

Urolithiasis in two periods in children of Elbasan, Albania

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Abstract

Background: Urolithiasis is an important disease that sometimes may lead to harmful effect on kidney. It is associated with significant morbidity, especially in children with recurrent stone formation.

In this study we aim to define the risk factors, metabolic characteristics and clinical features in children with urolithiasis in our city in two periods.

Material and Methods: Our study has been extended in two periods, five years each, from 2005-2015. We evaluated two groups of children with urolithiasis documented by their ultrasonography. All children underwent laboratory and radiological examinations. Biochemical investigation included: serum calcium, sodium, potassium, creatinine, uric acid, magnesium. The test of urine included: electrolytes, urinalysis, pH, volume and urinary flow in 24h, uroculture.

Results: Male/female ratio was 1.17:1 for the first period and 1.47:1 for the second one. The mean age was 9.7 (period I) and 8.8 (period II). Fourteen patients (37.8%)-first period and twenty one(50%) -second period had a positive family history for kidney stones.

Hypercalciuria was the most common metabolic abnormality 54% for the first period and 57% for the second one. It was followed by hyperoxaluria and hypocitraturia.

Conclusion: Urolithiasis is a permanent problem for children of our region. Hypercalciuria is the most common risk factor. In addition low urine output and positive family history are determined as important risk factor for urolithiasis.

KEYWORD: urolithiasis, risk factors, hypercalciuria, children.

Introduction

Urinary stones are aggregates of crystals sometimes mixed with a protein matrix. They are formed on the renal papillar by retention of lithogenic particles either by obstruction or by adherence to damaged renal epithelium.

Stone formation happens when urine is supersaturated with stone promoting factors or because the inhibitor activity is reduced [4,5,14]. Urolithiasis is an important disease that sometimes may lead to harmful effect on kidney. It is associated with significant morbidity, especially in children with recurrent stone formation. Recent studies have shown an increasing incidence of urolithiasis in both adults and children, (but in children it is different, as it is shown in etiology, presentation and incidence).

There are a lot of factors that may influence this increasing incidence of urolithiasis, such as global warming, diet, genetic inheritance, socio economic conditions[2,3]. The etiology of urolithiasis in children is different. It is important to know the causes of kidney stone because this can lead to better strategies in preventing them.

So, to decrease the morbidity and to prevent the recurrence it is essential to evaluate the metabolic characteristics of the patient with kidney stones[1].

In this study we aim to define the risk factors, metabolic characteristics and clinical features in children with urolithiasis in our city in two successive periods.

Material and Method

Our study has been extended in two periods five years each, the first one from 2005-2010, and the second one 2010-2015. In this study we evaluated two groups of children, 37 and 42 children each, with urolithiasis documented by their ultrasonography. For the first period we included thirty seven children with average age 9.7, and for the second period we included forty two children with average age 8.8.

Male/female ratio was 1.17:1 for the first period and 1.47:1 for the second period. Children came to the hospital with the following complaints: hematuria, urinary infection, abdominal pain, nausea and vomiting. A part of them was selected by the routine examination of ultrasonography, or by spontaneous pass of the calcul.

All children underwent laboratory and radiological examinations and all datas were gathered. We recorded demographic and clinical features in all patients, the location of stone, history of their family regarding kidney stones, their diet and consumption of liquids during 24 hour. Metabolic evaluation was performed in all children.

Biochemical investigation included : serum calcium, sodium, potassium, creatinine, uric acid, magnesium. The test of urine included : urinalysis, pH, volume and urinary flow in ml/kg/24 hours, urine culture to isolate the causative microbe of urinary infection, particularly in cases of repeated urinary tract infection. We calculated the urinary flow in ml/kg/24h and divided the patients in three groups where urinary flow was <0.5ml/kg/24h, 0.5-0.8ml/kg/24h and >0.8 ml/kg/24h which shown hypersaturated urine and risk for urolithiasis.

In 24 hours urine and spot urine we measured calciuria, creatinuria, natriuria, caliuria, phosphaturia, magnesuria. We determined all mineral to creatinine ratios and compared (by age) with reference values.

Knowing renal stasis associated with congenital ureteropelvic junction obstruction, can contribute to the formation of stones, all children with hydronephrosis, in addition to the ultrasonography underwent voiding cystography to detect the vesico ureteral reflux, and intravenous urography performed with contrast (urographine 60% or 76%) based on body weight and age. Through this examination we could search for other calculi, could notice urologic abnormalities, and judge the degree of obstruction and renal damage.

In anamneses all children were evaluated for family antecedente regarding calculosis, the diet, the amount of liquids consumed in 24 hours.

Results

We evaluated two groups of children in two successive periods 37 for the first period and 42 for the second one. We found that for the same period (five years) the number of children presented with urolithiasis in our hospital is growing.

Male/female ratio was 1.17:1 for the first period and 1.47:1 for the second one. The mean age was 9.7 for the first period and 8.8 for the second period, so the onset of the

desase is decreased. Fourteen patients (37.8%) for the first period and twenty one (50%) for the second period had a positive family history for kidney stones. The most clinical presentation were: abdominal pain respectively 38% and 33% and hematuria 32% and 24%. Urinary infection was found in 22% and 17%, nausea and vomiting in 8% and 19% and stone passage in second period in three children or 7% (table 1).

Table 1. Demographic and clinical characteristics of children with urolithiasis

	First period 2005-2010		Second period	
	Number of children	Percentage	Number of children	Percentage
Male/Female	20/17	54%/46%	25/17	60%/40%
Family history of urolithiasis	14	37.8%	21	50%
Abdominal pain	14	38%	14	33%
Hematuria	12	32%	10	24%
Urinary infection	8	22%	7	17%
Nausea and vomiting	3	8%	8	19%
Stone passage			3	7%

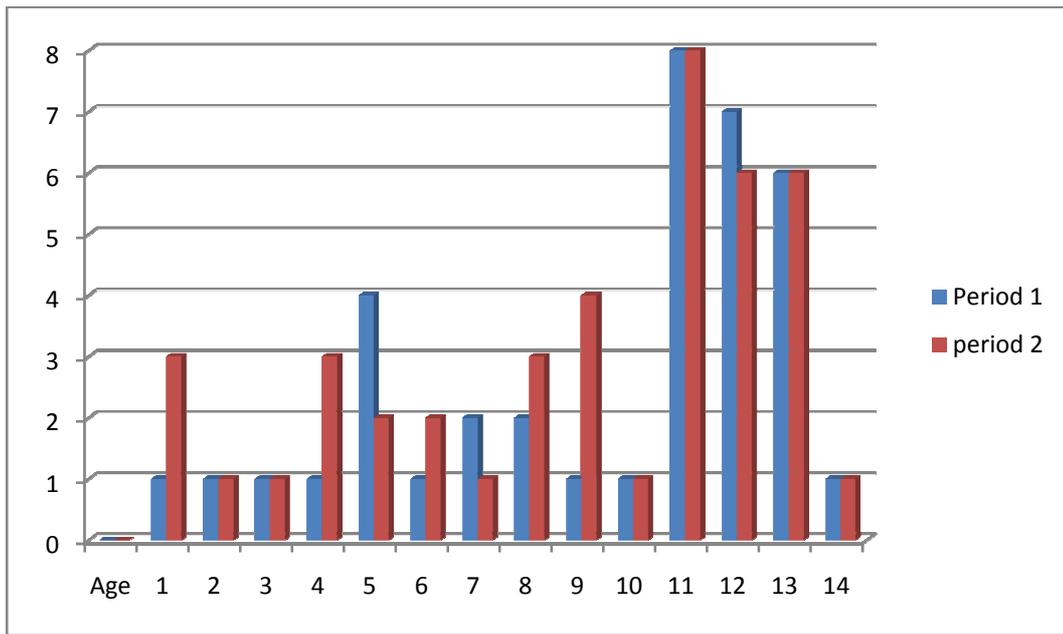
From the radiologic investigation we found anatomic abnormalities present : Vesico ureteral reflux two patient for each period, ureterocele one patient in second period, ureteropelvic junction obstruction two patient in first period and one patient in second period (table2).

Table 2 Anatomic abnormalities of urinary tract present in patients

Anatomic abnormality	First period		Second period	
	Number of children	Percentage	Number of children	Percentage
Vesico ureteral reflux	2	5.4%	2	4.8%
Ureteropelvic junction obstruction	2	5.4%	1	2.3%
Ureterocele			1	2.3%

The most effected age was eleven years old followed by age of twelve and thirteen, but in the second period we found urolithiasis more present in early ages, as it is shown in figure 1 below:

Figure 1 Age distribution in two periods



From the radiologic datas we found that the location of stone in majority of cases was in upper part of urinary tract, in kidneys, 89.2% and 92.8% for each period, in ureter in 5.4% for first period and 4.8% for second one and in bladder 2.7% and 2.4% respectively. In the first period we found 2.7% of cases that stone was located in kidneys and ureter (table 3 and figure 2) .

Table 3. Location of stones in all children in two periods

Location of stone	First period		Second period	
	Number of children	Percentage	Number of children	Percentage
Kidneys	33	89.2%	39	92.8%
Kidneys and ureter	1	2.7%		
Ureter	2	5.4%	2	4.8%
Bladder	1	2.7%	1	2.4%
Total	37	100%	42	100%

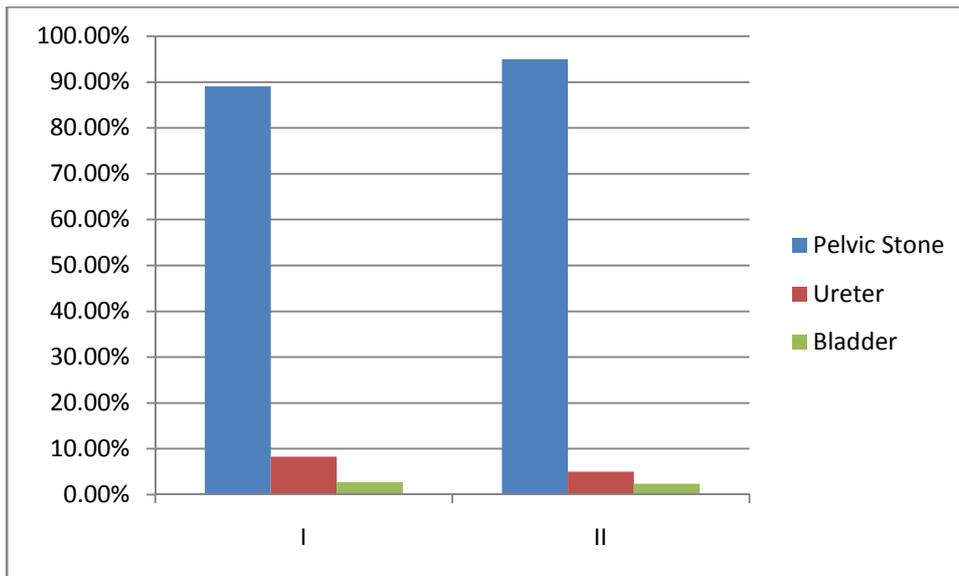


Figure 2 Stone location

All the patient underwent metabolic investigation and we found metabolic abnormality in 86.5% in first period and 88% in second period. Hypercalciuria was the most common metabolic abnormality 54% for the first period and 57% for the second one. It was followed by hyperoxaluria and hypocitraturia. Hyperoxaluria was detected in 10% in first period and 9.5% for the second one. Hypomagnezuria was found in 2.7% in first period and 7% in the second one. Hypocitraturia was found 5% in first period and 7% in second one. We found more than one metabolic abnormality in 13.5% of the patient in first period and 11.9% of the patient in second period. We didn't find metabolic abnormality in 13.5% in the first period and 12% in second period (table 4).

Table 4 Comparison of urinary metabolic abnormalities in two periods

	First period		Second period	
	%	n	%	n
Hypercalciuria	54%	20	57%	24
Hyperoxaluria	10%	4	9.5%	4
Hypocitraturia	5%	2	7%	3
Hypomagnezuria	2.7%	1	7%	3
Cistinuria	2.7%	1	-	
Hypercalciuria+hypocitraturia			2.4%	1
Hypercalciuria+hyperphosphaturia	5.4%	2		
Hypercalciuria+hypomagnezuria	8.1%	3	9.5%	4
No abnormality	13.5%	5	12%	5

We found that 73% of children in first period and 72% in second one, had a supersaturated urine, because their urine flow was less than 0.8ml/kg/24 h.

Ten children (27%) in first period and twelve children (28.5%) in second period didn't show risk for supersaturated urine (table 5).

Table 5 Urinary output in ml/kg/24h

	First period	Second period
ml/kg/24h	% n	% n
<0.5 ml/kg/24h	32% 12	28.5% 12
0.5-0.8 ml/kg/24h	41% 15	43% 18
>1 ml/kg/24h	27% 10	28.5% 12
Total	100% 37	100% 42

From the anamnesis taken from children and their parents we found the great consumption of salt (taken by cheese, sausages, bacon and pickles), chocolates and a low amount of liquids.

Discussion

Incidence of urolithiasis is increasing in last decades."A recent study, however, had reported a fivefold increase in the incidence of pediatric urolithiasis during the past decade" said in her article M Lopez[3]. In our study we found that the number of children with urolithiasis is increasing.

We saw that average age of presentation was 9.7 and 8.8 for each period. It is correlated with the average age of children with urolithiasis in Italy 9 ± 4 [27], Croatia 9.38 [12], Iceland 9.4 [19], but in Turkey [11], Iran [21] and Egypt [24] we found the average age is lower, respectively 3.7 ± 1.3 years old, 3.6 ± 3 years old and 3.5. In USA [29] and Canada [20] the average age is about eleven.

The male/female ratio is 1.17 and 1.47. We found the same ratio in Italy 1.17, Croatia 1.47, Canada 1.25, Turkey 1.03, Argentina 1.14 [27,12,11,26] but we found the predominance of female in some countries for example in USA 0.95, in Iran 0.84, in Island 0.73 [29,21,19].

An important risk factor for our children is the positive history of family regarding kidney stones 37.8% and 50%. We find in literature the same fact, for example in Turkey 55%, in Italy 77%, in Argentina 46.2%, in USA 37% [10,27,26,29]. This factor plays a great role in stone recurrence [31].

Regarding clinical symptoms, we found two specific signs: hematuria 32% and abdominal pain 24%. We find the same symptoms in Turkey: hematuria 25.7% and abdominal pain 28.7%. In Croatia we found abdominal pain in 83% of children and urinary infection in 62.1% of children. In Canada and Brazil abdominal pain was the most specific clinical sign 63% and 56.7%.

Metabolic evaluation showed that hypercalciuria is the most common metabolic risk factor 54% and 57%. Luana Amantio and her colleagues [15] in their article said that: "Many authors had shown hypercalciuria is present in 72%-88% of pediatric patient with urolithiasis [12,18,19,26,29]. Hypercalciuria accounts for 48% and 59.6% in

Turkey [10,11],74.6% in Brazil[18], 78% in Iceland[19]. It is followed by hyperoxaluria and hypomagnezuria.

In their study [16] Borghi L. and his colleagues conclude that “urinary volume is a real risk factor in nephrolithiasis and that a large intake of water is the initial therapy for prevention of stone recurrence”. In our study in two periods we found that 72% and 73% of patients have a low urine output less than 0.8 ml/kg/24h. In literature we find 63% of children with low urine output in USA[29]. The anatomic abnormalities are predisposing factors for stone formation. We found 11% of our children with anatomic abnormality. In literature we find 23.2% in children of Croatia, 14% in children of Canada, 32% in Iran, 20-24% in Turkey[12,20,11].

Conclusion

Urolithiasis is a permanent problem for children in our region. Hypercalciuria is the most common risk factor. In addition low urine output and positive family history are determined as important risk factor for urolithiasis, so children with urolithiasis and positive family history regarding kidney stones deserve a thorough metabolic evaluation.

REFERENCES

- 1-Albreth Hesse, Hans-Göran Tiselius, Roswitha Siener, Bernd Hoppe Urinary Stones Diagnosis, Treatment and Prevention of Recurrence. 3rd edition 2009 4-31
- 2- Ayay P, Sharma and Guido Filler Epidemiology of pediatric urolithiasis Indian Journal of Urology dec 2010 516-522
- 3-Ahmet Midhat Elmaci , Aydin Ece, Fatih Akin
Pediatric urolithiasis:metabolic risk factors and follow-up results in a Turkish region with endemic stone disease.
Urolithiasis (2014) 42:421-426
- 4- Andrew P Evan Physiopathology and etiology of stone formation in the kidney and the urinary tract
Pediatric Nephrology may 2010 25(5) 831-841
- 5-BorghiL, Meschi T, AmatoF, Briganti A, Novarini, Giannini A
Urinary volume,water and recurrences in idiopathic calcium nephrolithiasis:a 5-year randomized prospective study.
J Urologymarch 1996 155(3) 839-43
- 6 - C.Barbas, AGarcia, L Saavedra, M.Muros
Urinary analysis of nephrolithiasis markers.
Jurnal of Chromotography B,781(2002)433-455
- 7- Cheryl Guttman Krader Kids’ recurrent stone risk factors may rise with family history Urology Times may 2014
- 8- Carmen R.Amaro, Jose Goldberg, Joao L Amaro, Carlos R Padovani.
Metabolic assessment in patients with urinary lithiasis.

International braz.J Urol.Vol 31,no 1 Febr.2005 29-33

9- De Floor WR, Jackson E, Minevich E, Caillat A, Reddy P, Sheldon C, Asplin J The risk of recurrent urolithiasis in children is dependent on urinary calcium and citrate
Urology Jul 2010 242-5

10 -Douglass B,Clayton
The increasing pediatric stone disease problem Urology 2011 February 31(3)3-12

11- Edvardsson V, Elidottir H, Indridason OS, Palson R
High incidence of kidney stones in Icelandic children.
Pediatric Nephrology 2005 jul 20(7)940-4

12-Erbagci A, Erbagci AB, Yilmaz M, Yagci F, Tarakcioglu M, Yurtsevev C
Koyolouogluo, Sarica K
Pediatric urolithiasis -evaluation of risk factors in 95 children.
J Urology2003 37(2) 129-33

13-Elain M Worcester Fredric LCoe
Nephrolithiasis Primary care:Clinics in Office Practice 35(2008) 369-91

14-Fakhrossadat Mortazavi,Leila Mahbubi
Clinical features of Pediatric Urolithiasis.
Iran J Ped June 2007 Vol 17(2)129-33

15- Kovacevill, Wolfe-Christensen L, Edwards L, Sadaps M, Lakshmanan Y
From hypercalciuria to hypocitraturia a shifting trend in pediatric urolithiasis J
Urology2012 Oct 188(4 suppl) 1623-7

16- Luana Amancio, Maira Fedrizi, Nilzete LiberatoBresolin, Maria Goreti, Moreira
Guimaraes Penido.
Pediatric urolithiasis:experience at a tertiary care pediatric hospital.
J Bras.Nefrol.vol.38 no.1Sao Paulo Jan/Mar.2016

17 -Laura Chang Kit, Guido Filler, John Pike, MichaelP.Leonard
Pediatric urolithiasis:experience at a tertiary care pediatric hospital
CUAJ august 2008 2(4) 381-6

18- Michelle Lopez and Bernd Hoppe History epidemiology and regional diversities
of urolithiasis Pediatric Nephrologyjan 2010 25(1) 49-59

19- Monica Gripta, Seema Bhayana and S.K Sikka Role of Urinary inhibitors and
promoters in calcium oxalate crystallisation
International Journal of Research in Pharmacy and Chemistry JJRPC 2011 1(4)

20- Mihovil Biocic, Marijan Saraga, Andrea Cvitkovic, Zoran Bahtijarevic, Drazen
Budimir, Jakov Todoric and Radmila Majhen Ujevic. Pediatric Urolithiasis in Croatia;
Coll Antropol 27 2003 745-52

- 21-Mostafa Zakaria Sherif Azab Mona Rafat
Assessment of risk factors of pediatric urolithiasis in Egypt
Translational Andrology and Urology vol 1 No4 decemb 2012
- 22-Milliner DS, Murphy ME.Mayo Clin Proc..Urolithiasis in pediatric patients.
Mar;68(3):24
- 23-Paul J, Kokorowski, Katherine Hubert, Caleb P Nelson Evaluation of pediatric nephrolithiasis , Indian journal of Urology Oct 2010 26(4) 531-5
- 24-Pelin Ertan, Gokhan Tekin, Nece Oger Metabolic and demographic characteristics of children with urolithiasis in Western Turkey, Urological research 39(2)105 -10 April 2011
- 25-Simin Sadeghi, Faramarz Fazeli, Elham Zarifi.
Clinical characteristic and metabolic abnormalities in pediatric urolithiasis in South East Iran. J Ped.Nephrology2015 ;3
- 26 -Spivacow FR, NegriAL, del ValleEECalvino, IFradinger E, ZanchettaJR
Metabolic risk factors in children with kidney stone disease
Pediatric Nephrology 2008Jul 23(7)1129-33
- 27-Schwarz RD, Dwyer NT.Pediatric kidney stones: long-term outcomes.Urology.
2006 Apr;67(4):812-6.
- 28-Tasian GE Copelovitch
Evaluation and medical management of kidney stones in children J
Urology2014 Novemb. 192(5)1329-36
- 29-Tabel Y, Akin IM, Tekin S , Clinical and demographic characteristics of children with urolithiasis:Single center experience from Eastern Turkey.
Urol.Int 2009 83(2)217-21 Sept 2010
- 30-Van Dervoort K, Wiesen J, Frank R, Crosby V Urolithiasis in pediatric patients: a single center study of incidence, clinical presentation and outcome
J Urol 2007 177(6) 2300-5
- 31-Warren T Snodgrass, Linda A Baker Nicol C Bush
Pediatric Urology Evidence for optimal patient management
2013 259-74