Urolithiasıs in Children

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Introduction

Urolithiasis is a common disorder in adults. In children, the incidence of urolithiasis is low in industrialized countries but it is an endemic problem in developing countries like Turkey. The clinical outcome of urolithiasis varies in different pediatric series reported (1-3). In order to detect the etiology, clinical findings, coexisting diseases, outcome and treatment of childhood urolithiasis, we analyzed these parameters, helping to guide the clinical management of pediatric urolithiasis .

Materials and Methods

421 patients (179 girls and 242 boys, <16 years old) were evaluated and followed for urolithiasis at the Social Security Children's Hospital between 1993 and 2003. The diagnosis of urolithiasis was made radiographically on ultrasonography, plain x-ray film or intravenous pyelogram. A urine analysis and urine culture was performed in all patients. Blood of all patients was tested for electrolyte, calcium (Ca), phosphorus (P), blood urea nitrogen (BUN), creatinine and uric acid levels. Urine specimens of 329 patients were analyzed for calcium / creatinine ratios. A ratio>0,21 was accepted as hypercalciuria in children, and >0,4 in infants. A 24-hour urine specimen collection was performed in 173 patients. The 24 hour urine analysis criterion was greater than 4mg/kg/d for hypercalciuria, >0,5 mmol/1,73m2/d for hyperoxaluria, <320 mg/1,73m2/d for hypocitruria. Urinary aminoacids were evaluated in 217 patients. Urinary stone analysis was performed in 135 patients. The charts of all 421 patients were retrospectively reviewed with regard to age at diagnosis, gender, family history, clinical presentation, location and number of stones recurrences and accompanying diseases.

Results

The age distribution of 421 children was 69.80 ± 49.60 months (2 to 288 months). 168 children were under 4 years of age, and 70 children were under one year of age (40 and 17% respectively). Male to female ratio was 242/179 (1,35/1). A history of urolithiasis in family members was obtained in 190 patients (47%). A history of renal failure due to urolithiasis in family members was obtained in 32 patients (8%). The location of stones was as follows: 321 (76%) of calculi were found in the kidneys, and 65 (15%) in the ureters.

Table 1

Complaints and symptoms at presentation	n (%)
Pain (abdominal or loin)	211/386 (55)
Microscopic hematuria	187/388(48)
Macroscopic hematuria	147/389 (38)
Urinary tract infections	146/393 (37)
Fever	117/399 (30)
Dysuria	85/382 (22)
Vomiting	56/378 (15)
Spontaneous passage of calculi	54/395 (14)
Glob vesicale	8/383 (2)
Stone Data	
Stone location	
Kidney	321 (76)
Ureter	65 (15)
Bladder	30 (7)
Associated illness at presentation	
Congenital genitourinary anomaly	22
Duplication of the ureters	6
Vesicoureteral reflux	5
Ureteropelvic junction obstruction	4
Renal agenesis	3
Renal ectopia	2
Horseshoe kidney	2
Polycystic kidney disease	
(1 autosomal dominant and 1 autosomal recessive)	2
Metabolic	
Distal renal tubular acidosis	25
Cystinuria	15
Glycogen storage disease	3
Hereditary fructose intolerance	1
Ornithine transcarbamylase deficiency	1
Primary hyperparathyroidism	3
High dose vit. D intake	2
Other	
William's syndrome	1
Turner's syndrome	2
Lowe's syndrome	2
Dent's syndrome	1

Thirty children were found to have bladder calculi (7%). 27 patients had bilateral kidney stones. 21 patients had both kidney and ureter stones, four patients had bilateral ureteral

stones. The stones were evenly distributed on the left and right sides (Table I).

The most common complaints on admission were pain (abdominal or flank) and gross hermaturia (55 and 38% respectively). Microscopic hematuria was detected in 187 patients (48%). Dysuria was present in 86 patients (22%). Urinary tract infection at presentation was found in 144 patients (36%). The incidence of UTI was higher in infants than the elderly (62 and 30% respectively). A genitourinary anomaly was found in 22 patients (5,2%). The genitourinary anomalies found are given in Table I.

On routine biochemical evaluation of urine, hypercalciuria was detected in (139/329) (44%); hypocitruria in 51/81 (62%), hyperoxalurie in 9/173 (%5) patients. Stone analysis was performed in 135 patients. The results of stone analysis are given in Table II. Calcium oxalate stones (83) were most frequent (57%) and struvite calculi (22) were the second (18%). Cystine stones were detected in 15 patients (13 %). Hyperoxaluria and hypocitraturia were also detected in 8 and 16 patients with calcium stones (6 and 12% respectively).

The spontaneous passage rate for all renal stones was 70 (16 %). Among the 70 patients below 1 year of age, 21 patients (30 %) passed their stones spontaneously. ESWL was performed in 37 patients and 14 stones were removed endoscopically with a stone basket. Surgical removal of the stones was performed in 57 patients. 21 patients underwent nephrectomy either before or during our follow up.

71 patients showed recurrence of stones (17%). Among the patients having a stone analysis (135 patients), 35 showed recurrences. According to the types of stones the recurrence rates were as follows: 17 calcium (17/83, 20%), 11 cystine (11/15,73%), 6 struvite stones (6/22,27%), and one uric acid stone (1/9,11%). Recurrence rates are given at table II.

Table II. Type and recurrence rate of stones

Type of stones (135 stones)	n (%)	Recurrence (%)
Calcium oxalate	83 (61)	17 (20)
Struvite	22 (16)	6 (27)
Cystine	15 (11)	11 (73)
Uric acid	9 (6)	1 (11)
Xanthine	6 (4)	0

In our series 17 patients had either renal insufficiency or renal failure. Two of the patients had ESRD at presentation. In our center in 13% of the patients with ESRD the renal failure is due to urolithiasis.

Discussion

The incidence of pediatric urolithiasis varies among countries and geographic regions and is still an important problem of pediatric nephrologists and urologists in Turkey. The incidence of urolithiasis is low in industrialized countries and especially in young children (4-6). In our series 40% of the children were below four years of age, and 17% were below one year of age, in contrast to the reports from industrialized countries. This may be attributed to both high incidence of urinary tract infections and to high prevalence of metabolic stones due to consanguineous marriages in our country.

Men are known to be prone to urolithiasis. A male predominance is shown also in our series with a ratio of 1,35:1, which is similar to many other reports. A strong history of urolithiasis in the family members was present in about half of our patients. This is quite high indicating a genetic predisposition besides environmental factors like dietary habits and climate.

The presenting symptoms found in our series is similar to these reported in many different series including adult series (4, 7, 8). Urinary tract infection (UTI) was seen about 1/3 of patients at presentation. UTI was more frequent in infants with a rate of 2/3. This finding is impressive and leading to a conclusion that urolithiasis should be detected in all infants presenting with UTI, and also children with urolithiasis should closely be followed for diagnosis and treatment of UTI.

Hypercalciuria was found in about half of the patients. Among the hypercalciuric patients three had hyperparathyroidism, two had the history of high dose vit. D intake and one was with William's syndrome. Hypocitruria and hyperoxaluria were also found. These findings are comparable to the rates in many other series. Overall metabolic causes of calculi were detected in about 40% of patients and in 60% of analyzed stones.

The findings of stone analysis also were comparable with the literature with calcium oxalate stones predominancy and struvite stones as the second frequent one (3, 4, 8). The frequency of cystine stones was high in our series. This finding could be due to frequent consanguineous marriages seen in our country.

Recurrence of stones in the pediatric population has been reported to be ranging widely from 4% to 40% (4-7). In our series recurrence rate was 17%, similar to rates in the literature. According to the types of stones cystine stones showed the highest rate of recurrence (73%). This was followed by struvite stones with a rate of 27% and calcium stones with a rate of 20%. The high recurrence rate of cystine stones was as expected.

The prevalence of urolithiasis among dialysis patients varies (3,6-8%). Seventeen of our patients had some degree of renal insufficiency (two of them with ESRD), and 23% of these patients had a metabolic cause. Renal insufficiency rate is higher than the rates of adult series.

In conclusion children with urolithiasis should be analyzed for a metabolic cause, genitourinary anomaly, and urinary tract infections and followed closely in order to prevent renal failure.

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