

## Original Research Article

# Analysis of renal calculi disease among children: our tertiary care experience

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## ABSTRACT

**Background:** Renal calculi disease is a common disorder that affects patients of all age groups. Paediatric age group is no exception and due to lack of timely intervention it can prove disastrous in the years to come. This study is aimed to assess and evaluate the clinical and metabolic profile of paediatric patients presenting with renal calculi. The research was conducted in a cross-sectional manner.

**Methods:** The research enrolled a total of 254 urolithiasis patients aged 14 or less who presented to G. B. Panth hospital Srinagar. Structured history and relevant investigations were collected from all the patients. The physical exam, blood chemistry, and metabolite excretion in the urine (urinary calcium, citrate, magnesium, and oxalate) were all recorded.

**Results:** There were 65 percent males and 35 percent females (2:1) among the 254 patients, with an average age of  $8.15 \pm 5.04$  years at presentation. In 54% of the patients, hypertension was discovered. Urea and creatinine levels were respectively 73.01, 59 mg/dl and 4.45, 4.01 mg/dl. The amount of PTH in the blood was 51.2931 pg/l. The calcium and phosphorus levels in the blood were  $8.44 \pm 1.14$  and  $5.0234 \pm 0.895$ , respectively. Metabolic irregularities were discovered in 95 percent of the patients. Hypercalciuria was the most prevalent (54%), followed by hyperoxaluria (28%). In 21% of the patients, hypocitraturia was observed. In 7.8% of children, distal renal tubular acidosis was discovered. Just 4.7% of the children had a magnesium deficiency in their urine.

**Conclusions:** The majority of children with stone disease have a metabolic risk factor, with hypercalciuria being the most frequent in our environment.

**Keywords:** Paediatric, Urology, Stones, Hypercalciuria, Hypocitraturia, Metabolic workup, Urolithiasis

## INTRODUCTION

Renal stone disease is an ailment that is very distressing and a matter of concern for most of the patients. The prevalence of the disease has been reported as 1-15% worldwide. Over the last few years, the prevalence of the disease in children has risen.<sup>1</sup> In some countries, such as

the Middle East and Southeast Asian ones, urolithiasis is endemic. With renal calculus in 2% to 3% of the paediatric population, India is included in the 'stone belt'.<sup>2</sup> The stone itself is not a disease, but it can be one of the indications of other systemic diseases. For this reason, children presenting early with first stone event should undergo rigorous early and detailed medical

testing.<sup>3</sup> Detailed patient history and laboratory work, marks the beginning of the systemic diagnostic evaluation. Around 40% of children with a calcular disease have a positive history of stones in family members.<sup>4</sup> High recurrence rates of up to 26% to 53% have been recorded within 10 years of the first episode. Stone forming aetiology focuses on structural defects, metabolic disturbances, and dietary patterns.<sup>5</sup> Other risk factors and metabolic derangements also commonly co-exist in infants. The future of such patients is determined not only by the occurrence of renal stones, but also by the concomitant disease type.<sup>6</sup> In order to minimize long-term mortality and morbidity, the nature and aetiology of the stone must be properly understood. The rationale of this research was to do a metabolic assessment of kids with renal calcular disease that would aid in early identification and management of the underlying metabolic cause. This would be effective in slowing disease progression.

## METHODS

Current cross-sectional research involved a total of 254 patients in succession. The sample size was determined with the WHO sample size calculator.

### Location and duration of study

The research was performed at the G. B. Pant hospital Srinagar, from January 2017 to December 2017. The research involved patients up to 14 years of age from both the indoor and outdoor departments. Written informed consent was received from both guardians of the children.

### Inclusion criteria

Inclusion criteria for current study were; confirmed renal colic episode or haematuria due to renal stone or either ultrasonographic imaging or contrast enhanced computerized tomography in either kidney.

### Exclusion criteria

Exclusion criteria for current study were; solitary kidney, involvement of congenital renal or other urinary tract defects, primary or secondary reflux disease, or discrete calculus of the bladder. Patients who were on vitamin D, magnesium, antacids, diuretics, potassium citrate and vitamin C supplemental therapy were also excluded.

### Procedure

After treating active urinary tract infection, metabolic evaluation was conducted. There was focus on eating patterns, stone development and metabolic factors on the first visit. In all the patients, blood pressure was registered. For the measurement of calcium, phosphorus, urea, creatinine, uric acid, PTH, vitamin D, a 5 ml non-EDTA serum sample was obtained, while for blood

gases, heparinized arterial samples were taken. Patients with acutely compromised renal functions secondary to calculus concerns were stabilized before renal function normalization was attained and then considered for analysis. Calcium, oxalate, and citrate urine samples were collected for twenty-four hours. The anion gap was calculated in patients suspected of renal tubular acidosis. On a pre-designed proforma, the relevant information and results were entered. Criteria for labelling different metabolic abnormalities are depicted in (Table 1).

**Table 1: Metabolic derangements and their criteria.**

Metabolic abnormality	Criteria
<b>Hyper-calciuria</b>	>4 mg/kg/day (men > 7 mmol/day, women >6mmol/day)
<b>Hyper-oxaluria</b>	>40 mg/kg/day
<b>Hypo-citraturia</b>	<320 mg/day
<b>Hypo-magnesemia</b>	<0.8 mg/kg/24hr
<b>Renal tubular acidosis</b>	urine pH >5.5 with non-anion gap metabolic acidosis

### Statistical analysis

The data was analyzed in SPSS version 21. For the observed biochemical parameters, mean and standard deviations were determined, such as calcium, phosphorus, urea, etc (Table 2). From laboratory work up, percentages were calculated for different metabolic risk factors such as hypercalciuria, hyperoxaluria, hypocitraturia, and renal tubular acidosis.

## RESULTS

There were 166 (65.3%) males and 88 (34.6%) females out of 254 patients, as depicted in (Figure 1). The mean presentation age was 8.15±5.04 years. In 54% of patients, hypertension was documented, while the rest of them had normal blood pressure at the time of presentation. In (Table 2) mean levels of different serum biochemical parameters are presented.

**Table 2: Serum biochemical parameters for study patients.**

Biochemical parameters	Mean±SD (range)
<b>Serum Calcium (mg/dl)</b>	8.44±1.14 (6.09-10.2)
<b>Serum Phosphorus (mg/dl)</b>	5.0234±0.895 (3.15-6.7)
<b>Serum urea (mg/dl)</b>	73.01±59.44 (14-314)
<b>Serum creatinine (mg/dl)</b>	4.45±4.01 (0.4-16.3)
<b>Serum 25(OH) 2D3 (ng/dl)</b>	8.36±1.82 (6.15-10.30)
<b>Serum PTH (pg/l)</b>	51.2931±26.046
<b>Serum uric acid (mg/dl)</b>	4.71±1.033 (2.42-6.83)

Hypercalciuria was observed in 138 (54%) children, of whom 122 had idiopathic hypercalciuria, while it was associated with distal renal tubular acidosis (RTA) in six patients and increased urinary oxalate levels in two. 72 children were diagnosed with hyperoxaluria (28%). In 54 (21%) patients there were findings of hypocitraturia, while as hypercalciuria, distal RTA and hyperoxaluria, was found in 30, 18, 6 patients respectively. In 12 children (4.7%), hypomagnesemia was observed. In 20 (7.8%) patients, distal renal tubular acidosis was present, while six (4.7%) had no identifiable cause of calcular disease. Thus, 95% of patients found an underlying metabolic cause. The urinary metabolic risks have been tabulated in (Table 3).

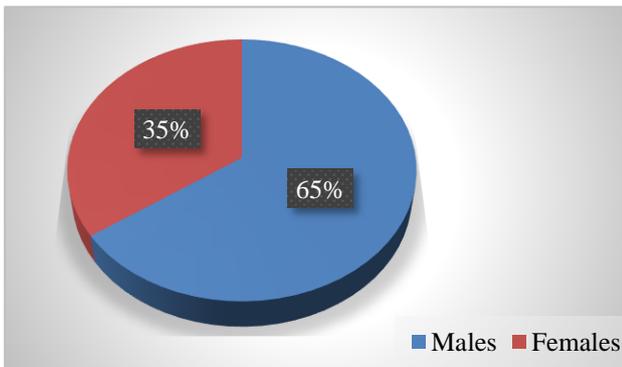


Figure 1: Gender distribution studies.

Table 3: Urinary metabolic risk factors.

Urinary Findings	N (%)
Hypercalciuria	122 (54)
Hyperoxaluria	72 (28)
Hypocitraturia	54 (21)
Hypomagnesemia	12 (4.7)
Distal renal tubular acidosis	20 (7.8)
Un-identified aetiology	12 (4.7)

## DISCUSSION

Marked diversity is seen in the occurrence and aetiology of renal calculi. The average risk of renal calculus in a lifespan is projected at 1 in 15%.<sup>7</sup> Paediatric patients with renal stones should be carefully examined as predisposing factors are very likely to occur. To decrease morbidity and mortality, early and accurate diagnosis is required.<sup>8</sup> The bulk of the research subjects (95%) had one or more underlying metabolic pathologies. The male patients were about twice the female patients, which is almost identical to the previous studies.<sup>9</sup> Hypercalciuria was found to be the most prevalent cause of stone disease (54%). In their report, Sepahi et al reported almost 28 percent of patients with hypercalciuria.<sup>10</sup> In their study, Rellum observed that 47% of patients had hypercalciuria.<sup>11</sup> Hyperoxaluria is the second most prevalent metabolic abnormality noticed; our occurrence is slightly higher (28%) relative to that recorded by Elmaci et al, which was 11.4% in their larger patient

population.<sup>12</sup> Alpay's team diagnosed 87% of metabolic derangement patients in their research group and observed hypocitraturia in 33.1% of them, while hypocitraturia was reported in 21% of patients in our study.<sup>13</sup>

Joshi et al diagnosed distal renal tubular acidosis in 5% of the patients, while 6% met the criterion.<sup>14</sup> In current study 5% were found to have hypomagnesemia. While genetic, racial, geographical and environmental backgrounds differed greatly in the occurrence of renal calculus and its aetiology. However, separate findings substantially show the underlying metabolic cause of calculus disorder even in infants in whom extrinsic causes are perceived to be less influential; metabolic issues were significantly identified.<sup>15,16</sup> While uric acid stones are significantly present in the adult population, they are less common in paediatric patients (11% vs. 2%).<sup>17</sup> Likewise, in our region there were less cysteine stones.<sup>18,19</sup> It is quite sad that stone disease was not historically known to be important in the paediatric community and as a result comparative evidence is not very strong. As a metabolic workup and its explanation is tedious, costly and often has no consistent solution, hence this subject often has conflicting problems. Concerning metabolic and genetic disorders, the preparedness of physicians is incomplete. While screening can be beneficial, tremendous financial and human resources are necessary due to high prevalence and recurring existence.<sup>20</sup>

## Limitations

Limitations of current study were; due to lack of awareness and basic education, a good portion of population of patient did not follow up and many did not have the resources to perform the tests. Though they were excluded from the study, their inclusion definitely would have added to the strength of the study.

## CONCLUSION

Most children who presented to our hospital with stone disease had an underlying metabolic risk factor, and hypercalciuria was found to be the most common in our environment. It is further pressed upon the need for an in-depth evaluation of such patients which can allay further the problems that the child may face in future.

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