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Pediatric Urinary Stones Compositions and its Relations with Age and Gender in Al-muthanna Governorate, Iraq

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Abstract--- Background: *Pediatric urolithiasis results in significant morbidity in later life. Incidence as well as site and chemical composition of calculi varies according to the changes in socio-economic and dietary habits leading to a marked variation in the spectrum of urinary stone composition. To evaluate the spectrum of urinary stone composition in pediatric population from al muthanna governorate, Iraq and its relations with age group and gender.*

Methods: *This was a prospective observational study conducted between October 2018 and February 2020 which included pediatric patients with urolithiasis. Demographic and epidemiological characteristics including age, sex, geography, socio-economic status, dietary habits were recorded. The location and sizes of stones were documented. The data was collected, analyzed by Fourier transform infrared spectroscopy (FTIR) and presented using summary statistics.*

Results: *A total of 149 patients with urolithiasis were enrolled, of which 65.1% male and 34.9% female with male to female ratio 1.87:1, Calcium oxalate 30.2%,uric acid 16.1%,mixed 9.4%,cysteine 34.2%, and phosphate stone 10.1%*

Conclusions: *the prevalence of calcium oxalate and uric acid stones were more common in school aged children while cysteine and mixed stones were more common in preschool age children with high incidence of phosphate stone in female patients.*

Keywords--- *Pediatric Urinary, Stones, Urolithiasis.*

I. INTRODUCTION

Urolithiasis is a common urological problem which is characterized by high recurrence rate, hence, strategies that help in identification of stone composition and appropriate prevention decreasing its recurrence are appreciated, particularly in children, given the increased lifespan in this population. Pediatric urolithiasis can results in significant morbidity in later life.1, 2

Understanding the composition of stone helps us to take appropriate preventive measures. This approach is important when stones have been diagnosed in pediatric age group. Unfortunately, there is paucity in the literature regarding the pediatric stone composition.3

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There is marked variation in the spectrum of stone composition between children from developed and developing countries. 4-6, vesical stones being more common in developing countries compared to developed world where renal stones predominate. As the economic status of a country gets uplifted there 6-8

Evaluation of urolithiasis along with blood and urine examination may help to understand possible cause and risk factors, which may help in avoiding recurrence. Though there are several physiccal methods for the evaluation of renal calculi Fourier transform infrared (FTIR) spectroscopy, X-ray diffraction crystallography, coherent -scatter analysis, etc., FTIR is considered more useful and accurate owing to its high sensitivity and specificity.9,10 This paper presents the results of a study that evaluated the spectrum urinary stone composition in pediatric population in Iraq.

II. METHODS

This was a prospective study conducted at Department of Surgery in al-hussain teaching hospital, samawa, Iraq between October 2018 and February 2020.

All pediatric patients aged less than 12years diagnosed with urolithiasis and operated at our institution were eligible to participate. Patients aged more than 12 years, patients or their parents who refused to provide consent, The study protocol and related documents were reviewed and approved by the institutional ethics committee.

Patients were screened and if eligible were included in the study and the patient data sheets were analyzed for the various epidemiological factors including age, sex, geography, location of stone, socio-economic status and dietary habits, The location and the sizes of stones were documented with ultrasonography of kidney ureter bladder (USG-KUB) along with an X-ray KUB or intravenous pyelography (IVP), as deemed appropriate, collection of stone samples were done after either spontaneous passage after medical expulsive therapy or post extra corporeal shock wave lithotripsy(ESWL) or by surgical removal of stone.

Surgical options included either endoscopicaly by supra pubic cysto lithotripsy (SPCL), percutaneous cystolithotomy (PCCL), ureteroscopic lithotripsy (URSL), mini-PCNL, or open surgical removal.

The stones recovered from surgery were washed with distilled water to remove particles attached, dried with filter paper, and then were cut for microscopic structural analysis. To prepare the renal stones for analysis, first they were grinded to a fine consistency (using a mortar and pestle) and this mixture was transferred to the mini hand press to form pellet which was subsequently transferred onto the spectrophotometer pellet holder of spectroscopy and record the result of stone compositions.

III. RESULTS

Total of 149 stone samples were conducted in this study 97 male and 52 female with male to female ratio 1.87:1, patients were divided into 3groups according to age, (65 patients less than 5 years), (50 patient from 6- 10 years) and (34 patients > 10 years) the source of stone collected 119 samples from upper urinary tract and 30 samples from lower tract, as show in table and figure.

Table 1: Descriptive characteristics of patients (N = 149)

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Variable		*No.*	*%*
Age (year)	≤5	65	43.6
	6 – 10	50	33.6
	> 10	34	22.8
	Total	149	100.0
Gender	Male	97	65.1
	Female	52	34.9
	Total	149	100.0
Source of stone	Upper	119	79.9
	Lower	30	20.1
	Total	149	100.0
Way of detection of stone	Open surgical removal	37	24.8
	Endoscopic	74	49.7
	Spontaneous	38	25.5
	Total	149	100.0

Mean age ± SD = 6.88 ± 3.44 (range: 1 – 12),

Male: Female ratio: **1.87: 1**

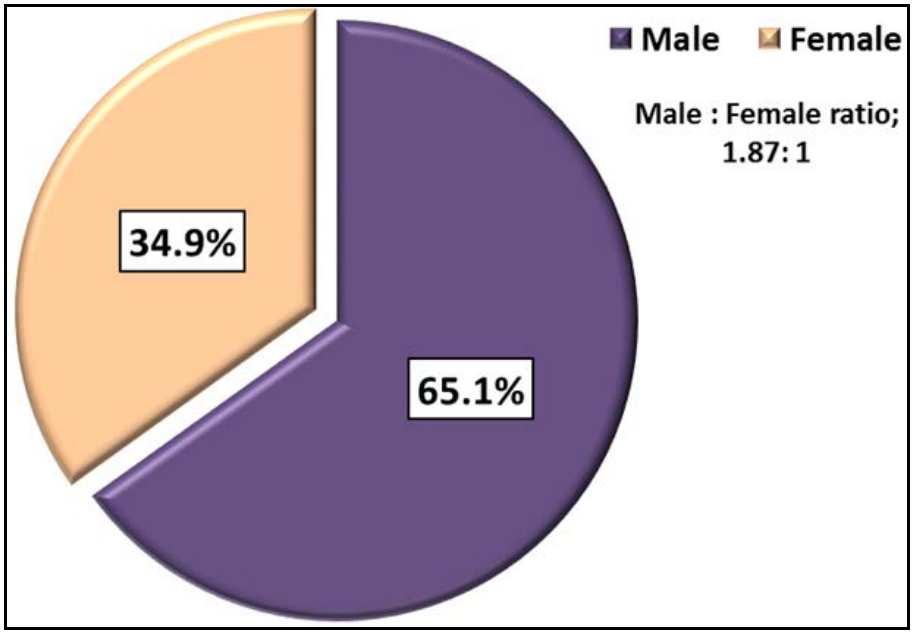

Table 2: Results of stone analysis

Stone analysis	*No.*	*%*
Calcium oxalate	45	30.2
Calcium oxalate monohydrate	22	14.8
Calcium oxalate dihydrate	23	15.4
Urate	24	16.1
Mixed	14	9.4
Cystine	51	34.2
Phosphate stone	15	10.1
Carbonate apatite	1	2.0
Struvite	12	8.1
Total	149	100.0

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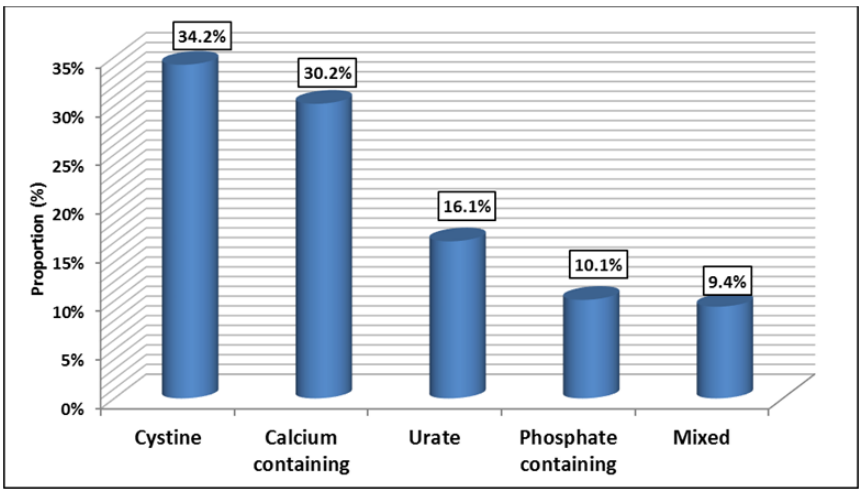

Figure 2: Proportional distribution of stone analysis among pediatric patients aged ≤ 12 years of all regions

Regarding the result of stone analysis and its relation with age there were increased incidence of calcium oxalate and uric acid stone in 6_10 years age group, while mixed and cysteine stone were more prevalent in ≤5 years age group, with statistical significance relationship as show in table and figure

Table 3: Relationship between stone analysis and age of the pediatric patients aged ≤ 12 years (N = 149).

Stone analysis	***Age (year)***						***Total***	***P***
	≤ 5		*6 – 10*		*> 10*			
	No.	*%*	*No.*	*%*	*No.*	*%*		
Calcium oxalate	10	15.4	22	44.0	13	38.2	**45**	**0.002**
Urate	8	12.3	13	26.0	3	8.8	**24**	**0.035**
Mixed	10	15.3	2	4.0	2	5.9	**14**	**0.042**
Cystine	30	46.2	9	18.0	12	35.3	**51**	**0.006**
Phosphate stone	7	10.8	4	8.0	4	11.8	**15**	0.82
Total	65	100.0	50	100.0	34	100.0	149	

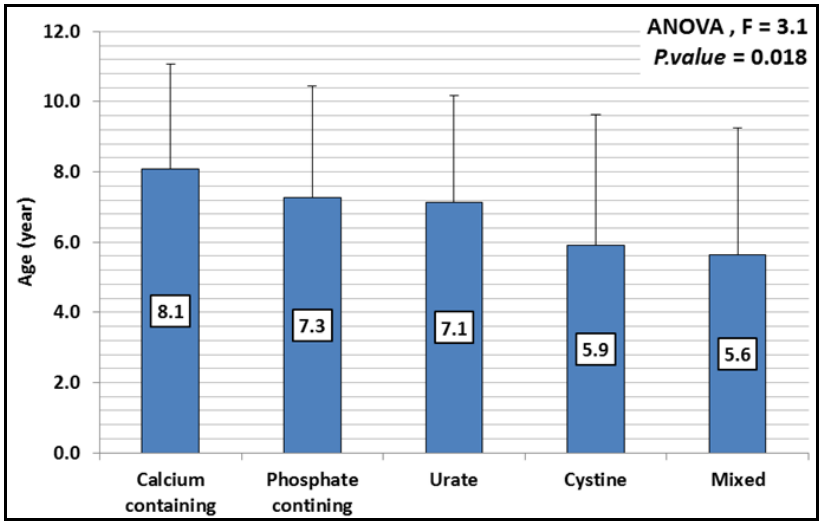

Figure 3: Comparison of the mean age of the pediatric patients aged ≤ 12 years according to the stone analysis (N = 149)

Regarding the relation between stone analysis and gender, there was increased prevalence of phosphate stone in

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female patients with statistical significant p value as show in table.

Table 4: Relationship between Stone Analysis and Gender

Stone analysis	*Male*		*Female*		*Total*	*P. value*
	No.	*%*	*No.*	*%*		
Calcium oxalate	31	32.0	14	26.9	45	0.65
Urate	17	17.5	7	13.5	24	0.68
Phosphate stone	5	4.1	**10**	19.2	15	**0.007**
Cystine	36	37.1	15	28.8	51	0.41
Mixed	8	9.3	6	11.5	14	0.88
Total	97	100.0	52	100.0	149	

IV. DISCUSSION

Incidence as well as site and chemical composition of urinary calculi vary according to the changes in socio-economic and dietary habits over time and the subsequent changes in. Urinary stone composition varies across the world and calcium oxalate stones are found to be the most predominant composition. Pediatric patients show different stone profile than adults 11, 12

In the present study, out of total 149 patients, 97 (65.1%) patients were male with 52 (34.9%) female patients giving a male to female ratio of 1.87:1. However, in previous report from the United States the ratio was found to be 0.77:1.15, Two other studies have reported male: female ratios as high as 20:1 from Syria and from China.13,14,15

In our study the prevalence of calcium oxalate and uric acid stone was high in school aged child while cysteine stone was more prevalent in preschool age group Calcium oxalate stones linked to dietary habits are more frequent among adults compared with children (18, 19). The high frequency of calcium oxalate s stones in school age children evokes the role of food borne hyperoxaluria in the development of these stones. In fact, our dietary surveys revealed an excessive intake of chocolate and sorghum in more than half of patients in this age group. However, urinary lithiasis caused by genetic diseases is proportionately more frequent (20). This is not surprising since these diseases are congenital and therefore can occur at birth. Cystinuria, an autosomal recessive disorder of a renal tubular amino acid transporter, these results in agreement with similar studies from other countries. 17,18.23,24

Regarding the prevalence of phosphate stone in female which was more than male in our study ,phosphate stone remains the best sign of urinary tract infections caused by urease producing bacteria (16, 21), particularly in young female. Between 54% and 90% of phosphate containing stones are associated with urinary tract infection (18, 22). These results are comparable to those reported by Daudon (18), but significantly different to that of neighbouring countries (17, 23), and in some developed countries, such as Switzerland (24).

V. CONCLUSION

These observations indicate the prevalence of calcium oxalate and uric acid stones in school aged children while the prevalence of cysteine and mixed stones in preschool age children with high incidence of phosphate stone in female gender in al muthanna governorate, Iraq. The incidence of pediatric stone disease in our population can't be ignored. Recurrence of stone disease is a very common phenomenon and hence subjecting a proper stone analysis in cases of renal stone disease especially more in a pediatric stone disease would help us manage the patient more

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appropriately, with valuable guidelines especially regarding the etiological factors going a long way to help reduce the recurrence and the morbidity that comes with this disease.

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