



Pan African Urological Surgeons' Association

African Journal of Urology

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www.sciencedirect.com



Original article

An epidemiological study on the composition of urinary stones in Morocco in relation to age and sex



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Received 21 January 2015; received in revised form 19 February 2015; accepted 20 February 2015

KEYWORDS

Urolithiasis;
Epidemiology;
Stone composition;
Infrared spectroscopy

Abstract

Objective: To study the composition of urinary stones, evaluate the percentage of each stone type and assess the association between the stone type and the sex and age in Moroccan stone formers.

Subjects and methods: This epidemiologic study of urolithiasis was carried out in the Rabat-Salé region (Morocco) between 2008 and 2013. A series of 828 urinary stones from 537 men and 265 women was analyzed using Fourier transform infrared spectroscopy in order to evaluate the percentage of each stone type. The results were compared to the patients' demographic data in order to assess the association between the stone type and the sex and age.

Results: The overall sex ratio (male/female) was 2.03:1, and the majority of patients were aged between 40 and 60. The majority of stones were composed of calcium oxalate (66.6%), followed by anhydrous uric acid (18.1%), carbapatite (7.9%), struvite (4.4%) and cystine (0.6%). Anhydrous uric acid stones in this study accounted for a relatively higher rate in males and females compared to that reported in other studies. Our results also showed a higher percentage of carbapatite stones in females compared to males and an increase of the prevalence of anhydrous uric acid stones with age. In addition, the percentage of calcium oxalate stones decreased, while that of carbapatite stones increased with age.

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Peer review under responsibility of Pan African Urological Surgeons' Association.

<http://dx.doi.org/10.1016/j.afju.2015.02.006>

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Introduction

Urolithiasis is characterized by the formation of a stone in the kidneys or urinary tract. The prevalence is estimated to be about 1–5% in Asia, 5–9% in Europe, 13% in North America and 20% in Saudi Arabia [1–3]. In addition, the recurrence rate is increasing and exceeds 50% over a 5 to 10-year period [4]. Therefore, prevention of stone formation is of great importance in the first place.

Shockwave lithotripsy (SWL), ureteroscopy (URS), percutaneous nephrolithotomy (PCNL) and open surgery are all effective methods to remove urinary calculi, and knowing the urinary stone composition is frequently a key factor in determining the most appropriate management [5]. Urinary stone analysis is a tool for assessing the possible etiology and the physiopathology of stone formation [6]. Fourier transform infrared spectroscopy (FT-IR) is now considered a standard method for stone analysis. It requires a minimal sample volume and is very sensitive and selective for all stone components [6,7].

Stone analysis is a routine test for patients with urolithiasis in Western countries, but not in Morocco. To our knowledge, there are no large-scale data about stone composition. Hence, we evaluated the percentage of each stone type and established the association between the stone type and the sex and age of the patients.

Subjects and methods

Between January 2008 and September 2013, 828 stones were collected from 537 men (67%) and 265 women (33%) attending the urological and nephrological services of the Hospitalo-University Centers in Rabat-Salé. The stones were obtained from spontaneous passage, endoscopy (URS and PCNL), SWL and open surgery.

The patients' average age was 49 (range 20–87) years for the men and 48 (range 18–86) years for the women. For 26 stones, no information concerning the sex of the patient was available. The overall male/female ratio was equal to 2.03:1.

All stone samples were washed using distilled water and dried at 60 °C for 24 h. Every stone was analyzed entirely from the core to the surface. The fragments of stones collected by endoscopic methods were recomposed to establish their original shape as effectively as possible.

A pulverized stone sample (5%) was mixed with potassium bromide (KBr) using a pestle and mortar. From this mixture, a calculus + KBr tablet was prepared at 10 tons of pressure under vacuum for 2 min [2,7]. In a final step, the tablet was analyzed using the JASCO FT-IR Spectrophotometer 460-PLUS.

The results were analyzed by chi-square test. A statistical significance was defined as $P < 0.05$.

Results

A first classification of the stones according to sex and age showed that stones affect all age groups regardless of sex, with a predominance of the age group 31–60 years (Table 1), and a higher prevalence of stones in male patients.

Table 1 Anatomical location of the stones according to age.

Location	Age range					
	18–30 years		31–60 years		>60 years	
	N	%	N	%	N	%
Kidney	26	71.8	159	67.7	33	44
Ureter	10	25.6	50	21.2	8	10.7
Bladder	1	2.6	26	11.1	34	45.3

Furthermore, the anatomical location was largely renal (62.9%), with an increase of bladder stones after the age of 60 with a prevalence of 45.3%.

Extracorporeal lithotripsy was the most common method for urinary stone removal, accounting for 43.7%. Conventional surgery was still common, representing 35.6% of cases compared to 14% of spontaneous expulsion and 6.8% endoscopic treatment.

In this series, 13 stone types were identified: calcium oxalate monohydrate (COM), calcium oxalate dihydrate (COD), carbapatite (CARB), struvite (STR), whitlockite, brushite, amorphous carbonated calcium phosphate (ACCP), uric acid (URI) (anhydrous and dihydrate), urates ammonium and sodium (URA), cystine (CYS) and proteins which are found in almost all stones. Most of the stones had a mixed composition ranging from 2 to 5 components with a predominance of a combination of COM, COD and CARB.

Among the 828 stones, 66 contained struvite (8.0%). The review by sex shows that 26/265 women (9.8%) and 39/537 men (7.2%) had struvite stones, indicating that an increased bacterial infection was frequently involved in the formation of urinary calculi in both sexes.

The stones were classified according to their major components (Table 2). The preponderant type of stone was COM (56.4%), followed by URI (18.1%), CARB (7.9%), COD (10.2%), STR (4.4%) and CYS (0.6%). The other (OTH) types accounted for less than 1% of the cases.

COD occurred more frequently in males than in females ($P < 0.05$), whereas carbapatite and urate stones were more prevalent in females than in males ($P < 0.05$).

We also studied the frequency of the main components in terms of age (Table 3). CaOx was mainly found in the age group 18–30 years, while anhydrous uric acid was more common after the age of 60 ($P < 0.05$).

Examination of crystalline phases showed that COD was 2–6 times less frequent than COM depending on the age, while the prevalence of COM varied widely from 53.4% (31–60 years) to 31.2% after 60 years. A small proportion of CaPh was noted in the age group 18–30 years (6%); this proportion rose slightly in older age groups. URI accounted for 6% of stones in patients aged between 18 and 30 years, then its frequency increased gradually to 49.5% in the age group above 60 years. In contrast, struvite stones represented 6% of stones in the age group 18–30 years, and then its incidence decreased slightly in older age groups. Similarly, ammonium urate stones represented 2% of lithiasis in patients aged between 18 and 30 years, while their incidence dropped to less than 0.6% with increasing age.

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