

# Clinical Characteristics and Patient Outcomes of Urolithiasis and Ureteral Stones in a Pediatric Population: A Prospective Analysis from a Tertiary Care Centre

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## ABSTRACT

**Objectives:** This study was aimed to highlight the clinical characteristics and patient outcome associated with urolithiasis and ureteral stones in a pediatric urological department.

**Methodology:** A descriptive study was conducted between February 2021 and April 2022 at Gambat Medical Hospital, Khairpur, Sindh. All patients between the ages of 2 years and 17 years presented at the outpatients department and inpatients department for the management of urolithiasis were included in the study. All patients with congenital renal abnormalities were excluded from the study. Sociodemographic and clinical characteristics, treatment/management offered, outcome, and early postoperative complications were documented. All data was analyzed using SPSS version 24.

**Results:** During the study period of one year, a total of 72 pediatric patients were diagnosed with urolithiasis. A mean age of 8.33 (5.6) years was noted with 26 (36.1%) female patients and 46 (63.8%) male patients. 20 (27.8%) patients had left renal stones. Two of these patients had right ureteral stones as well. These patients were managed with right ureterolithotomy and double J-stent placement. There were ten patients with bilateral renal stones. Two patients with a right vesicoureteric junction (VUJ) stone were treated with ureteroscopy (URS). In six (8.3%) cases, residual stones were noted.

**Conclusion:** The majority of the pediatric population had solitary right renal stones and the most common procedure performed at our centre was pyelolithotomy followed by nephrectomy. The majority had a good postoperative outcome.

**Keywords:** Renal Colic, Pyelolithotomy, Percutaneous Nephrolithotomy (PCNL), PUJO, J-stent placement

## INTRODUCTION

Pediatric urology has gained immense importance since its foundation was set in the 1960s. In the year 2008, The American Board of Urology granted subspecialty certificates along with an increase in the general activities in pediatric urology<sup>1-4</sup>. Pediatric urolithiasis is a very common condition in Pakistan<sup>1</sup>, the burden of which is growing continually<sup>5</sup>. The prevalence of pediatric stones is high due to a lack of awareness, lack of access to medical consultations and a high burden of risk factors of renal stones<sup>6</sup>.

Renal stones in pediatric patients are a lot different from those of adults, in terms of a greater recurrence rate and presence of comorbidities. In children, the anatomical structure of kidneys perinephric tissue and ureter is different from adults, due to which pediatric percutaneous nephrolithotomy (PCNL) and ureteroscopy have to be carefully performed<sup>7</sup>. There is disagreement between the American Urological Association and the European Society for Pediatric Urology in terms of a lack of consensus regarding the best treatment for upper ureteric calculi<sup>8</sup>. For larger stones, extracorporeal shockwave lithotripsy has lost its popularity, and is replaced by PCNL<sup>9,10</sup>.

The main aim of the present study was to assess the clinical characteristics and outcome in pediatric patients with renal stones at a newly founded hospital over the last several months.

## METHODS AND MATERIALS

A descriptive study was conducted between February 2021 and April 2022 at Gambat Medical Hospital, Khairpur, Sindh. Using non-probability consecutive sampling method, pediatric patients were enrolled in the study. A sample size of at least 62 participants was determined using an online sample size calculator by keeping the stone free rate as 98% and 84% after open surgery and extracorporeal shock wave lithotripsy (ESWL), respectively<sup>4</sup>. The power and confidence level were 80% and 95% respectively.

All patients between the ages of < 18 years presented at the outpatients department and inpatients department for the management of renal stones were included in the study. All patients with congenital renal abnormalities were excluded from the study because these conditions may influence the outcome of patients with renal stones. The authors examined the records for age, sex, clinical characteristics, radiological findings, stone burden (size and location), management, metabolic problems, and recurrence after receiving institutional review board approval. All patients had intravenous urography after being firstly diagnosed with urolithiasis on abdominal ultrasound (USG). In uncertain situations, a computed tomography urography was performed.

Based on the load and distribution of the stones, therapy was given to all individuals. Young kids with tiny calculi (3 mm or less) throughout the urinary tract who were symptom free (accidentally found to have calculi during assessment for incontinence, abdominal discomfort, bowel problems, as well as other symptomatology which are not commonly linked with stone formation), had no crystalluria, and were asymptomatic, were appropriately managed with observation alone.

All kidney calculi bigger than 5 mm were treated with one of the different therapeutic approaches, such as PCNL, pyeloplasty with or without nephrectomy, or retrograde intrarenal surgery. Stones around 3 and 5 in diameter were managed conservatively if found in the kidney (RIRS).

All surgeries were performed by a consultant level urologist of over 5 years experience. If the diameter of the stone was 10 mm or greater, PCNL or laparoscopic ureterolithotomy were used to manage it. If the size of the stone was < 10mm the patient was managed with ureteroscopic lithotripsy (URSL)<sup>10</sup>.

When deemed necessary, the double J stents and nephrostomy tube were regularly inserted at the conclusion of the treatment. If the diameter of the stone was 1 cm or larger, laparoscopic ureterolithotomy was employed to treat lower ureteric and mid-ureteric calculi. In that scenario, URSL was chosen. A

Richard Wolf ureteroscope (4.5/6-Fr and 7.5/9-Fr semirigid and 7.4/9-Fr flexible) was deployed to perform ureteroscopic lithotripsy. A double J stent was left in position for two weeks in the event that ureteroscopy was not possible.

Abdominal imaging performed following the removal of the stent was used to assess the stone-free status. The authors analyzed their participants by abdominal imaging six months following surgery and by USG once a year after that.

All data analysis was performed using SPSS version 25. Mean values were presented as mean and standard deviation, and categorical variables were presented as proportions.

## RESULTS

During the study period of one year, a total of 72 pediatric patients were diagnosed with urolithiasis. A mean age of 8.33 (5.6) years was noted with 26 (36.1%) female patients and 46 (63.8%) male patients. 20 (27.8%) patients had left renal stones. Two of these patients had right ureteral stones as well. There were ten patients with bilateral renal stones. Two of these patients had developed hydronephrosis and pelvic ureteric junction obstruction (PUJO) (Table 1).

Table 1. Demographic and clinical profile of patients

Parameter	Mean or Proportions
Mean Age (SD) in years	8.33 (5.6)
Gender	
Male	46 (63.8%)
Female	26 (36.1%)
Stone Laterality	
Left	20 (27.8%)
Right	42 (58.3%)
Bilateral	10 (13.8%)
Stone Size in mm	2.54 (1.32)
Complications	
Hydronephrosis	1 (1.38%)
Pelvic ureteric junction obstruction (PUJO)	1 (1.38%)

The Management of Renal Stones in the Pediatric Population

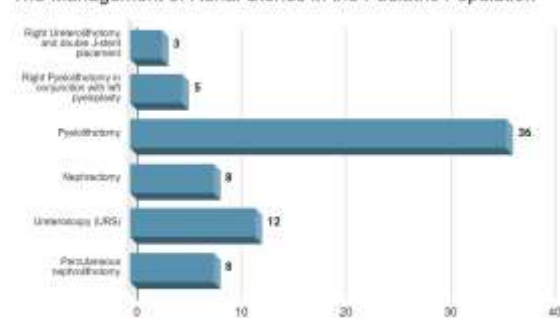


Figure 1. The Management of Renal Stones in the Pediatric Population

Incidence of Residual Stones among the Study Participants

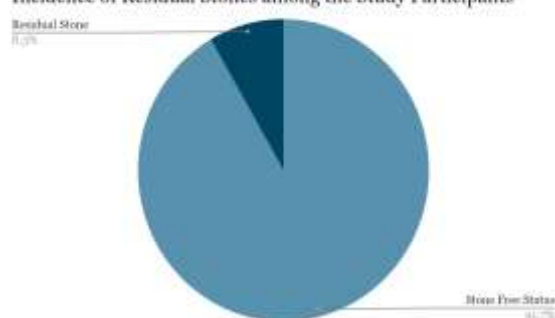


Figure 2. Incidence of Residual Stones among the Study Participants  
In six (8.3%) cases, residual stones were noted (Figure 2).

These patients were managed with right ureterolithotomy and double J-stent placement. Right Pyelolithotomy in conjunction with left pyeloplasty was performed. 42 (58.3%) had a solitary right renal stone which was managed mostly via pyelolithotomy. In 8 of the patients with the right renal stone, nephrectomy was done. Two patients with a right vesicoureteric junction (VUJ) stone were treated with ureteroscopy (URS) (Figure 1).

## DISCUSSION

The prevalence of pediatric urolithiasis has increased considerably in recent years. These stones differ in terms of cause, clinical presentation, incidence and natural history with respect to the environment and geographical area.

In developing countries such as Pakistan and Turkey, the average age of presentation of kidney stones was found to be 7.3 years<sup>11,12</sup> while the research conducted by Kit et al., found that the age of presentation in Canada was slightly higher i.e. 11.3 years<sup>13</sup>. Our findings indicate an average age of presentation to be 8.3 years, suggesting that there is a wide discrepancy in the age of presentation between the developed and developing countries. This implies that there is a difference in the healthcare and morbidity rates in young children in terms of economic and social development.

The findings in our study indicated a strong male predominance in the development of stones. This was consistent with the findings of the study by Ali et al., which found the male to female ratio to be 2.8:1<sup>14</sup>. However, another study<sup>13</sup> showed no discrepancies between the two sexes in the presentation of urolithiasis. A strong male predilection for the disease is more marked in the adult male population<sup>15</sup>, however in male children, the cause is less clear. In recent studies, an equal gender distribution is found<sup>16</sup>, with some researches also highlighting a slight female predominance<sup>17</sup>.

In a study by Rizvi et al., management of urolithiasis was based on the size of stones. For stone size up to 1.5cm, SWL was considered to be the mainstay for treatment, while for stones much larger than 1cm, PCNL was conducted. Nephrectomy was performed in cases where kidney stones presented with pyonephrosis. YAG laser was used for the treatment of vesical stones<sup>18</sup>. In the present study however, PCNL was indicated for the management of stones as small as 5mm. PCNL is a treatment of choice either as monotherapy or in association with SWL, as it ensures promising results with stone free rates of 68-100%.

A tertiary care hospital in Brazil found the recurrence rate of urolithiasis to be 34.2%<sup>19</sup>. This was much higher than the rate found in the present study, which was 8.3%. The low recurrence rate in the present study signifies efficient management of urolithiasis, with positive and satisfactory outcomes.

Another article compared the outcomes for pediatric of renal stones from 2003-2010 and from 2010 to 2018 in India<sup>20</sup>. Out of the total pediatric population presented till 2010, 115 children received conventional PCNL, while out of the total patients who presented after 2010, 129 children underwent mini-PCNL and nine participants had standard PCNL. For mini-PCNL, those who presented after 2010 showed a considerably greater stone removal rate ( $P < 0.001$ )<sup>20</sup>. In a study by Davidson J et al., a secondary assessment was performed using the retrospective data collected from the National Surgical Quality Improvement Program Pediatric<sup>21</sup>. It was revealed that out of the total of 2050 pediatric population who underwent ureteroscopy, 45.2% had renal stone. The postoperative outcomes in the present study were good. Keeping in mind the limited resources and the newer tertiary care setup, the outcomes were much better than expected.

## CONCLUSION

The majority of the pediatric population had solitary right renal stones, and the most common procedure performed at our center was pyelolithotomy followed by nephrectomy. The majority had a good postoperative outcome. Recurrence rates are high and long-term follow-up is recommended. Pediatric urology is an important

subspecialty that caters to all urological problems during the first 17 years of life.

## REFERENCES

1. Woodhouse C. History of Adolescent Care in Urology. In: *Transitioning Medical Care* 2019 (pp. 11-21). Springer, Cham.
2. Koyle MA. Pediatric Urology: Past, Present and Future. *Revista Urologia Colombiana/Colombian Urology Journal*. 2018 Mar;27(01):001-2.
3. Okhunov Z, Safiullah S, Patel R, Juncal S, Garland H, Khajeh NR, Martin J, Capretz T, Cottone C, Jordan ML, McDougall E. Evaluation of urology residency training and perceived resident abilities in the United States. *Journal of Surgical Education*. 2019 Jul 1;76(4):936-48.
4. Rizvi SA, Naqvi SA, Hussain Z, Hashmi A, Hussain M, Zafar MN, et al. Management of pediatric urolithiasis in Pakistan: experience with 1,440 children. *J Urol*. 2003 Feb;169(2):634-637.
5. Naqvi R, Hashmi S. Nephrology in Pakistan. In: *Nephrology Worldwide* 2021 (pp. 377-386). Springer, Cham.
6. Luyckx VA, Cherney DZ, Bello AK. Preventing CKD in developed countries. *Kidney international reports*. 2020 Mar 1;5(3):263-77.
7. Aboumarzouk OM, Cook P, Traxer O, Osther PJ, Villa L, Cloutier J, Jung H, Andreassen KH, Somani BK. Kidney and ureter calculi. *Blandy's Urology*. 2019 Mar 22:277-319.
8. Jiang P, Xie L, Arada R, Patel RM, Landman J, Clayman RV. Qualitative review of clinical guidelines for medical and surgical management of urolithiasis: consensus and controversy 2020. *The Journal of urology*. 2021 Apr;205(4):999-1008.
9. Qin P, Zhang D, Huang T, Fang L, Cheng Y. Comparison of mini percutaneous nephrolithotomy and standard percutaneous nephrolithotomy for renal stones > 2cm: a systematic review and meta-analysis. *International braz j urol*. 2022 Jul 25;48:637-48.
10. Rakib MA, Islam MS, Waheed SS, Alam MS, Alam M. Outcome of Standard Percutaneous Nephrolithotomy and Totally Tubeless Percutaneous Nephrolithotomy for Renal Calculi: A Comparative Study. *Bangladesh Journal of Urology*. 2021;24(1):53-7.
11. Rizvi SA, Naqvi SA, Hussain Z, Hashmi A, Hussain M, Zafar MN, Sultan S, Mehdi H. Pediatric urolithiasis: developing nation perspectives. *The Journal of urology*. 2002 Oct;168(4 Part 1):1522-5.
12. Erbagci A, Erbagci AB, Yilmaz M, Yagci F, Tarakcioglu M, Yurtseven C, Koyluoglu O, Sarica K. Pediatric urolithiasis. *Scandinavian journal of urology and nephrology*. 2003 Jan 1;37(2):129-33.
13. Kit LC, Filler G, Pike J, Leonard MP. Pediatric urolithiasis: experience at a tertiary care pediatric hospital. *Canadian Urological Association Journal*. 2008 Aug;2(4):381.
14. Ali SH, Rifat UN. Etiological and clinical patterns of childhood urolithiasis in Iraq. *Pediatric Nephrology*. 2005 Oct;20(10):1453-7.
15. TEKIN A, TEKGUL S, ATSU N, SAHIN A, OZEN H, BAKKALOGLU M. A study of the etiology of idiopathic calcium urolithiasis in children: hypocitruria is the most important risk factor. *The Journal of urology*. 2000 Jul;164(1):162-5.
16. Reisiger K, Vardi I, Yan Y, Don S, Coplen D, Austin P, Venkatesh R, Bhayani S, Hmiel P, Figenshau R. Pediatric nephrolithiasis: does treatment affect renal growth?. *Urology*. 2007 Jun 1;69(6):1190-4.
17. Novak TE, Lakshmanan Y, Trock BJ, Gearhart JP, Matlaga BR. Sex prevalence of pediatric kidney stone disease in the United States: an epidemiologic investigation. *Urology*. 2009 Jul 1;74(1):104-7.
18. Rizvi SA, Sajid Sultan HI, Mirza ZN, Ahmed B, Saulat S, Umar SA, Naqvi SA. Open surgical management of pediatric urolithiasis: a developing country perspective. *Indian journal of urology: IJU: journal of the Urological Society of India*. 2010 Oct;26(4):573.
19. Ganpule AP, Mishra S, Desai MR. Percutaneous nephrolithotomy for pediatric urolithiasis. *Indian journal of urology: IJU: journal of the Urological Society of India*. 2010 Oct;26(4):549.
20. Yadav P, Madhavan K, Syal S, Farooq A, Srivastava A, Ansari MS. Technique, complications, and outcomes of pediatric urolithiasis management at a tertiary care hospital: evolving paradigms over the last 15 years. *J Ped Urol*. 2019;15(6):665.e1-665.e7.
21. Davidson J, Ding Y, Chan E, Dave S, Bjazevic J, Filler G, Wang PZ. Postoperative outcomes of ureteroscopy for pediatric urolithiasis: a secondary analysis of the National surgical quality improvement program pediatric. *J Ped Urol*. 2021 Oct 1;17(5):649-e1.