Risk Factors for Recurrence of Pediatric Renal Stones in Qena Governorate

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Abstract

Background: A new population of pediatric individuals is at risk for a recurrence of kidney stones as a result of the recently observed increase in the occurrence of nephrolithiasis in children.

Objectives: The purpose of this research was to identify risk factors and the prevalence of renal stone recurrence in children.

Patients and methods: Cross-sectional research was carried out on 100 children and adolescents aged 1-16 years diagnosed with renal stones from February 2020 to January 2021. Metabolic workup (including serum uric acid, serum oxalic acid, and 24-hour calcium, magnesium, phosphorus, citrate, cysteine, urate, and oxalate in urine) and analysis of the chemical compositions of stones were performed.

Results: Recurrent renal stones were detected in 36% of the studied cases, with a mean age of 7.29 ± 1.6 SD and a male predominance of 72.2%. Cases with recurrent urolithiasis had a significantly larger stone size, higher stone density, higher serum oxalic acid, and higher levels of 24-hour urinary oxalate in comparison to the other group. Multivariate logistic regression analysis showed that increase in the patient's body weight, a positive family history of urolithiasis, a delay in the age of diagnosis, and required surgery were associated with increased recurrence risk. An increase in age at the onset of symptoms was correlated with a reduction in the chance of recurrence.

Conclusion: Positive family history of urolithiasis, younger age with symptom at onset, increased weight, and patients who needed surgery were associated with an increased risk of stone recurrence in the pediatric age group.

Keywords: Risk factors; Recurrence; Pediatric; Renal stones; Qena Governorate.

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Introduction

Nephrolithiasis (NL) is a significant contributor to morbidity and mortality on a global scale. In the past, urinary stones were regarded as a condition that targeted adults. Nevertheless, accumulating evidence suggests that stone formation has increased in the pediatric population, and between 1997 and 2012, the number of children evaluated for urinary stone disease doubled (**Ang et al., 2020**).

Particular metabolic abnormalities that contribute to the formation of stones are more prevalent in children compared to adults, and their rates of spontaneous stone passage are also lower. In contrast to adults, children typically undergoe a more extensive metabolic evaluation and have a higher propensity to necessitate surgical intervention for the treatment of acute stones (**Schwaderer et al., 2019, Rodriguez et al., 2020).**

A new population of pediatric individuals is at risk for a recurrence of kidney stones as a result of the recently observed increase in the occurrence of nephrolithiasis in children (**Baum 2020**).

Urinary stone illness is distinguished by the existence of calcified kidney stones, stones in the ureter, bladder, or urethra, and /or stones in the ureter. In recent years, the incidence of illness among minors has escalated from four to six percent to ten percent (**Önal and Kırlı 2021**). Achieving this increase also requires a greater frequency of imaging modalities, in addition to modifications to one's lifestyle and diet (**Demirtas et al., 2024**). The pathogenesis of the illness is influenced by various factors, including environmental, anatomical, metabolic, nutritional, infectious, and genetic factors all contribute to the disease's etiology (**Alelign and Petros 2018**). Children are more susceptible to complications as renal dysfunction and complications related to stone recurrence, which can be attributed to anatomical and metabolic factors (**Sas et al., 2016**). The mechanism of recurrent urolithiasis involves several factors that take part in the repeated formation of kidney stones after initial episodes. Stone formation is a complex process that involves renal stone components retained within tubular cells through a variety of physicochemical processes, including nucleation, growth, aggregation, and super saturation (**Alelign and Petros 2018).**

Childhood is associated with a high risk of kidney stone recurrence, with approximately fifty percent of cases manifesting a symptomatic recurrence within three years of the initial stone (**Tasian et al., 2017).**

This research aimed to evaluate the occurrence and risk factors for the recurrence of kidney stones in the pediatric age group to aid in the formulation of preventative interventions and improve the patient's outcomes.

Patients and methods

Study design

A cross-sectional study was carried out on 100 children and adolescents aged from one to 16 years old, diagnosed with renal stones, and attending the pediatric nephrology clinic. The study was carried out from February 2020 to January 2021 after approval from the Ethical Committee of Qena Faculty of Medicine **(approval code: SVU-MED-PED025-4-24-1-804, Qena, Egypt)**. Informed written consent was obtained from the relatives of the individuals.

Cases were separated into two groups according to the occurrence or absence of arecurrence of renal stones. Recurrence has been variably defined as new stone formation, stone growth, or stone disappearance (from passage with or without symptoms) (**D'Costa et al., 2019**). Cases with renal tubular acidosis, inborn errors of metabolism, cases associated with congenital anomalies, and other chronic diseases were not included in the research.

Clinical evaluation

All individuals were subjected to complete history taking. Anthropometric evaluation (weight, height, and body mass index (BMI) was calculated) and a complete meticulous clinical evaluation was performed. Estimated glomerular filtration rate (eGFR) was calculated by Schwartz's formula: eGFR = k x (height in cm) ÷ (serum Cr mg/dl) (where the k = 0.33 in preterm infants, k = 0.45 in term infants to 1 year of age, k = 0.55 in children to 13 years of age, and the k = 0.70 in adolescent males (females remain at 0.55 after age 13 years) **(Schwartz et al., 1976)**.

Investigation

- **Routine investigations,** including a complete blood count (CBC), serum electrolyte, serum urea, serum creatinine and random midstream urine sample for routine urine analysis were estimated.
- A 24-hour urine sample was obtained to assess urine metabolites, including calcium (Ca), magnesium (Mg), phosphorus (Ph), oxalate, citrate, and urate, by the colorimetric method using spectrophotometer
- **Analysis of the Chemical Compositions of Stones:** the stone sample was washed several times with sterile water and each stone was then crushed into powder by sterilized mortar and pestle and was then used for qualitative biochemical analysis of compositions of each stone for carbonate, calcium, magnesium, phosphate, oxalate, uric acid, and cysteine **(Kasidas et al. 2004)**.
- **Radiological Investigations:** A plain kidney, ureter, and urinary bladder (KUB) X-ray and abdominal ultrasound were done. A computed tomography scan was done if needed. Renal stone size was classified according to its site, with the lower pole of the kidney and ureters classified according to their size as small (< 1 cm), moderate (1-2 cm), and large (> 1.5 cm), whereas the upper or middle pole of the kidney was classified as small (< 1 cm), moderate (1-2 cm), and large (> 2 cm) **(Saeed et al., 2016).**

Statistical analysis

The distribution of data was checked with the twentieth version of the Statistical Package for the Social Sciences (SPSS) software. The chi-square test was utilized to compare frequencies and percentages of qualitative factors. Normally distributed data was presented as means ± standard deviation (SD), and a student t-test was utilized to compare the two groups. Non-normal distributed data was presented with median and range, and the Mann-Whitney U test was used to compare the differences in median and range between groups. Multivariate logistic regression analysis was used to evaluate the independent risk factors related to recurrent urolithiasis with an OR (95 percent CI). A P-value < 0.05 was considered significant.

Results

Clinical data of studied cases with recurrent renal stone formation

The current study included 100 children and adolescents diagnosed with renal stones. Having a median age of 6 years (range of 1–15 years). The majority of cases were male (63%). Most cases were from rural areas (89%), with low socioeconomic status (65%). Family history was figured out in 58 cases, of which 6 cases had a first-degree and 4 cases had a second-degree family history. 55% of cases had positive consanguinity.

The median age at onset of symptoms was 3.4 years, and the median age at diagnosis was 3.9 years.

According to disease history, 84 cases had recurrent abdominal pain, 51 cases had recurrent urinary tract infections (UTI), 40 cases had red urine, 36 cases had recurrent urolithiasis, 23 cases had urine retention, and lastly, 8 cases had spontaneous stone passage. 92% of studied cases had a metabolic etiology of stone formation, and 23% of cases had an infective etiology, which was known according to the chemical composition of the stone, for example, ammonium stone.

Anthropometeric evaluation showed that the median weight of the studied cases was 18 kilograms (kg) with a range of 6–50 kg, the median height was 109.5 cm with a range of 64–167 cm, and the median BMI was 15.7 kg/m^2 with a range of 12–20 kg/m^2 **(Table. 1)**.

Table 1.Baseline and clinical characteristics of the whole studied cohort no (100)

Variables	All patients	n (%)
Age/years	**Mean ± SD**	6.64 ± 3.5
	Median (Range)	6 (1 - 15)
Sex	**Male**	63 (63%)
	Female	37 (37%)
Residence	**Rural**	89 (89%)
	Urban	11 (11%)
Socioeconomic status	**Low**	65 (65.0%)
	Middle	35 (35.0%)
Family history of Stone Formation	**Negative**	42 (42%)
	Positive	58 (58%)
Degree of positive family history (58 case)	**1st degree**	6 (10.3%)
	2nd degree	4 (6.9%)
	3rd degree	48 (82.8%)
Consanguinity	**Negative**	45 (45%)
	Positive	55 (55%)
Age at Symptom Onset/ year	**Mean ± SD**	4.30 ± 3.2
	Median (Range)	3.4 (0.1 – 11.5)
Age at Diagnosis/year	**Mean ± SD**	4.60 ± 3.1
	Median (Range)	3.9 (0.1 – 11.6)
Disease History	**Recurrence of urolithiasis**	36 (36%)
	Recurrent abdominal pain	84 (84%)
	Recurrent UTI	51 (51%)
	Urine retention	23 (23%)
	Red urine	40 (40%)
	Spontaneous stone passer	8 (8%)
Aetiology of stone formation	**Infective**	23 (23%)
	Metabolic	92 (92%)
	Unknown	8 (8 %)
Anthropometric Measures		
• **Weight/kg**	**Mean ± SD**	20.24 ± 8.9
	Median (Range)	18 (6 - 50)
• **Height/cm**	**Mean ± SD**	110.90 ± 22.3
	Median (Range)	109.5(64 - 167)
• **BMI (kg/m^2)**	**Mean ± SD**	15.68 ± 1.3
	Median (Range)	15.7 (12 - 20)

We found that 36% of cases had recurrent renal stones, with a mean age of 7.29 ± 1.6 years and a male predominance of 72.2%. Cases with recurrent stone formation had a significantly positive family history (75.0%) versus cases without recurrent renal stones (48.4%) ($P = 0.01$). Recurrent cases had a younger age at onset of symptoms (3.60 ± 1.7 years) versus (5.17 ± 1.5 years) and a younger age at diagnosis (4.09 ± 2.6 years) versus (5.42 ± 1.5 years) in the group without recurrent stone formation, respectively. The mean BMI value was significantly lower in cases with recurrent renal stones (15.20 ± 1.2 kg/m^2) in comparison to cases without recurrent renal stones (15.87 ± 1.3 kg/m^2) (**Table. 2).**

Table 2. Demographic and baseline anthropometric data of the studied groups

Variables		Recurrent stone formation group (N = 36)	Non-recurrent stone formation group (N = 64)	P-Value
Age/year (Mean ±SD)		7.29 ± 1.6$^{\#}$	6.27 ± 1.2	0.165
Sex (N%)	Female	10(27.8%)""	27(42.2%)	0.152
	Male	26(72.2%)	37(57.8%)	
Residence (N%)	Rural	31(86.1%)	58(90.6%)	0.518
	Urban	5(13.9%)	6(9.4%)	
Socioeconomic state N (%)	Low	20 (55.6%)	45(70.3%)	0.137
	Medium	16 (44.4%)	19(29.7%)	
Positive family history of stone formation N (%)		27(75.0%)	31(48.4%)	0.01*
Consanguinity N (%)		24(66.7%)	31(48.4%)	0.078
Age at Onset /year (Mean ±SD)		3.60 ± 1.7	5.17 ± 1.5	0.0001*
Age at diagnosis/Year (Mean ±SD)		4.09 ± 2.6	5.42 ± 1.5	0.001*
Weight (kg) (Mean ±SD)		21.75± 5.4	19.69± 6.8	0.120
Height (cm) (Mean ±SD)		116.21±20.5	108.75± 22.7	0.133
BMI kg/m^2 (Mean ±SD)		15.20±1.2	15.87 ± 1.3	0.013*

$^{\#}$Independent Sample t-test; ""Chi-square test; *: significant; BMI: Body mass index; Kg: kilogram; Cm: centimeter.

Comparing clinical characteristics in cases with and without recurrent stone formation revealed that cases with recurrent renal stones had insignificant incidences regarding history of abdominal pain (91.7%), recurrent UTI (58.33%), urine retention (27.8%), and red urine (47.2%). Spontaneous stone passage was present in 19.4% of cases with recurrence. Double intervention with ESWL and surgery was performed in 66.7% of the recurrent group. The mean stone size was 18.64 ± 11.9 mm, and density (783.81 ± 63.1 HU) was significantly higher in cases with recurrence renal stone than cases without recurrence renal stone (15.42 ± 3.8 mm and 662.43 ± 34.7 HU, respectively) ($p < 0.05$). Severe hydronephrosis was detected in 7 cases (19.4%) versus 3 cases (4.7%) in cases without recurrence renal stone (p = 0.027) **(Table.3).**

Table 3: Comparing clinical characteristics in the studied variable percentage

Variables		Recurrent stone formation group (N = 36)	Non-recurrent stone formation group (N = 64)	P-Value
Disease History	Recurrent abdominal pain	33 (91.7%)""	51 (79.7%)	0.208
	Recurrent UTI	21 (58.33%)	30 (46.87%)	0.271
	Urine retention	10(27.8%)	13(20.3%)	0.649
	Red urine	17(47.2%)	23(35.1%)	0.304
	Spontaneous stone passer	7(19.4%)	1(1.6%)	0.003*
Treatment Modality	ESWL	7(19.4%)	25(39.1%)	0.003*
	Surgery	5(13.9%)	19(29.7%)	
	Both	24(66.7%)	20(31.3%)	
Plain X-ray	Radiolucent	11(30.6%)	21(32.8%)	0.499

	Radio-opaque	25(69.4%)	43(67.2%)	
Stone Site	**Kidney only**	26 (72.2%)	41 (64.1%)	0.439
	Ureter only	1(2.8%)	4(6.3%)	
	Pelvis only	2(5.6%)	1(1.6%)	
	Combined	7 (19.4%)	18(28%)	
Stone size (mm) (Mean ±SD)		18.64 ± 11.9#	15. 42 ± 3.8	0.048*
Stone size category	**Small**	0(0%)	2(3.2%)	0.483
	Medium	6(16.7%)	14(21.8%)	
	Large	30(83.3%)	48(75%)	
Stone Density (HU) (Mean ±SD)		783.81 ± 63.1	662.43± 34.7	0.0001*
Multiplicity	**Single**	8 (22.2%)	21(32.8%)	0.263
	Multiple	28(77.8. %)	43(67.2%)	
Laterality	**Unilateral**	27(75%)	48(75%)	1.000
	Bilateral	9(25%)	16(25%)	
Affected Kidney	**Left**	16(44.4%)	22(34.4%)	0.295
	Right	11(30.6%)	25(39.1%)	
	Both	7(19.4%)	16(25.1%)	
Nephrocalcinosis		2 (5.6%)	2 (3.1%)	0.455
Hydronephrosis	**Mild**	10(27.8%)	29(45.3%)	0.027*
	Moderate	7(19.4%)	16(25.0%)	
	Severe	7(19.4%)	3(4.7%)	

#:Independent Sample t-test; "": Chi-square test; *: significant; BMI: Body mass index ESWL: Extracorporeal shockwave lithotripsy HU: Hounsfield unit UTI: urinary tract infection

Laboratory evaluation of the studied cases showed that cases with recurrent stone formation had significantly higher serum oxalic acid and serum creatinine levels (22.77 ±9.88 mg/dl) and (0.69 ±0.35 mg/dl), respectively, in comparison to cases without stone recurrence (18.55 ± 9.37 mg/dl) and (0.58 ±0.15 mg/dl), respectively (**Table.4).**

Table 4. Laboratory data in the studied groups

Variables		**Recurrent stone formation group (N = 36)**	**Non-recurrent stone formation group (N = 64)**	**P-Value**
CBC (Mean ±SD)	**WBCs count ($\times 10^3$)**	8.08±2.6#	8.73± 2.5	0.231
	Hb (g/dl)	11.10± 1.5	11.87± 1.3	0.712
	Platelet count ($\times 10^3$)	322.11± 15.3	346.57± 10.1	0.185
S. Electrolytes (Mean ±SD)	**Ca (mg/dl)**	9.81± 0.5	9.82± 0.6	0.933
	Na (mmol/L)	139.07 ± 2.9	138.99 ± 2.6	0.887
	K (mmol/L)	4.16±0.6	4.06±0.4	0.370
	Mg (mg/dl)	2.06±0.5	1.99±0.25	0.352
	Ph (mg/dl)	4.67±0.722	4.76±1.1	0.615
Serum salts (Mean ±SD)	**Uric Acid (mg/dl)**	3.85±1.2	4.01±1.1	0.522
	Oxalic Acid (mg/dl)	22.77±9.88	18.55±9.37	0.03*
Kidney function test (Mean ±SD)	**B. Urea (mg/dl)**	23.72±7.1	24.20±7.9	0.767
	S. Creatinine	0.69±0.35	0.58±0.15	0.031*
eGFR (ml/min) (mean ± SD)		113.45±8.1	108.52± 3.9	0.541
eGFR Category N (%)	**Stage I (≥ 90)**	22(61.1%)""	47(73.4%)	0.146
	Stage ≥ II (< 90)	14(38.9%)	17(26.6%)	
Urine Analysis N (%)	**Hematuria**	17(47.2%)	29(45.3%)	0.509
	Pyuria	19(52.8%)	39(60.9%)	0.427

	Albumin	3(8.3%)	9(14.1%)	0.397
Urine Culture N (%)	**Negative**	34(94.4%)	60(93.8%)	0.325
	Positive	2(5.6%)	4(6.2%)	

#:Independent Sample t-test; "": Chi-square test; *: significant; CBC: complete blood count; WBCs: white blood cells; ESBL: Extended-spectrum beta-lactamases; eGFR: estimated glomerular filtration rate; Hb: hemoglobin.

Evaluating the 24-hour urinary metabolites of the studied groups showed that the recurrent group had statistically higher levels of 24-hour urinary oxalate, with a median and range of 56.5 mg/24-h (3.86–86) versus 26.85 mg/24-h (1.2–88) in the non-recurrent group (**Table .5**).

Table 5.24-hour Urinary metabolites and chemical stone analysis in the studied groups

Variables		**Recurrent stone formation group (N = 36)**	**Non-recurrent stone formation group (N = 64)**	**P-Value**
24-hour Urinary metabolites median (IQR)	**Ca (mg/24-h)**	50 (8-320)##	63.5 (6-263)	0.763
	Ph (mg/24-h)	570 (10 - 2593)	725 (85 - 2320)	0.360
	Oxalate (mg/24-h)	56.5 (3.86 - 86)	26.85 (1.2 - 88)	0.032*
	Urate (mg/24-h)	630 (270 - 1210)	550 (48 - 1520)	0.669
	Cysteine (mg/24-h)	15.5 (0.7 - 65)	17 (0.3 - 75)	0.532
	Mg (mg/24-h)	66 (30 - 104)	73 (11.5 - 285)	0.659
	Citrate (mg/24-h)	69 (26 - 435)	89 (11 - 330)	0.275
Chemical stone analyzer (67 cases) N (%)	**Calcium oxalate**	16 (44.4%)""	9 (29.03%)	0.813
	Calcium carbonate	1 (2.8)	1 (3.22%)	
	Ammonium salts	3 (8.3%)	3 (9.77%)	
	Uric acid	7(19.4%)	8 (25.8%)	
	Cysteine	2(5.6%)	1 (3.22%)	
	Phosphate	7 (19.4%)	9 (29.03%)	

##: Mann-Whitney U test; "": Chi-square test; *: significant;

Multivariable logistic regression analysis showed that the chance of stone recurrence was increased by 6% with a one-kg increase in the patient's body weight (OR = 1.06, 95% CI: 1.003–1.117, p = 0.047). Also, children with a positive family history of stone formations have a 2.1 times greater chance of stone recurrence (OR = 2.14, 95% CI: 1.02–5.06, p =0.035). Furthermore, an increase in age at symptom onset by one year was correlated with a reduction of 67% (OR = 0.33, 95% CI: 0.13–0.81, p = 0.016). Likewise, the increase in age at diagnosis (delay in the diagnosis after onset of symptoms) by one year was correlated with an increase in the recurrence likelihood by 2.8 times (OR = 2.8, 95% CI: 1.12–6.97, p = 0.028).
Children with recurrent renal stone formation had higher odds of increased serum creatinine 4.4 times than cases without recurrence. Moreover, regarding treatment modality, cases that required surgical intervention had a 4.5 times increased recurrence rate (OR = 4.5, 95% CI: 1.3–9.6, 0.018) (**Table.6).**

Table 6. Multivariable Logistic Regression analysis for risk factors of recurrent stone formation in pediatric patients

Variables	**OR (95% CI) ***	**P**-value
Age/years	0.936 (0.674 – 1.299)	0.691
Sex (Male)	1.897 (0.785 – 4.584)	0.155
Weight/kg	1.056 (1.003 – 1.117)	0.047
Positive Family History	2.135 (1.021 – 5.065)	0.035

Age at Symptom Onset/year	0.327 (0.131 – 0.814)	0.016
Age at Diagnosis/year	2.794 (1.120 – 6.968)	0.028
Treatment Modality		
ESWL	Ref.	0.006
Surgery	4.500 (1.292 – 9.624)	0.018
Both	0.983 (0.220 – 3.996)	0.930
S Creatinine (mg/dl)	4.406 (1.224 – 12.396)	0.027

OR=Odds Ratio CI: Confidence Interval ESWL: Extracorporeal shockwave lithotripsy. Ref. means that ESWL was used as a reference for calculation of the odds ratio for both surgery and combined surgery plus EWSL.

Discussion

Significant variation exists in the recurrence rate of kidney stone disease (KSD) between individuals. Although certain individuals experience nephrolithiasis only once, others are afflicted with it frequently. Although significant results have been reached with the implementation of preventive measures such as diet and medication, the efficacy of these interventions remains limited (**Wang et al., 2022a**).

In the current study, recurrent renal stones were detected in 36% of the studied cases with a mean age of 7.29 years ± 1.6 SD and male predominance of 72.2%. **(Tasian et al. 2017)** performed research on 285 children with renal stones with a median age of 14.8 years (IQR 11.3-16.6) and figured out that 24% of cases developed recurrent stone formation. Another research performed by **De Ruysscher et al., 2020** revealed a recurrent rate of 34% in a research of 97 children with a mean age of 3.9 years old, and **De foor et al., 2020** in a collection of children with a mean age of 12.7 years revealed a recurrent rate of 36.96%.

Demirtas et al. 2024 illustrated that stone recurrence rate was significantly associated with older age as 20% of patients were >5 years old.

In line with our results, **Cameron et al. 2005** reported that sex predisposition has varied, with some studies indicating a greater risk among boys.

Regarding our results, family history was positive in 75% of the recurrent stone formation group versus 48.4% in the non-recurrent group, and the regression analysis revealed that positive family history increases the recurrent rate to 2.1 times more (OR=2.14, 95% CI; 1.02–5.06, p = 0.035). also increase in age at diagnosis by one year was correlated with an increase in the recurrence likelihood by 2.8 times (OR = 2.8, 95% CI: 1.12–6.97, p = 0.028). In line with our results (**Demirtas et al. 2024)** showed that in the non-recurrent group, family history was positive in 59.3% of patients and revealed that age at diagnosis was higher in recurrent stone formation patients.

In the current study, it was found that with a one-kg increase in the patient's body weight, there was a 6% (OR = 1.06, 95% CI; 1.003–1.117, p = 0.047) increase in the chance of recurrence{the higher body weight in spite of lower BMI in the recurrent group than the group of non-recurrent stone formation, interpreted by younger age and lower body weight and height in cases with non-recurrent stone formation, which lead to higher BMI in this group}. Supporting our result, **Hess (2012)** in his study revealed that greater weight and—major weight gain are independently related to an increased risk of renal stone formation. Also, **Taylor et al. (2005)** carried out prospective research of three large cohorts to assess the potential correlation between waist circumference, BMI, weight, weight gain, the development of kidney stones and revealed that BMI, waist circumference, and weight are positively related to the risk of developing incident kidney stones.

Our results revealed that large stone size mean was 18.64 ± 11 in the recurrent group and large stones commonly presented with this group at

83.3% of cases. Confirming our results, **(Wang et al. 2022b)** documented that higher stone size was associated with stone recurrence.

In the current study, the recurrent group had significantly higher levels of serum oxalate and 24-hour urinary oxalate levels, the most common renal stones in cases with recurrent stone formation were calcium oxalate stones 44.4% **Parmar (2004) and Bhasin et al. (2015)** documented that the formation of calcium oxalate is predominantly attributed to a physiological imbalance between oxalate and calcium concentrations & /or insufficient crystallization inhibitors. **(Taylor and Curhan ,2008)** reported that Oxalate stands out among urinary compounds as the most potent inducer of renal calculi. The risk of developing kidney stones elevates by a factor of 2.5 to 3.5 when the daily urinary oxalate intake rises from twenty milligrams to forty mg a day. Even relatively minor fluctuations in urinary oxalate levels can significantly affect the formation of kidney stones. **(Ahmed et al., 2023)** found that hyperoxaluria, hyperuricosuria, and hypocitruria were higher in the recurrent group, while hypercalciuria was lower in the recurrent group.

In the current study, no significant difference as in calculated GFR in both groups. this was in line with **Wang et al. (2021)**.

In concordance with our results, **(De Ruysscher et al., 2019**; **Ito et al., 2021)** It was hypothesised that individuals who required surgical intervention would be at a greater risk for developing KSD recurrence. This might be because Patients who require surgery typically have more difficult stone problems, such as numerous stones or stones with a bigger diameter.

Limitations of this study included that small sample size and cross-sectional design may produce insignificant results and it was a single- centre study.

Conclusion

Positive family history of renal stone formation, younger age at onset of symptoms, increased body weight, and surgery as an intervention modality were related to elevated risk of stone recurrence in the pediatric age group in Qena governorate.

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List of abbreviations:

BMI	Body mass index
Ca	Calcium
CBC	Complete blood count
Cm	Centimetre
CT	Computed tomography
ESWL	Extracorporeal shockwave lithotripsy
GFR	Glomerular filtration rate
HU	Hounsfield unit
KSD	Kidney stone disease
Kg	Kilogram
Mg	Magnesium
Ph	Phosphorus
UTI	Urinary tract infection

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