ICS Teaching Module: Measurement of Post-Void Residual Urine

A D Asimakopoulos, C De Nunzio, E Kocjancic, A Tubaro, P Rosier & E Finazzi-Agro

ICS Teaching Module: Measurement of Post-Void Residual Urine

Dr. Fatih Tarhan

Definitions

PVR

"The amount of residual urine in the bladder after a voluntary void"

Kaplan SA et al. J Urol. 2008 Jul;180(1):47-54.

Increased in pts with:

1. BOO (BPH, poor sphincter relaxation, urethral/meatal stricture or bladder stones)
2. Detrusor underactivity
3. Bladder diverticulum
4. Large volume vesicourethral reflux → "pseudoresidual"

PVR and BOO

Limits

I. Can be due to detrusor underactivity

II. 1/3 of male patients with BPH and bladder outflow obstruction do NOT present PVR

More useful if used in combination with uroflowmetry or other parameters.

Belal M, Abrams P: J Urol 2006

PVR

- *Threshold values delineating what constitutes an abnormal PVR are poorly defined.*

- *Most urologists agree that volumes of 50-100 mL constitute the lower threshold to define an abnormal PVR.*

Abrams PH et al . Br Med J 1978; 2: 1258.

Measurement

PVR measurement

- Urethral catheterization has been accepted as the gold standard for PVR measurements, but this may cause discomfort for patients and carries a risk of urinary tract infection and trauma.

Schaeffer AJ, et al. J Urol 1983;130:1096--9.

- Non-invasive ultrasound bladder volume measurement has been used as an alternative to urethral catheterization, as a good compromise between accuracy and patients safety/comfort.

Griffiths CJ, et al. J Urol 1986;136:808-812

PVR measurement by US

Ultrasound bladder volume estimation can be performed in two ways:

1. By a real-time ultrasound to directly visualize the bladder.

   Griffiths CJ, et al. J Urol 1986;136:808-812

2. By using a portable bladder scanner to calculate the volume automatically without directly visualizing the bladder.

Hartnell GG et al, Br J Radiol 60 (1987), pp. 1063–1065.

PVR measurement

Bladder scanner advantages:

1. easy to use;
2. requires only basic training;
3. can be carried out on the ward.

Reliability? (Better with additional real-time pre-scan imaging?)

Park YH: Neurourol Urodyn 2011; 30:335–8.

Significance

Significance of PVR
PVR and acute or chronic urinary retention

Chronic urinary retention has been widely accepted as corresponding to a PVR of more than 300 mL (nevertheless variable definitions).

Abrams PH, et al. Br Med J 1978; 2: 1258.

(Chronic) PVR does not seem to be a strong predictor of acute urinary retention (AUR).

Roehrborn CG, et al. J Urol, suppl., 2005; 173: 443, abstract 1638.

Significance of PVR
BOO

- *It is commonly thought that the increase in PVR indicates the severity of BOO.*
- *However, abnormal measurements of free uroflowmetry or PVR can detect only voiding dysfunction without indicating BOO specifically.*
- *Nevertheless,* PVR measurements are used as parameter of efficacy for medical and surgical treatments of BPO.

Kaplan SA, et al. Eur Urol. 2007 Jun;51(6):1717-23. Epub 2007 Jan 16.

Significance of PVR
PVR and clinical progression of BPO

- *High PVR is associated with an increased risk of LUTS deterioration and should thus be reconsidered in practice as a predictor of BPO progression.*

- *According to the* EAU guidelines on the Management of Male Lower Urinary Tract Symptoms (LUTS), incl. Benign Prostatic Obstruction (BPO) *, very large PVRs may herald progression of disease and may indicate bladder dysfunction and predict a less favourable response to treatment.*

Oelke M, et al EAU Guidelines on the Management of Male LUTS, incl. BPO

Significance of PVR
PVR and clinical progression of BPO

- However, residual urine is not a contraindication to watchful waiting or medical therapy and no level of residual urine mandates invasive therapy and no PVR "cut-point" is yet established for decision-making.

Oelke M, et al EAU Guidelines on the Management of Male LUTS, incl. BPO

Significance of PVR
PVR and Antimuscarinics in men

- It is common belief that antimuscarinics should not be used in men with BOO for a potential of AUR.
- Some placebo controlled clinical trial data suggest that antimuscarinics (alone or in combination with an alpha-blocker) do not increase the risk of AUR and do not produce a clinically significant increase of PVR in men, even in presence of BPO.

Roehrborn CG,et al. Urology. 2008 Nov;72(5):1061-7; discussion 1067.

Athanasopoulos A, et al. Eur Urol. 2011 Jul;60(1):94-105.

However, patients with significant PVR were excluded from these studies and the safety of antimuscarinics in men remains to be confirmed.

Significance of PVR
PVR and bacteriuria

Large PVRs may be associated with UTIs, especially in persons at risk (children, patients with spinal cord injury or diabetes).

Kelly CE. Rev Urol. 2004;6 Suppl 1:S32-7.

Other studies, however, demonstrated that elevated PVR is not correlated to bacteriuria, incontinence, immobility, impaired cognition, or neurological disease.

Significance of PVR
PVR and Chronic kidney disease (CKD)

- Very large PVRs (>300 mL) may be associated with an increased risk of upper urinary tract dilation and renal insufficiency.

Kelly CE. Rev Urol. 2004;6 Suppl 1:S32-7.

- A PVR >100 mL has been associated with CKD, even if other studies do not suggest this association.

Significance of PVR
PVR and Female incontinence

Measurement of PVR is recommended in the management of female urinary incontinence.

Thüroff JW, et al. EAU guidelines on urinary incontinence. Eur Urol. 2011 Mar;59(3):387-400.

PVR should be measured during the assessment of women complaining of overactive bladder symptoms to exclude voiding dysfunction and anticholinergic medication should be used if PVR is low.

Milleman M, et al. J Urol. 2004 Nov;172(5 Pt 1):1911-4

Significance of PVR
PVR and Children

Assessment of PVR is mandatory in a variety of pediatric patients, such as those with voiding LUTS, UTIs, vesicoureteral reflux, posterior urethral valves or neural tube defects.

Kelly CE. Rev Urol. 2004;6 Suppl 1:S32-7.

Recommendations and evidence summary

PVR
Actual recommendations

- The interval between voiding and PVR measurement should be as short as possible (eo). It is advisable to ask the patients if the voiding was similar to a typical micturition in his/her daily life (eo).
- Use preferably noninvasive ultrasound bladder volume measurement instead of urethral catheterization (LE 3).
- Measurement of PVR is recommended at the management of female urinary incontinence (LE 3).
- Assessment of PVR is considered mandatory in a variety of pediatric patients (LE 3).

PVR
Evidence summary

- Unrepresentative results may be obtained when voiding has to occur in unfamiliar surroundings or on command with an only partially filled or an overfilled bladder (eo).
- Portable bladder scanner may present some advantages over real-time ultrasound, especially if equipped with an additional real-time pre-scan imaging (LE 3).
- There is no universally accepted definition of a significant residual urine volume. For clinical practice, PVR <30 mL can be considered insignificant, while residual volumes persistently >50 mL could be regarded as relevant (eo).

PVR
Evidence summary

- Large PVR (>200–300 mL) often indicates LUTD and may predispose to unsatisfactory treatment results if invasive BOO treatment is undertaken (LE 3). Nevertheless, no level of residual urine, of itself, mandates invasive therapy and no PVR threshold is yet established for decision-making (LE 3).

PVR
Evidence summary

- PVR cannot be used as a robust predictor of acute urinary retention (LE 3).
- PVR can detect only voiding dysfunction without indicating BOO specifically (LE 2-3).

PVR
Evidence summary

- PVR is not increased significantly in patients treated with antimuscarinic drugs (LE 2). However, consider that patients with significant PVR were excluded from studies published up to now.
- PVR may be associated with UTI, especially in subjects at risk, such as children or patients with spinal cord injury or diabetes (LE 3). This association among adults is far from clear (LE 3).
- Large PVR may be associated with chronic kidney diseases (LE 3).

PVR
Conclusions

- Measurement of PVR is recommended in guidelines and recommendations on the management of LUTS and urinary incontinence.
- Increased PVR values may be associated with an increased risk of UTI, risk of upper urinary tract deterioration and renal failure, risk of progression in men with BPO, risk of AUR following antimuscarinic treatment and risk of poor outcome following surgery of BPO.
- Up to now, most of the ominous features associated with PVR are not evidence-based.