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## Intravesical Residual Urine of Patients with Benign Prostate Hyperplasia, Sonography Accuracy

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**Abstract:** Measurement of intravesical residual urine is experimentally a diagnostic, therapeutic and follow-up criterion in patients with benign prostate hyperplasia. The study aims at evaluating sonography accuracy in measuring intravesical residual urine in comparison with standard and accurate way of measurement through bladder catheterization. The study was conducted on 60 patients hospitalized for benign prostate hyperplasia. Mean age of the patients was  $67.10 \pm 8.33$  years. In all patients with full bladder and after urination, the post void residue was initially measured by sonography at supine position and then immediately through bladder catheterization. This study evaluated 60 patients with mean age of  $67.10 \pm 8.33$  years. The difference between measuring through sonography and catheterization was  $7.89 \pm 0.86$ ,  $14.46 \pm 1.87$  and  $32.73 \pm 2.99$  mL in postvoid residue less than 50, 51-100 and more than 100 mL, respectively. In patients with benign prostate hyperplasia, transabdominal sonography is a non-invasive method to determine postvoid residue amount.

**Key words:** Benign prostate hyperplasia, postvoid residue, sonography

### INTRODUCTION

Significant intravesical Postvoid Residue (PVR) is one of the manifestations of Benign Prostate Hyperplasia (BPH). Determining PVR volume is one of the routine important evaluations in BPH and serial measurement may indicate to clinical progress (Park *et al.*, 2012; Zabkowski, 2012). Determination of PVR through bladder catheterization is regarded a standard technique but it is associated with infection of the urinary system and injury of urinary tract. Additionally, it may bear some degrees of error in some cases (Dell'Atti, 2012; Elmansy *et al.*, 2012). Nevertheless, it carries the risk of infection and trauma to the urethra. In addition, it has been reported to be inaccurate to some extent (Hossain *et al.*, 2012). Ultrasonogram is useful for general screening at the urinary tract. It is the examination of choice in defining renal cysts, detecting renal masses, kidney size and contour, diagnosing and following hydronephrosis and evaluating the bladder by measuring its maximum cystometric capacity, post voidal residue, wall thickness, any mass lesion and vesicle calculus. It is a useful adjunct in demonstrating renal calculi (Chen *et al.*, 2012; Kim *et al.*, 2012). Non-invasive urine volume measurement is an important tool in the measuring of intravesical residual urine. Sonography is used as a quick and noninvasive method to evaluate PVR volume instead

of bladder catheterization. Although some take care in interpretation of PVR measurement through transabdominal ultrasonography (Homma *et al.*, 2011; Zhu *et al.*, 2011), this study aimed at determining PVR volume in BPH patients which is in contrary to this mental background.

### MATERIALS AND METHODS

This analytical study evaluated 60 patients with BPH hospitalized at urology ward of Sina hospital from Aug 2011 to Aug 2012. This study was approved by ethic committee of Tabriz University of Medical Sciences. Written consent was obtained from all the patients. Two patients were excluded from the study due to tract stenosis and impossibility of bladder catheterization. Also, those patients with permanent catheter in their bladder due to acute urinary retention or neurogenic disorders did not enter the study. Patients with sonographic evidences of upper urinary system dilatation and consumption of bladder diuretic were excluded from the present study. In every patient, urine volume was initially measured with full bladder and supine position through transabdominal sonography. Then, the patients were asked to empty their bladder through urinating for two times. Then, sonography was repeated to measure and record PVR volume. It was described to the patients

that mild bladder catheterization will be used to measure their postvoid residue to exactly and completely evaluated the conditions before operation. After informing the patients and completely satisfying them, a Nelaton catheter (No.18) was inserted into the bladder. The postvoid residual (if any) were evacuated and measured using a scaled container. The measured PVR varied between zero and 809 mL (averagely  $83.55 \pm 16.63$ ) and zero and 845 mL (averagely  $98.19 \pm 17.85$ ) in sonography and catheter methods, respectively. The study data was analyzed with SPSS 16 software. Mc Nemar and Kruskal-wallis statistical tests were used to study error values of the postvoid residue measured through sonography. The  $p < 0.05$  was regarded as meaningfull.

### RESULTS

Mean age of the patients was  $67.10 \pm 8.33$  years. PVR measured through sonography and bladder catheterization were compared. Results of PVR measurement through sonography and bladder catheterization revealed that PVR measured through sonography is equal or relatively less than standard bladder catheterization method in 88% of cases (Table 1). To accurately analyze the obtained data, the patients were divided into three groups of 0-50, 51-100 and more than 100 mL considering PVR volume. It was revealed that there is a meaningful difference between three groups considering mean measurement error ( $p < 0.001$ ). In other words, the less the PVR, the less the measurement error will be (Table 2). Sonography with error of about  $7.89 \pm 0.86$ ,  $14.46 \pm 1.87$  and  $32.73 \pm 2.99$  mL in volumes less than 50, between 51 and 100 and more than 100 mL may determine PVR. The Mc Nemar statistical test confirms the above findings (Table 3). Since  $PVR > 100$  mL is regarded as one of criteria to make decisions about BPH diagnosis and treatment and paying more attention to outcomes resulted from statistical test, it can be concluded that sonography averagely demonstrates PVR less than ( $32.73 \pm 2.99$ ) the real value in PVR volumes  $> 100$  mL. regression test indicated to a positive meaningful relationship between PVR values measured through sonography and bladder catheterization ( $p < 0.001$ ,  $r = 0.997$ ). Determination coefficient between PVR values measured through sonography and bladder catheterization is 0.94. Regression model demonstrates general relationship between PVR values measured through sonography and bladder catheterization:  $PVR$  (with sonography)  $*1.069 + 8.85 = PVR$  (with catheter), i.e., it is possible to

Table 1: PVR values measured through sonography

PVR volume	No.	Percentage
Sonography less than catheter	49	84.5
Sonography equal to catheter	2	3.4
Sonography more than catheter	7	12.1

Table 2: Comparison of PVR measurement error in different postvoid residue volumes

PVR volume measured by bladder catheterization method	Mean difference	Standard error of mean
0-50 mL	7.89	0.86
51-100 mL	14.46	1.87
More than 100 mL	32.73	2.99

Table 3: Comparison measurement accuracy of postvoid residue in two methods of sonography and bladder catheterization

Catheter group	Sonography group			Sum
	0-50	51-100	<100	
0-50	28	0	0	28
51-100	2	13	0	15
<100	0	2	13	15
Sum	30	15	13	58

predict accurate value of PVR obtained with bladder catheterization using the above mathematical model and considering PVR measured through sonography.

### DISCUSSION

Intravesical residual urine is one of the most common complaints in the elderly men and benign prostate obstruction is one of the most frequent causes. Pressure flow study has been recommended before surgical treatment of prostate enlargement by many authors. Searching for new accurate methods that could substitute the gold standard pressure-flow study demonstrates the need for lowering costs, expanding accessibility and relieving patient discomfort (Dicuio *et al.*, 2010; Lee *et al.*, 2010). Clinical data such as IPSS, post voiding residue and flowmetry have been previously demonstrated to correlate mostly to lower urinary tract functional status rather than mechanical obstruction itself. Therefore, noninvasive measurements of the prostate intend to delineate a morpho-functional correlation in order to orient conduct towards LUTS secondary to benign prostate obstruction (Park *et al.*, 2010; Shinbo *et al.*, 2010). Significant PVR may result in symptoms including frequent urination, enuresis, urinary incontinence of over flow type and recursive urinary infections. PVR measurement is important in denying neurologic disorders or occlusive diseases (El-Husseiny and Buchholz, 2011; Seo *et al.*, 2011). PVR measurement will be helpful in primary evaluation and control of clinical progress process of BPH patients (Takada *et al.*, 2011). Considering ever-increasing

prevalence of chemotherapy in BPH patients, it is more necessary to use a quick and noninvasive way with sufficient accuracy (Foo, 2010). During recent years, PVR is measured through bladder catheterization which is regarded as an accurate and standard method. However, bladder catheterization is associated with infection and urinary tract trauma risk (Wang *et al.*, 2011; Wang and Foo, 2010). During the last three decades, sonography has been used as an alternative method to determine bladder urine volume. Although several studies have been conducted in this regard, measurement accuracy of PVR through sonography in comparison with conventional and standard way of bladder catheterization is still controversial (Choi *et al.*, 2010; Foo, 2010). Findings of the present study are considered especially when PVR volume used in clinical decision making for treatment equals 100 mL or exceeds it. Intravesical protrusion seems to corroborate with urinary obstruction through a "valve ball" mechanism, in which the prostate's lateral and medium lobes interfere on the complete opening of the vesical neck while the patient urinates. According to this mechanism and based on the present study, it was demonstrated that the intravesical protrusion of the prostate relates not only to the urinary obstruction itself, but it also provides information concerning the severity of obstruction. It has been demonstrated that the greater the IPP, the higher BOOI. Still significant, but to a lesser extent, results of prostatic volume obtained through ultrasound and PSA also related to the degree of obstruction (Han *et al.*, 2010).

### CONCLUSION

According to the results, it seems that conventional transabdominal sonography is a healthy, quick and reliable way to evaluate PVR in BPH patients. Considering ever-increasing intention to use chemotherapy for BPH, sonography can be used frequently and repeatedly, even in clinic, to control the disease progress and its treatment without risk of infection and urinary tract trauma.

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