https://doi.org/10.29309/TPMJ/2023.30.12.7758

The Professional Medical Journal
www.theprofesional.com
2023, Volume, 30 Issue, 12

ORIGINAL ARTICLE

Frequency of urinary metabolic abnormalities in children with renal stone disease.

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Article Citation: Jehan S, Ibrahim MN, Khan SA, Abro B, Moorani KN, Riaz M. Frequency of urinary metabolic abnormalities in children with renal stone disease. Professional Med J 2023; 30(12):1530-1535. https://doi.org/10.29309/TPMJ/2023.30.12.7758

ABSTRACT… Objective: to determine how frequently children in developing countries like Pakistan with urolithiasis have metabolic abnormalities alongwith clinical features. **Study Design:** Descriptive Cross Sectional study. **Setting:** Department of Paediatric, National Institute of Child Health, Karachi. **Period:** January 2021 to February 2022. **Material & Methods:** To determine how frequently local children with urolithiasis have metabolic problems. A total of 80 children who were aged 4 to 14 years and who had renal stones were included, while those suffering from chronic kidney diseases, liver and biliary tract diseases and children, receiving vitamin D supplementation are excluded. Urine samples were analyzed urinary uric acid, calcium, Demographics and metabolic abnormalities—hypercalciuria, hyperuricosuria analyzed. **Results:** The study analysis included 80 patients. Seventy one patients (88.8%) had metabolic abnormalities. Most frequent metabolic abnormality was hypercalciuria 60(75%) followed by hyperuricosuria in 52(65%) of participants. There was no significant association observed between metabolic abnormalities and age, gender and BMI classification. **Conclusion:** Metabolic abnormalities were found 88.8% of children presenting with urinary lithiasis. The most frequent abnormality observed was hypercalciuria followed by hyperuricosuria. Early identification helps manage such patients appropriately, mitigating long-term sequelae.

Key words: Hypercalciuria, Hyperuricosuria, Kidney Stones, Metabolic Abnormalities.

INTRODUCTION

Over the past two decades, there has been a rapid increase in urinary lithiasis among children. This increase is likely caused by environmental causes such as global warming, the widespread adoption of western diets that have resulted in an obesity epidemic, and other environmental variables.[1] Six to ten percent of children are thought to be impacted, while the actual rate is unknown. Though the lifetime risk differs greatly between countries, metabolic problems are present in 40% to 50% of kids with urolithiasis.[2] The disease is endemic in Pakistan, Turkey, Saudi Arabia, and other countries, in addition to other South Asian and African nations.[3] Urinary stones are typically classified by their location in the kidney, urethra, and bladder. Kidney stones are hard, rock-like crystals of varying sizes and shapes. They occur when salts in the urine precipitate and form solid materials.[4] Many correctly view pediatric urolithiasis as a sign of an underlying problem, whether metabolic or anatomical, with a poorly known etiopathogenesis.[5] The theory that is the most widely recognized is supersaturation-crystallization. Most patients initially appear with vague symptoms. It is common for patients to present late, which causes a sizable delay in the diagnosis. The chosen initial investigation is ultrasonography since it is non-invasive, widely accessible, and repeatable.[6] The key to preventing morbidity and long-term renal problems is a thorough metabolic examination of every child with renal stones. Additionally, there is a considerable chance that children with stone illness may develop it again, necessitating early risk assessment, prophylaxis, and lifestyle changes.[7]

Identification of metabolic anomalies in those who are at risk is necessary for preventative treatment to stop recurrence. Globally, research have revealed increased prevalence of metabolic

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Article received on: 11/07/2023
Accepted for publication: 14/09/2023

abnormalities in children with nephrolithiasis.[8] The metabolic assessment of stone formers has been the subject of various studies in past; however, the bulk of these studies concentrate on adult populations and are limited by a lack of 24-hour urinary metabolic screening, a lack of local data, and small sample sizes.[9]

It has been seen that metabolic abnormalities that increase the risk of nephrolithiasis are identifiable in 75% to 84% of children. Common metabolic abnormalities in children with stone disease are; hypercalciuria (74.6%), hyperoxaluria (8.5-21%), hyperuricosuria (30.5%) and hypocitraturia (44-68 %)[10] Metabolic abnormalities were discovered in 22.8% of children with urinary lithiasis, according to a study conducted by Sajid MT in 2021. The most common anomaly found was hypocitraturia, which was followed by hypercalciuria and hypomagnesuria.[11]

The purpose of the current study is to determine how frequently children in developing countries like Pakistan with urolithiasis have metabolic abnormalities alongwith clinical features. This is meant to assist doctors in creating management protocols that include urine metabolic tests as a key component in an effort to stop stone recurrence. Based on the findings of this study, we can be more cautious when treating children with urolithiasis, and we will be more watchful in spotting typical metabolic derangements and assist in prescribing prophylaxis to prevent repeated stone formation.

MATERIAL & METHODS

From January 2021 to December 2021, this descriptive cross-sectional study was carried out in the Pediatric Department of the National Institute of Child Health in Karachi after approval from the hospital's ethical review board (IERB: 03/2020). The sample calculation was done using the WHO software for "Sample size calculation" by using the prevalence reported by Bevill M, et al. who observed the lower prevalence 11% of hypercalciuria in pediatric stone disease[12], taking confidential interval 95% and margin of error 7%, the sample size stands to be n=77. Eighty patients who were children of both sexes, aged 4 to 14 years, with a confirmed diagnosis of renal stones were included in the study while those with chronic kidney disease, liver disease, biliary tract disease, and children receiving vitamin D supplementation and who required surgical intervention like DJ stenting / PCN or PCNL were excluded using a non-probability consecutive sampling technique. The patients' and their guardians' written informed consent was obtained where it was judged necessary.

When acute UTI on urine cultures and associated lithiasis symptoms were settled, all spot urine samples were collected from the patients, without dietary restrictions. Collection adequacy was verified by urine creatinine excretion rate. Urinary calcium and uric acid were determined by a calorimetric method. Presence or absence of metabolic abnormalities i.e, hypercalciuria and hyperuricosuria (as per operational definition), as well as demographic details (age, sex, BMI, clinical presentation i.e pain, haematuria, dysuria, urgency, nausea, vomiting, retention) were recorded on proforma. hypercalciuria was defined as calcium/creatinine (Ca/Cr) ratio of > 0.4 calcium/creatinine for children 1-2 years of age and > 0.2 for children greater than 2 years of age.[13] Hyperuricosuria was defined on uric acid/ creatinine ratio > 0.65.[14]

Statistical analysis was conducted in SPSS 26.0. For categorical variables frequencies with percentage (age, gender, clinical presentation, BMI Classification, metabolic abnormalities). Chi square test was used to determine association between demographic variables and metabolic abnormalities.

RESULTS

A total of 80 children with urolithiasis were included in the study. Majority were of the age group 5-8 years 33(41.3%) followed by 9-12 years 32(40%). Fifty two 65%) were males. Majority were underweight 35(43.8%) while 71(88.8%) showed metabolic abnormalities. Detailed socio demographic characteristics of participants are given in Table-I.

Variables	Frequency (n)	Percentage (%)
Age		
1-4 years	15	18.8%
5-8 years	33	41.3%
9-12 years	32	40%
Gender		
Male	52	65%
Female	28	35%
BMI Classification		
Underweight	35	43.8%
Normal	21	26.3%
Overweight	3	3.8%
Moderately obese	9	11.3%
Severely obese	12	15%
Metabolic Abnormalities		
Present	71	88.8%
Absent	9	11.3%

Table-I. Socio demographic characteristics of participants

Most common clinical symptom was pain 77(96.25%) followed by dysuria 32(40%). Figure-1 shows clinical features of participants.

Most frequent metabolic abnormality was hypercalciuria 60(75%) followed by hyperuricosuria in 52(65%) of participants.

There was no significant association observed between metabolic abnormalities and age, gender and BMI classification. Association of demographic variables with metabolic abnormalities is given in Table-II.

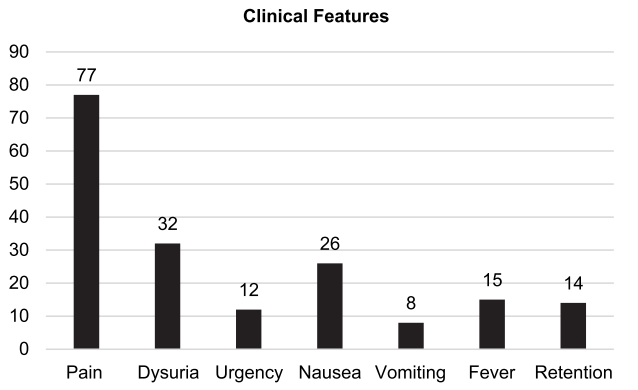

Figure-1. Clinical features of participants

DISCUSSION

Current study was conducted to analyze frequency of urinary metabolic abnormalities in children with urolithiasis the findings revealed that 88.8% of the children in the study had metabolic abnormalities, with hypercalciuria (71%) and hyperuricosuria (59%) being the most prevalent. Age, gender, or BMI categorization did not significantly correlate with metabolic problems.

In another study of patients with metabolic disorders, 65.54% were male children and 34.45% were youngsters. The patients' ages ranged from 8 months to 14.5 years, with a 7.8 year average. Metabolic problems were more prevalent in patients aged 5 to 10 years. Under the age of 5, 26.89% of patients had metabolic abnormalities, while 40.33% of patients aged 5 to 10 had metabolic abnormalities.

Variable	Hypercalciuria		P-Value	Hyperuricosuria		P-Value
	Yes	No		Yes	No	
Age						
1-4 years	11	4	0.802	7	8	0.137
5-8 years	26	7		25	8	
9-12 years	23	9		22	12	
Gender						
Male	37	15	0.279	35	17	0.555
Female	23	5		17	11	
BMI Classification						
Underweight	26	9	0.176	24	11	0.937
Normal	18	3		14	7	
Overweight	2	1		2	1	
Moderately obese	4	5		5	4	
Severely obese	10	2		7	5	

Between the ages of 10 and 15, 32.77% of patients had metabolic abnormalities.[15] In study done in AFIU the mean age of presentation was 7.81 years, and there was no significant difference in the frequency of abnormal urinary metabolic parameters between gender.[16]

The study also discovered that pain (96.25%) was the most typical clinical sign of renal stone disease in children. This is in line with earlier research that have demonstrated that pain is the most typical kidney stone presenting symptom in both adults and children. The most common presenting symptoms as reported by Girişgen İ et al. (2020) were abdominal pain (34%), macroscopic hematuria (9.4%), urinary tract infection (15.2%), dysuria (7.5%), vomiting (9.4%), anuria (1.9%), and spontaneous passage of stones (9.4%).[17]

In children older than 12 months, hypocitraturia was the most prevalent metabolic risk factor (MRF), whereas hypercalciuria predominated infancy. A study in the UK on pediatric patients found that the median age of presentation was 4.4 years for males and 7.3 years for females. The median height and weight for males was on the 25th centile, and for females, it was on the 10th and 25th centiles, respectively. The study also found that 175 (34%) of the patients had an underlying metabolic abnormality.[18] A study was conducted in Peshawar to determine the levels of calcium, citrate, oxalate, and uric acid in urine samples from patients with urinary tract stones. The study found that 72.12% of the patients had metabolic abnormalities, which were defined as levels of these substances that were outside the normal range.[18] Frequent metabolic abnormality was hypercalciuria, observed in 47.0%. Other metabolic abnormalities included hypocitraturia (31%), hyperoxaluria (18%), and hyperuricosuria (11.65%).[19] The incidence of metabolic abnormalities in children with urinary lithiasis was the subject of a study at the AFIU Rawalpindi. The study found that 22.8% of the children had metabolic abnormalities, with the most common abnormality being hypocitraturia (59.5%). Other metabolic abnormalities included hypercalciuria (44%) and hypomagnesuria (40.8%).[16] Another study found that small stones (less than 3 mm in diameter) were present in 31.6% of patients. Of those patients with small stones, 64.5% were infant.[20] A study of children with urinary stone disease found that the most common metabolic abnormality was low levels of citrate in the urine (hypocitraturia). This was followed by high levels of oxalate, calcium, and uric acid in the urine.[21] The study's findings suggest that metabolic abnormalities are common in children with urinary stone disease. Hypocitraturia was the frequent metabolic abnormality, and female gender was a predisposing factor. These findings can help doctors to better diagnose and manage children with urinary stone disease.

CONCLUSION

The findings revealed that 88.8% of the children in the study had metabolic abnormalities, with hypercalciuria (71%) and hyperuricosuria (59%) being the most prevalent. Age, gender, or BMI categorization did not significantly correlate with metabolic problems.

Multicentre studies can be conducted for strength of evidence. Case control studies are needed to how common are these metabolic abnormalities in patient without any history of stone disease

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