**INTRODUCTION:**

- Bladder stones are rare in Western world, comprising 5% of all urolithiasis.
- Endemic stones, usually in children, are associated with dehydration, diarrhea, infection and dietary deficiencies.
- Neurogenic bladder, history of augmentation and foreign bodies (retained sutures, indwelling ureteral or Foley catheters) pose risk for formation of bladder calculi.
- Composition of bladder stones which was once predominantly magnesium ammonium phosphate (MAP), has recently changed—now predominantly calcium oxalate.
- Urac acid cystolithiasis is increasing, possibly associated with changing demographics and increased incidence of metabolic syndrome.
- Bladder stones postulated to form from 2 separate processes:
  - Upper tract stones retained in bladder and with further crystalization and growth
  - de novo formation in the bladder secondary to urinary stasis and obstruction.
- Bladder outlet obstruction commonly cited as inciting factor for bladder stone formation, but incidence in men requiring surgery for BPE only about 25%.
- Formation of bladder stones in men with BPE was absolute indication for prostatic reduction surgery.
- Recent studies demonstrate efficacy of removing bladder stones and treating BPE conservatively for symptom management.
- Other factors:
  - History of upper tract stones and renal colic associated with bladder stones.
  - Bladder stone patients presenting with urinary retention more likely to have had recent renal colic compared to those presenting with LUTS.
  - In men with BPE, uric acid bladder calculi associated with lower urine pH and higher uric acid.
  - Some men refuse or defer therapy for bladder outlet obstruction due to religious reasons and/or concerns regarding retrograde ejaculation.
- To our knowledge, no studies have looked at bladder stone recurrence after bladder stone treatment.
- We describe the clinical and metabolic differences between patients who do and do not have bladder stone recurrence.

**METHODS:**

- Database of patients undergoing bladder stone procedures from 2012-2017 at a tertiary referral center retrospectively analyzed.
- Patients with bladder stones associated with foreign bodies (e.g., stents, catheters, suprapubic tubes), on clean intermittent catheterization, having neurogenic bladder, having bladder infection, or having urinary diversion excluded.
- 66 patients in final analysis, 44 recurrent and 22 non-recurrent.
- Of the non-recurrent group, 16 patients (36%) were non-compliant with BPE and stone regimen medications.
- Day 1 of the clinical and metabolic differences were used to determine statistical significance in several parameters.
- *p* value was calculated using the IBM SPSS Statistics.

**RESULTS:**

- 66 patients; 19 bladder stone recurrences in mean of 14 mos.
- All patients male
- No differences in age (65.2 vs 67.4) and BMI (29.1 vs 27.8) between the non-recurrent and recurrent groups.
- No differences in mean prostate size (68.13 vs 66.84 cc), flow rate (7.28 vs 8.71 ml/sec), PVR (121.32 ± 95.28 cc), stone burden (2.48 vs 3.25 cm) and uric acid levels (6.1 vs 5.8 mg/dl) between non-recurrent and recurrent groups.
- No patients had previous prostate surgery and none proceeded to prostatic surgery after bladder stone treatment.
- 30 of 47 (64%) in the non-recurrent group had a known history of BPE, compared to 18.19% (5%) (p = 0.048).
- 36% vs 84% of patients required 2 or more medications to control BPE and/or calculus disease in non-recurrent and recurrent groups, respectively (p = 0.008).
- Non-compliance with BPE and stone regimen medications 28% vs 66% respectively, in non-recurrent group compared to 37% and 61% in recurrent group (p = 0.038 and p = 0.001) (See Table 1).

**CONCLUSIONS:**

The etiology of bladder stone formation is multifactorial with bladder outlet obstruction and metabolic disturbances as major contributors. Both must be addressed and treated accordingly. Patients prescribed multiple medications were found to have a higher rate of recurrence, possibly secondary to compliance. Medication non-compliance is a major risk factor for formation of recurrent bladder stones in men who do not undergo outlet procedures.

**REFERENCES:**


**Table 1. Demographics, clinical characteristics and voiding dynamics between patients with and without bladder stone recurrence**

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Non-Recurrent (n=47)</th>
<th>Recurrent (n=19)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (years)</td>
<td>65.2 (±14)</td>
<td>67.4 (±9)</td>
<td>0.453*</td>
</tr>
<tr>
<td>Mean BMI</td>
<td>29.1</td>
<td>27.8</td>
<td>0.358*</td>
</tr>
<tr>
<td>Clinical:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Known History of BPE</td>
<td>30</td>
<td>18</td>
<td>0.047*</td>
</tr>
<tr>
<td>Non-Compliance with BPE</td>
<td>28% (n=13/47)</td>
<td>37% (n=7/19)</td>
<td>0.038*</td>
</tr>
<tr>
<td>Non-Compliance with Stone Regimen</td>
<td>29% (n=2/7)</td>
<td>61% (n=8/13)</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Use of Two or More Medications</td>
<td>36% (n=16/44)</td>
<td>84% (n=16/19)</td>
<td>0.008*</td>
</tr>
<tr>
<td>Mean Follow-Up (months)</td>
<td>12</td>
<td>14</td>
<td>0.694*</td>
</tr>
<tr>
<td>Mean Stone Burden</td>
<td>2.48 cm</td>
<td>3.25 cm</td>
<td>0.404*</td>
</tr>
<tr>
<td>Mean Stone Prostate Size (cc)</td>
<td>68.13 cc</td>
<td>66.84 cc</td>
<td>0.926*</td>
</tr>
<tr>
<td>Mean Max Flow Rate</td>
<td>7.36 ml/sec</td>
<td>9.79 ml/sec</td>
<td>0.221*</td>
</tr>
<tr>
<td>Mean Post Void Residual</td>
<td>112.32 ml</td>
<td>95.28 ml</td>
<td>0.682*</td>
</tr>
<tr>
<td>Mean Urine Acid</td>
<td>6.1</td>
<td>5.8</td>
<td>0.565*</td>
</tr>
</tbody>
</table>

**Table 2. 24 Hour Urine Parameter differences between patients with and without bladder stone recurrence**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Non-Recurrent (n=42/47)</th>
<th>Recurrent (n=19)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.04</td>
<td>5.64</td>
<td>0.050*</td>
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<tr>
<td>Vol24</td>
<td>6.625</td>
<td>0.531</td>
<td>0.70</td>
</tr>
</tbody>
</table>