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Original Research Article

Metabolic Evaluation in Pediatric Urolithiasis from Western Uttar Pradesh

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Abstract: Pediatric urolithiasis is an important medical problem, which has seen an increasing incidence in developing countries. A wide geographic variation in urolithiasis prevalence has been documented, which might be due to differences in diet, fluid intake, ethnicity and climate. The aim is to assess the biochemical and metabolic characteristics of the patients. The current study was conducted by the Department of Biochemistry of a tertiary care teaching hospital of western Uttar Pradesh. Pediatric patients presenting with urolithiasis formed the sampling frame. Medical records were studied for clinical and laboratory data. Study tools were records of the patients. Metabolic evaluation was done in all children. Sixty pediatric urolithiasis cases were included in this study. Gender wise, there were 23 females (38.3%) and 37 males (61.7%) with age ranged from 1 year to 11 years. Stone analysis revealed that big chunk (78.3%) of stones was renal stones. Vesicle calculus was least common (5%). On the other hand, Calcium oxalate stone was most common variety found in nearly half (46.20%) of the study participants. Least common variety (3.3%) was cystine type of stone. Hypocalcaemia was most common variety found in 86.67% of the study participants. Hyperuricaemia was observed in 3.33% of participants. Hyperoxaluria was the most common (78.3%) metabolic abnormality detected. 26.67% had Hypercalciuria. Only 5/29 (17.24%) patients managed conservatively had stone recurrence whereas 13/31 (41.9%) managed with a procedure had stone recurrence. Association of management modality with recurrence of Urinary Calculi was found statistically significant ($p<0.05$). Metabolic evaluation is advised in all pediatric patients as it helps in segregating patients needing medical therapy. Further studies are warranted to establish paediatric reference ranges for 24 hour urinary super saturation parameters in Indian population.

Keywords: Urinary calculi, child, metabolic evaluation, urological abnormalities

INTRODUCTION

True incidence of pediatric urolithiasis might be underestimated due to lack of routine practice of using ultrasonography in children with specific and non- specific UTI symptoms. Pediatric urolithiasis is an important medical problem, which has seen an increasing incidence in developing countries [1]. Pediatric urolithiasis are associated with significant morbidity and frequently associated with metabolic abnormalities [2]. By treating these abnormalities stone formation can be prevented.

A wide geographic variation in urolithiasis prevalence has been documented, which might be due to differences in diet, fluid intake, ethnicity and climate. Clinical and metabolic patterns of urolithiasis have changed over the years [3]. As most children with stone disease have an underlying metabolic abnormality, it is necessary that these children should be cautiously evaluated so that the etiology of their disorder can be obtained [4].

The metabolic evaluation for urolithiasis helps us to identify children those at increased risk for recurrent stone disease and also to diagnose specific treatable metabolic derangements. Paucity of literature on this topic also warrants this study. Therefore aim of the present study was to evaluate the biochemical and metabolic characteristics of the patients and the interventions required to prevent recurrence.

METHODS

The current study was conducted by the Department of Biochemistry of a tertiary care teaching hospital of western Uttar Pradesh. Retrospective cohort of pediatric patients presenting with urolithiasis at this medical college formed the study population. Only confirmed cases of pediatric urolithiasis were included in this study. Diagnosis of stone disease was confirmed by Ultrasonography and Intravenous pyelography and Computed Tomography in selected cases.

Medical records were studied for clinical and laboratory data. Study tools were records of the patients. Metabolic evaluation was done in all children. In children with UTI, metabolic evaluation was performed after treatment and only after confirmation of clear urinalysis and culture report they were included in the study. Urine tests included urinalysis, urine culture, 24 hours urinary pH, volume, calcium, oxalate, citrate, uric acid, creatinine. Biochemical investigations included Serum calcium, Serum phosphorus, Serum creatinine, Serum uric acid, Serum electrolytes, Serum Parathyroid hormone and Serum albumin. Finally data of 60 pediatric urolithiasis cases were analyzed.

All the proforma were manually checked and edited for completeness and consistency and were then coded for computer entry. After compilation of collected data, analysis was done using Statistical Package for Social Sciences (SPSS), version 21. The results were expressed using appropriate statistical methods. The chi- square (χ^2) test or Fisher's exact test was used to test level of significance.

RESULTS

Data of 60 pediatric urolithiasis cases was subjected to analysis. Gender wise, there were 23 females (38.3%) and 37 males (61.7%) with age ranged from 1 year to 11 years (mean ± S.D., 6.44 ± 1.06 years). Stone analysis revealed that big chunk (78.3%) of stones was renal stones. Vesicle calculus was least common (5%). On the other hand, Calcium oxalate stone was most common variety found in nearly half (46.20%) of the study participants. Least common variety (3.3%) was Cystine type of stones (Table 1).

Table 1: Types and distribution of urinary calculi

Stone analysis- Types and distribution	N	Percentage
Distribution of stone		
Renal	47	78.3
Ureteric	6	10
Vesicle calculus	3	5
B/L Renal calculi	12	20
B/L Staghorn calculi	3	5
Types of stone		
Calcium oxalate	28	46.67
Calcium phosphate	9	15
Uric acid	13	21.67
Cystine	2	3.33
Struvite	8	13.33

Regarding pattern of serum metabolic abnormality, hypocalcaemia was most common variety found in 86.67% of the study participants. Hypocalcaemia along with hyperphosphataemia was seen in 10% of subjects. Hyperuricaemia was observed in 3.33% of participants (Table 2).

Table- 2: Pattern of serum abnormality

Serum metabolic abnormality	N	Percentage
Hypocalcaemia	52	86.67
Hypocalcaemia + Hyperphosphataemia	6	10
Hypercalcaemia	00	00
Hyperuricaemia	2	3.33

Regarding urinary metabolic abnormality, Hyperoxaluria was the most common (78.3%) metabolic abnormality detected. 26.67% had Hypercalciuria whereas 20% had high urinary uric acid levels (Table 3).

Table- 3: Pattern of urinary metabolic abnormality

Urinary metabolic abnormality	N	%age
Hypercalciuria	16	26.67
Hyperoxaluria	47	78.3
Hypocitruria	13	22.4
Hyperuricosuria	12	20.0

48.3% (n=29) were managed conservatively, while remaining was managed surgically. 30% (n=18) had stone recurrence during follow up and 6 of these had more than one metabolic abnormality. Only 5/29 (17.24%) patients managed conservatively had stone recurrence whereas 13/31 (41.9%) managed with a procedure had stone recurrence. Association of metabolic abnormality with recurrence of Urinary Calculi was found statistically insignificant but on the other hand management modality with recurrence of Urinary Calculi was found statistically significant ($p<0.05$) (Table 4).

Table 4: Association of metabolic abnormality and management modality with recurrence of Urinary Calculi

Variable	Recurrence		P value*
	Yes	No	
Number of metabolic abnormalities in a single case			
One (n=60, Recurrence rate=20%)	12	48	0.74
More than one (n=26, Recurrence rate= 23.1%)	6	20	
Type of management			
Conservative (n=29, Recurrence rate= 17.2%)	5	24	0.03
Surgical (n=31, Recurrence rate= 41.9%)	13	18	
Chi-square test*,			

DISCUSSION

Children with urolithiasis are associated with considerable morbidity and commonly associated with metabolic abnormalities. Urolithiasis is less common in children than in adults. The incidence in children is generally about 2-3% [5]. However its incidence, composition, location and clinical characteristics vary greatly from one country to another. This wide geographic variation is related to climatic, dietary and socioeconomic factors.

In the current study, Stone analysis revealed that big chunk (78.3%) of stones was renal stones. Vesicle calculus was least common (5%). On the other hand, Calcium oxalate stone was most common variety found in nearly half (46.20%) of the study participants. Least common variety (3.3%) was Cystine type of stones. Erbagci *et al*., in his series of 95 patients found urinary metabolic abnormality in 90% of patients with hypocitruria most common abnormality [6]. Naseri *et al.,* in series of 144 patients, 54% patients had urinary metabolic abnormality [3].

Bhatt S. *et al* from Manipal [7] observed that majority (82.6%) of stones were renal stones. Vesicle calculus was least common. Calcium oxalate stone was most common variety found in half of the study participants. Hyperoxaluria was the most common (79.3%) metabolic abnormality detected. 24% had high urinary uric acid levels whereas 25.9% had Hypercalciuria. She concluded that hyperoxaluria seemed to be the most important metabolic factor of calculus forming in her pediatric series.

Borghi L *et al* [8] found that stone risk factor in nephrolithiasis is urine volume and for prevention of stone recurrences, large intake of water is the initial therapy. Therefore, the treatment of all children with urinary stones starts with the recommendation to maintain a high oral fluid intake and mothers are instructed to give adequate water so as morning sample of urine remains pale yellow or straw colour.

The usual causes of hypocalcaemia related to diet are low calcium intake, high intake of phosphates, low magnesium. Cause of hypocalcaemia in our study is low calcium intake. It is difficult to find correlation between hypocalcaemia and urolithiasis as majority of the patient had associated low water intake and urine volume.

In our study, 5/29 (17.24%) patients managed conservatively had stone recurrence whereas 13/31 (41.9%) managed with a procedure had stone recurrence. Association of metabolic abnormality with recurrence of Urinary Calculi was found statistically insignificant. Similar findings are reported from Manipal but management modality with recurrence of Urinary Calculi was found statistically significant in our study, which does not match with the results of study from Manipal [7].

Metabolic evaluation can lead to identification of metabolic abnormalities present in patients and help one to establish effective therapy. When pediatric patients form calculi, they usually do so in recurrent fashion (65% life- long risk of recurrence), and because of potential morbidity of the disease, metabolic evaluation is indicated in all children with urolithiasis [9, 10]. Type and extent of evaluation depends on the severity and type of calculus, presence and absence of systemic diseases, risk factors of recurrent calculus formation, and family history of nephrolithiasis (considered as a significant risk factor of relapse) [7,11,12].

CONCLUSIONS

On the basis of empirical findings of this study, it can be concluded that subjects having a metabolic abnormality are more likely to have stone recurrence. The metabolic evaluation for urolithiasis can prioritize increased risk for recurrent stone disease. Metabolic evaluation is advised in all pediatric patients as it helps in segregating patients needing medical therapy. Further studies are warranted to establish paediatric reference ranges for 24 hour urinary super saturation parameters in Indian population.

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