Simultaneous Bilateral Percutaneous Nephrolithotomy: A Single-Center Experience

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ABSTRACT

Purpose: To evaluate the safety and efficacy of simultaneous bilateral percutaneous nephrolithotomy (SBPCNL) for bilateral renal calculus disease.

Patients and Methods: A retrospective study was conducted from June 1996 to February 2006 involving 38 male and 7 female patients with a mean age of 44 years (range 5–73 years) with 90 affected renal units who underwent SBPCNL under general anesthesia. Those patients with established nephrostomy tracts were excluded from the study group.

Results: The average duration of the procedure was 107 ± 43 minutes (range 60–220 minutes). The average drop in hemoglobin was 2 ± 1.2 g/dL (range 0.3–5.6 g/dL), with 3 patients (7%) requiring blood transfusion. In 87% of patients, a single stage was performed on both sides, while 13% required two stages on one side. A single tract was utilized in 78%, while 22% of the patients required two tracts on one side. None required two tracts on both sides or more than one stage on both sides. The stone-clearance rate was 96%. The average hospital stay was 6 days. Complications consisted of renal-pelvic perforation in two patients and transient pyrexia in five. Three patients had persistent urine leak on one side, of which two stopped spontaneously and one necessitated ureteral stenting.

Conclusion: Simultaneous bilateral PCNL is a safe procedure and can be used effectively in adults as well as in children. In addition to being cost effective, it involves only a single anesthesia with a shorter hospital stay and faster convalescence. However, patients with a large stone burden or complex pelvicaliceal anatomy should not be selected for SBPCNL.

INTRODUCTION

Patients with bilateral renal calculi often pose a clinical challenge to the urologist. Shockwave lithotripsy (SWL) monotherapy often is inadequate to treat a large stone burden or very dense calculi. Percutaneous nephrolithotomy (PCNL) has become an established safe and minimally invasive technique since Fernström and Johannson first described it in 19761 and subsequent reports confirmed its safety and efficacy. However, the use of PCNL to treat bilateral renal calculi in one sitting is not widespread, even though the first cases were reported as early as 1987.2 The object of this study was to establish the safety and efficacy of simultaneous bilateral PCNL (SBPCNL).

PATIENTS AND METHODS

The hospital records of 45 patients who underwent SBPCNL in this department from June 1996 to February 2006 were reviewed. The series consisted of 37 male and 8 female patients with a mean age of 44 years (range 5–73 years). The average preoperative plasma creatinine concentration was 1.1 mg/dL. Three patients had unilateral staghorn calculi, three had associated unilateral ureteral calculi, two had vesical calculi, and one had a bladder-neck stenosis. Several patients had renal anomalies, and 19 had comorbidities (Table 1). The average total stone burden was 22.35 mm (range 10–54 mm).

All patients were informed preoperatively that the procedure on the second side would be done only if the procedure on the
first side was uneventful. All procedures were done with the patient under general anesthesia. Standard PCNL was performed. Cystoscopy was done, and ureteral catheters (4F to 6F) were placed on both sides. The patient was then turned prone, and the two sides were painted and draped separately. All punctures were made under ultrasound guidance and the tracts dilated with Alken metal dilators. Selection of tract size (20F–28F) was based on the infundibular width and stone bulk. In all cases, a 20F or 24F nephroscope was employed. Pneumatic lithotripsy with or without suction was used in all cases. The second side was started only if the procedure on the first side was uneventful. After the first side was completed, the patient table was rotated 180°, and the contralateral side was painted and redraped.

Nephrostomy tubes were placed on both sides at the end of the procedure. Hemoglobin and plasma creatinine assays and plain abdominal radiography were done after 48 hours. If there were residual fragments, the patient underwent a second-stage PCNL. Nephrostomy tubes were removed if radiographs confirmed complete stone clearance.

These patients were evaluated for hemoglobin drop, postoperative leak, perioperative complications, requirement for ancillary procedures, stone-clearance rates, and length of hospital stay.

RESULTS

Six patients (13%) underwent another endourologic procedure (ureteroscopy, bladder-neck incision, cystolithotrity) during the same anesthesia. The operative statistics are as given in Table 2. Of the 45 patients, 10 (22%) required two tracts on one side; none required two tracts on both sides. The average operating time was 107 ± 43 minutes (range 60–220 minutes). Double-J ureteral stents were placed unilaterally in 10 cases (22%) and bilaterally in 7 (15%). The remaining patients had ureteral catheters placed retrograde until leakage from the nephrostomy site subsided after nephrostomy-tube removal. A second stage was required on one side in 6 patients (13%).

Most patients (43; 95.5%) had complete stone clearance, while two had residual fragments of <3 mm. The average hemoglobin drop was 2 g/dL (range 0.3–5.6 g/dL). Blood transfusion was required in 3 patients (7%). There was no significant change in the serum creatinine concentration. The average

<table>
<thead>
<tr>
<th>Series (no. of patients)</th>
<th>Mean OR time (min) (range)</th>
<th>Hb drop (g/dL)</th>
<th>Transfusion (%)</th>
<th>Second stage required (%)</th>
<th>Associated procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present series (45)</td>
<td>107.4 ± 43 (60–220)</td>
<td>2.02 ± 1.19 (0.3–5.6)</td>
<td>3 (6.6)</td>
<td>6 (13.3)</td>
<td>URS 3, cystolithotry 2, BNI 1</td>
</tr>
<tr>
<td>Holman et al³ (198)</td>
<td>46 (20–100)</td>
<td>1.73</td>
<td>12 (6)</td>
<td>6 (3)</td>
<td>URS 4, endopyelotomy 4, laparoscopic ureterolithotomy 1</td>
</tr>
<tr>
<td>Holman et al⁴ (150)</td>
<td>45 (15–130)</td>
<td>1.73</td>
<td>8 (5.3)</td>
<td>4 (2.6)</td>
<td>Cystolitholapaxy 1, endopyelotomy 5, laparoscopic ureterolithotomy 1, percutaneous ureterolithotomy 1</td>
</tr>
<tr>
<td>Ahlawat et al⁵ (14)</td>
<td>83</td>
<td>4 (28.6)</td>
<td>4 (28.6) + 1</td>
<td>SWL</td>
<td></td>
</tr>
<tr>
<td>Regan et al² (3)</td>
<td>248 (190–365)</td>
<td>2.4</td>
<td>0</td>
<td>2 (66.6)</td>
<td></td>
</tr>
<tr>
<td>Shah et al⁶ (10)</td>
<td>116</td>
<td>1.59</td>
<td>1 (10)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

aURS = ureterorenoscopy; BNI = bladder-neck incision.
hospital stay was 6.6 ± 1.9 days (Table 3). Not including one patient who required prolonged admission (15 days) because of postoperative pyrexia, the average hospital stay was 6.4 ± 1.4 days.

The perioperative complications are outlined in Table 4. Two patients had transient hypotension intraoperatively that responded to fluid alone. Two patients had small renal-pelvic perforations, which needed no intervention. Three patients had prolonged (>48-hour) urinary leakage from the nephrostomy site after nephrostomy-tube removal. In two patients, the leak stopped spontaneously, while one required placement of a Double-J stent. Five patients had transient fever (>100°F), which resolved with conservative management. Three patients developed urinary-tract infection after the procedure. None of these complications could be attributed to the procedure being done bilaterally.

**DISCUSSION**

A PCNL allows removal of large renal stones with minimal morbidity. The advantages of SBPCNL include reduced total operating time, less blood loss, and a requirement for only a single anesthesia and a single cystoscopy. The hemoglobin drop (2.02 ± 1.19 g/dL) and blood transfusion rate (6.6%) in this study are much like those in our experience with unilateral procedures (hemoglobin drop of 1.68 ± 1.23 g/dL and blood transfusion rate of 7.9%).

The less obvious but equally important advantages are a shorter convalescence and reduced psychological stress on the patient as well as the attendants. A potential disadvantage of SBPCNL by retrograde ureteral catheterization in a patient with infected urine.

The stone-free rate was 95.5%, which correlates well with other reported series (see Table 3). Six patients (13%) required a second-stage procedure for residual fragments, and this was a factor in increasing the hospital stay. No additional complications were seen in patients with other medical illness or those who underwent other endourologic interventions during the same anesthesia. This is in accordance with other published data.

Holman and coworkers reported unilateral pneumothorax in one patient, which healed spontaneously. We did not have any pneumothorax in our series, possibly because no patient required a supracostal puncture. The same group also reported a left retroperitoneal colon fistula in one patient, which healed spontaneously within 2 days. We did not have any bowel fistulas in our series. Those earlier authors also saw one case of late postoperative bleeding that necessitated lower-pole resection. We did not have any significant postoperative hemorrhage.

In our series, six patients had abnormal anatomy. In the patients with ectopic kidneys, the PCNL technique was as described by Desai and Jasani. No additional complications were seen in these patients.

The initial selection of cases is important. We began with bilateral simple calculi (where multiple tracts were not anticipated) in patients with normal renal function who had no significant comorbid illness and in whom intravenous urography showed favorable caliceal anatomy. With increasing experience, we extended the indications to include patients with medical comorbidities, chronic kidney disease, abnormal anatomy (ectopic or horseshoe kidneys), and staghorn calculi. With proficiency in endourologic techniques, the procedure can be undertaken safely in complex stones and staghorn calculi, where

### Table 3. Hospital Stay and Stone-Free Rate in Simultaneous Bilateral Procedures

<table>
<thead>
<tr>
<th>Series (no. of patients)</th>
<th>Mean stay (days) (range)</th>
<th>No. (%) stone free</th>
<th>No. (%) with clinically insignificant fragments (&lt;3 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present series (45)</td>
<td>6.6 ± 1.94 (4–15)</td>
<td>43 (95.5)</td>
<td>2 (4.4)</td>
</tr>
<tr>
<td>Holman et al³ (198)</td>
<td>4.3 (3–8)</td>
<td>190 (95.6)</td>
<td>8 (4)</td>
</tr>
<tr>
<td>Holman et al⁴ (150)</td>
<td>5.4 (3–17)</td>
<td>145 (96.6)</td>
<td>5 (3.3)</td>
</tr>
<tr>
<td>Ahlawat et al⁵ (14)</td>
<td>5.4</td>
<td>11 (78.6)</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Regan et al² (3)</td>
<td>6 (5–8)</td>
<td>3 (100)</td>
<td>—</td>
</tr>
<tr>
<td>Shah et al⁶ (10)</td>
<td>2.5</td>
<td>15/20 renal units</td>
<td>(75)</td>
</tr>
</tbody>
</table>

### Table 4. Complications of Reported Simultaneous Bilateral Procedures

<table>
<thead>
<tr>
<th></th>
<th>Present series (n = 27)</th>
<th>Holman et al³ (n = 198)</th>
<th>Holman et al⁴ (n = 150)</th>
<th>Ahlawat et al⁵ (n = 14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leak</td>
<td>3 (7%)</td>
<td>1</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Fever</td>
<td>5 (11%)</td>
<td>8</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Colonic fistula</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
</tr>
</tbody>
</table>
FIG. 1. Example of results. (A) A 56-year-old diabetic and hypertensive man with bilateral renal calculi. (B) Intravenous urogram. (C) After SBPCNL with right side cleared first. Complete clearance was achieved in one sitting.
FIG. 2. Another example of results. (A) A 40-year-old woman with bilateral renal calculi. (B) Intravenous urogram. Patient was offered SWL but wanted complete clearance in single hospital admission. (C) After SBPCNL, complete clearance of stones.
FIG. 3. Patient with previous open surgery. (A) This 38-year-old woman had history of bilateral pyelolithotomy. (B) Intravenous urography. (C) After first SBPCNL session, complete clearance is apparent on left side and partial clearance on right side. (D) After second-stage PCNL on right side through established tract and fresh puncture. Complete clearance has been achieved.
multiple punctures and tracts may be required. However, as a rule, patients with a large stone burden, complex caliceal anatomy, and secondary stones (where an auxiliary procedure to relieve obstruction will be required) should not be subjected to SBPCNL. Most importantly, if there is an intraoperative technical problem on the first side; e.g., prolonged operative time or hemorrhage, the contralateral procedure should be postponed to a later date. Bilateral simultaneous tubeless PCNL has been proposed as a safe procedure; however, it is our policy to place nephrostomy tubes on both sides.

CONCLUSION

Simultaneous bilateral PCNL is a safe and effective option in well-selected cases, which is associated with low morbidity, short hospital stay, maximum stone-free rate, and early return to normal activity. However, patients with large stone burdens and complex pelvicaliceal anatomy should not be chosen for simultaneous bilateral procedures.

REFERENCES


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ABBREVIATIONS USED

PCNL = percutaneous nephrolithotomy; SBPCNL = simultaneous bilateral percutaneous nephrolithotomy; SWL = extracorporeal shockwave lithotripsy.