Postvoid residual urine in women with pelvic floor dysfunction

Komkrit Aimjirakul¹, Jittima Manonai², Rujira Watanayingcharoenchai³, Apichart Chittacharoen⁴

¹, ², ³, ⁴ Reproductive Health Unit, Department of Obstetrics & Gynecology, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Abstract

Objective: To evaluate the correlation between postvoid residual urine (PVR) and urinary tract infection (UTI) in women with pelvic floor dysfunction.

Methods: A retrospective chart review was carried out of all new patients with symptoms of pelvic floor dysfunction. PVR was assessed with transvaginal ultrasonography. UTI was diagnosed by urine culture in women as growth of more than 100,000 colony forming units (CFU)/ml of the uropathogenic bacteria.

Results: Two hundred and forty (82%) of 290 medical records were completed for this analysis. The overall percentages of PVR were 82.9% at 0-30 ml, 7.1% at 31-50 ml, 7.5% at 51-100 ml and 2.5% at more than 100 ml. The percentage of women who had ≥ 30 ml PVR were 29% and 6% in pelvic organ prolapse (POP) stage II or greater with stress urinary incontinence (SUI) and SUI alone groups, respectively. The percentages of UTI were 27.1%, 35.3%, 11.1% and 33.3% for PVR at 0-30 ml, 31-50 ml, 51-100 ml and more than 100 ml, respectively. Elevated PVR was not associated with UTI (P>0.05).

Conclusions: Elevated PVR was not associated with UTI. Women with POP stage II or greater and SUI tended to have higher PVR (more than 30 ml) compared to women who had SUI alone.

Keywords: postvoid residual urine, urinary tract infection

Corresponding Author: Komkrit Aimjirakul
Reproductive Health Unit, Department of Obstetrics & Gynaecology, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand.
Telephone (+66)2-201-2167 Fax. (+66)2-201-2579 E-mail: komkrit.aim@mahidol.ac.th
Introduction

Postvoid residual (PVR) volume is defined as the volume of urine left in the bladder at the end of micturition. Traditional measures of PVR volume include urethral catheterization and ultrasonography. Urethral catheterization is the method of measuring PVR volume but might cause complication by trauma, discomfort and its potential to induce infection. Transvaginal ultrasonographic PVR measurement might be equivalent to urethral catheterized techniques. Normal value for PVR volume has not been clear. Volumes less than 50 ml indicate adequate bladder emptying, and volumes greater than 200 ml can be considered inadequate emptying. Clinical judgement must be exercised in interpreting the significance of PVR volumes, especially in the intermediate range of 50 to 200 ml. However, previous studies showed that women with symptoms of pelvic floor dysfunction; stress urinary incontinence or pelvic organ prolapse can have elevated PVR volume. Elevated PVR and urinary tract infections (UTI) are quite common in women with pelvic floor dysfunction. Elevated PVR has been considered to have the potential to cause UTI although this concept has been challenged by the previous studies. The diagnosis of urinary incontinence and pelvic organ prolapse were based on the International Continence Society (ICS) definition. Patients were included in the study if they had symptoms of urinary incontinence and/or pelvic organ prolapse stage II or greater and a PVR had been obtained during their initial visit. Exclusion criteria included diabetes mellitus, neurogenic bladder and women with urinary retention. UTI was diagnosed by urine culture as growth of more than 100,000 colony forming units (CFU)/ml of the uropathogenic bacteria. This definition for UTI is in accordance with the definition as proposed by the Centers for Disease Control and Prevention (CDC). Demographic data included age, parity, menopausal status, prior hysterectomy. PVR volume and final diagnosis were entered into an SPSS data file. Chi-square or Fisher exact test was used to explore the correlation between PVR volume and UTI. A p-value of < 0.05 was considered as a level of statistical significance.

Materials and Methods

A retrospective chart review was carried out of all new patients with symptoms of pelvic floor dysfunction in our urogynecology clinic, Department of Obstetrics & Gynaecology, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand. The registration forms were about demographic data (age, parity, menopausal status and history of hysterectomy) and symptoms of pelvic floor dysfunction including urinary incontinence and pelvic organ prolapse. After a comprehensive history, a full examination was performed. Initial testing for clinical stress leakage was performed by coughing in the standing position with the presenting bladder volume. We routinely measure PVR volume with transvaginal ultrasonography within 5 minutes of a spontaneous, private void in the restroom. Measurement of depth (D) and height (H) in sagittal plane and width (W) in transversal plane were performed, then PVR volume (ml) was calculated using the equation (0.7) x (D x H x W). The diagnosis of urinary incontinence and pelvic organ prolapse were based on the International Continence Society (ICS) definition. Patients were included in the study if they had symptoms of urinary incontinence and/or pelvic organ prolapse stage II or greater and a PVR had been obtained during their initial visit. Exclusion criteria included diabetes mellitus, neurogenic bladder and women with urinary retention. UTI was diagnosed by urine culture as growth of more than 100,000 colony forming units (CFU)/ml of the uropathogenic bacteria. This definition for UTI is in accordance with the definition as proposed by the Centers for Disease Control and Prevention (CDC). Demographic data included age, parity, menopausal status, prior hysterectomy. PVR volume and final diagnosis were entered into an SPSS data file. Chi-square or Fisher exact test was used to explore the correlation between PVR volume and UTI. A p-value of < 0.05 was considered as a level of statistical significance.

Results

Two hundred and forty (82%) of 290 medical records were completed. The mean age of patients was 55 ±12.4 years (range, 23-86) and
the median parity was 2 (range, 0-16), see Table 1. A hundred and forty-nine (62%) were postmenopausal women and twenty-four (10%) were nulliparous. The median PVR volume was 8 ml (range 0-310); the mean PVR volume was 20 ± 39 ml. The overall percentage of PVR was 82.9% at 0-30 ml, 7.1% at 31-50 ml, 7.5% at 51-100 ml and 2.5% at more than 100 ml. The percentages of UTI were 27.1%, 35.3%, 11.1% and 33.3% for PVR at 0-30 ml, 31-50 ml, 51-100 ml and more than 100 ml, respectively (Figure 1). The percentage of women who had PVR volume more than 30 ml were 29% and 6% in pelvic organ prolapse stage II or greater with stress urinary incontinence (SUI) and SUI alone group, respectively. As a result, there was a statistically significant increase in the percentage of PVR more than 30 ml in the patients who had SUI with pelvic organ prolapse stage II or greater (P = 0.048).

Table 2 demonstrates the factors associated with PVR volume more than 30 ml. There was no significant relationship between the PVR volume more than 30 ml and either age (P = 0.721) or parity (P = 0.963). The increasing age was not associated with PVR volume more than 30 ml. (Figure 2). There was no significant correlation between the PVR volume of more than 30 ml and either prior hysterectomy (P = 0.50) or postmenopausal status (P = 0.38).

There were 64 (26.6%) patients with pelvic floor dysfunction who had urinary tract infection and most of them had a PVR volume at 30 ml or less, ten (4.1%) in the PVR > 30 ml group and two (0.8%) in the PVR > 100 ml group. No statistically significant correlation was found between elevated PVR and UTI (P > 0.05). (Figure 1)

Discussion

This study analyzed PVR volumes in women with symptoms of pelvic floor dysfunction including urinary incontinence and pelvic organ prolapse. Our findings demonstrated that most women with pelvic organ prolapse with or without stress urinary incontinence could adequately empty their bladders. These data are consistent with previous studies, which reported that most urogynecology patients have no or small residual urine volumes. Elevated post-void residual urine volume (PVR) has been suggested to contribute to bacteriuria. Haylen et al. reported a significant relationship between PVR volume of more than 30 ml and higher prevalence of recurrent UTI in 1,140 women with symptoms of pelvic floor dysfunction. Nevertheless, the correlation between PVR volume and UTI was not found in the present study, and this is consistent with previous studies. In the study of Omli et al. who found that PVR of 100 ml or greater was not associated with greater risk of developing a UTI in 150 nursing home residents with a follow-up period of 1 year. The similar result was demonstrated in another prospective study of 1,017 postmenopausal women, aged 55 to 75 years with 2 years to follow-up. The retrospective study of Hampson et al. compared UTI occurrence in patients with a PVR of less than 100 ml and a PVR of 100 ml or greater. No significant differences in 342 measurements were found. FitzGerald MP et al. also found that PVR volume of 50 ml or greater was not associated with significantly greater risk of UTI.

The hypothesized mechanism of genital prolapse is the distortional effect of the prolapse on the urethra to create bladder outflow obstruction. Pelvic organ prolapse with stress urinary incontinence showed a significant positive relationship with elevated PVR in our study.
The limitations of this study were retrospective, small sample size and there was up to a 5-minute delay in PVR measurement by transvaginal ultrasound scanning. However, further research will be necessary to explore relationship between PVR volumes and UTI, which requires a prospective study of sufficient power.

### Conclusions
Eighty-two percent women with pelvic floor dysfunction had PVR of 30 ml or less. Women with POP and SUI tended to have higher PVR (more than 30 ml) compared to women who had SUI alone. Elevated PVR was not associated with UTI in women with pelvic floor dysfunction.

### Table 1 General characteristics and PVR volume (n=240)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (y): mean ±SD</strong></td>
<td>55 ±12.4</td>
</tr>
<tr>
<td><strong>Parity: median (range)</strong></td>
<td>2 (0-16)</td>
</tr>
<tr>
<td><strong>Menopausal status</strong></td>
<td></td>
</tr>
<tr>
<td>- Premenopause</td>
<td>91 (37.9)</td>
</tr>
<tr>
<td>- Postmenopause</td>
<td>149 (62.1)</td>
</tr>
<tr>
<td><strong>Hysterectomy: N (%)</strong></td>
<td></td>
</tr>
<tr>
<td>- No</td>
<td>209 (87.1)</td>
</tr>
<tr>
<td>- Yes</td>
<td>31 (12.9)</td>
</tr>
<tr>
<td><strong>PVR (ml): median (range)</strong></td>
<td>8 (0-310)</td>
</tr>
</tbody>
</table>

### Table 2 Factors associated with PVR more than 30 ml

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>No. (%) of PVR more than 30 ml</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of women</strong></td>
<td>240</td>
<td>41 (17.0)</td>
<td>0.72</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td>0.96</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
<td>0.38</td>
</tr>
<tr>
<td><strong>Menopause</strong></td>
<td></td>
<td></td>
<td>0.50</td>
</tr>
<tr>
<td>- yes</td>
<td>149</td>
<td>23 (15.4)</td>
<td></td>
</tr>
<tr>
<td>- no</td>
<td>91</td>
<td>18 (19.7)</td>
<td></td>
</tr>
<tr>
<td><strong>Hysterectomy</strong></td>
<td></td>
<td></td>
<td>0.048</td>
</tr>
<tr>
<td>- yes</td>
<td>31</td>
<td>4 (12.9)</td>
<td></td>
</tr>
<tr>
<td>- No</td>
<td>209</td>
<td>37 (17.7)</td>
<td></td>
</tr>
<tr>
<td><strong>SUI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- without POP</td>
<td>32</td>
<td>2 (6.2)</td>
<td></td>
</tr>
<tr>
<td>- with POP</td>
<td>31</td>
<td>9 (29.0)</td>
<td></td>
</tr>
</tbody>
</table>

PVR, postvoid residual volume; UTI, urinary tract infection; SUI, stress urinary incontinence; POP, pelvic organ prolapsed stage II or greater.

*P*-value <0.05
Figure 1 Correlation between PVR volume and UTI (PVR, postvoid residual; UTI, urinary tract infection.)

Figure 2 Percentage of PVR less or more than 30 ml by age.
References


ปัสสาวะเหลือค้างในสตรีที่มีความผิดปกติของกล้ามเนื้ออุ้งเชิงกราน

คมกฤช เอี่ยมจิรกุล¹, จิตติมา เบญจา², ธีริยา วัฒนาธัญบุรี³, อภิชาติ จิตต์เจริญ⁴

¹, ², ³, ⁴ ภาควิชาสุตติศาสตร์–นรีเวชวิทยา คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล

บทคัดย่อ

วัตถุประสงค์: เพื่อประเมินความสัมพันธ์ระหว่างปัสสาวะเหลือค้างกับการติดเชื้อทางเดินปัสสาวะในสตรีที่มีความผิดปกติของกล้ามเนื้ออุ้งเชิงกราน

วิธีการศึกษา: ทบทวนเวชระเบียนของผู้ป่วยใหม่ทั้งหมดที่มีอาการผิดปกติของกล้ามเนื้ออุ้งเชิงกราน ซึ่งได้ทำการตรวจวัดปริมาณปัสสาวะเหลือค้างด้วยเครื่องตรวจคลื่นเสียงความถี่สูงทุกราย รวมทั้งเก็บปัสสาวะเพาะเชื้อ โดยใช้เกณฑ์การวินิจฉัยการติดเชื้อทางเดินปัสสาวะจากผลเพาะเชื้อที่มีเชื้อก่อโรคมากกว่า 100,000 หน่วยโคโลนีต่อมิลลิลิตร

ผลการศึกษา: 240 เวชระเบียนที่มีข้อมูลสมบูรณ์จากเวชระเบียนผู้ป่วยใหม่ทั้งหมด 290 ราย ภายหลังจากการวิเคราะห์พบว่าสตรีที่มีความผิดปกติของกล้ามเนื้ออุ้งเชิงกรานมีปัสสาวะเหลือค้าง 0-30 มิลลิลิตร ร้อยละ 82.9 มีปัสสาวะเหลือค้าง 31-50 มิลลิลิตร ร้อยละ 7.1 มีปัสสาวะเหลือค้าง 51-100 มิลลิลิตร ร้อยละ 7.5 มีปัสสาวะเหลือค้าง 101-200 มิลลิลิตร และร้อยละ 2.5 มีปัสสาวะเหลือค้างมากกว่า 200 มิลลิลิตร

สรุป: การเพิ่มขึ้นของปัสสาวะเหลือค้างไม่สัมพันธ์กับการติดเชื้อทางเดินปัสสาวะ สตรีที่มีอุ้งเชิงกรานหย่อนมากกว่าระดับสองรวมก็มีการประเมินปัสสาวะเหลือค้างมีแนวโน้มที่จะมีปัสสาวะเหลือค้างมากกว่า 30 มิลลิลิตรเมื่อเทียบกับสตรีที่มีปัสสาวะเหลือค้างอย่างเดียว

Corresponding Author: คมกฤช เอี่ยมจิรกุล ภาควิชาสุตติศาสตร์–นรีเวชวิทยา คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล 270 ถนนพระรามที่ 6 แขวงทุ่งพญาไท เขตราชเทวี กรุงเทพฯ 10400 โทรศัพท์ (+66)2-201-2167 แฟกซ์ (+66)2-201-2579 อีเมล์: komkrit.aim@mahidol.ac.th