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Clinical Presentation, Etiological Factors and Outcome in Children Diagnosed With Urolithiasis in Ghaziabad, Uttar Pradesh

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Abstract –

Background – Children with urolithiasis (UL) are often encountered in general pediatric practice. Its rising incidence, high recurrence rate, serious long term consequences & paucity of data on pediatric urolithiasis led to present research work. Recurrence usually remains unaltered unless dietary restrictions are followed stringently so emphasis in present research was on analysis of diet consumed by participants.

Material & Methods – Children with UL were enrolled from general pediatrics OPD of an urban hospital over 22 months in a prospective study. Data was collected on clinical profile, 24 hour dietary details, blood & urine investigations and USG abdomen. Attempts were made to get basic metabolic work-up in as many children as possible.

Results – Abdominal pain alone or with symptoms of UTI was found in 83.3% & 45.8% subjects. Important etiological associations found were UTI(62.7%),positive family history of UL (45.8%) and obesity (10.4%). Idiopathic hypercalciuria, hyperuricosuria & hyperoxaluria were found in 9 (18.7%),2(4.2%) &12(25%) participants. Daily intake of liquids & calcium was low in 79% & 72.9 % children respectively. Intake of both salt & proteins was high in 62.5% children. Persistence of symptoms found in 58.3% subjects. Recurrence was found in 14.5% subjects.

Conclusion – Having high index of suspicion of UL in all children presenting with recurrent unexplained UTI & /or recurrent abdominal pain and advocating USG abdomen early in such children can aid in timely diagnosis of UL. Simple dietary manipulations like adequate daily fluid & calcium intake along with avoiding high salt & animal protein diet may be beneficial by decreasing the recurrence rate of UL.

Key Words – Paediatric, Urolithiasis, Diet, Clinical Features, Hypercalcinosis, UTI

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INTRODUCTION

Urolithiasis (UL) is often encountered in general paediatrics practice affecting children of all age groups Prevalence quoted for Asian countries like India, Pakistan, Thailand & Myanmar which lie on Afro-Asian stone belt is 1-5%.[1] **Universal rise of UL cases** in last two decades[2] has been referred as stone wave. **UL lead to high morbidity and** accounts for 4-8% cases of end stage renal disease during childhood.[4-7]

The etiology of pediatric urolithiasis still remains largely unknown in the developing world.[8,9] although western studies show anatomical abnormalities, infection and metabolic causes in up to 90% of the cases.[10] Various dietary factors, metabolic disorders,[11-20] obesity, diabetes etc contribute to the pathogenesis of the different types of stones.[2-4] High prevalence, rising incidence, troublesome symptoms and serious long term consequences along with relative paucity of data in childhood UL were the reason to conduct present research work.

MATERIAL METHODS

Study design- prospective observational study

Place - General Pediatric OPD, of a tertiary level care hospital situated in urban Ghaziabad.

Duration -September 2016- June 2018 (22 months)

Sample size -All consecutive subjects of urolithiasis attending pediatrics OPD of hospital were enrolled prospectively.

Inclusion Criteria-: Children (till 18 yrs of age) diagnosed with urolithiasis

Exclusion Criteria-: Nephrocalcinosis.

Ethical clearance was obtained from institute ethics committee.

METHODOLOGY

information on clinical presentation ,positive family history of UL, 24 hr diet recall was recorded & used to analyze daily average intake of liquids, protein ,calcium & salt . Dietary calcium was considered normal if it was between 800-1000mg/dl per day. High salt intake was considered if it was more than 5gms/day. High protein was considered if it was more than 2.25gms/kg/day.

Definitions for diagnosing various metabolic anomalies[20]

Idiopathic hypercalciuria- if child 24 h urine calcium was >4mg/kg/d with serum calcium levels of 9-11 mg/dl OR if spot urinary calcium to creatinine ratio was > 0.2

Idiopahic Hyperoxaluria - if child 24 h urine oxalate was >40mg/1.73 m^2/d

Idiopathic Hyperuricosuria - if child 24 h urine uric acid was >815/1.73 m^2/d & his S.Uric acid is between 2-6 mg/dl

Urine routine microscopy, complete blood count, blood urea &serum creatinine were done in all participants. Metabolic evaluation advised was serum calcium & magnesium, 24 hr urinary calcium, oxalate & uric acid, spot urinary calcium to creatinine ratio. Attempt was made to get these investigation done in all patients but even if these investigation couldn't be done due to any reason the patient was still included in the study. USG abdomen was done in all children. The dietary advice given to all participants consisted of -Increase daily fluid intake to 1-2 liters, to ensure adequate daily intake of calcium providing age specific RDA and to keep daily salt intake restricted to 3-5gms.

In follow up parents were contacted telephonically at 6 months and 1year & information related to the persistence of symptoms, recurrence of stones & spontaneous passage of stones was recorded.

RESULTS

Population Characteristics:

During study period 48 children were enrolled. Median age of participants was 8.5 years; Age range was 1.3 years to 17 years. Majority (31, 64.5%) were male. The common presenting complaints were - localised abdominal pain/renal colic, dysuria and increased frequency of micturation reported by 40 (83.33%), 22 (45.83%) and 22 (45.83%) subjects respectively (Table I) .Two children (4.16%) presented with secondary enuresis while vomiting associated with abdominal pain was reported by 16 (33.33%) children.

Table I: Showing clinical symptoms in study participants

Symptoms	Number n / N =48	%
Abdominal Pain	40	83.33
Increased frequency	22	45.83
Dysuria	22	45.83
Vomiting	16	33.33
Secondary Enuresis	2	4.16

Pyuria was found in 30 (62.7%) children while hematuria and granular casts were present in 29 (60.41%) & 1 (2.08%) children respectively. Urine culture was positive in 5 (10.41%) children. None of the participants had macroscopic hematuria. Majority (30, 62.5%) had unilateral stones. The kidney stones were commoner found in 33 (68.75%) participants than stones elsewhere in urinary tract. Bladder stones were found in 5 (10.41%) children only. Ureteric stones were found in 10 (20.83%) children of which only 2 (4.16%) had hydronephrosis requiring surgical intervention. Stones were smaller than 5 mm in 26 (54.16%) children.

Metabolic Risk Factors: The metabolic abnormalities detected in study participants were idiopathic hyper-calciuria, hyperoxaluria & hyperuricosuria found in 9 (18.7%),12 (25%) & 2(4.2%)children respectively.

Predisposing dietary factors found in study participants are shown in table II

Table II: predisposing dietary factors for UL in study participants

Dietary Factor	n/N (total) 48%
Daily calcium intake less than RDA	35 72.9
Daily fluid intake less than recommendation	38 79.1
Daily salt intake more than recommendation	30 62.5
Daily protein intake more than RDA	30 62.5

Among **studied etiological associations** genetic /familial predisposition and positive family history of UL was found in 22 (45.83%) children. The second most significant association was found was hot and dry weather conditions and nearly half (45.83%, 22)participants presented in summer months (May & June). The next most important association was history of recurrent diarrhea present in 10 (20.83) children. Anatomical genito-urinary tract defects found was hydronephrosis .Only 2 participants were taking predisposing drug- magnesium trisilicate for few weeks due to gastritis out of the list of culprit drugs (like loop diuretics, acetazolamide, topiramate, laxatives, ciprofloxacin, magnesium trisilicate, indinavir, ephedrine).Nutritional status of nearly 90% (43) children was normal and only 5(10.41%) children were overweight. None was immobilized for long duration. **Outcome of study participants** Out of total 48 children enrolled in study 46 were being managed with conservative medical treatment & 2 children underwent surgery for stone removal. History of recurrent renal calculi was found in 7 children (14.58%) while 18 (37.5%) children reported spontaneous passage of calculi and remained symptoms free till last contact at the end of 1 year. 28 (58.3%) children continue to suffer from mild to moderate attacks of renal colicky pain requiring intermittent symptomatic treatment.

DISCUSSION

The primary objective of present research was to identify the clinical profile of pediatric urolithiasis (UL), its associated etiological factors & outcome after one year follow-up. Since it was a hospital based study so the data collected gave a rough idea of disease (symptomatic cases) burden in served locality. Forty eight USG confirmed cases of UL were enrolled

The important feature of abdominal pain in most children was it being quite severe, non-localized & without associated gastro-intestinal symptoms like constipation or diarrhea unlike in adults where presentation is typical colicky loin pain & its characteristic radiation of groin. The important clue for getting detailed investigations done in study subjects was either recurrent abdominal pain or UTI and symptoms refractory to routine treatment.

Almost similar results have been reported from different parts of India by few researchers& according to them the top three presentations of pediatric UL were urinary tract infection (UTI), abdominal pain and flank pain found in 29.3%, 24.1% and 17.2% children respectively.[3,7,17-19] While Rajma et al reported that 90% children with UL presented with abdominal pain & symptomatic UTI was present in 33% children.[3] According to Bhatt et al 54% children presenting with UTI had UL.[1]

None of the participants in present study had gross hematuria although microscopic hematuria was found in nearly two third (60%) subjects. This symptom was found in 15.5% cases by Bhatt et. al.[1] The plausible explanation for this difference in percentages of various presenting symptoms could be the difference in the site of affection or size, shape, type of stones & duration of disease.

Another significant finding in present study was confirmation of the preponderance of kidney stones over bladder stones. This shift from bladder stones to kidney stones is recent & has been documented by many researchers worldwide including India.[1,7] In present research the stones were located in kidneys, upper urinary tract & urinary bladder in 68.7%, 20.8% & 10.4 % children respectively. The observations of present research are in concordance with Bhatt et. al.[1] who found kidney stones in 82.6% children and bladder stones in 3.4% children.

Second objective of present study was to identify various etiological associations in enrolled study participants. Different etiological factors implicated in pediatric UL are metabolic[16-19], genitourinary defects, genetic[1,2], infective and dietary factors which may often co-exist.[16] Important associations found in present study were UTI, positive family history of urolithiasis, history of frequent diarrhea & obesity found in 62.7%(30), 45.83%(22), 20.83%(10) & 10.4%(5) participants respectively . Some researchers[2] found UTI in 54% & metabolic abnormality like idiopathic hypercalciuria in 2(6.6%) children.[16] In a retrospective study hyperoxaluria, hypercalciuria ,hypocitruria & hyperuricosuria were found in 79.3%, 25.9%,22.4% & 24% pediatric urolithiasis patients respectively.[10]

The major limitation of present research work was that basic metabolic evaluation could be done in only 13(27%) children and hypercalciuria, hypercalcemia & hypocalcaemia was present in 6.25%, 4.16% & 8.33% children respectively. Various reasons for this inability to get basic metabolic workup done in present study ranged were financial constraints, parental reluctance & their firm faith in alternative treatment forms (other than allopathy).

Petrarulo et. al.[6] reported UTI in 25% subjects and according to them majority of such children had uro-genital anomalies in contrast to our observations where hydronephrosis was found in 4.16% subjects only. In present research only 5(10.4%) children were obese and none was malnourished, this may be because of small sample size & the enrolled patients belonged to middle or lower middle class families.

Third objective in present study was to identify the dietary factors associated with UL. Among dietary risk factors for UL in present work inadequate water intake topped the list & was found in staggering 79% children, which directly explained

the seasonal increase in UL cases observed during summer month. This has been reported by Rajama et. al.[3] also. The explanation is dehydration coupled with decrease fluid intake leading to super saturation of calcium and other metabolites followed by stone formation.

Low dietary calcium intake was found in 72.9% children in present study which is higher than 59% reported by Gajengi et. al.,[7]. Low calcium intake causes UL by two mechanisms; first it increases intestinal oxalate availability and rising super saturation of calcium oxalate. Second mechanism could be via stimulation of calcitriol production leading to hypercalcemia, inhibiting PTH production and hyper-calciuria. In their large cohort study Curhan et. al.[8] stressed on the need of high oral fluid intake and optimum (to meet RDA) calcium supplementation.

Another important observation related to diet consumed in present study participants was that their daily consumption of salt & protein was much higher than recommendations. The high dietary protein (animal source) is associated with calcium oxalate stones which are usually located in upper urinary tract.[1] High dietary salt intake expands intravascular volume, increases urinary calcium level most probably by decreasing renal tubular calcium re-absorption and is associated with increased urinary stones.[16]

The last objective was to know the outcome at the end of study period in the participants. In present research recurrent calculi were reported by 7 (14.5 %), spontaneous passage of calculi was reported by 18 (37.5%) while 28 (58.3 %) children continued to suffer from persistence of symptoms of variable severity. Only 2 children in our study underwent surgery for stone removal & rest all were being managed conservatively. Stone recurrence was found in 31 % children by Bhatt et. al.[1]. Sternberg et. al.[4] reported that pediatric UL patients have 65 % lifelong recurrence of stone. This recurrence could be prevented or at least it could be decreased by taking sufficient amount of liquids, dietary calcium should be adequate to provide RDA along with reduced consumption of amounts of salt, animal protein, and oxalate rich foods. “At risk children” like those with positive family history of UL or those with urogenital malformations may also be benefitted by these dietary modifications. One of the major limitations of present work was inability to get stone for its chemical analysis so that specific dietary manipulations could be advocated to the children.

There is still strong need of multi-centric studies having larger sample size, longer follow up period with more detailed metabolic workup in maximum number of participants to obtain answers to lots of poorly answered queries related to pediatric UL.

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