

Stone composition of urinary tract stones from our region

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Özet

Bölgemizdeki üriner sistem taşlarının taş içeriği

Amaç: Bölgemizde tedavi edilen üriner sistem taş hastalarının taş kompozisyonunun spektrumunu değerlendirmek. Metod: Ekstrakorporeal şok dalga litotripsi, endoskopik veya çeşitli açık cerrahi yöntemleriyle elde edilenler ile hastaların kendi düşürdükleri toplam 710 üriner taş, laboratuvarında esas olarak mineralleri saptamak için kullanılan kimyasal ve fizikokimyasal yöntemler kullanılarak incelendi. Bulgular: Taşların 454'ü (%64.9) kalsiyum okzalat, 104'ü kalsiyum fosfat (%14.6), 99'u struvite (%13.9), 24'ü ürik asit (%3.3), 21'i karışık (%2.9), 5'i (%0.7) sistin, 3'ü ksantin (%0.4) idi. Sonuç: Bizim bölgemizde kalsiyum taşları, özellikle kalsiyum okzalat diğer taş tipleri arasında daha fazla görülmektedir. Enfeksiyon taşları da kalsiyum fosfat taşlarına yakın seviyede belirgin bir insidansa sahiptir. Bu veriler taş analizi değerlendirilmesi yapılmamış hastalarda beslenme önerileri ve tedavi planları için yararlı olabilir.

Anahtar kelimeler: içerik, kalsiyum okzalat, üriner taş

Abstract

Objective: To evaluate the spectrum of urinary tract stone compositions in patients managed at one center. Methods: A total of 710 urinary calculi, passed spontaneously or after extracorporeal shock-wave lithotripsy as well as collected by endoscopic or open surgical procedures were analyzed by applying chemical and physicochemical methods primarily used for detecting minerals in our laboratory. Results: The distribution of stone compositions were noted as 454 (64.9%) calcium oxalate; 104 (14.6%) calcium phosphate; 99 (13.9%) struvite; 24 (3.3%) uric acid; 21 (2.9%) mixed; 5 (0.7%) cystine; and 3 (0.4%) xantine stones. Conclusion: Calcium stones, calcium oxalate in particular predominate among other types of urinary calculi in our center. Infection stones still have a considerable incidence that stays near to calcium phosphate calculi. This data can be helpful for dietary recommendations and treatment plans in cases without stone type assessment.

Key words: composition, calcium oxalate, urinary calculi

Introduction

Urolithiasis is a common urologic disease and effects the population in all countries. The overall probability of forming stones is different in various parts of the world (1,2). Studies have concluded that the prevalence of urolithiasis has been increasing in parallel to the progressive increase in animal protein intake, which reflects the gradual rise in living standards (3-5). Stone composition may also have changed during this period (6,7). Knowing the composition of urinary stone is important because

urolithiasis is a recurrent disease and preventive measures must be based on such information. Urinary stones may contain different combinations of chemicals. The most common type of stones is comprised of calcium in combination with either oxalate (8,9) or phosphate. Struvite stone is a less common type that is caused by infection in the urinary tract. Uric acid stone, however, is much less common than struvite stone. Cystine is a rare stone. The aim of our study was to evaluate the spectrum of urinary tract stone compositions in patients managed at one center with the hope of applying the data obtained to the study of the etiology of stone formation, treatment of stones, and the prevention of stone recurrence.

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Material and Methods

A total of 710 urinary calculi were included in the analysis. Patients had no previously known predisposing metabolic disorder. Stones that passed spontaneously or after extracorporeal shock-wave lithotripsy as well as collected by endoscopic or open surgical procedures were analyzed by applying chemical and physicochemical methods primarily used for detecting minerals in our laboratory. The results of stone composition analysis were collected retrospectively.

The stones were first ground into a fine powder and the analysis done by chemical methods as reported by Wootton (10). Cold N-nitric acid was added to the powder. Efferevescence indicated the presence of carbonate. The mixture was then boiled, cooled and filtered. The filtrate was then used to detect calcium with ammonium oxalate, magnesium with potassium phosphate and ammonia, phosphate with ammonium molybdate and oxalate with calcium chloride. The powder was boiled with N-potassium hydroxide and Folin's uric acid reagent and sodium cyanide was added to the filtrate to detect uric acid. Cystine was detected with sodium cyanide and sodium nitroprusside.

According to chemical and physicochemical methods primarily used for detecting minerals in urinary stone composition, urinary calculi were classified into seven groups: calcium oxalate, calcium phosphate, struvite, uric acid, mixed, cystine and xantine stones.

Results

The distribution of stone compositions were noted as 454 (64.9%) calcium oxalate; 104 (14.6%) calcium phosphate; 99 (13.9%) struvite; 24 (3.3%) uric acid; 21 (2.9%) mixed; 5 (0.7%) cystine; and 3 (0.4%) xantine stones (Figure 1). The results of urinary stone analysis are also summarized in table 1.

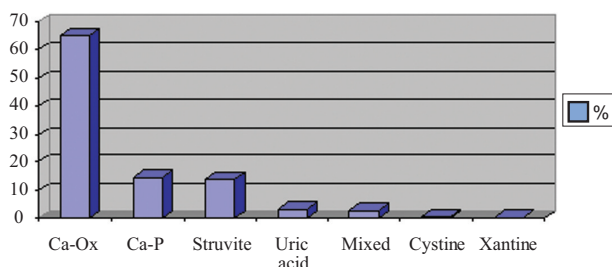


Figure 1. Distribution of stone compositions

Table 1. Composition of urinary stones

Stone type	Number of stones	Percentage (%)
Calcium oxalate	454	64.9
Calcium phosphate	104	14.6
Struvite	99	13.9
Uric acid	24	3.3
Mixed	21	2.9
Cystine	5	0.7
Xantine	3	0.4

The range of patients age was 2– 79 years (mean: 31 years) and male to female ratio was approximately 2:1. Number of stone formers in each stone type according to age and sex are given in Table 2.

Discussion

According to the European Association of Urology Guidelines on Urolithiasis, stones that pass spontaneously are removed surgically, or excreted as fragments following disintegration, should be subjected to stone analysis to determine their composition (11-15).

Questions have also arisen about the necessity of chemical stone analysis for patients with nephrolithiasis. It has been stated that although stone composition analysis is not always feasible or desirable, there is helpful information from such an investigation that can aid with preventive therapy (16). Other investigators have found that knowledge of the stone composition can be a helpful adjunct to a metabolic evaluation. Pak et al. (17) reported that calcium apatite and mixed calcium oxalate-calcium apatite stones were associated with the diagnoses of renal tubular acidosis and primary hyperparathyroidism.

Ansari et al. (18) had listed the reasons to research for stone composition as follows: (i) to provide an understanding of the nature of the underlying metabolic disturbances that lead to the stone formation; (ii) with the advent of Shock Wave Lithotripsy, to be able to predict the stone fragility (i.e. the ease with which a given stone might be fragmented) and hence the suitability of a given patient for a given protocol; (19) (iii) to predict the basic wavelength of laser light to be used for maximum effect in treatment; (20) and (iv) to permit urologists to advise patients on how to prevent further recurrence.

The currently available literature on urinary calculi clearly shows a different urinary stone composition pattern across the world. The calcium oxalate is the most frequent chemical compound in composition of urinary stones. Pak et al (17) reported that the most

common form of kidney stones were calcium oxalate (74.8%), mixed calcium oxalate–calcium apatite (34.8%), calcium phosphate alone (10.5%), uric acid stones (5.8%), infection stones (3.9%), and cystine stones (2.7%). In an analysis of 10617 urinary calculi Daudon *et al.* found that 65.98% were oxalate calculi (21). In our study, calcium oxalate stones were found in 64.9% of all cases. As compared to the European studies, the Indian counterparts produced very different results. These studies showed a high incidence of calcium oxalate stones which is significantly higher than that in Western countries (22-25).

Knowing about the composition of a urinary stone can be helpful in the selection of stone treatment modality. For instance, calcium oxalate and struvite stones are more amenable to disintegration by shock wave lithotripsy than are those composed of cystine (26). In some conditions, definition of urinary stone composition may yield the underlying metabolic disturbance, such as the relation between magnesium ammonium phosphate stones and chronic infection of the urinary tract with a urea-splitting organism (27). For more common stones like calcium oxalate or calcium phosphate, the diagnostic value of stone composition is less apparent (28). Renal tubular acidosis and primary hyperparathyroidism are associated more likely with calcium phosphate stones than with calcium oxalate stones (17). Uric acid stones are associated with gouty diathesis.

Complete urinary stone disease treatment consists of both removal of the stone and prevention against recurrence. To prevent stone recurrence, it is better to be able to detect underlying metabolic disturbance and know the stone composition. It is also necessary to know the stone composition before choosing the treatment techniques and during the treatment of this disease, which has a very high potential of recurrence, in order to make adequate metaphylaxis to ensure less morbid and more cost-effective treatment especially in the regions with high prevalence. Urinary stone disease is increasingly common especially in wealthy industrialized countries. Eating habits and lifestyle have a direct effect on the lithogenic urinary risk factors and the pathogenesis of this condition. A diet characterized by a high intake of fluids, fruits, and vegetables; a low consumption of salt and protein; and a balanced intake of calcium, fats, and carbohydrates constitutes an efficacious approach to the prevention and treatment of this illness. A correct body weight, regular exercise, and

a reduction in stressful life events are also useful preventive actions. Besides these general preventive measures, special dietary changes can be offered to patients with the knowledge of stone type. One of the limitations of this study is the type of method used for stone analysis. Chemical analysis is frequently used in various centers and but its margin of error is relatively high. In last years, three methods turned out to be the best methods of stone analysis: X-ray diffraction, infrared spectroscopy, and polarization microscopy. It is reported that these methods meets the demands for stone analysis (29). Calcium stones, calcium oxalate in particular predominate among other types of urinary calculi in our region. Infection stones still have a considerable incidence that stays near to calcium phosphate calculi. This data can be helpful for dietary recommendations and treatment plans in cases without stone type assessment.

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