(Original Research Article)

Significance of Chemical Composition Analysis in Urolithiasis

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Abstract

Introduction: Urolithiasis is the formation of stones in the urinary tract. Between 1% and 15% of people globally are affected by kidney stones at some point in their lives. Knowledge of chemical composition of Renal stones may be helpful in clinical management of patients as well as in reducing risk of prevalence and recurrence of stones in this region.

Aims and Objectives: To analyse the chemical composition of Urinary tract stones.

Material and Method: The present study included 100 uroliths obtained by surgical intervention of Urolithiasis patients diagnosed at MM Institute of Medical Sciences, MMDU , Mullana from August 2018 to October 2019. The powdered form was qualitatively analyzed for their chemical composition adopting standard methods.

Results: In the present study, out of total 100 patients, the incidence of urolithiasis was more in males (72%) compared to females(28%).Distribution of stones based on their location, showed a high incidence of stones in the ureter (42%), followed by Bladder (26%) and Urethra (19%). Calcium oxalate was the most predominant chemical composition in the stones analyzed (63%), followed by Uric acid (18%). Calcium carbonate, Calcium phosphate and Magnesium Ammonium phosphate were predominant in 8%, 6% and 5% of stones respectively.

Conclusion: Analysis of the chemical composition of stones and knowledge of its etiology will help in improving the management of patients with Urolithiasis.

Key Words: *Urolithiasis ; Chemical ; Ureter; Calcium; Oxalate*

Introduction

Urolithiasis is the formation of stones in the urinary tract.A small stone may pass asymptomatic[1] If a stone grows to more than 5 millimeters, it can cause blockage of urinary tract, resulting in severe pain in the lower back or abdomen.[1][2] A stone may also result in hematuria, vomiting, or painful urination.[1] Risk factors for stone formation include high urine calcium levels, obesity, certain foods, medications like calcium supplements, conditions like hyperparathyroidism, gout and not drinking enough fluids.[1][3] Stones form in the kidney when minerals in urine are at high concentration such as Calcium, Magnesium, Oxalate, Carbonate, Phosphate, Urate etc. Between 1% and 15% of people globally are affected by kidney stones at some point in their lives. [3] High incidence of urolithiasis with varied chemical composition of calculi has been reported from different regions of India [4].Generally, more men are affected than women.[1]

There is limited data on the analysis of chemical composition of renal calculi in the population in and around Mullana. So the present study was undertaken to qualitatively analyse the renal stones. Knowledge of chemical composition of Renal stones may be helpful in clinical management of patients as well as in reducing risk of prevalence and recurrence of stones in this region.

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Aims and Objectives

To analyse the chemical composition of Urinary tract stones.

Material and Method

The present study included 100 uroliths obtained by surgical intervention of Urolithiasis patients diagnosed at MM Institute of Medical Sciences, MMDU , Mullana from August 2018 to October 2019. The stones obtained from the Surgery Department to Clinical Biochemistry Laboratory were washed with distilled water to remove the debris, dried completely and weighed. The stones were cut and crushed, the powdered form was qualitatively analyzed for their chemical composition adopting standard methods [5] using chemicals of Analytical reagent grade. The research project was approved by the ethical committee of institute.

Inclusion Criteria

Patients above 14 years were included in the study

Results

In the present study, out of total 100 patients, the incidence of urolithiasis was more in males (72%) compared to females(28%). The highest percentage of urolithiasis was found in the age group 31-45 years in both the sexes(51%). (Table 1)

Distribution of stones based on their location, showed a high incidence of stones in the ureter (42%), followed by Bladder (26%) and Urethra (19%). Males showed high incidence of Ureteric stones while females had high incidence of bladder stones.(Table 2) All the stones analysed were of heterogenous mixed type. Calcium oxalate was the most predominant chemical composition in the stones analyzed (63%), followed by Uric acid (18%). Calcium carbonate, Calcium phosphate and Magnesium Ammonium phosphate were predominant in 8%, 6% and 5% of stones respectively. (Table 3)

TABLE 1: Occurrence of Urolithiasis in relation to age and sex of the patient

Age group (in years)	No. of cases (Male) (n=72)	No. of cases (Female) (n=28)	% of Occurrence
15-30	12	03	15%
31-45	32	19	51%
46-60	18	05	23%
>60	10	01	11%

Table 2 : Distribution of stones according to their site of Occurence

Location	No. of Males	No. of Females	% of Occurrence
Renal	07	06	13%
Ureteric	39	03	42%
Vesicle/Bladder	08	18	26%
Urethral	18	01	19%

Table 3 : Chemical composition of the urinary stones

Composition of Stone	No. of stones	%
Calcium Oxalate	63	63%
Calcium Phosphate	06	6%
Calcium Carbonate	08	8%
Uric Acid	18	18%
Magnesium Ammonium Phosphate	05	5%

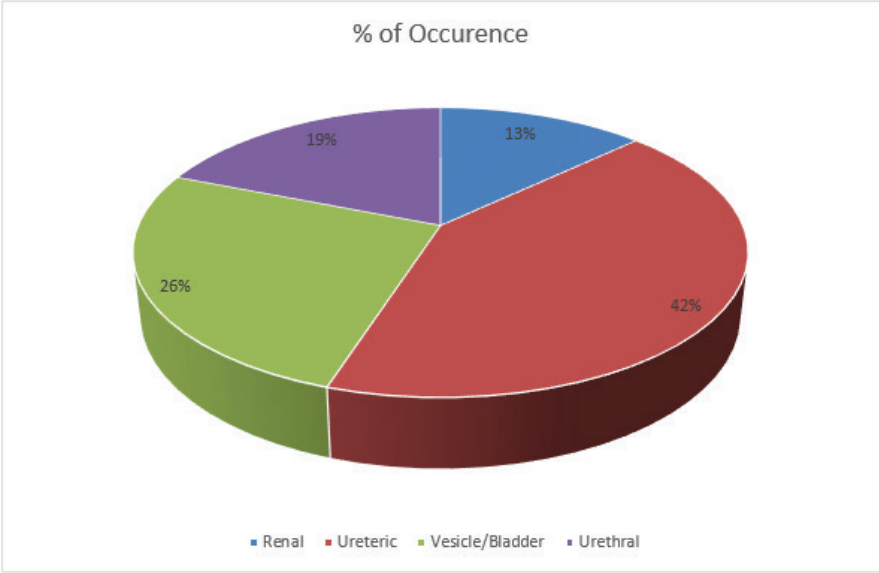

Figure 1 showing percentage occurrence of stones according to location

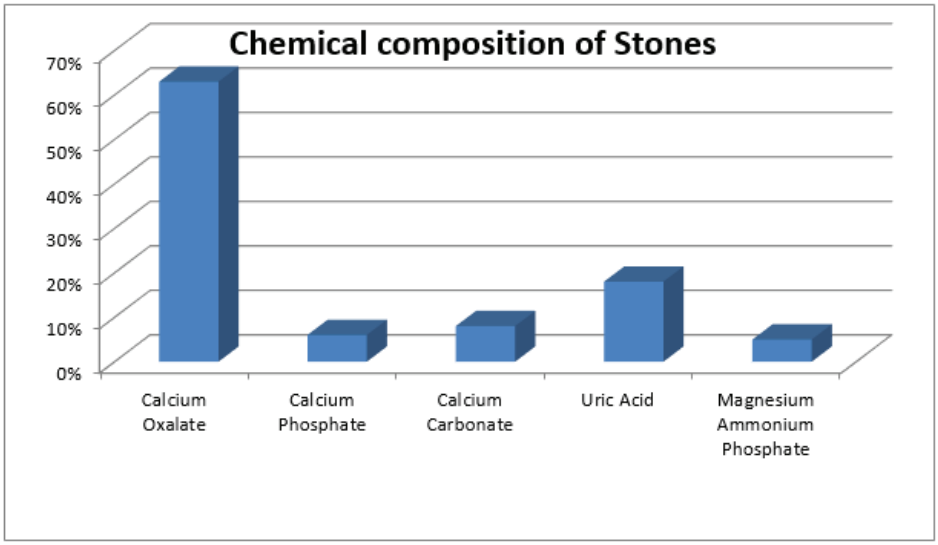

Figure2 showing chemical composition of stones

Discussion

Kidney stones affect all geographical, cultural and racial groups. [6] Stones result when urine becomes too concentrated and substances in the urine crystallize to form stones. [7] In the present study, the urolithiasis was predominant in males compared to females. Our findings were similar to study by Rafique et al [8] who found the incidence to be three times in males compared to females. Smaller diameter and increased length of urethra or large muscle mass in men may be the reason behind higher incidence in males compared to females. [9] Tissue breakdown on daily basis contributes to metabolic waste and a tendency towards formation of stones. [10] The type of diet consumed in the area is reflected by the composition of urine which in turn indicates the type of stones formed. Poor drinking leads to low urine volume which in turn contributes to stone formation . [11] In the present study, Calcium oxalate stones were predominant. Our findings were similar to the stone analysis study done in Manipur by P.P Singh et al who found calcium and oxalate in all the 196 stones analysed. [12] Ureteric stone analysis done in Jodhpur also reported a similar finding.[13] Hypercalciuria and hyperparathyroidism are the risk factors for calcium stone formation. Excessive consumption of Oxalate containing foods or excessive absorption of oxalate in enteric diseases or ileojejunal surgery or Vitamin C supplementation [14] contributes to oxalate stone formation. [9]

Excessive consumption of meat causes over acidification of urine leading to increased excretion of calcium, oxalate and uric acid and thus an increase in the kidney stone formation.

The composition of stones , urinary risk factors and analysis of diet suggest that urinary tract infections, nutritional habits and poor fluid intake contribute to urolithiasis. Therefore, sufficient intake of fluids can prevent stone formation and its recurrence. [15]

Conclusion

Analysis of the chemical composition of stones and knowledge of its etiology will help in improving the management of patients with Urolithiasis. The high incidence of renal stones in this area can be reduced by planning preventive measures and also the recurrence of stone formation can be prevented in the patients of urolithiasis by advising them on diet modification.

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Conflict of interest - Nil

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