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**Original Article**

**Urology**

# Review For Urolithiasis In Patients Attending The Pediatric Surgery Unit At Al-Qadisiya Governorate –Iraq

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## Abstract

**Background:** Pediatric urolithiasis is an uncommon occurrence in developed countries, with a prevalence of 1%–5% accounting for about 1 in 1000 pediatric hospital admissions in North America. Though a rare pathology, there is a high degree of morbidity associated with pediatric urolithiasis.

Aim: To report the pattern and the outcome of to treatment modality (open surgery) in children with urinary stone disease.

**Materials and Methods:** This study was conducted in the pediatric surgery unit at the maternity and Child Teaching hospital in Al-Qadisiya governorate-Iraq during the period from the 1st of January 2005 to the end of December 2008, a total of 46 patients, admitted through this single unit, were included in this study and prospectively reviewed.

**Results:** 46 children with urolithiasis were observed 34 (73.9%) were males and 12 (26%) were females male to female ratio was 2.8:1. Their ages ranged from 6 months to 14 years with a mean age of 5.5 years. Pediatric patients with stones present in a manner similar to adults. Primary care physicians need to be highly suspicious of stone disease in a patient presenting with flank or abdominal pain and gastrointestinal symptoms.

Pyelolithotomy was done in 22 patients (47.8%) and ureterolithotomy in 7 patients (15.2%). Pyelonephrolithotomy, extended pyelolithotomy with pyeloplasty were performed in 3 cases (6.2%) each being in one case.

**Conclusion:** Traditional open surgery may be preferred treatment for pediatric urolithiasis in expert hands with excellent stone clearance and minimal complications.

*Keywords:* **Pediatric urolithiasis, Al-Qadisiya governorate, Iraq.**

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## INTRODUCTION

Pediatric urolithiasis is an uncommon occurrence in developed countries, with a prevalence of 1%–5% [1] and accounts for about 1 in 1000 pediatric hospital admissions in North America [2] . However, recent studies by several major pediatric centers in the United States have observed an increased incidence [3]. Though a rare pathology, there is a high degree of morbidity associated with pediatric urolithiasis. Pediatric patients tend to form stones in a recurrent pattern, with rates of recurrence of 6.5%–44% [4]. This tendency as well as the destructive nature of stone formation can quickly lead to progressive decline in renal function in the fragile pediatric kidney. The incidence of urolithiasis is lower in children than in adults. As an example, in a population-based study of patients over 10 years of age, adolescents between 10 and 19 years of age accounted for only 4 percent of the total episodes of urolithiasis [5]. For the total population, the incidence of urolithiasis was 109 per 100,000 men per year and 36 per 100,000 women per year. The explanation for the lower pediatric incidence is unknown but may be due in part to the higher concentrations of crystal formation inhibitors such as citrate and magnesium in the urine of children compared to adults [6, 7]. Worldwide, boys have a slight increased risk for renal stone disease compared to girls [8-12] .The incidence and composition of renal stones differs significantly with regard to geographic region [13]. In European children infection related stones predominate. These stones are often located in the upper urinary tract, are composed of struvite (magnesium ammonium

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calcium phosphate), and are frequently related to proteus urinary tract infection **(14).** Hypercalciuria is the most common metabolic cause of stones in Western children. No diagnosis is determined in a quarter of cases. If more detailed investigations are undertaken it is possible that the number of "idiopathic" cases will decrease. The aim of this paper to report the pattern and the outcome of to treatment modality (open surgery) in children with urinary stone disease.

## PATIENTS AND METHODS

This study was conducted in the pediatric surgery unit at the maternity and Child Teaching hospital in Al-Qadisiya governorate-Iraq during the period from the first of January 2005 to the end of December 2008, a total of 46 patients, admitted through this single unit, were included in this study and prospectively reviewed. All the children were under the age of fourteen years belonging to either sex with urinary tract stone disease. No standard protocol or algorithm was available for investigating children with suspected urolithiasis in the pediatric surgery outpatient setting.

All the patients were evaluated pre-operatively with detailed history, thorough general physical and genitourinary tract examination and the following investigations; a. Blood complete examination , b. Urine complete examination( culture and sensitivity test included ) , the diagnosis of urinary tract infection UTI in our cases based on signs and symptoms of UTI such as fever, abdominal/flank pain, dysuria, and urinating frequency and a colony of at least $10^5$ organisms/ ml in a midstream, clean–voided specimen, $10^3$ or more organisms/ ml in a catheterized urine or any growth in a nephrostomy aspirated urine specimen , c. Blood urea , d. Serum creatinine , e. Renal ultrasonography ,f. Plain X Ray KUB area and a metabolic evaluation, including serum electrolytes, calcium, uric acid, 24-hour urine collection for volume, was carried out for all patients . Unfortunately, there was no gold standard imaging test that was administered to each child. Size and site of stone was noted. Degree of hydronephrosis was estimated on renal ultrasonography. Serum electrolytes, Intravenous autography and voiding cystourethrography were done in selected cases. In all patients demographic and clinical features, family history, size and location of stone, history of vitamin D3 injection, results of imaging and laboratory findings were recorded. No Criteria for selection of mode of treatment was done because we have no facilities in our unit like the major advancement in the treatment of urinary tract calculi in children, which is now available world wide, for example, the use of extra corporeal shockwave lithotripsy (ESWL).So all patients under went conventional open surgery for stone removal (pyelolithotomy, nephrolithotomy, ureterolithotomy or cystolithotomy are used to extract the stones depending on the site ) , those on medical oral dissolution therapy and whom the small size stone and passed were excluded from the study .The data was analyzed by Excel soft ware program .

## RESULTS

Forty six children with urolithiasis were observed 34 (73.9%) were males and 12 (26%) were females male to female ratio was 2.8:1. Their ages ranged from 6 months to 14 years with a mean age of 5.5 years. The majority of them presented with flank pain 20 patients (Table 1). Other presenting symptoms were recurrent urinary tract infection 11 patients, gross hematuria 10 patients (2 patients had both urinary tract infection and hematuria), non-specific abdominal pain in 6 patients, and 2 patients presented with failure to thrive. One patient presented with acute urinary retention due to a stone in the urethra. From the urinalyses study microscopic hematuria was found in 29 patients , while 11 of patients showed pyuria and 4 had bacteriuria, 2 patients were negative (the most common causative pathogen was E. coli followed by Pseudomonas and proteus spp. ) .

Bilateral kidney stones were found in 3 patients (6.5%). In those with unilateral urolithiasis, the stone was located in 14 (30.4%) patients on the left and in 9 (19.5%) patients on the right side, without significant difference ($p>0.05$), (Table 2) demonstrates the location of stones. The distribution of the stones in the urinary tract was as follows: 24 had kidney stones, 10 had bladder stones , 7 had ureteric stones and one had a urethral stone .Two patients had both kidney and vesicle stones , 2 patients had both ureteric and vesicle stones . The stones' diameter was 5-45 mm (mean 1.30±3.20) (Figure 1-4).

Anatomical malformation was found in 12 children (26%) including vesicoureteral reflux in 4, ureteropelvic junction stenosis in 3 and ectopic kidney with hydronephrosis in 2 cases. Duplex collecting system, single kidney and ureterocele was encountered each in 1 case (Table 3).

Evaluation for possible predisposing factors revealed that 11 (23.9%) patients had positive pyuria. Five patients (10.8%) had history of vitamin D3 injection in a dose of more than 300.000 IU for suspected rickets and 3 of them were under 1 year old. family history of urolithiasis in the first or second

degree members of family found in 8 (17.3%) patients .

All patients treated with open surgery, pyelolithotomy was done in 22 patients (47.8%) and ureterolithotomy in 7 patients (15.2%). Pyelonephrolithotomy, extended pyelolithotomy with pyeloplasty were performed in 3 cases (6.2%) each being in one case (Table 4). The overall stone clearance rate was 97% being 100% for ureteric stones, 100% vesicle stone and 95.5% for renal stones. Only one patient (3.33%) was left with residual stone after open surgery. Complication rate after open surgery was 26.40% (n=08). The most common complication seen was post operative respiratory tract infection 16% (n=05) while 07 %( n=2) developed nausea and vomiting and 3.3% (n=l) had residual stone. No complication was seen in 73.60% (n=22) of the cases in this group.

Of 46 patients analyzed, 28 (60.8%) the stones were composed of calcium oxalate or phosphate. Two patients had stone recurrence during follow-up.

**Table (1). Presenting Symptoms In 46 Pediatric Patients With Urolithiasis.**

| | Symptom | No. | %. |
|---|---|---|---|
| 1 | Flank Pain | 20 | 43.4% |
| 2 | Recurrent UTI* | 11 | 23.9% |
| 3 | Gross Hematuria | 8 | 17.3% |
| 4 | Abdominal Pain | 6 | 13.0% |
| 5 | Failure To Thrive | 2 | 4.4 % |
| 6 | Acute Urinary Retention | 1 | 2.1 % |

***** *Two Patients Had Both Urinary Tract Infection And Hematuria*

**Table (2): Location of Stones In 46 Children With Urolithiasis.**

| Locations | No. | % | Notes |
|---|---|---|---|
| Kidneys | 26 | (56.5%) | Left 14 (30.7%), right 9 (19.5%), bilateral 3 (6.3%), (p>0.05). |
| Urinary bladder | 10 | (21.7%) | 2 patients had both kidney and vesicle stones. |
| Ureter | 7 | (15.2%) | 2 patients had both ureteric and vesicle stones. |
| Urethra | 1 | (2.1%) | |

**Table (3): Genitourinary Anatomic Abnormalities Present In 12 Patients.**

| Anatomic abnormality | No. of cases |
|---|---|
| Vesicoureteral Reflux | 4 |
| Ureteropelvic Junction Stenosis | 3 |
| Ectopic Kidney With Hydronephrosis | 2 |
| Duplex Collecting System | 1 |
| Single Kidney | 1 |
| Ureterocele | 1 |
| Total | 12 |

**Table (4): Surgical Operations Performed On The Patient In The Study.**

| Surgical Procedures | No. | % |
|---|---|---|
| Pyelolithotomy | 22 | 47.8 |
| Cystolithotomy | 11 | 23.9 |
| Ureterolithotomy | 7 | 15.2 |
| Pyelonephrolithotomy , Extended Pyelolithotomy With Pyeloplasty | 3 | 6.2 |
| Nephrolithotomy | 2 | 4.3 |
| Extraction Through Meatatomy | 1 | 2.1 |

**Figure (1). Large Urinary Bladder Stone In A 3 Years Old Male Patient.**

**Figure (2): Large Right Ureteric Stone In A 5 Years Old Male Patient.**

**Figure (3): Large 2 Urinary Bladder Stones In A 4 Years Old Female Patient.**

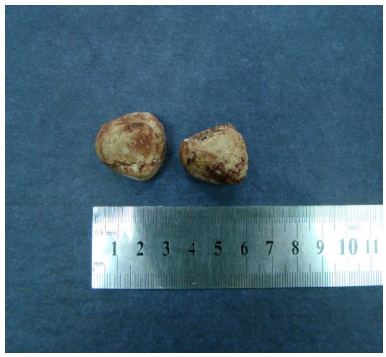

**Figure (4): About 1.2 Cm Stone In Renal Pelvis In A 18 Months Old Male Patient.**

**Figure (5): Stone Formed Over Suture In The Bladder For Previous Surgery To Remove Stone.**

## DISCUSSION

Pediatric stone disease varies widely in etiology, presentation, incidence and natural history depending on geographic location and economic environment [1, 3, 9, 15-17]. We saw an average age of presentation of about (mean 5.5 yr) , it is similar to that reported in literature from developing countries such as Turkey, Pakistan and Armenia (mean 7.3) [1,4,12] , but which correlated well with North American literature [18,19] . Childhood urolithiasis is more common in males with a reported male: female ratio varying from 1.2:1 to 3:1 in different series [20]. In our study, the male: female ratio was 2.8: 1.

Clinical symptoms of urolithiasis in children may be nonspecific and misleading. Renal colic is uncommon in younger age [21]. In some studies hematuria has been reported as main cause of presentation [22-24]. A child presenting with flank or abdominal pain and (or) gastrointestinal complaints (nausea, vomiting) should always be investigated with at least a urinalysis to evaluate possible stone disease. Microscopic hematuria is detected in up to 90% of children with urolithiasis [3, 17], and we observed a 26% rate in our series.

In a study performed in Croatia, most children less than 5 yrs old presented with UTI, and most patients more than 5 yrs presented with abdominal pain and hematuria [25]. In this study UTI and restlessness, were the 2nd causes of presentation, probably due to the lower mean age of our cases (5.5 yrs) comparing with mean age of 7-10 yrs reported in most literature [4, 25-27]. The reported incidence of urinary tract infection in children with urolithiasis varies from 9% to 80% [28]. In our series, 15 (32.6%) patients had proven associated urinary tract infections, 11 of them presented with recurrent history. *Proteus* is the most common urease producing microorganism. Other urease-producing microorganisms often present in stones are *Staphylococcus, Enterobacter, Providencia, Haemophilus, Mycoplasma* (*Ureaplasma urealyticum*), *Pseudomonas, Corynebacterium, Klebsiella, Bacteroides*, and *Micrococci* [28]. Urease production is, however, not a consistent finding in these microorganisms and it is necessary to analyze for urease production in order to definitely establish the etiological importance of the isolated strain. Stagnation of urine increases the risk of maintaining bacteria in the calices, the renal pelvis, and the collecting ducts. Such a condition also significantly contributes to a rapid stone development. Anatomical abnormalities leading to retention of urine and crystals are common in patients with infection stones, but are of etiological importance also in non-infection stone disease [29]. Cervera et al [30] reported an increased risk of developing stones only in the children with frequency-dysuria syndrome associated with urological malformations. Garcia et al [31] found that 10 of 58 (17%) children with hematuria and frequency-dysuria syndrome developed renal calculi. Children with symptomatic frequency- dysuria syndrome are at risk for future calculus formation. Reports indicate that 13-23% of children with frequency-dysuria syndrome-associated hematuria develop urolithiasis [31, 32]. Plain film radiography (kidney, ureter, and bladder, or abdominal radiography), ultrasonography and intravenous urography have been used to diagnose urinary tract calculi, all this techniques used in our study , recently the unenhanced helical CT scan currently considered the gold-standard imaging technique [33], this technique unfortunately not present in our institute .

Primary bladder stones used to be very frequent but have almost disappeared in the Western world, this trend away from bladder calculi to upper urinary tract stones is seen in association with industrialization and increasing affluence. Bladder stones are often composed of concentric layers and contain calcium-oxalate and/or uric acid. Dietary factors are mainly incriminated in their formation. Once removed, they do no tend to recur. Some primary bladder stones are of infectious origin. Bladder stones are sometimes found in association with foreign bodies or after surgical procedures, where sutures or metallic staples give basis for crystal deposition and agglomeration , in our study we are faced such problem when the stone formed over suture in the bladder for previous surgery to remove stone **( figure 5 )** . Anatomical anomalies like uretero-pelvic junction obstruction, primary ureter or neurogenic bladder, are often found to be the reason for stone disease in pediatric patients. Renal calculi then develop due to disturbances in urine transport, due to urine stasis or changes in urinary flow [34].

The etiology and location of urinary tract stones in children varies in different parts of the world. In North American and certain European countries, stones tend to be located in the upper urinary tract and are largely of calcium oxalate or struvite in composition, while in certain parts of Southeast Asia lower urinary tract stones predominate. The high incidence of these stones in endemic areas is attributed predominantly to a cereal-based, low-protein diet as well as a high incidence of urinary tract infection, whereas in the United States and Scandinavian countries, metabolic disorders are the most common cause of renal stones [20].

Although the modern technology has changed the trends. The size, location and composition of stone, and urinary tract anatomy all factor into the choice of surgical therapy for persistent urinary calculi .Open surgery still remains an acceptable

approach in large calculi. In addition, in less affluent societies like ours, open surgery may be most cost effective modality, permitting simultaneous correction of associated anatomical abnormalities [35].

## CONCLUSION

Pediatric patients with stones present in a manner similar to adults. Primary care physicians need to be highly suspicious of stone disease in a patient presenting with flank or abdominal pain and gastrointestinal symptoms. Anatomic abnormalities may coexist; anatomic anomalies and metabolic disorders are the two important etiological factors for childhood urolithiasis .Children must be investigated for these at their first diagnosis of stone disease. Traditional open surgery may be preferred treatment for pediatric urolithiasis in expert hands with excellent stone clearance and minimal complications.

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