Original Research Article

Assessment of biochemical composition of renal calculi among patients visiting SVIMS, Tirupati

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Abstract

Background: Worldwide urolithiasis is most common urological disease affecting both males and females. A kidney stone is a disease caused by some multi-factorial reasons like biochemical, environmental, epidemiological, genetic factors and especially diet will play an important role in expression of the tendency to stone formation.

Aim: The present study was aimed to determine the composition of renal calculi by biochemical analysis.

Materials and methods: A total of 43 study subjects of both sex groups were selected from the surgical urology unit of S.V.I.M.S Tirupati, and private Nursing homes in Tirupati, during the period of 16 months (May 2009 to September 2010).

Results: A total of 50 renal stones were analyzed qualitatively, from 43 patients. In 43 patients, 39 were Males (90.69 %) and only 4 were Females (9.31%) and the incidence in male and female was in the ratio of 10:1. The highest number of cases, 40% of the total case is present in age group of 35-40 years followed by 32% in age group of 30-35 years. The Qualitative chemical analysis of renal stones revealed the presence of mixed stones with highest percent of CaOx (Calcium Oxalate) with CaP (Calcium Phosphate) stones for followed by uric acid.

Conclusion: The present study concluded that knowing the biochemical composition of renal calculi is important during the treatment of renal stone disease and also giving advice to people for taking preventive measures for reducing the stone formation.

Key words

Urolithiasis, Nephrolithiasis, Renal calculi, Kidney stones, Urinary tract, Calcium oxalate, Urates, Phosphates.

Introduction

Urolith is commonly called as a kidney stone (uro- refers to urine, and -lith means stone) and the condition is known as urolithiasis or renal calculi or nephrolithiasis. These kidney stone are formed by the extra chemicals that are not flushed out of the system through urine and get collected in the kidneys. These collected chemicals converted into crystals and harden into stones. The basis of formation of these accumulations is the changes in the normal balance of salt, minerals, water, and other substances found in urine [1].

A kidney stone is a disease caused by some multi-factorial reasons like biochemical, environmental, epidemiological, genetic factors and especially diet will play an important role in the expression of the tendency to stone formation [2, 3, 4]. So excessive intake of diet rich in oxalates, purines, animal protein, high content of calcium in water, sodium chloride, and potassium-rich vegetable effects the urine chemistries and low pH (urine) , high uric acid and calcium excretion and low citrate excretion . All these consequences lead to urinary crystals and the renal stone formation [5, 6].

Worldwide, the prevalence and probability of forming kidney stone vary in different parts of the world. Globally, the high prevalence of kidney stone formation is observed among the areas like Mediterranean countries, northern Australia, central Europe, china, and the northern part of India. Whereas the prevalence of kidney stone formation is lower in areas like south and Central America and parts of Africa [7, 8].

So the present study was aimed to determine the composition of renal calculi by biochemical analysis.

Materials and methods

The present study was carried out in the department of Biochemistry, Sri Venkateswara Medical College (SVIMS), Tirupati. A total of 43 study subjects of both sex groups were selected from the surgical urology unit of S.V.I.M.S Tirupati, and private Nursing homes in Tirupati, during the period of 16 months (May 2009 to September 2010). The age of subjects having stones was ranging from 30 to 50 years. This study was approved by institutional ethical committee and investigations were carried out in the biochemistry laboratory, S.V.I.M.S, Tirupati.

The calculi were either removed by surgery or Extracorporeal shock wave lithotripsy (ESWL) or spontaneous passage of stones in urine and were brought to the laboratory in a sterile container. Brief clinical history of each patient was also provided. In most of the cases, each calculus was weighed and its size, shape, color, surface appearance and consistency were noted. In some cases stones are fragmented by ESWL, these fragments were brought to the laboratory.

The stones were then pulverized. The Analysis of the stones was performed according to the procedure used routinely at S.V. Medical College using the manual chemical method of analysis based on the formation of colors or precipitates [9, 10].

Results

A total of 50 renal stones were analyzed qualitatively, from 43 patients. In 43 patients, 39 were Males (90.69 %) and only 4 were Females (9.31%) and male to female ration was 10:1 which is shown in **Table - 1**. The highest number of cases, 40% of the total case is present in the age group of 35-40 years followed by 32% in age group of 30-35 years which is shown in **Table - 2**.

Table - 1: Gender wise distribution of patients.

Gender	Frequency	Percentage	Ratio
Male	39	90.69%	10:1
Female	04	9.31%	
Total	43	100%	

Table - 2: Age wise distribution of stones.

Age group (Years)	No. of stones	Percentage
<30	1	2%
30-35	16	32%
35-40	20	40%
40-45	7	14%
45-50	6	12%
Total	**50**	**100%**

The chemical composition most of the stones analyzed were Oxalates (90%) followed by uric acid (40%). The inorganic constituents of stones were composed of calcium (90%), phosphate (34%), and very few number of stones were composed of ammonia (6%), carbonate (10%), magnesium salts (12%), which is shown in **Table - 3**.

The Qualitative chemical analysis of renal stones revealed the presence of mixed stones with the highest percent of CaOx (Calcium Oxalate) with CaP (Calcium Phosphate) stones for followed by uric acid.

Table – 3: Chemical composition of stones with Percentage.

Chemical constituents	No. of stones	%
Ca+ Oxalate	45	90%
Ca-phosphate	23	46%
Uric acid	20	40%
Phosphate salt	17	34%
Magnesium-phosphate	11	22%
Ca-non oxalate	9	18%
Magnesium salts	6	12%
Carbonate	5	10%
Oxalate	3	6%
Ammonia	3	6%
Cystine	1	2%
Xanthine	1	2%

Discussion

In the present study, prevalence of kidney stones among males is more common than in women. Similar prevalence was observed by Stapleton FB, et al.; and Singh, et al. [11, 12]. Out of 43 patients 39 were males, 4 were females increased incidence in males also has been attributed to increased dietary protein intake, which increases urinary excretion of phosphates and magnesium and reduces urinary citrate concentration. The lower risks of stone formation in women were attributed initially to increased urinary citrate concentrations due to the lower urinary saturation of stone forming salts. Endogenous estrogen and estrogen treatment in post menopausal women may decrease the risk of stone recurrence by lowering urinary calcium and calcium oxalate saturation [13, 14]. While compare with females, males are more prone to stone development because of male urethra is small in size and easily obstructed by a stone [15].

In our study, we observed that calcium oxalate (90%) stones were the most common stones in our patients. This finding is in agreement with

the reported data that calcium oxalate stones are encountered in the worldwide stone belt. They may be associated with either a persistently or consistently increased excretion of urinary calcium or oxalate. Also our data indicate that, this type of stone is not composed of pure calcium oxalate, however, calcium oxalate predominates with small quantities of calcium phosphate (48%) as well as uric acid (40%). Any stone former presenting with his first episode should be subjected to a number of routine screening procedures, which, in some instances, will identify a recognized cause for the function of the stone. Such procedures include the recording of a detailed history, the performance of a plain abdominal X-ray or intravenous urogram, qualitative analysis of the stone and the measurement of serum uric acid [16, 17, 18, 19].

Low fluid intake greatly increases the risk of developing virtually all types of stones. For this reason, individuals at risk of developing stones are often advised to increase their fluid up take. High intakes of sodium and protein may also increase risk of calcium oxalate stones. Oxalate-rich foods such as spinach and cocoa may also increase the risk of developing calcium oxalate stones [13].

Modern life style, unhealthy dietary plan, overweight problems and sedentary habits to be the important promoters for the stone formation. So, further studies are required in lager sample size in preventing renal stone formation.

Conclusion

The present study concluded that knowing the biochemical composition of renal calculi is important during the treatment of renal stone disease and also giving advice to people for taking preventive measures for reducing the stone formation. Further studies are required in larger samples size and health education in this regard may be helpful in preventing the renal stone formation.

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