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Original Article

Chemical Composition of Calculi Removed From Urinary Tract

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ABSTRACT

Urinary stone (calculi) disease is the most prevalent occurrence in the outpatient urology department by far. It is becoming more and more common worldwide. Since most of the calculi might recur, understanding chemical composition is crucial. **Objective:** To analyze the different compositions of calculi removed from urinary tract. **Methods:** A descriptive study was performed in the Department of Urology, Avicenna Medical College and Hospital, Lahore, from July 2016 to October 2022. 300 Patients operated for urinary stone disease were selected as the sample population. All calculi removed from these patients were subjected to stone analysis and then results were prepared. **Results:** The most common stone type based on chemical composition was calcium oxalate (52%), followed by uric acid stones (25%), mixed stones (17%) and magnesium ammonium phosphate MAP (5%). Other less common types were accountable for only 1%. **Conclusions:** Calcium oxalate, uric acid and mixed composition stones are most common varieties in the draining area of our hospital setup.

INTRODUCTION

The most common presentation in urology outpatient department is urinary stone (calculi) disease. its prevalence is increasing worldwide [1]. The incidence of urinary stones has been reported to be 5.8% in China and 12% in India [2, 3]. Unfortunately, no authentic data is available in Pakistan. Understanding the chemical composition (stone analysis) of these calculi is very important for prevention of recurrence [4]. Patients who develop calculi in early age are at increased risk of recurrence [5]. If we know the chemical composition of stones removed from urinary tract, we can advise the patient about dietary precautions, life style modifications, medication or further investigations to prevent future recurrence of stone [6]. Stone analysis can also tell us that which type of stone is most common and which one is least common in our society. Chemical composition of urinary calculi depends upon metabolic disorders, environmental, geographic, socio-economic factors, presence of urinary tract infection [7]. Knowledge of chemical composition is very important as most of these calculi can recur [8, 9] Once the patient has been operated and stone has been removed, measures to prevent the recurrence depend

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solely on the chemical composition of the stone [10, 11].

METHODS

A descriptive study was conducted in the Urology department of Avicenna medical college and hospital Lahore. A total of 300 patients were included in study by simple random sampling and sample size was measured using formula of adjusted sample size

$$(S)/[1+(S-1)/Population]$$

where, S = sample size for infinite population, Z = Z score, P = population proportion (Assumed as 50% or 0.5) and M = Margin of error.

Patients who had first presentation with renal and upper ureteric calculi and who underwent surgery were included in the study. Patients who removed their calculi by medication or lithotripsy were excluded from the study. Calculi or pieces of calculi were collected during surgery. patients usually underwent pyelolithtomy, PCNL, ureterolithotomy or URS. Patients clinical data like age, sex, site of stone was collected. Study was carried out from July 2016 to October 2022. Stones were sent to laboratory for stone analysis. Stone analysis was carried out using infrared spectroscopy, chemical composition or x-ray diffraction. Data were analyzed using SPSS Statistics V22.0, mean, frequency and percentages were calculated using descriptive stats.

RESULTS

A total of 300 patients were operated and same number of calculi were sent for analysis. out of 300 patients,75 were females and 225 were males. Male to female ratio was 3:1. Mean age was 35 years with 50% patients falling between 25 years to 45 years(table 1).

Table 1: Demographic Characteristics of Participants(N=300)

Variables	Frequency (%)
Gender	
Male	225 (75)
Female	75 (25)
Age	
0-15	27 (9)
15-25	43 (14.3)
25-35	79 (26.3)
35-45	71 (23.6)
45-55	30 (10)
55-65	28 (9.3)
65 and above	22 (7.3)

Out of these the 300 patients who had calculi removed, 69 were removed from ureter and 271 were removed from kidneys(table 2).

Table 2: Sites of Calculi Removal

Site of Removal	Frequency (%)
Kidney	23 (177)
Ureter	69 (23)

The most common stone type on chemical composition was calcium oxalate(52%),followed by uric acid stones (25%), mixed stones (17%),magnesium ammonium phosphate MAP (5%) Other less common types were accountable for only 1%. As far as the distribution of chemical composition according to gender was considered, there was no major difference in both sexes. Equal percentages of chemical composition of calculi were observed in both sexes with very negligible difference (table 3).

Table 3: Distribution of Calculi based on their Chemical Composition

Chemical Composition	Frequency (%)
Calcium oxalate	156 (52)
Uric acid	75 (25)
Mixed	51 (17)
Magnesium Ammonium Phosphate (MAP)	15 (5)
Others	3 (1)

DISCUSSION

Stone analysis is an important post operative investigation that should be carried out in all patients under going any stone removal surgery [12-14]. An important aspect of management of urolithiasis is prevention of recurrence [15]. There are different methods being used for stone analysis, out of these infra red spectroscopy, chemical analysis and x-ray diffraction are most commonly used [16]. Among these three methods chemical analysis is cheap, quick results and can be performed in any laboratory [17]. In our study, the most common stone type based on chemical composition was calcium oxalate(52%),followed by uric acid stones (25%),mixed stones (17%), magnesium ammonium phosphate MAP (5%) Other less common types were accountable for only 1%. In a similar study of 258 calculi removed from upper urinary tract by Zafar *et al.*, from south punjab showed that calcium oxalate are the most common stone type followed by mixed variety [18]. According to a study conducted by Shahjehan and Rahman, forty stones were examined in order to identify the etiological variables. There was a significant prevalence of urates in the stones, and the majority of the stones were of mixed types. When comparing 29 stone formers to 21 normal people, the associated etiological factors seem to be abnormalities in urine pH, crystalluria of calcium oxalate—dihydrate and hypercalciuria in certain cases, and elevated serum and urine mucoproteins in adults [8, 19]. In another study conducted at Dera Ghazi Khan by Sial *et al.*, found that mixed stones are the most common variety.

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calcium oxalate being the 2nd and uric acid calculi being the 3rd [20]. Rizvi and colleagues conducted a study in Karachi concluded that most common stone variety was calcium oxalate and second most common variety was mixed calculi containing calcium oxalate, uric acid, calcium phosphate [21]. As far as the international data was studied, we found that calcium oxalate was around 77% in china,58% in united states of America,39% in United Kingdom and 75% in Sudan [22]. One of the important limitation of our study is that it is single center study and the data might not show the real prevalence of stone composition, later on we might take on board and collect data from other centers in the city to portray a true picture of the chemical composition of urinary calculi in the area. Another limitation was that we only considered calculi which were surgically removed from urinary tract, we have not included in the study the calculi those who naturally passed through urethra.

CONCLUSIONS

Concluding the whole study, the most common variant of calculi according to chemical composition in draining population of our hospital was calcium oxalate followed by uric acid.

Authors Contribution

Conceptualization: AAC
Methodology: ABN
Formal analysis: NA, SS
Writing-review and editing: HRA, MZA, MA, ABN

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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