High Recurrence Rate at 5-Year Followup in Children after Upper Urinary Tract Stone Surgery

Michael Lao, Barry A. Kogan,* Mark D. White and Paul J. Feustel

From the Urological Institute of Northeastern New York, Albany Medical College, Albany, New York

Abbreviations and Acronyms

KUB = x-ray of kidneys, ureters and bladder

PCNL = percutaneous nephrolithotomy

SWL = shock wave lithotripsy

URS = ureteroscopy

Accepted for publication September 3, 2013.

* Correspondence: 23 Hackett Blvd., Urological Institute of Northeastern New York, Albany Medical College, Albany, New York 12208 (telephone: 518-262-3296; FAX: 518-262-4784; e-mail: koganb@mail.amc.edu).

Purpose: Pediatric urolithiasis has been treated with shock wave lithotripsy, ureteroscopy and percutaneous nephrolithotomy with high success rates during short-term followup. We studied our success rate and modifiable risk factors in patients with at least 5 years of followup postoperatively.

Materials and Methods: Retrospective chart review was performed for patients younger than 18 years who underwent upper tract stone surgery between 1999 and 2007, were stone-free afterward and had at least 5 years of followup. Recurrence rate, and anatomical and metabolic abnormalities were assessed.

Results: Of 60 eligible children 30 (33 kidneys) had at least 5 years of followup. Average patient age at surgery was 10 years, 17 patients were female and 20 kidneys had anatomical abnormalities. Overall recurrence rate at 5 years was 55% (95% CI 38%–70%). Ureteral stones had a lower recurrence rate than renal stones (5 of 19 and 13 of 14, respectively, $p < 0.001$). Patients with abnormal anatomy had a 65% (95% CI 43%–82%) chance of recurrence within 5 years vs 38% (95% CI 18%–65%) in those with normal anatomy ($p = 0.17$). Of the 18 recurrences 10 required a second operation, 7 demonstrated abnormal anatomy and 14 involved calcium based stones. A 24-hour urine test in 13 children revealed 10 with hypercalciuria and 11 with hypocitraturia, with 9 patients exhibiting both conditions.

Conclusions: We found a high recurrence rate in children with stones requiring surgical intervention, particularly those with abnormal anatomy. This finding should be confirmed in a larger multicenter study of recurrence rates. In the meantime our results suggest a need for aggressive diagnosis and treatment of metabolic abnormalities.

Key Words: hypercalciuria, pediatrics, recurrence, urolithiasis

During the last decade there has been a nearly fivefold increase in the incidence of pediatric urolithiasis.[1,2] Multiple factors can contribute to urolithiasis, including anatomical and metabolic abnormalities, particularly in children.[3] Ureteroscopy, percutaneous nephrolithotomy and shock wave lithotripsy have been used for stone removal in children. The current literature describes high success rates in achieving stone-free status and rendering children stone-free from several weeks to 2 years after surgical intervention.[4–9]

It has been reported in adults that during 5-year followup stone recurrence can affect 37% of patients after PCNL and 54% after SWL.[10,11] We sought to elucidate recurrence rates of pediatric urolithiasis after at least 5 years of postoperative followup. We also sought to discover modifiable risk factors for stone recurrence.

0022-5347/14/1912-0440/0
THE JOURNAL OF UROLOGY®

http://dx.doi.org/10.1016/j.juro.2013.09.021
Vol. 191, 440-444, February 2014
Printed in U.S.A.

PATIENTS AND METHODS

Retrospective chart review was performed to identify pediatric patients (younger than 18 years) who underwent surgical intervention for upper urinary tract stones between 1999 and 2007. Stones localized to the kidneys or ureters and visualized on computerized tomography or ultrasound were included. Those located in the bladder were excluded. Surgical modalities used included URS (for small/moderate volume stones in the ureter or kidney), SWL (for renal stones in patients with normal anatomy) and PCNL (for large volume stones and lower pole stones without good ureteroscopic access). For patients to be included they had to have been considered stone-free based on operative x-rays, and KUB and/or ultrasound performed 4 to 12 weeks postoperatively. Patients also needed to have been followed by us for at least 5 years after initial surgical intervention.

Patient records were reviewed for demographics such as gender and age. Size and location of the stone, date of surgery and age at initial surgery were recorded, as were subsequent office and emergency room visits. Early in the series there was no routine followup, although later patients were seen yearly. The percentage of patients with at least 1 recurrence was calculated for the 5-year period. Date of stone recurrence, subsequent surgery and time interval were recorded. Data were collected for number of patients and renal units.

Anatomical abnormalities considered significant included neurogenic bladder, vesicoureteral reflux, stricture disease and ureterovesical junction or ureteropelvic junction hydronephrosis. All patients were treated aggressively and none had obstruction postoperatively. If collected, a 24-hour urine obtained when the children were stone-free was used to assess for metabolic abnormalities. Hypercalciuria was assessed by evaluating 24-hour excretion of calcium and creatinine. This measure was defined as abnormal if the ratio was more than 0.2. Hypocitraturia was defined as 24-hour citrate/creatinine ratio less than 130 for males and less than 300 for females. When available, stone composition was recorded.

Efforts were made to locate each patient lost to followup via mail and telephone. The data were evaluated overall and for different subgroups, including stone location, surgical technique, and anatomical and metabolic abnormalities. Statistical analysis was performed using Fisher exact test and chi-square where appropriate.

RESULTS

A total of 60 patients were identified who had undergone surgical intervention for urolithiasis at least 5 years previously and were stone-free postoperatively. Of these patients 2 underwent surgical intervention but no stone was found at operation, and 28 did not have at least 5 years of contact with us. We were able to get 5 of these 28 children to return, and all had evidence of recurrence but since they did not return for more than 5 years after the procedure, we could not determine whether disease recurred within 5 years or afterward. Therefore, these patients are not included in this study. The remaining 30 children (17 females and 13 males) had regular followup for 5 years and were included in the study.

Since some children had stones present bilaterally, a total of 33 kidneys were operated on, yielding 33 renal units in 30 patients for analysis. Initial symptoms at presentation were flank or loin pain in 18 patients (60%) and urinary tract infection in 2 (7%), and were absent in 10 (33%). Mean age at initial surgery was 9.9 years (11.2 in boys and 8.8 in girls). Of the 33 renal units URS was performed in 18, SWL in 7, PCNL in 7 and stent placement only in 1.

The overall recurrence rate at 5 years was 55% (95% CI 38%–70%). There was no relationship between recurrence and patient age or gender (data not shown). Of the stones 14 were renal and 19 were ureteral. A total of 13 kidney stones (93%) recurred, compared to 5 ureteral stones (26%, $p < 0.001$). Recurrence was on the ipsilateral side in all cases, and 4 of 5 initial ureteral stones recurred in the kidney. The lowest rate of recurrence was in patients undergoing URS (5 of 18, 28%), with higher rates after SWL (5 of 7, 71%) and PCNL (7 of 7, 100%, $p < 0.002$).

Anatomical and Other High Risk Abnormalities

Of the renal units with stones there were 20 with anatomical or other high risk abnormalities (18 patients) and 13 without anatomical abnormalities (12). Anatomical abnormalities are outlined in the table. Patients with abnormal anatomy had a 65% chance (95% CI 43%–82%) of recurrence within 5 years. In contrast, those with normal anatomy had a 38% chance (95% CI 18%–65%) of recurrence within 5 years ($p = 0.17$). Of the 18 patients with recurrence 10 underwent a second operation, of whom 7 had abnormal anatomy. Of the remaining 8 patients with recurrence 3 had spontaneous stone passage and 5 have undergone no surgery to date.

Hypercalciuria and Hypocitraturia

Of 13 patients with 24-hour urine data available 10 had hypercalciuria (defined as increased 24-hour calcium/creatinine ratio) and 11 had hypocitraturia

Anatomical conditions

	No. Pts
Hydronephrosis	12
Vesicoureteral reflux	5
Prior pyeloplasty	4
Complex renal anatomy (horseshoe or crossed fused kidney)	5
Cerebral palsy	3
Prematurity (less than 32 wks)	3
Spina bifida/neurogenic bladder	3
Ureteral stricture	2
Treacher Collin syndrome	1