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# Pediatric urolithiasis: Experience from a tertiary referral center

**Abhishek, Jatinder Kumar, Anil Mandhani, Aneesh Srivastava, Rakesh Kapoor, M.S. Ansari***

*Department of Urology and Renal transplantation, Sanjay Gandhi Postgraduate Institute of Medical Science, Raebreali Road, Lucknow 226014, U.P, India*

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**Abstract** *Objective:* Pediatric urolithiasis can cause significant morbidity and damage to the kidney, or even renal failure. We review our experience of the management of urolithiasis in pediatric patients at a tertiary referral center.
*Patients and methods:* We reviewed medical records of all children with urolithiasis who were diagnosed and managed at our center from August 2003 to October 2011. Management was planned according to stone burden and location. We noted and statistically analysed data about age, sex, stone burden, clinical features, management, metabolic abnormalities and recurrence.
*Results:* There were 325 children with 378 stone sites. Age range was 3—17 (mean 8) years. The male to female ratio was 3:1. Most common presentation was abdominal pain in 257 children (79%), and the most common stone site was kidney in 215 (57%). Twenty-four (7%) children (stone burden $\leq$3 mm) were managed conservatively, while the rest received some form of intervention. Metabolic workup could be done in 154 (47%) children. A metabolic abnormality was seen in 67 (43%) children, normocalcemic hypercalciuria being the most common. Recurrence of urolithiasis was seen in 78 (24%) children after a mean follow-up of 3.2 (1—6) years, and was more common in those who had a metabolic abnormality or in whom small residual fragments were left in situ.
*Conclusions:* Availability of smaller instruments has led to safer use of percutaneous endoscopy and ureteroscopy in children, with results comparable to those in adults and an acceptable complication rate. The presence of a metabolic abnormality is quite common and is a cause of recurrence.


* Corresponding author.
*E-mail address:* ansarimsa@hotmail.com (M.S. Ansari).

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## Introduction

Pediatric urolithiasis is one of the important renal disorders encountered in clinical practice. It is uncommon in developed countries with a prevalence of 1—5% [1]. In the USA, it accounts for about 1 in 1000 pediatric hospital admissions [2]. Though India falls in the stone belt region of the world, the true incidence of pediatric urolithiasis on the Indian subcontinent is not known. Improvement of methods for diagnosing and managing stones in children has led to the easy identification of anatomic abnormalities and stone location, and provided a broader range of treatment options. There is an abundance of literature on adult urolithiasis, but larger series from the pediatric population are still sparse. We review here our experience at a tertiary referral center for the management of urolithiasis in pediatric patients.

## Materials and methods

We reviewed the medical records of all children with urolithiasis who were diagnosed and managed at our center from August 2003 to October 2011. From these records we extracted data about age, sex, stone burden, clinical features, management given, recurrence, and metabolic abnormalities if any. All children in the study had undergone radiological investigations in the form of ultrasonography (USG) and intravenous pyelography (IVP) to establish the diagnosis of pediatric urolithiasis. Computerised tomographic (CT) urogram was done in only a few children, in whom stones were not visualized on IVP but were found on USG. Stone burden was noted by measuring the largest size of stone on imaging and the stone surface area was calculated accordingly. The metabolic workup included serum electrolytes, serum calcium, magnesium, phosphate, uric acid, blood and urine pH, and 24-h urine collection for calcium, oxalate, uric acid and citrate was done. Recurrence was noted by taking periodic X-ray kidney—ureter—bladder (KUB) or USG abdomen in follow-up.

Management of pediatric urolithiasis in this study was planned according to stone burden and location. Conservative management was used when the child was asymptomatic with a small stone burden (stone size $\leq$3 mm). Renal stones were managed by percutaneous nephrolithotomy (PCNL) or shockwave lithotripsy (SWL) depending on the stone diameter being more or less than 2.0 cm, respectively. Upper ureteric stones of diameter up to 1 cm were managed by SWL, and more than 1 cm were managed by laparoscopic ureterolithotomy or antegrade PCNL. Mid and lower ureteric stones were managed by either ureteroscopy (URS) or laparoscopic ureterolithotomy again depending on stone size ($\leq$1 cm or $\geq$1 cm). Open surgery was done in those children whose stones could not be managed by either lithotripsy or other endoscopic methods.

The SPSS software (version 17) was used for data entry and analysis. Data were tested for statistical analysis using a simple frequency table chart.

## Results

A total of 325 children with 378 stone sites were managed at our center. Age range was 3—17 years (mean 8 years). Among them, 244 children were male and 81 were female, with male and female ratio 3:1. Most common presentation was abdominal pain in 257 children (79%), followed by hematuria and urinary tract infection (UTI), in 39 (12%) and 29 (9%) children, respectively (Table 1). Renal stones were more common on the right side while ureteral stones were more common on the left side. Stone size for renal stones ranged from 5 mm to 3.5 cm (120—1200 $mm^2$), and for ureteric and urinary bladder stones from 2 mm to 2.2 cm (100—950 $mm^2$) and 8 mm to 3.0 cm (150—1050 $mm^2$), respectively. The most common location for urinary stones was the kidney, accounting for 215 of the 378 (57%) sites. Of these, the renal pelvis was the most common, with 136 (36%) sites. Of the renal stones, 26 (12%) sites had staghorn stones measuring 2.4 cm—3.5 cm (mean 2.9 cm). Stones in the ureter and urinary bladder accounted for 98 (26%), and 27 (7%) stone sites respectively, while multiple stones were present at 38 (10%) stone sites (Table 2).

Twenty-four (7%) asymptomatic children with a small stone burden ($\leq$3 mm) were managed conservatively while the 301 (93%) symptomatic children with any stone size were managed by some intervention. PCNL was done at 121 (32%) stone sites for renal and upper ureteric stones using a nephroscope size 15—26 Fr. A single tract was made at 109 (90%) stone sites, while two tracts were made for 12 (10%) stone sites, mainly those with a large stone burden including staghorn stones. Post PCNL nephrostomy tube placement was done in 95% of PCNL cases while tubeless PCNL was done in 5%. We did ureteroscopy in children under general anesthesia. Retrograde pyelogram was routinely done to delineate anatomy at the time of the procedure. Ureteroscopic retrieval of stone was done at 50 (13.2%) stone sites using a Richard Wolf semi-rigid ureteoscope of size 4.5/6 Fr with 2.5 Fr and 3 Fr working channels, 7.5 Fr/9 Fr tapered scope with 3.2 and 2.3 Fr working channels, and flexible scope of size 7.4 Fr/9 Fr with a 4.5 Fr working channel. For stone fragmentation we used Ho:YAG laser and pneumatic lithotripter. Post URS JJ stent placement was done for at least 48 h in younger children and children where multiple manipulations of distal ureter and ureteric orifice were done. Combined PCNL and URS were done at 3% of stone sites. Pelvic ureteric junction obstruction (PUJO) with stone was present in 18 (5.5%) children. These children were managed by laparoscopic pyeloplasty and pyelolithotomy. Laparoscopic ureterolithotomy was done for 9 ureteral stones. These were the stone sites where other procedures like PCNL, URS and SWL had failed. Percutaneous cystolithotripsy (PCLT) for urinary bladder stone was done in 22 (7%) children. Open surgery in the form of pyelolithotomy or ureterolithotomy was done in 18 (5.5%) children (Table 3).

Stone clearance was 91% in the PCNL group while 100% stone clearance was noted after URS, laparoscopic or open

**Table 1** Clinical presentation.

| Symptoms | No. of children (%) |
|---|---|
| Abdominal pain | 257 (79%) |
| Hematuria | 39 (12%) |
| UTI | 29 (9%) |
| Total | 325 |