

Research Article

Epidemiology of urinary stones in children Attending Minia University Hospital for Urology



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Abstract

Background: Pediatric urolithiasis is a significant health problem with considerable morbidity. Over the past decades, the prevalence of pediatric nephrolithiasis has increased due to increased sodium intake, decreased calcium intake, low water intake, increased use of antimicrobials, poor nutrition, obesity, and a sedentary lifestyle. Aims of study: To assess the prevalence of paediatric urolithiasis among children attending Minia University Hospital for Urology and to determine different risk factors related to pediatric urolithiasis. **Methods:** This study is a cross-sectional study conducted among children < 16 years old attending Minia University Hospital for Urology during the period from January 2023 to October 2023. Children and their parents were interviewed and the data was collected through a designed well-structured sheet included socio-demographic data and clinical data of children. **Results:** Out of 1200 children who met the inclusion criteria, 85 children were diagnosed with urolithiasis and the prevalence was estimated to be 7%. The mean age was 8.3 ± 4 years with 57.5% males and 42.5% females, 70% of the studied cases have positive family history of urinary stone. There are significant differences between various age groups regarding the clinical presentations; the recurrence rate was significantly higher in males (49%) than females (16%). **Conclusions:** The prevalence of pediatric urolithiasis is estimated at 7% in children attending Minia University Hospital with a positive family history of 70% and a rate of recurrence of 35%, so children with a positive family history should be followed up cautiously to avoid stone recurrence.

Keywords: Urolithiasis; epidemiology; children.

Introduction

Pediatric urolithiasis can be defined as a condition of having urinary calculi in children less than 16 years where the root word “lith” means a stone. Urolithiasis is a broad term that can be further divided into nephrolithiasis which means deposition of crystalline structures or stones in kidneys, ureterolithiasis (ureteral stone), and (cystolithiasis) which mean bladder stone⁽¹⁾. These crystalline structures composed most commonly from calcium oxalate salts due to super-saturation and the super-saturated urine occurs mainly due to dehydration, high fat diet, low animal intake, high salt intake and obesity⁽²⁾.

Prevalence of urolithiasis varies significantly in different parts of the world from less than 1% to reach 20% in some areas known as “stone belt countries” as in Egypt⁽³⁾. In these areas, urinary stones affect all age groups from less than 1 year to more than 70 years of age with increased medical expenditure, morbidities and rate of recurrence that may reach to 50% with mean interval time of recurrence 3-6 years⁽⁴⁾.

Risk factors of pediatric urolithiasis in children are multifactorial which can be divided into non-metabolic risk factors as; age, sex, race, family history, structural renal abnormalities,

infection, stones inducing medication, environmental factors and dietary factors and metabolic risk factors as; hypercalciuria, hyperoxaluria, hypocitraturia, hyperuricosuria and cystienuria⁽⁵⁾.

Clinical presentation of urolithiasis in the pediatric population are fairly heterogeneous, Pain is a more common presenting symptom in older children and is present in 47% to 80% of children with urolithiasis. While 32% to 55% of children with urolithiasis present with gross hematuria⁽⁶⁾. Younger children may present with non-specific symptoms as: fever, nausea, vomiting, urinary tract infection, irritability and feeding difficulties in infant with urinary stones. Asymptomatic cases may be discovered accidentally during imaging for other reasons⁽⁷⁾.

For diagnosis of urinary stones in children, physicians shouldn't focus only on detecting stones by imaging technique such as ultrasound, Kidney Ureter Bladder film (KUB) and MRI, but also greater concern should be paid to detect the cause of stones and determine the different risk factors associated with stones formation to prevent recurrence⁽⁸⁾. Physician can do this through detailed history taking including dietary history, family history and medical history and also detailed physical examination and metabolic evaluation for all children presenting with urinary stones⁽⁹⁾.

Management of pediatric urolithiasis includes management of acute stone episodes as well as prevention of disease recurrence. Prevention of disease recurrence can be accomplished through diet modification and pharmacological intervention according to the cause of stone. While the acute management includes observation with supportive care, medical expulsive therapy (MET) and surgical intervention. The approach to acute management depends on several factors, such as stone location, size, likelihood of stone passage, severity of pain and risk of infection or obstruction⁽¹⁰⁾.

Preventive management of urinary stones should be individualized to each patient. Greater attention should be paid towards supportive and/or lifestyle changes such as a

Dietary Approach to Stop Hypertension eating plan (DASH), drinking plenty of fluids, and limiting fructose intake. Appropriate fluid intake, about 1.5 l/m²/d, to produce at least 30 mL/kg/day of urine to prevent super saturation of urinary metabolites such as calcium oxalate, calcium phosphate and uric acid should be advised⁽¹¹⁾.

Aim of the study

- 1- Assessment of different risk factors associated with urinary stones in children.
- 2- Prevalence estimation of urinary stones in Minia governorate.
- 3- Describe different clinical presentation of paediatric urolithiasis.

Subjects and methods

This cross-sectional study was conducted among children attending Minia University Hospital for Urology, Minia, Egypt, during the period from January to October 2023, and included all children less than 16 years who were diagnosed with urinary stones and attended Minia University Hospital for Urology for seeking treatment during the study period, 2 cases refused to participate with a response rate of 97.7%.

The sample size was calculated according to this formula: $n = [z^2 * p (1 - p)] / e^2$, where n = sample size, z = is the 95% confidence level (CI), p = expected prevalence of urinary stones (6%) and e = the 5% margin of error. Accordingly, the minimum sample size needed was 85 children;

Data collection

All children and their parents were interviewed, and data was collected by a well-designed, well-structured questionnaire. The aim of the study was explained, consent from the parents was obtained, and the researcher filled in the questions. The questionnaire inquired about socio-demographic data such as age, sex, father and mother occupation and education, family history, clinical presentation, and recurrence rate.

Ethical considerations: The approval of the Minia University administration as well as Research Ethical Committee of the Faculty of

Medicine, Minia University, was obtained, and all participants and their parents were informed about all steps of the study to be oriented by all the data extracted from this study. All participants took part in the study voluntarily. Confidentiality and privacy of data were ensured.

Statistical analysis

Collected data were computerized and analyzed by Statistical Package for Social Sciences (SPSS) version 26. All the data collected were given serial numbers. Data entered, checked for data entry errors. Data were summarized using descriptive statistics in the form of number and percentage for qualitative data, mean (SD) and range for quantitative data, Chi-square test was used for qualitative data. Student's t-test was used for quantitative data. p value of <0.05 was considered to be statistically significant.

Results

Total number of children aged <16 years attending Minia University Hospital for Urology during the period from January 2023 to October 2023 was 1200 children from which 85 children diagnosed with urolithiasis and the prevalence was estimated to be 7%. As shown in table (1), the age of the studied cases ranges from 1-16 years with a mean age of 8.3 ± 4 and 53% of the studied cases are in age group 4-10 years. There is male predominance (57.5%) in the studied cases with male to female ratio 1.3:1. Also about 70% of the studied cases have positive family history of urinary stone either first degree relative (55%) affecting father, mother or both or second degree relative (45%). Moreover, nearly 82.5 % of the studied cases are rural residents.

Table (2) shows that nearly 60% of fathers are manual workers while small percent about 4.5% have professional jobs. Regarding the education level of father, about 46% are below

secondary education and only 23% completed secondary education or intermediate institute. While the majority of mothers (82%) are housewives and about one half of them is below secondary education and about one fourth are illiterate.

Table (3) describe the different clinical presentations according to the age group. The most common clinical presentations for urinary stones among children <4 years are fever and vomiting (nearly 81%) for each item separately, followed by feeding difficulties (69%) and burning micturition or screaming at micturition (50%). While hematuria, dysuria and pain are less common in this age group. However, the most common clinical presentations for urinary stones among children 4-10 years are pain (nearly 87%), followed by hematuria and vomiting (42% and 40% respectively). While fever, feeding difficulties and burning micturition are less common in this age group. The most common clinical presentations for urinary stones among children >10 years, are pain (nearly 67%) followed by hematuria and fever (37%) for each item separately and dysuria (33%). While vomiting is less common and no one complain of feeding difficulties in this age group.

As shown in Table (4) and table (5) about one third of cases have history of recurrent episode of urinary stones after the first episode by about 5 years and the interval time of recurrence ranged from 2-8 years. There is a significant difference in the recurrence rate between the age groups. Also, there is a statistically significant difference between males and females regarding recurrence rate as 49% of males had history of recurrent urolithiasis compared with 16% among females. Moreover, the mean interval time of recurrence was about 5 years in males compared with 4 years in females.

Table (1)-Socio-demographic characteristics of studied cases, Urology Minia University Hospital, 2023

Socio demographic Characteristics	Total (n=85) N (%)
Age (Years) (mean± SD) Range	8.3 ± 4 1: 16
Age group < 4 years 4-10 years > 10 years	16(18.8%) 45(52.9%) 24(28.2%)
Sex Male Female	49 (57.5%) 36(42.5%)
Residence Urban Rural	15(17.5%) 70(82.5%)
family history of urinary stone positive negative	60(70.5%) 25(29.5%)
Positive family history (60 case) Father Mother Both Sibling	12(20%) 9(15%) 12(20%) 27(45%)
Child labor Yes No	18(21.2%) 67(78.8%)

Table (2) – Socio-demographic characteristics of parents of the studied cases, Urology Minia University Hospital, 2023

Socio demographic Characteristics	Total (N=85) N (%)
Occupation of father Not working Manual worker Trade and business Semi professional Professional	6(7%) 51(60%) 15(17.5%) 9(10.5%) 4(4.5%)
Education level of father Illiterate Below secondary Secondary or institute University level	17(20%) 39(46%) 20(23.5%) 9(10.5%)
Working state of mother Worker House wife	16(18.8%) 69(82.2%)
Education level of mother Illiterate Below secondary Secondary or institute University level	24(28.2%) 42(49.5%) 14(16.5%) 5(5.8%)

Table (3): Clinical presentation of studied cases according to age group, Urology Minia University Hospital, 2023

Clinical presentation	Age group			Total (N=85)	P value
	< 4 years (N=16)	4_10 years (N=45)	> 10 years (N=24)		
Pain	2 (12.5%)	39(86.7%)	18(75%)	59 (69.4%) ^(a)	<0.001*
Hematuria	3(18.8%)	19(42.2%)	9(37.5%)	31(36.5%)	0.220
Dysuria	3(18.8%)	13(28.9%)	8(33.3%)	24(28.2%)	0.501
Fever	3(81.3%)	9(20%)	9(37.5%)	31(36.5%)	<0.001*
Vomiting	13(81.3%)	18(40%)	7(29.2%)	38(44.7%)	0.003*
Burning micturition or screaming at micturition	8(50%)	9(20%)	8(33.3%)	25(29.5%)	0.061
Feeding difficulties	11(68.7%)	6(6.7%)	0(0%)	17(20%)	<0.001*
Discovered accidentally	0(0%)	3(13.3%)	0(0%)	3(3.5%)	0.201

* p value was calculated by using chi square test and considered significant if less than 0.05.

^(a)Numbers do not add to 100% as children might have more than one symptom.

Table (4): Recurrence rate of the studied cases according to age group, Urology Minia University Hospital, 2023

	Age-group			Total (N=85)	P value
	< 4 years (N=16)	4_10 years (N=45)	>10 years (N=24)		
Recurrence rate (N--%)	0 (0%)	15 33.3%	15 62.5%	30 35.3%	<0.001*
Time to recurrence Mean \pm SD Range	0	4.3 \pm 1.4 2:7	5.6 \pm 1.2 4:8	5 \pm 1.4 2:8	0.010*

* p value was calculated by using independent sample t test and chi square test and considered significant if less than 0.05

Table (5): Recurrence rate among the studied cases according to sex, Minia University Hospital for Urology, 2023.

	Sex		Total (N=85)	P value
	Male (N=49)	Female (N=36)		
Recurrence rate (N--%)	24 49%	6 16.6%	30 35.3%	0.002*
Mean of interval time of recurrence	5.2 \pm 1.4	4 \pm 1.2	4.9 \pm 1.4	0.07

* p value was calculated by using independent sample t test and chi square test and considered significant if less than 0.05

Discussion

In the current study the prevalence of pediatric urolithiasis is estimated to be 7% among children <16 years attending Minia University Hospital for Urology during our study period. This is in agreement with what was reported by Tasian et al., 2016⁽¹²⁾ about prevalence which range from 6-10%. Also this result approximated what had been reported by Eraslan et al., 2022⁽¹³⁾ who estimated the prevalence of paediatric urolithiasis to be 8.1% in Somalia and Aggour et al., 2009⁽¹⁴⁾ who reported that the prevalence of paediatric urolithiasis reached 12% among Egyptian children.

As regard to the age of children in this study, about 53% are 4-10 years old and 19% are < 4 years old with mean age about 8 years as shown in table (1). This is similar to what was reported by Milošević et al., 2014 and Mohamed Ayed et al., 2022^{(15),(16)} in Croatian and Egyptian children in which the mean age was 9.1 ± 4.8 (range 1:16years). While Zakaria et al., 2012⁽¹⁷⁾ in Egypt reported that the mean age at diagnosis of stone disease was 3.5 years (range, 1-14 years) and Elfadil *et al.* 2010⁽¹⁸⁾ in Sudan who reported that mean age of paediatric urolithiasis was 4.96 ± 4 years (range three months to 16 years). We can hypothesize this difference to increase UTI in this age group.

Regarding sex of the studied children, males represented 57.5% while females represented 42.5% with male to female ratio 1.3:1. This is consistent with Eraslan et al., 2022, Sagymbayeva 2023^{(13),(19)} who reported a male to female ratio 1.3:1 in Somali and Kazakhstan children. Also this is in agreement with Elmacı et al. 2014⁽²⁰⁾ who reported male predominance in pediatric urolithiasis in turkey (58% were males and 42% were females). Moreover, this result approximated to what had been reported by Nazmy et al. 2022⁽²¹⁾ who also reported that the percentage of male patients with pediatric urolithiasis (63.9%) outweigh female patients (36.1%) in Assiut Urology and Nephrology Hospital. This may be explained by high incidence of UTI in male than female in our studied children.

Regarding family history of pediatric urolithiasis, about 70% of children in this study had positive family history of urinary stones. This is

consistent with what was reported by Spivacow et al., 2010⁽²²⁾ as rate was 78.7%. Different results were reported by Zakaria et al. 2012 and Mohamed Ayed et al., 2022^{(16),(17)} in Egypt as about 40% of children had positive family history of urinary stones, this high percentage may be related to high rate of consanguinity in our region.

As regard to clinical presentation, pain was the most common clinical presentation (69%) followed by vomiting (44.7%), then hematuria and fever (36.5%) for each item separately. While dysuria and burning micturition were found in 29% of cases and feeding difficulties was less common and found in 20% of the studied cases. Only 3.5% of the studied cases discovered during routine checkup as shown in table 3. These findings approximated the results of Sagymbayeva, 2023⁽¹⁹⁾ among Kazakhstan children who reported that pain and colic was found in 50% and hematuria in 17% of cases and asymptomatic children were 3%. Similarly, the study by Milošević et al., 2014⁽¹⁵⁾ who reported that pain and renal colic was the most common clinical presentation (75%) followed by hematuria (58%) and 10.5% had no symptoms at time of diagnosis.

On the country, the findings that were reported by Sadeghi et al., 2015⁽²³⁾ in his study on Iranian children found that the most common clinical features on admission were restlessness/irritability (62%), flank pain (33%) and hematuria in 4%. While 21% discovered during evaluation of other condition. Also Al-Eisa et al., 2002⁽²⁴⁾ in Kuwait reported in his study that hematuria was the most common clinical presentation (71%) then abdominal pain (42%) while asymptomatic children were (5%). There is marked variation in presenting symptoms, especially abdominal or flank pain, among different countries, which may be due to the degree of awareness in the population and onset of seeking medical advice.

Conclusion

The prevalence of pediatric urolithiasis was estimated to be 7% in Minia University Hospital, with a male-to-female ratio of 1.3:1, a positive family history of 70%, and a rate of recurrence of 35%. Careful metabolic evaluation and regular follow-up of children

with a positive family history should be paid for to avoid recurrence.

Recommendation:

1. Through metabolic evaluation should be recommended to all children presented with specific or non-specific symptoms of stones to decrease rate of recurrence
2. All children should be encouraged to drink amount of fluid that meet recommendation for their age to prevent dehydration that is considered the main risk factors for stone formation
3. Future studies are needed in this aspect to assess the different risk factors associated with stones formation in children
4. Children should be provided a note for school to allow water bottles and more frequent bathroom breaks
5. Health education of mothers to encourage them changing dietary lifestyle of their children as increase water, limit sodium, increase fruit and vegetables and decrease processed food.

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