Floor Dysfunct, 1997; 8(4): 200-2.
9. Kaplan SA, Wein AJ, Staskin DR, Roehrborn CG, Steers WD. Urinary retention and post-void residual urine in men: separating truth from tradition. J. Urol., Jul, 2008; 180(1): 47-54.
10. Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. Am J Med., 2002; 113: 5-13.
11. Hashmi S, Kelly E, Rogers SO, Gates J. Urinary tract infection in surgical patients. Am J Surg, 2003; 186: 53-6.
12. Ouslander JG, Simmons S, Tuico E, Nigam JG, Fingold S, Bates-Jensen B, Schnelle JF. Use of a portable ultrasound device to measure post-void residual volume among incontinent nursing home residents. J Am Geriatr Soc., Nov, 1994; 42(11): 1189-92.
13. Park YH, Ku JH, Oh SJ. Accuracy of post-void residual urine volume measurement using a portable ultrasound bladder scanner with real-time pre-scan imaging. NeuroUrol. Urodyn, Mar, 2011; 30(3): 335-8
14. Nwosu C.R, Khan K.S, Chien P.W, HonestIs M.R real-time ultrasonic bladder volume estimation reliable and valid? A systematic overview Scand J Urol Nephrol, 1998; 32: 325-330.
15. Paltieli Y., Degani S, Aharoni A., Shapiro I, Reiter A, Scharf M., *et al.* Ultrasound assessment of the bladder volume after anterior colporrhaphy Gyne Obst Invest, 1989; 28: 209-211.