Ecographic postvoid residual urine volume, is it valid and reliable?

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Aim
To assess whether ultrasound post-void residual volumes (PVR) are reproducible (reliability) by different observers and close to those obtained by bladder catheterization as gold standard (validity).

Introduction
Clean Intermittent Catheterization (CIC) is a gold standard treatment in many voiding dysfunction patients. Postvoid residual volume (PVR) measurement is necessary to establish the appropriate number of daily catheterizations. Discordance between ultrasound measurement of PVR and real PVR volume (measured by bladder drainage) is often found. So, we hypothesized that ultrasound is not a valid test to measure real PVR volume.

Material and Method
- Diagnostic, prospective, double-blind study
- 150 patients undergoing an urodynamic study because of lower urinary tract symptoms (LUTS)
- Both sexes, with and without neurological disease, from November 2011 to January 2012
- Variables:
  - Ultrasound PVR measured (mL) using an ultrasound system (Aloka® prosound2) by two observers (1st observer: nurse, 2nd observer: physician)
  - Catheterization PVR if ultrasound PVR >50 mL (98/150 patients)
- Three subanalysis groups (PVR >100 mL, >150 mL, >200 mL)
- Reliability outcomes as Kappa Index, Intraclass Correlation Coefficient (ICC) and Bland-Altman plot
- Validity outcomes as sensibility, specificity and COR curves

Results

Descriptive
- 32.4% male and 67.6% female
- Neurogenic patients 48%
- 98/150 (65.3%) catheterized
- < 100 mL = 39 (30.8%)
- 100-200 mL = 24 (24.5%)
- > 200 mL = 35 (35.7%)
- Mean (SD) catheterization PVR = 158 (13) mL

Reliability

<table>
<thead>
<tr>
<th>US PVR</th>
<th>Kappa</th>
<th>p value</th>
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<tbody>
<tr>
<td>&gt;100 mL</td>
<td>0.896</td>
<td>0.000</td>
</tr>
<tr>
<td>&gt;150 mL</td>
<td>0.850</td>
<td>0.000</td>
</tr>
<tr>
<td>&gt;200 mL</td>
<td>0.897</td>
<td>0.000</td>
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</table>

Global ICC

<table>
<thead>
<tr>
<th>US PVR</th>
<th>95% CI</th>
<th>p value</th>
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<tbody>
<tr>
<td>0.97</td>
<td>0.96-0.98</td>
<td>0.000</td>
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Validity

<table>
<thead>
<tr>
<th>US PVR</th>
<th>Sensibility</th>
<th>Specificity</th>
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<tbody>
<tr>
<td>&gt;100 mL</td>
<td>72.4% (60-84,7%)</td>
<td>95% (87-100%)</td>
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<tr>
<td>&gt;150 mL</td>
<td>59.1% (44,4-73,9%)</td>
<td>100% (98,2-100%)</td>
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<tr>
<td>&gt;200 mL</td>
<td>54,2% (36,3-72,2%)</td>
<td>100% (97,3-100%)</td>
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Fig 3. Subgroup sensibility and specificity of Ultrasound PVR compared to gold standard (Catheterized PVR), expressed as value (95% confidence interval)

Conclusions
1. Ultrasound is a reliable diagnostic test to quantify PVR given its high reproducibility rate and interobserver agreement.
2. Ecography ensures diagnosis given a positive PRV, due to its high specificity whereas may have considerable false negative results, most in high ones. Ultrasound measurement of PVR may underestimate real PVR, specially in high ones.
3. The number of CIC needed in patients with positive PVR shouldn’t be decided by ultrasound measurement.