



STUDY OF CALCIUM CREATININE RATIO IN UROLITHIASIS

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ABSTRACT Urolithiasis is one of the common cause of morbidity in human population. The metabolic defects are less likely to occur in the first time than recurrent stone formers. The present study was aimed to determine the urinary levels of calcium and creatinine in such patients. Calcium and creatinine ratio was determined to screen patients with hypercalciuria also to find out recurrent stone formers. In our research work we took 30 clinically diagnosed cases of urolithiasis and 30 age and sex matched healthy controls. Our results showed increased concentration of stone promoters such as calcium and decreased concentration of stone inhibitors such as creatinine in urine of urolithiasis patients. Observations of our research work provide some evidence regarding the role of the above mentioned ratios in the pathogenesis of urolithiasis.

KEYWORDS : Metabolic defects, Calcium/Creatinine Ratio, Uric acid/Creatinine Ratio, Urolithiasis patients

INTRODUCTION:

Urolithiasis prevalence in India is 11%. Men are three times more affected than women. It is defined as formation of crystalline aggregates composed of crystalloid and a some amount of organic matrix in the urinary tract (kidney, ureter & bladder). Various factors that guide the probability of urolithiasis are age, gender, race and geographic region. Stone disease has the highest prevalence in western population followed by Asians & African populations. Urolithiasis shows more prevalence in hot and dry climate which is due to high temperature leading to increased perspiration as well as fluid losses and by increased formation of sunlight induced Vitamin D. Occupations involving higher exposure to high temperature lead to reduced urine volumes and pH leading to increased risk of stone formation. Obesity is a independent risk factor for stone formation. Stone disease has less incidence in areas with hard water supply compared to areas with soft water supply. Such prevalence might be attributed to urine becoming super saturated with respect to stone formation salts leading to ions or molecules precipitating out of solution and forming crystals. Once such crystals are formed, either they may flow out with the urine or get retained in the kidney at anchoring sites that promote their aggregation and leads to stone formation. Concentration of calcium oxalate in normal human urine is 4 times higher than its solubility in water. Urinary factors favoring stone formation includes low volume, hypocitraturia and increased calcium, uric acid as well as phosphorus. Phosphorus increases Calcium oxalate super saturation; once the concentration product exceeds the solubility product crystallization can potentially occur^[1].

Calcium is seen in majority of the stones in different proportions. Previous studies have shown association of calcium with hypercalciuria and hyperuricosuria. Idiopathic hypercalciuria is well established pathophysiology for renal stone disease. Hypercalciuria is defined as urinary calcium excretion of more than 4 mg/kg/day^[2].

A direct positive correlation between urinary Calcium-Creatinine ratio in hypercalciuria has been shown by Osorio et al^[3]. The renal handling of promoters and inhibitors of stone formation by the kidney tubules as well as their urinary pattern can be strongly influenced by genetic factors.^[4] A study has shown that urine Calcium/Creatinine ratio is believed to be varying with climate and exposure to sunlight, age, sex, mineral composition of drinking water, dietary habits and genetics^[5]. The present study was carried out to evaluate Calcium/Creatinine ratio in urolithiasis patients with hypercalciuria and hyperuricosuria.

MATERIAL AND METHODS

The study was conducted from July 2012 to January 2013 in Department of Biochemistry, JJM Medical College, Davangere, Karnataka, India on 30 clinically and radiologically diagnosed cases of urolithiasis from Department of Urology, JJM Medical College and on 30 age and sex matched healthy controls taken from general population of Davangere. Written informed consent was taken from psoriasis

patients as well as healthy controls. An approval from Institutional Ethical Committee of JJM Medical College, Davangere was also obtained before study.

The urinary calcium was estimated by ARSEZANO'S method using semi-automated analyzer. The urinary uric acid was estimated by URICASE method by semi-automated analyzer. Urinary creatinine was measured by rapid enzymatic method in semi-automated analyser^[9,6].

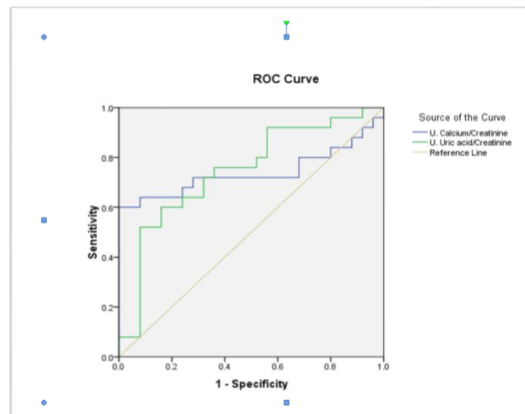
The results were analyzed statistically using SPSS 19.0 and were expressed as Mean \pm SD. p-value of 0.05 or less was considered as statistically significant [Table-1].

RESULTS

A total of 30 urolithiasis patients with mean age of 45 years comprising and 30 controls with mean age of 45 years were investigated in this study. Study showed that the Urinary Calcium levels were significantly increased ($p < 0.05$) but urinary Creatinine level was not significantly decreased or increased in urolithiasis patients as compared to healthy controls. This Study also showed that Urinary Calcium/Creatinine ratio was significantly increased ($p < 0.05$) as compared to healthy controls. [Table/fig 1]. Our findings are substantiated by plotting a ROC curve for our findings. [Table/fig 2]

[Table/fig 1]- Various parameters and calcium creatinine ratio in subjects

Parameters	Controls	Cases	P value
U. Calcium	5.13 \pm 0.67	7.06 \pm 1.85	< 0.001
U. Uric acid	2.43 \pm 0.44	4.26 \pm 0.54	< 0.001
U. Creatinine	16.98 \pm 4.43	17.04 \pm 0.44	0.98
U. Calcium/Creatinine ratio	0.32 \pm 0.09	0.62 \pm 0.44	0.002



[Table/fig 2]- ROC curve of calcium creatinine ratio

DISCUSSION

The recurrent stone disease is a well-documented clinical problem and often requires surgical management. It is generally believed that metabolic defects are less likely to occur in the patients with recurrent renal disease. The relationship between calcium excretion and calcium intake is not well documented. Therefore both diagnostic and therapeutic purposes, it appears to be more useful to get information on the dietary dependence rather than on calcium dependence of hypercalciuria^[3].

A study shows that a diet having less calcium leads to excessive negative calcium balance in patients with idiopathic hypercalciuria and urolithiasis. Patients in whom calcium was well absorbed from diet having high calcium also showed significant calcium loss on low calcium diets. Study also suggested that a sustained high flux of calcium through kidney may attenuate the calcium conservation mechanisms in the renal tubules^[3]. This would explain the higher calcium excretion during fasting that we found in patients as compared with normal subjects. Such a superfluous when the kidney is being flooded with calcium^[4].

Values of creatinine tend to be lower in acidified or alkalinized samples than in untreated urine. This influence of pH on creatinine levels has been shown in the studies on aqueous solutions^[5]. Several factors like geographical location, genetics, dietary habits, drinking water, climatic conditions, sunlight and even pollutants have been documented to affect the calcium/creatinine ratio in controls and cases^[6].

The purpose of this study was to examine the pathophysiology of alkaline urine pH in patients with CaPHO₄ stones who do not have distal RTA. Objective was to identify patients whom dietary factors do not seem to play a significant role in the pathophysiology of their alkaline urine pH^[7].

Hypercalciuria is a major risk factor for urolithiasis. Although hypercalciuria and bone mass loss are classic features of primary hyperparathyroidism, there is no evidence that the prevalence of osteopenia is statistically increased in lithiasis patients with idiopathic hypercalciuria^[8].

CONCLUSION

In our study we found that urinary calcium and uric acid were found to be increased and there was no significant change in urinary creatinine level. Ratios such as calcium creatinine ratio and uric acid creatinine ratio were also increased. There was a significant co relation between the promoters and inhibitors with stone formation in the urinary tract. High concentration of calcium and calcium/creatinine ratio and uric acid/creatinine is used as an index of stone formation and also a screening tool to detect hypercalciuria and hyperuricosuria respectively.

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