

Original Article  
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# 24 HOUR URINARY METABOLIC PROFILE AFTER PERCUTANEOUS NEPHROLITHOTOMY

Sreedhar Dayapule<sup>1</sup>, Suryaprakash Vaddi<sup>1</sup>, Vijaya Bhaskar G<sup>1</sup>, Ramamohan Pathapati<sup>2</sup>

<sup>1</sup> - Assistant Professor, Department of Urology and Renal Transplantation, Narayana Medical College & Super Speciality Hospital, Nellore.

<sup>2</sup> - Assistant Professor, Department of Pharmacology, Narayana Medical College & Super Speciality Hospital, Nellore

Corresponding Author:

Dr Sreedhar Dayapule, M.Ch (Urology)  
Assistant professor

Department of Urology and Renal Transplantation  
Narayana Medical College & Super Speciality Hospital  
Nellore – 524 003,  
Andhra Pradesh, India.

Email: sreedh2003@rediffmail.com

Mobile: 9440 713 718

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**Abstract:**

**Introduction:** Renal stone disease is a common problem and prevalence ranges about 1% to 15%. Recurrence is seen in up to 50% in the next 10 years after first stone episode. Identifying and correcting the metabolic abnormality helps to reduce recurrence. For this, we evaluated metabolic profile of renal stone formers from their 24 hour urinary sample.

**Methods:** In this cross sectional study, we estimated the levels of 24 hour urinary citrate, calcium, sodium, potassium, creatinine, phosphorus, magnesium, chloride, uric acid, oxalate, volume, and urinary Ph in 77 consecutive renal stone formers. All patients were on normal diet with no special instruction.

**Results:** The prevalence of metabolic abnormalities were in the order hypernatruria>hypercalciuria>hypophosphaturia>hypocitraturia=hypomagnesuria>hyperoxaluria> hyperuricosuria. 72/77(93.5%) had at least two abnormality, 57/77 (74.02%) had three, 29/77(37.66%) had four and 8/77 (10.38%) had five abnormalities. Significant correlation was observed between urine calcium and urine sodium( $r=0.497$ ,  $p<0.0001$ ), urine calcium and urine uric acid( $r=0.425$ , $p<0.0001$ ), urine uric acid and urine sodium( $r=0.362$ , $p<0.001$ ). Metabolic profile in 24hr urinary samples was statistically similar among males and females, unilateral and bilateral disease and vegetarian and mixed diet.

**Conclusion:** The prevalence of metabolic abnormalities were in the order hypernatruria>hypercalciuria>hypophosphaturia>hypocitraturia=hypomagnesuria>hyperoxaluria> hyperuricosuria. Urine calcium levels significantly correlated with urine sodium and uric acid levels. So we suggest that dietary restriction of sodium as an important factor in reducing urinary calcium and uric acid along with potassium citrate supplementation to prevent stone recurrence.

**Key-words:** Stone, Hypercalciuria, Hypophosphaturia, Hypocitraturia, Hypomagnesuria, Hyperoxaluria, Hyperuricosuria.

## Introduction:

Renal stone disease is a common problem and prevalence ranges from 1% to 15%. It carries significant morbidity and imposes tremendous financial burden on healthcare system. Recurrence is seen in up to 50% in the next 10 years after first stone episode. Life time risk of urinary stone is 5-9% in Europe, 10-15% in North America, 1-5% in Asia and 20-25% middle-east.<sup>1</sup> A stone is created when the urine does not have the correct balance of fluid and a combination of minerals and acids.<sup>2</sup> Super saturation of solutes in urine may be one of the reasons for stone formation. Majority of resources are being utilized in treatment of stone disease while the prevention aspect is often forgotten. A study<sup>3</sup> had demonstrated that a significant proportion of patients with recurrent nephrolithiasis do not undergo appropriate metabolic investigations. So identifying the common abnormalities and preventing them helps to reduce the recurrence rates. Our aim is to identify the metabolic abnormalities from 24 hour urinary profile in stone formers in our area and their correlation.

## Methods:

This is a descriptive cross sectional study done in dept. of urology in Narayana medical college, Nellore from March to August 2013. In this study we evaluated 77 consecutive patients with renal stone (existence of stone on imaging: kidney sonography, abdominal KUB, IVP, CT.) These patients were first or recurrent stone formers, having small renal calculi and subjects with complete stone clearance following intervention. Patients with chronic kidney disease, children below 14 years of age, urinary tract infections and urinary tract obstruction

were excluded. All patients underwent complete urine examination to know urinary pH, specific gravity and to exclude the patients with infection. 24 hour urine was collected in a plastic container with HCl from 6:00 am to next day 6:00 am either at home or as inpatient. All patients were on normal diet with no special instruction. Patients who underwent intervention samples were taken 1 month later. Control values were used as per commercially available kits. 24 hour urinary parameters were analyzed using various techniques and data was obtained.

## Statistical Analysis:

Data was presented as mean  $\pm$  SD, actual numbers and percentages and analyzed using SPSS version 16. For comparison of means between males and females was done by 'independent sample t test'. Correlations between numerical values were assessed by Pearson analysis. A value of  $p < 0.05$  was considered statistically significant.

## Results:

A total of 77 patient's data were evaluated. 51 were men (66.2%) and 26 were women (33.8%). Mean age is  $39.43 \pm 12.19$  years. The prevalence of various metabolic abnormalities in all patients and between male and females are shown in table-1. 47/77 (61%) patients had unilateral stone disease and 30/77 (39%) had bilateral stone disease. 11/77 patients were recurrent stone formers and 66/77 were first time stone formers. 16/77 (20.8%) patients were pure vegetarians and 61/77 (79.2%) were having mixed diet. All had adequate urine output ( $>1$ lts). 8/77 (10.38%) patients urine volume was less than 2 liters, 48/77 (62.33%) between 2-4 liters and 21/77 (27.27%) more than 4 liters.

Most common abnormality in our study was hypernatremia in 71 (92.2%) followed by hypercalciuria in 48 (62.33%), hypophosphaturia in 34 (44.15%), hypocitraturia in 21 (27.27%), hyperoxaluria in 20 (25.97%), hypomagnesuria in 21 (27.27%), hyperuricosuria in 13 (16.88%). 72/77 (93.5%) had at least two abnormality, 57/77 (74.02%) had three, 29/77 (37.66%) had four and 8/77 (10.38%) had five abnormalities. Significant positive correlation was observed between urine calcium and urine sodium ( $r=0.497$ ,  $p < 0.0001$ ), urine calcium and urine uric acid ( $r=0.425$ ,  $p < 0.0001$ ), urine uric acid and urine sodium ( $r=0.362$ ,  $p < 0.001$ ) Metabolic profile in 24hr urinary samples was statistically similar among males and females, unilateral and bilateral disease and vegetarian and mixed diet.

<b>Table-1- Clinical and 24 hr urinary constituents of patient having nephrolithiasis</b>			
<b>Parameters</b>	<b>Total N=77 (%)</b>	<b>Female N=26 (%)</b>	<b>Male N=51 (%)</b>
Unilateral stone disease	47(61%)	17(65%)	30(59%)
Bilateral stone disease	30(39%)	10(38%)	20(39%)
First time stone formers	66 (85.71%)	20(77%)	46(90%)
Recurrent stone formers	11(14.28%)	4(15%)	7(14%)
Pure vegetarian diet	16(20.8%)	6(23%)	10(19%)
Mixed diet	61(79.2%)	20(27%)	41(81%)
Hypernatruria	71 (92.20%)	24 /71(92.3%)	47/71 (92.15%)
Hypercalciuria	48 (62.33%)	14/48 (53.84%)	34/48 (66.66%)
Hypocitraturia	53 (68.83%)	22/53 (84.21%)	31/53 (60.78%)
Hyperoxaluria	20 (25.97%)	8/20 (30.76%)	12/20(23.52%)
Hypomagnesuria	21 (27.27%)	9/21 (34.61%)	12/21 (23.52%)
Hyperuricosuria	13 (16.88%)	2/13 (7.69%)	11/13 (21.56%)
pH	5.66±0.49	5.60 ± 0 .42	5.698 ± 0.51
Oxalate (mg)	35.043±12.84	33.89 ± 12.43	35.62 ± 13.13
Citrate (mg)	412.92±386.22	325.50± 221.437	457.48± 442.97
Uric acid (mg)	507.69±200.86	464.37± 178.44	529.77± 209.60
Calcium (mg)	240.87±155.98	220.97± 122.169	251.02± 170.90
Phosphorus (mg)	388.26±168.32	403.08± 159.605	380.70± 173.66
Sodium (mmol)	578.31±350.76	418.88± 363.44	659.584± 392.04
Potassium (mmol)	125.12±122.21	126.415± 126.68	124.461± 121.15
Magnesium (mg)	103.70±67.73	86.938± 34.73	112.259± 78.41
Urine Volume	3.26±1.21	2.877± 1.16	3.448± 1.20
Oxalate- M: 7 – 44mg/24hrs, F: 4 – 31mg/24hrs., Citrate-M: > 450mg/24hrs ,F: >550mg/24hrs. Uric acid-250 – 750mg/24hrs..Calcium-5 – 150mg/24hrs (Low to average calcium diet), Phosphorus-400 – 1300mg/24hrs, Sodium-40 – 220m mol/24hrs, Potassium-25 – 125m mol/24hrs, Magnesium-70 – 130mg/24hrs.			

### Discussion:

Nephrolithiasis is a recurrent condition with significant associated morbidity and economic impact and it occurs when the urine contains more crystal-forming substances than the fluid can dilute. Recurrence rate is about 5% per year in people who are not treated<sup>4</sup> although urologic intervention addresses symptomatic stone episodes, prevention of recurrences with proven medical therapy is indicated. In present study we evaluated metabolic profile in 24 hour urinary samples of stone forming patients and found that our subjects are having 39.4± years of age corresponding to the peak age incidence (4th to 6th decades). More over men are effected mote

than females in a ratio 2.2:1 which was similar to Khoromi et al who demonstrated that renal stones (nephrolithiasis) affect approximately 12% of men and 5% of women by age 70.<sup>5</sup> Another study showed men to women stone incidence ratio of 3.4 to 1.3.<sup>6</sup> A study has shown that Men show a dual summer calcium oxalate and uric acid high risk, while women show a high early winter calcium oxalate high risk.<sup>7</sup>

Sarda et al<sup>8</sup> reported that hypercalciuria and hyperoxaluria were common in males whereas females had hypocitraturia. Hussein NS et al,<sup>9</sup> reported hyperoxaluria, hypomagnesuria and hypocitraturia to be more common in females.

In our study hyperuricosuria and hypercalciuria are more common in males and hypocitraturia is more common in females. In our study, metabolic profile in 24hr urinary samples was statistically similar among males and females, unilateral and bilateral disease and vegetarian and mixed diet.

Urinary stone composition in the Indian population, with a larger percentage of patients having calcium oxalate stones, predominantly calcium oxalate monohydrate and is different from that in western countries.<sup>10</sup> Most of the rest are composed of uric acid (UA; 5-10%) and struvite (5-15%). According to (Hussein NS et al) males subjects had propensity to excrete

more uric acid compared to females.<sup>2,9</sup>

High animal protein intake is considered a risk factor for stone formation.<sup>11</sup> According to Borghi et al<sup>12</sup> low salt and low animal protein diet decreases the stone recurrence rates. In our study there is no difference in urine parameters in patients with and without animal protein intake. This can be explained by the fact that meat consumption in our area is minimal. A general advice such as animal protein restriction as may not be applicable to our population.

Many published series<sup>13,14</sup> have shown that high salt intake causes increased excretion of sodium leading to increased calcium excretion. This result in increased risk of stone formation.<sup>13</sup> In our study hypernatruria was most common abnormality. Similar observations were found by many investigators<sup>15-17</sup> also reported hypernatruria in 80.7% patients with renal stones. In our study it was 578.31±350.76 which was very high compared to values reported in other studies. Sakhaee et al<sup>13</sup> showed that high urine sodium positively correlated with high urine calcium. Nader et al also showed this correlation in addition to positive correlation between urine calcium and uric acid. In Our study high urine sodium was associated with high urine calcium and uric acid (positive correlation) and high urine calcium positively correlated with high urine uric acid. Majority of our patients had normal to high urine volume. This might be due to increased urine sodium and /or due to patient bias taking plenty of water. One study reported that increased salt intake might be protective by increasing water intake thereby increasing 24hr urine volume.

Limitations- We did not evaluate the dietary intake by 24 recall method

to know the complete status of various nutrient and dietary intake. Additionally, we used a single 24 hour urinary sample to diagnose metabolic abnormalities in our patients since a single 24-hour sample is not sufficient for evaluating patients before metabolic treatment for stone prevention because misdiagnosis is common, leading to inappropriate treatment.<sup>5</sup>

### Conclusion:

The prevalence of metabolic abnormalities were in the order hypernatruria>hypercalciuria>hypophosphaturia >hypocitraturia= hypomagnesuria>hyperoxaluria>hyperuricosuria. Urine calcium levels significantly correlated with urine sodium and uric acid levels. There is no statistically significant difference in parameters between patients on vegetarian and non-vegetarian diet. So we suggest that dietary restriction of sodium as an important factor in reducing urinary calcium and uric acid along with potassium citrate supplementation to prevent stone recurrence. However, a general advice of protein restriction may not be suitable for our population.

**Conflict Of Interest:** None

**Ethical committee approval:** Approval taken

**Informed consent:** Informed consent was obtained from all individual participants included in the study

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