

Research Article

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Frequency of Kidney Stone Different Compositions in Patients Referred to a Lithotripsy Center in Ilam, West of Iran

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Introduction: Ilam is one of the provinces with the highest prevalence of kidney stone. The aim of this study was to calculate the frequency percentage of kidney stones by composition in Ilam.

Materials and Methods: This cross-sectional study was conducted on 160 patients referred to the lithotripsy center of Ilam for the treatment of kidney stones from 2014 to 2015 (9 months). A two-part questionnaire including demographic information and stone type was used for collecting data. Finally, the obtained data were analyzed with SPSS version 17.

Results: The frequency of kidney stones was 68% in men and 31.8% in women. The prevalence of kidney stones was higher in men than women, but there was no significant relationship between gender and the stone type. The highest prevalence of the stone was in the age group 31-41 years (33.7%) and there was a significant relationship between age and the stone type ($P=0.001$). The frequency of calcium oxalate (CaOx), mixed, uric acid, and cysteine kidney stones was 61.25%, 36.25%, 1.9%, and 0.6%, respectively. The most prevalent mixed stone was uric acid together with calcium oxalate stones (21.8%) followed by CaOx together with calcium phosphate stones (10.6%).

Conclusions: The prevalence of CaOx and uric acid and CaOx stones was high. It is likely the increase in mixed stones in Ilam, especially uric acid and CaOx stones, is due to the nutritional pattern of subjects. More studies are required to determine the relationship between the stone type and diet in this area.

Keywords: Kidney stones; Nephrolithiasis; Urolithiasis; Calcium phosphate; Calcium oxalate; Struvite; Uric acid.

Running Title: Frequency of Kidney Stone in Ilam

Introduction

Kidney stone is one of the most important diseases which has been known for many years [1]. Kidney stone results from an imbalance between the solvent and solute in the urine and the deposition of minerals in the inner urine ducts [2]. Kidney stone is a common disease that affects 4-7% of the

world population [3]. This disease has the highest prevalence in developed and rich countries; its prevalence has been reported 2-3% in developed and 0.5-1.5% in developing countries [4, 5]. The prevalence of this disease in Iran has been reported 4.2 per thousand, which is a high prevalence [6].

The highest prevalence in Iran has been reported in western and southwestern provinces such as Ilam, Kermanshah, Hamedan, Kurdistan, and Lorestan [7-9].

Severe flank and back pain following expansion, tension, and spasm in 20% of the cases is the symptoms of the kidney stone. The highest incidence of this disease is seen in individuals aged 20 to 30 years [7]. Various factors could be involved in the formation, incidence, and prevalence of kidney stones including high blood pressure, type 2 diabetes, obesity, diet, fluid intake, race and ethnicity, metabolic diseases, and genetic causes [8].

Fifty percent of people with kidney stones have been once again within a period of 10 years. The risk of stone recurrence depends on its type. For example, if the core stone is uric acid, the risk of infection will increase due to its low stability [10]. Stones types include calcium oxalate, calcium phosphate, uric acid, Struvite, uric acid, and mixed stones.

Calcium stones are the most common and account for approximately 70- 80% of the stones. They are seen in several forms. They can be seen as pure stones or in combination, mostly as calcium oxalate (CaOx) and calcium urate and in rare cases as calcium phosphate [11-15]. Predisposing factors for these stones include hypercalciuria, oliguria, hyperparathyroidism, hyperoxaluria, malignancies, sarcoidosis, hyperthyroidism, renal tubular, inflammatory bowel disease, and genetic factors [16- 18].

Uric acid stones have a prevalence of approximately 10%. These stones tend to form in people with hyperuricosuria [19-22]. About 20-30% of the patients have a history of gout. High protein diets, medications, and IBD are predisposing factors for these stones. Purine resulting from proteins during the catabolism process converts to uric acid [21, 23,24]. The risk of uric acid stones in a urinary pH less than 5.5 is high because uric acid in cysteine his pH, is Low solubility [25].

Cysteine stones are seen in people who have cystinuria. They have a low prevalence of 1%. Cysteine stones have an equal frequency in men and women. This type of stones can be seen in children. The most common causes are infection and urinary tract obstruction [26,27].

Struvite stones, also called infectious stones (staghorn), have a prevalence of 10%. These stones are formed in the upper urinary tract and one of the reasons for developing this type of stone has been reported infection by urease-producing bacteria.

The prevalence of this stone is three times higher in women than men [28-30].

Mixed stones are a mixture of some stones such as calcium and uric acid [31].

Diet can have a direct effect on the urine PH. Because the urine PH is very important for the formation of some stones, the type of the stone can depend on the diet and nutritional habits of the society [32]. Appropriate assessment and management of the diet can greatly prevent the recurrence of kidney stones [25,32]. For this reason, proper assessment and medical treatment are necessary to know the stone type. As for the high prevalence of kidney stones, especially in the west band and costly treatment of this disease, the recurrence of the disease can be decreased by determining the type of the stone. Thus, this study aimed to determine the frequency of kidney stones by composition in patients referred to a lithotripsy center in Ilam.

Materials and Methods

Study Population:

In this descriptive -analytical study, the subjects were randomly selected from patients referring to a lithotripsy center in Ilam for the treatment of their kidney stones from 2014 to 2015 (9 months). The sample size was estimated 117 patient based on the prevalence of kidney stones in Iran (5.7%) in a study by Safarinejad [33] using the statistical formula $[N=1/d^2(Z^2P(1-P))]$. However, 240 patients were studied because it was possible that the stone could not exerted in some of them.

Inclusion and Exclusion Criteria:

Inclusion criteria were Iranian nationality, having kidney stones, the passage of stones during the study period, and willingness to cooperate. Patients whose stones were not specified, and those whose stones did not pass during the 9 months of the study were excluded. Accordingly, 80 patients were excluded: 60 of them did not pass their stones and 20 did not have the inclusion criteria.

Procedures:

The data collection tool was a two-part questionnaire. The first part of the questionnaire included demographic information (age, gender, etc.) and the second part included the information subordinate with the kind of stone. The study started after completing the consent form by the patients. The first part of this questionnaire was completed through visiting Asia lithotripsy center of Ilam and face-to-face interview. Then, the patients received explanations about how to collect

the stones after passage and were asked to keep the stones. For this purpose, to complete the second part of the questionnaire, telephone contacts were made with the patients one week after lithotripsy to ask whether the stone was passed. If the stone was passed, the patient was asked to deliver it to a special laboratory for determining the stone type and analyzing it. Analysis of the stones was conducted by the qualitative method using chemical reagents of stone ingredients and interpretive kits. If the stone was not passed, the patient was contacted again two weeks later. The patients were followed for 9 months. The patient was on the final list if the stone was passed and sent to the lab. Then, test results received by referring a colleague in Asia Lab and the second part of the questionnaire was completed.

Statistical Analysis:

The data were collected and analyzed using SPSS version 16. Chi-square and T-test were used for inferential statistics and also descriptive statistics. P values less than 0.05 were considered significant.

Results

Of 160 people whose stones were analyzed completely, 109 patients (68.1%) were men and 51 (31.9%) were women. The age range of the patients was 9-81 years with the mean of 1.1 ± 43.8 years.

The frequency of pure stones was 63.8%. CaOx stones had the highest and cysteine stones had the lowest frequency with 98 (96%) and with 1 (0.98%) case, respectively (Table 1).

The frequency of pure stones was 63.7% in men and 36.3% in women. CaOx stones with 60.7% and 35.2% in men and women respectively have the most prevalence. The details of the stone type based on sex are shown in Table 1.

There was no significant relationship between gender and stone type (P = 0.371).

The frequency of impure stones was 36.2%. CaOx + uric acid + calcium phosphate (CaP) had the minimum (1.7%) and CaOx + uric acid had the maximum frequency (60.3%) (Table 2).

According to Table 3, the frequency of kidney stones by age showed the highest prevalence was in patients in the third and fourth decades. The third and fourth decades of life accounted for 25.6% and 23.7% of kidney stones, respectively. The lowest prevalence was seen in the first and eighth decades of life.

The relationship between the type of the kidney stone and age was statistically significant (P<0.0001).

Table 1. Frequency of kidney stone type by gender

Gender	Calcium Oxalate	Mixed	Cysteine	Uric Acid	Total
Male	62 (38.7%)	44 (27.5%)	1 (1.25%)	2 (1.25%)	109 (68%)
Female	36 (22.5%)	14 (8.8%)	0	1 (6%)	51 (31.8%)
Total	98 (61.25%)	58 (36.25%)	1 (0.6%)	3 (1.9%)	160 (100%)

Discussion

Diet, geographic location, race, background diseases, and lifestyle can be mentioned among the underlying factors of kidney stones. The stone type very much depends on the diet [25, 34, 35]. In our study, the prevalence of stones was 61.2% for CaOx, 36.2% for mixed, 1.8% for uric acid, and 62% for cysteine stones. In a study in Saudi Arabia, the frequency of different types of kidney stones was 78% for CaOx, 19% for uric acid, and 3% for struvite that is similar to the results of our study on CaOx [36]. In another study conducted in Isfahan, the most frequent stone was mixed stones (87.6%). The frequency of other stones was 10.7% for CaOx, 1.7% for CaP, and 4% for uric acid [6]. The difference may be related to different geographical location.

The prevalence of CaOx stones was 50.6% in a review study conducted on a sample of 1301 people in Tunisia [37]. In another study with a sample size of 44 people in Iraq, the frequency of mixed stones was reported 100% [38] which is not consistent with the results of our study maybe due to racial or diet differences.

Our results showed that kidney stones were more prevalent in men than women with a ratio of 2:1. These results are consistent with the results of a study by Altaf [39]. This could be due to greater production of Estrogen in women than men. Estrogen prevents the formation of kidney stones by increasing the production of citric acid [39]. In our study, the prevalence of mixed stones was 36.2% with a ratio of 3:1 in men to women. In a study by Tadayyon, the prevalence of these stones was reported 87.6% [6]. Also, the prevalence of mixed stones was reported 55% in a study by Altaf [39]. This difference could be due to differences in the lifestyle and geographical location.

In the present study, among mixed stones, CaOx + uric acid stones were the most prevalent (21.8%). The frequency of CaP, uric acid and CaOx stones was 62%, the frequency of CaP and CaOx stones was 10.6%, the prevalence of CaP and uric acid

Table 2. Frequency of mixed stones by gender

Variable	Calcium Phosphate+ Calcium Oxalate	Calcium Phosphate + Calcium Oxalate + Uric Acid	Calcium Oxalate + Uric Acid	Calcium Phosphate + Uric Acid	Calcium Oxalate + Cysteine	Total
Male	12 (37.2%)	0	27 (61.3 %)	2 (4.5 %)	3 (6.1 %)	44 (100%)
Female	5 (35.7%)	1 (7.1%)	8 (57.1 %)	0	0	14 (100%)
Total	17 (29.3%)	1 (7.1 %)	35 (60.3 %)	2 (3.4 %)	3 (5.1 %)	58 (100%)

Table 3. Frequency distribution of stones by age

Type of Stone	Pure			Impure				
	Calcium Oxalate	Uric Acid	Cysteine	Calcium Oxalate + Calcium Phosphate	Calcium Oxalate + Uric Acid	Calcium Oxalate + Calcium Phosphate + Uric Acid	Calcium Oxalate + Cysteine	Calcium Phosphate + Uric Acid
Age								
9-19	3	0	1	0	0	0	1	0
20-29	1	0	0	2	2	0	1	1
30-39	226	1	0	6	9	1	1	0
40-49	22	1	0	5	6	0	0	1
50-59	19	0	0	1	12	0	0	0
60-69	13	1	0	3	4	0	0	0
70-83	3	0	0	0	2	0	0	0
Total	98	3	1	17	35	1	3	2

(stones was 1.2%, and the prevalence of CaOx and cysteine stones was 1.8%. In the study by Tadayyon et al, the frequency of mixed stones; CaOx and CaP, CaOx + CaP + uric acid; CaOx + uric acid; CaP + uric acid; CaOx + struvite; and CaOx + CaP + uric acid + cysteine was 40.5%, 14.5%, 10.2%, 4.2%, 3.8%, and 85%, respectively [6]. In the study by Altaf et al, the prevalence of CaOx + uric acid stones was 37%, and the prevalence of CaOx + CaP stones was 5% [35], which is close to the results of our study.

In this study, the highest frequency of uric acid + CaOx stones was seen in men with 27 cases and the male to female ratio of the prevalence was 3:1, which is close to the results of a study by Riyadh et al [36].

In our study, the highest prevalence of pure and impure stones was seen in the age group 30-39 years. Calcium oxalate had the highest prevalence of stones in this group followed by calcium + uric acid. In our study, the age of the patients was higher than 9 years and the mean age of the population was 43.78±1.45. Also, the highest prevalence of the stones was seen in the age group 30-39 years (25.8%) and 40-49 years (20.5%), which is consistent with the results of the study by

Tadayyon et al [6]. In another study conducted in New York in 2006, the highest prevalence was reported in the age group 18- 45 years [35]. In our study, a significant relationship was found between age and stone type, which is consistent with the results of a study by Antonia Boza [40].

Conclusions

In our study, the prevalence of CaOx and uric acid + CaOx stones was high. It is likely the increase in mixed stones in Ilam, especially uric acid + CaOx stones, is due to the nutritional pattern of the subjects. However, more studies are required to determine the relationship between the stone type and diet in this area. Since the formation of these stones is directly related to diet, it is recommended to consider dietary modifications in addition to medical treatment to prevent recurrent kidney stones and reduce their risk.

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Conflict of Interest

None expressed.

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