

## METABOLIC DISORDERS IN PATIENTS WITH HIGH RISK FOR RECURRENT URINARY TRACT STONES

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**Abstract:** A cross-sectional study was conducted to assess the frequency of metabolic disorders detected in 24-hour urine collection in patients with increased morbidity for recurrent upper urinary tract stones. This research was conducted Department of Urology Bakhtawar Amin Hospital, Multan. Study was carried out over a period of six months from 01-12-2021 to 01-06-2022. Total 100 cases presented with the recurrent urinary tract stone were enrolled in this study. Patients were asked about their demographics which include name, age, gender and contact details. A 24-hour urine sample from each patient was analyzed for its contents. Metabolic abnormalities were recorded as per operational definition. Out of 100 patients, 30 % (n=30) were in age Group of 12-30 years whereas 70 % (n=70) were in age Group of 31-60 years, mean age was calculated as 35.85 ± 9.83 years. Mean duration of kidney stone was 1.69 ± 0.46 months. Frequency of metabolic abnormalities were 42%. We concluded that, the most common 24-hour urine abnormalities were hyperuricosuria (32%), hypercalciuria (19%), hypernatruria (20%).

**Keywords:** Urinary tract stone, metabolic abnormality, Urolithiasis

### Introduction

In the past decade, the risk of developing urinary tract stones has increased. As per the research conducted, 24.3% men and 18.7% developed kidney stones in 2022 globally (Moftakhar et al., 2022) as compared to 12% and 6% respectively in 2013 (Bandegudda et al., 2023). As observed, the gender gap has decreased significantly and similarly the trends of kidney stone disease have also increased in the pediatric population. Due to hot climate and increased global warming, South Asian and Southeast Asian population are mostly affected by urolithiasis (Abufaraj et al., 2022), such as 16% in Pakistan (Saeed et al., 2020) and 16.9% in Thailand (Piyarungsri et al., 2020). In India (Faridi and Singh, 2020) and Malaysia (Perumal et al., 2023), 40 individuals developed a kidney stone in every 100,000 people according to studies conducted three decades back. Now, 930 people in India and 442 people in Malaysia among every 100,000 suffer from kidney stones. Stones may develop due to high concentration of salts or low concentration of stone inhibitors like citrate. Stones may also be formed due to conditions like hyperparathyroidism, renal tubular acidosis, high animal source protein, high levels of vitamin C and bariatric surgery. The family history also increases the

risk of developing kidney stones which may be recurring.

The symptoms of urinary tract stones include renal colic, nausea and vomiting, sweating, blood in urine, restlessness and frequent urination (Kittanamongkolchai et al., 2018) (Fontenelle and Sarti, 2019). Keeping in view the recurrent nature of this disease, there is 50% risk at 5 year and 80% risk at 10 year. The metabolic parameter study will help to understand problem and treatment of that parameter will reduces the recurrent rate. Rational of this study is to resolve the variability in the already published literature with respect to abnormalities of the metabolic parameters. There is no set parameter about the recurrent of the urinary stone so this study will set a parameter which could predict the onset of the urinary stone preliminary. This will help the patient to treat and manage at early stages.

### Methodology

A cross sectional study was conducted in Department of Urology in Bakhtawar Amin Hospital, Multan from 01-12-2021 to 01-06-2022. A total of 100 cases were selected for the study through non-probability

consecutive sampling. Inclusion criteria was patients of both genders, aged between 12 to 60 years, patients with clinical suspicion of the formulation of the urinary stones at the time of presentation and patients who have given their consent for being the part of study. Patients with single stone, urological conditions including proteinuria, recurrent UTIs, ureteral obstruction and bladder outlet obstruction, chronic diseases i.e. chronic kidney disease (Cr >1.3mg/dl), liver failure (ALT > 63, AST > 37 U/L), history of drug abuse, known metabolic abnormalities and hypothyroidism or hyperthyroidism were excluded from the study. The design was approved by the ethical committee of the hospital.

Patients were informed about the purpose of the study and informed consent was obtained that their enrollment in this study will not affect their treatment. Patients were asked about their demographics which include name, age, gender and contact details. Patients were asked to collect a 24-hour urine sample which was collected and analyzed for its contents including magnesium, oxalate, calcium, creatinine, citrate, phosphate and uric acid. The PH and specific gravity of the sample was also evaluated. The samples were stored at 2-8 Celsius. Serum levels of creatinine, calcium, urea, uric acid, phosphate and metabolic parameters were also analyzed by collecting a blood sample from each patient. Metabolic abnormalities were recorded.

**Results**

Age distribution of the patients was done, it showed that out of 100 patients, 30% (n=30) were in age Group of 12-30 years whereas 70% (n=70) were in age Group of 31-60 years, mean age was calculated as 35.85 ± 9.83 years. Mean duration of kidney stone was 1.69 ± 0.46 months. Gender distribution of the patients was done, it showed that 62 % (n=62) were male whereas 38 % (n=38) were females. (Table I) Frequency of Hyperoxaluria 17%, Hypercalciuria 19%, Hypocitraturia 16%, Hypernatruria 32%, Hyperuricosuria 32%, Hypomagnesuria 1%, Hyperphosphaturia 1%. And overall metabolic abnormalities were 42%. (Table II)

**Table I: Distribution of patients with respect to age, duration of kidney stones, gender, family history and recurrence (n=100)**

Variable	Percentage (%)	Valid percentage	Cumulative percentage
<b>Age</b>			
<b>12-30 years</b>	30	30	30
<b>31-60 years</b>	70	70	70

<b>Duration of kidney stones</b>			
<b>1-12 months</b>	21	21	21
<b>&gt;12 months</b>	79	79	79
<b>Gender</b>			
<b>Male</b>	62	62	62
<b>Female</b>	38	38	38
<b>Family history of urinary stones</b>			
<b>Yes</b>	36	36	36
<b>No</b>	64	64	64
<b>Episodes of recurrence</b>			
<b>1<sup>st</sup> episode</b>	80	80	80
<b>2<sup>nd</sup> episode</b>	20	20	20

**Table II: Data regarding metabolic abnormalities**

Abnormality	N (%)
<b>Hyperoxaluria</b>	17 (17%)
<b>Hypercalciuria</b>	19 (19%)
<b>Hypocitraturia</b>	16 (16%)
<b>Hypernatruria</b>	20 (20%)
<b>Hyperuricosuria</b>	32 (32%)
<b>Hypomagnesuria</b>	1 (1%)
<b>Hyperphosphaturia</b>	1 (1%)
<b>Total</b>	42 (42%)

**Discussion**

The prevalence of urolithiasis has increased globally over the years. Urolithiasis is the condition in which stones are formed in the urinary tract due to elevated levels of salts in urine. According to studies, almost 2% individuals in their 20s and 30s develop kidney stones (Stamatelou and Goldfarb, 2023). Age, sex, genetics, environmental factors and metabolic disorder also become a cause of forming urinary tract stones. Among these factors, metabolic disorder should be paid attention as their treatment can prevent stones. Metabolic disorders including hypokalemia, hypercalciuria, hypophosphatemia, hyperuricosuria and hyperuricemia cause stones and may vary depending upon environmental conditions and genetics. In current study, Age distribution of the patients was done, it showed that out of 100 patients, 30% (n=30) were in age Group of 12-30 years whereas 70% (n=70) were in age group of 31-60 years, mean age was calculated as 35.85 ± 9.83 years. Gender distribution of the patients was done, it shows that 62 % (n=62) were male whereas 38 % (n=38) were females.

In this study, we found that frequency of metabolic abnormalities was 42%. Where frequency of hyperoxaluria 17%, hypercalciuria 19%, hypocitraturia 16%, hypernatruria 32%,

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hyperuricosuria 32%, hypomagnesuria 1%, hyperphosphaturia 1%. Mean duration of kidney stone was  $1.69 \pm 0.46$  months. 36% patients had the family history of kidney stone and 1st episode of recurrence was in 80% of the patients and 2nd episode of recurrence was in 20% of the patients.

In another study, 14.5% patients were diagnosed with hypercalciuria, 61.4% had hyperoxaluria, 57.2% individuals reported hypocitraturia, 19.7% had hyperuricouria, 59.3% had hypomagnesuria and 12.5% had hyperphosphaturia.

In another study, it was noted that hypercalciuria in (60%), hypomagnesuria in (50%), hyperoxaluria in 25%, hypocitrauria in 60%, hyperphosphouria in 47% and hypophosphaturia in 3.20% (Qiu et al., 2021).

Another study reported that 92.3% of the study population was diagnosed with at least one metabolic abnormality and 58.9% had more than one abnormality assessed in our study. 82% of the subjects had hypocitraturia and 56% were diagnosed with hyper-oxaluria (Ping et al., 2019).

Keeping in view the recurrent nature of this disease, there is 50% risk at 5 year and 80% risk at 10 years in Pakistan. The metabolic parameter study will help to understand problem and treatment of that parameter will reduces the recurrent rate. In Korea, the occurrence of urolithiasis has been found to be 5.7% which poses a 12% risk in males and 6% in females of developing kidney stones in their lifetime. The occurrence also increases the risk of recurrence up to 50%. (Tae et al., 2018). Most urolithiasis patients receive acute treatment in ED. The causes of urolithiasis are multifactorial. Numerous epidemiological studies indicate sex, race, age, climate, occupation, and obesity influence occurrence (Arumham et al., 2019). Except for urolithiasis patients who visit a hospital for follow-up observation, most patients receive treatment in ED for pain control.

The most frequent strategy for treatment of acute renal colic is conservative management with the aim of achieving spontaneous passage of the urinary stone (medical expulsive therapy) (evidence level 1a, recommendation grade A).

Stones in the renal pelvis and upper/intermediate calyces can be treated by ESWL, PCNL, and flexible URS. (Oman et al., 2019).

## Conclusion

The common 24-hour urine abnormalities were hypercalciuria(19%), hypernatriuroa (16%), hyperoxaluria (17%), hypocitraturia (16%), hyperuricouria (32%), hypomagnesuria (1%) and hyperphosphaturia (1%). Hyperuricosuria (32%), hypercalciuria (19%), hypernatriuria (20%).

## Conflict of interest

The authors declared absence of conflict of interest.

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