

## Twenty four hours urine and serum biochemical parameters in patients with urolithiasis

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### ABSTRACT

From the analysis of various urinary constituents and the estimation of serum parameters, it is now possible to identify the risk factors responsible for or contributing for stone formation metabolic factor included calcium, oxalate, uric acid, citrate and pH. Environmental factors where total volume, sodium, phosphate and magnesium. Urinary citrate and magnesium found to be lower in stone formers. The levels of serum parameters like calcium, sodium and intact parathyroid hormone (IPTH) is higher than normal. Where as potassium and magnesium is found to be lower than normal. Higher level of IPTH is associated with primary hyperparathyroidism and is related with stone formation in-patient with urolithiasis. Serum levels of phosphorus, uric acid and Creatinine found to be normal.

**Keywords:** Parathyroid hormone, hypocitraturia, hypercalciuria, hyperoxaluria.

### INTRODUCTION

Urolithiasis is a common disorder marked by kidney stones. Studies have shown that metabolic causes of urolithiasis were hypercalciuria, hypocitraturia, high or low pH of urine hyperuricouria, hyperoxaluria, hypomagnesaemia.

Citrate is a natural substance that inhibits urinary calcium stone formation. Deficient urinary excretion of citrate has often associated with urinary stone disease. Moreover, successful correction of hypocitraturia, which has been documented largely in adults, positively correlates with a decreased stone recurrence rate.<sup>1</sup>

Internal environment of the tissue and its osmotic concentration is mainly maintained by connecting the circulatory blood volume to the excretory system such as kidney, skin and lungs. It is one of the major function of kidney. Therefore in urolithiasis assessment of plasma concentration of metabolites and electrolytes along with the concentrations of urinary excretory products, urine pH and hormonal assay is of prime importance.<sup>2</sup>

Urine parameters like urine pH, eliminating probable infection, and the most importantly learning the type of crystals (crystals usually seen during the acute attack) are important in urolithiasis. Concentrations of serum electrolytes, calcium, phosphates, creatinine and uric acid have to be measured as the first biochemical investigation of patients with urolithiasis. In addition 24-hour urine volume, creatinine, calcium, phosphate, uric acid, oxalate, citrate, urine pH and serum level of intact parathyroid hormone (IPTH) may be assessed.

Therefore, the purpose of this study was to find out the quantitative relations between urine and serum parameters in local population, as the incidence of urolithiasis in this region is very high as well as potable ground water is extremely hard. Since citrate and magnesium, inhibits oxalate and phosphate stone formation respectively, while uric acid solubility depends on urine hydrogen ion concentration therefore correlation of urolithiasis and these parameters was also one of the object of this study.

### MATERIALS AND METHODS

The study included 100 patients with stone disease (76 males and 24 females) mean age 34 years. Renal stone patients were selected among those attending the local clinics at A.C.P.M. Medical College, Dhule, Maharashtra (India). One hundred healthy persons of Dhule district (75 males and 25 females) mean age 36 years, who served as controls, with no recent report of ill health of any kind and had no past history of urolithiasis, including that in the family. Twenty four hours of urine samples and blood samples were collected from both patients and controls were analysed.

The diagnosis of urolithiasis was supported by plain abdominal X – ray, ultrasonography and / or intravenous pyelography.

Urine volume and concentration of serum and urine calcium, phosphate, uric acid, creatinine was estimated by normal standard colorimetric procedures and in addition urinary citrate and serum magnesium were also quantitatively estimated by using standard methods.<sup>3,4</sup>

**Table-1:** Analysis of 24 Hour Urinary excretions and its constituents

| Parameters              | Control levels | Patients (n= 100) | P      |
|-------------------------|----------------|-------------------|--------|
| Urine Volume (ml /24hr) | 1586 ± 97      | 1671 ± 646        | NS     |
| Oxalate (mmol/24hr)     | 0.29 ± 0.07    | 0.45 ± 0.19       | 0.000  |
| Citrate(mmol/24hr)      | 1.94 ± 0.29    | 1.0 ± 0.35        | 0.000  |
| Calcium(mmol/24hr)      | 4.0 ± 0.96     | 11.5 ± 8.0        | 0.0001 |
| Uric acid (mmol/24hr)   | 2.5 ± 0.64     | 3.4 ± 1.3         | 0.01   |
| Phosphorus(mmol/24hr)   | 31.8 ± 6.0     | 32.2 ± 8.7        | NS     |
| Creatinine(mmol/24hr)   | 13.2 ± 2.1     | 14.6 ± 3.0        | 0.20   |
| Magnesium (mmol/24hr)   | 3.82 ± 1.3     | 2.38 ± 1.20       | 0.01   |

**Note:** Values expressed mean ± Std Deviation, NS:- Not Significant

The RA- 50 Chemistry analyzer was used to carry out all analysis, oxalates by titration against permanganet, sodium and potassium were estimated by using Dr Reddys disgnostic assay kits.<sup>5</sup> IPTH was measured with Bayer’s diagnostic chemiluminescence immune assay analyzer.

**RESULTS**

The results were presented as mean ± SD, student’s t test was used for statistical analysis. P values < 0.05 were regarded as statistically significant.

The mean values of urinary and serum parameters were shown in Table-1 and Table-2 respectively. Metabolite analysis showed that in patients with urolithiasis 24 hours urine calcium, oxalate, uric acid excretion is higher than normal. Although urine excretions of phosphorus and creatinine were normal, excretion of citrate was significantly lower in renal calculus patients.

**DISCUSSION**

In present study, different metabolites of 24-hour urine sample and serum parameters were assessed in patients with urolithiasis.

**Table-2:** Serum chemistry tests and PTH in subjects

| Parameters          | Control levels | Patients (n= 100) | P      |
|---------------------|----------------|-------------------|--------|
| Calcium (mmol/L)    | 2.4 ± 0.12     | 4.9 ± 0.21        | < .03  |
| Phosphorus (mmol/L) | 1.16 ± 0.23    | 1.2 ± 0.29        | NS     |
| Uric acid (mmol/L)  | 0.31 ± 0.04    | 0.41 ± 0.01       | NS     |
| Sodium (mmol/L)     | 140.4 ± 4.8    | 156.4 ± 15.3      | 0.0001 |
| Potassium (mmol/L)  | 4.1 ± 0.44     | 2.6 ± 1.31        | 0.01   |
| Creatinine (µmol/L) | 91.9 ± 20.3    | 94.3 ± 22.2       | NS     |
| Magnesium (mmol/L)  | 15.5 ± 8.80    | 0.81 ± 0.26       | 0.0001 |
| Intact PTH (Pg/ml)  | 3.37 ± 13.2    | 46.4 ± 28.7       | 0.04   |

**Note:** Values expressed mean ± Std Deviation, NS:- Not Significant

It is well known that the raised excretion of oxalate, uric acid, calcium and phosphorus in the urine increase the formation of urolithiasis, while raised excretion of citrate, magnesium, albumin and alkali in urine decrease this process.<sup>6</sup> We found the levels of urine phosphorus, Creatinine and the level of 24 hour urine volume were within normal limits but the levels of urinary magnesium and citrate were found to be lower than normal.

Others reports claim that idiopathic stone formers excrete significantly less citrate in their urine than normal subjects.<sup>7-9</sup> Citrate excretion is depends in relation to age and

sex. It is generally higher in women than in men. Our results correlate with these findings:-

The levels of serum parameters like calcium, sodium and IPTH is higher than normal. Where as potassium and magnesium is found to be lower than normal. Higher level of IPTH is associated with primary hyperparathyroidism and is related with stone formation in-patient with urolithiasis. Serum levels of phosphorus, uric acid and Creatinine found to be normal.

Determination of serum sodium and potassium offers valuable information. Intake of sodium increase urine calcium excretion because urinary sodium excretion is directly correlated with urinary calcium excretion such that increasing the excretion of one leads to an increase in excretion of the other. The decreased potassium is a cause of hypocitraturia, marked, hypocitraturia often seen among these stone subject is probably aggravated by the combined deficiencies of both potassium and magnesium.<sup>10-13</sup>

The present study found positive correlation between parathyroid hormone and urolithiasis, calcium nephrolithiasis associated with primary hyper parathyroidism appears representative. It may suggests a causative association, which may be explained by the metabolic changes induced by PHP and their influences on the urine environment, making it conducive to calcium oxalate and calcium phosphate stone formation.<sup>14</sup>

In conclusion, excretion of citrate and magnesium was very less in stone renal calculus patients. These quantitative findings will be useful for diagnosis and prognosis purpose.

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## ERATA

The list and sequence of authors of “Treatment of intertrochanteric femoral fractures with a proximal femoral nail (PFN): A short follow up” printed in Vol. 11; No. 4; Page: 229-231 of this *Nepal Med Coll J* (December 2009 issue) has been corrected as **MP Anjum, FN Hussain and I Mehboob**.