Thamar University Journal of Natural & Applied Sciences ISSN: 2073-0764
2012 A(**5**) 11-19

Biochemical Compositions of Urolithiasis among Yemeni Patients

Taher Aithah[1], Ahmed A. K. Thabet[2], Khaled Baker[3] and Saaed Albahlooli[4]

1. Urologist, Surgical Department, Faculty of Medicine & Health Sciences, Thamar University , Yemen. E.maile : taheraithah@gmail.com.
2. Epidemiologist, communicable diseases specialist, Community Medicine Department, Faculty of Medicine & Health Sciences, Thamar University, Yemen. e-mail: thabet64@live.com.
3.Urologist, Surgical Department, Faculty of Medicine & Health Sciences, Thamar University , Yemen. E.maile : bakerkhaled@hotmail.com
4.Surgeon, Surgical Department, Faculty of Medicine & Health Sciences, Thamar University , Yemen. E.maile :Dr.saeed58@hotmail.com.

ABSTRACT

Objectives: Since the chemical composition of calculi is very important for the purpose of determining both the origin and etiology, the present study was therefore done to perform the chemical analysis of stones to know the pattern of biochemical composition of stones among Yemeni patients.

Methodology: Kidney stones were sent to Central Laboratory; in Sana'a, the capital of the Republic of Yemen for chemical analysis. The stones were washed in distilled water grinded and powdered in a mortar and were analyzed by samiquantitative method. The poweredred stones and standard both were analyzed for uric acid, cystine, oxalate, carbonates, phosphates; ammonia, calcium and magnesium contents. Data extracted from the records included age, sex, occupation and place of residence. The software SPSS 13.0 for Windows was used for data entry and analysis. Chi-Square test was used to compare between different results. P values < 0.05 were considered significant.

Results: One hundred eight (108) stones were analyzed chemically during the period from 1st January, 2010 to 30th October 2011. All patients were Yemeni from different part of the country working in the military and their families were included in the study. The mean age of the participants included in the analysis was 29.65 ± 11.36. There were 94 (87%) stones belonged to males, while 14 (13%) stones to female. The male to female ratio was 6:1.Out of a total of 108 stones, 60 stones (55.6%) were calcium oxalate, 30(27.8%) were uric acid mixed with calcium oxalate and 5 (4.6%) stones were phosphate mixed with calcium oxalate. The association between gender and biochemical composition of renal stones were positive and statistically significant (χ = 19.072, P s= 0.025).

Conclusions: Renal stone disease in Yemini was not uncommon .The majority were calcium oxalate, followed by uric acid stones. The relative increased frequency of stones in Yemen, which is a part of Mediterranean region, indicates that nutritional, environmental and genetic factors play a role in the occurrence of stones.
Keywords: urolithiasis, biochemical composition, Yemen.

INTRODUCTION

Urolithiasis is the first most common urological disease affecting both males and females; it is predominant among males in a proportion of approximately 2:1 [1, 2].

Urolithiasis incidence varies in different parts of the world , high incidence areas are Scandinavian Countries, Mediterranean Countries, British Isles , Northern Australia, central Europe, portion of the Malayan Peninsula, China, Pakistan and northern India, whereas the incidence of kidney stones formation is lower in areas like Central and South America and some parts of Africa.

In Asia stone -forming belt has been reported to stretch across Saudi Arabia, the United Arab Emirates, the Islamic Republic of Iran, Pakistan, India, Myanmar, Thailand Indonesia and Philippines [3]. Yemen lies in the south of Saudi Arabia.

The peak incidence is observed in the 2^{nd} and 3^{rd} decades of life. Renal Calculi are characterized clinically by renal colic as they pass down along the ureter and manifest as haematuria [4].

Both genetic and environmental factors contribute to stone formation. Factors believed to predispose to sporadic urinary lithiasis include hygienic-dietic issues, occupation, geographic and climatic aspects, as well as the special characteristics of drinking water. [5,6].

The biochemical aspects of the disease have centered on the metabolic activity of the patient including certain enzyme disorders. Winer [7], listed seven factors that may contribute to the formation of calculi:

- Metabolic disturbance such as gout
- Endocrinopathies
- Urinary obstruction
- Infectious
- Mucosal metaplasia
- Intrinsic conditions such as dehydration
- Dietary excess, drug excess, or hemotherapy
- Isohydruria

Analysis of urinary calculi is an essential step in the examination and initial treatment of the patient with kidney stones (urolithiasis). Knowledge of the composition of calculi yield fundamental information concerning the pathogenesis of the disease, including metabolic abnormalities, presence of infection, possible artifacts and even drug metabolism [8].

Most stones, approximately 75% are calcium containing largely of calcium oxalate mixed with calcium phosphate. Another 15% are called triple phosphate stones or struvite

stones composed of magnesium ammonium phosphate. 6%are uric acid stone and 1-2% is made up of cystine stones [9, 10].

Since the chemical composition of calculi is very important for the purpose of determining both the origin and etiology, the present study was therefore done to perform the chemical analysis of stones to know the pattern of biochemical composition of stones among Yemeni patients.

METHODOLOGY

Kidney stones were sent to Central Lab; in Sana'a, the capital of the Republic of Yemen for chemical analysis. These stones were removed surgically from the patients exposed to surgical treatments between 1st January, 2010 to 30th October 2011, in the "48 Model Hospital" in Sana'a, which is one of the majors Teaching Hospitals in the Republic Of Yemen. A request form having a brief history was sent with the patient's stone.

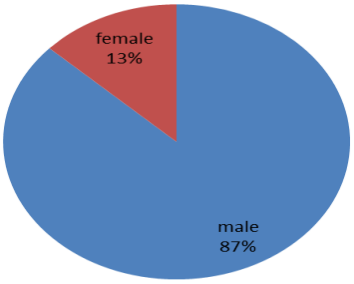
The stones were washed in distilled water grinded and powdered in a mortar and were analyzed by samiquantitative method [11]. The kits supplied by Mascia Brunell S.P.A (Italy) were used for chemical analysis of stones. The synthetic standard available in the form of fine powerder was analyzed along with the test samples to serve as a control. The poweredred stones and standard both were analyzed for uric acid, cystine, oxalate, carbonates, phosphates; ammonia, calcium and magnesium contents. Data extracted from the records included age, sex, occupation and place of residence.

The software SPSS 13.0 for Windows was used for data entry and analysis. Chi-Square test was used to compare between different results. P values < 0.05 were considered significant.

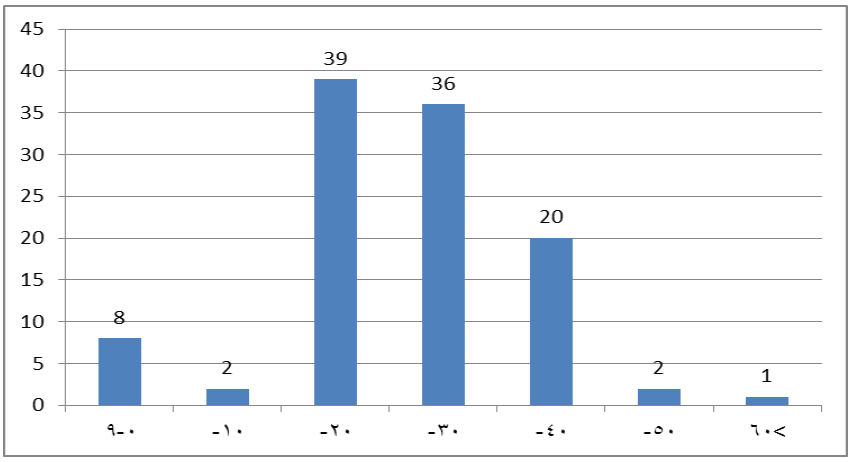
RESULTS

One hundred eight (108) stones were analyzed chemically during the period from 1st January,2010 to 30th October 2011. All patients were Yemeni from different part of the country working in the military and their families were included in the study.

The mean age of the participants included in the analysis was 29.65 ± 11.36. There were 94 (87%) stones belonged to males, while 14 (13%) stones to female (graph1& 2). The male to female ratio was 6:1.



Graph.1: distribution of urolithiasis according to the gender



Graph2. Distribution of urolithiasis according to the age groups

Out of a total of 108 stones, 60 stones (55.6%) were calcium oxalate, 30(27.8%) were uric acid mixed with calcium oxalate and 5 (4.6%) stones were phosphate mixed with calcium oxalate . Table1.Type of stones.

Table 1: urolithiasis according to the types of stones

Type of stones	**frequency**	**%**
uric acid	**2**	**1.9**
calcium+oxalate	**60**	**55.6**
calcium+oxalate+phosphate	**5**	**4.6**
magnisium+calcium+oxalate	**2**	**1.9**
calcium+oxalate+amonia+uric acid	**3**	**2.8**
calcium+oxalate+uric acid	**30**	**27.8**
calcium+oxalate+ammonia	**1**	**.9**
amonia+uric acid+oxalate	**1**	**.9**
calcium+phosphate+uric acid	**2**	**1.9**
cabonate+calcium+uric acid	**2**	**1.9**

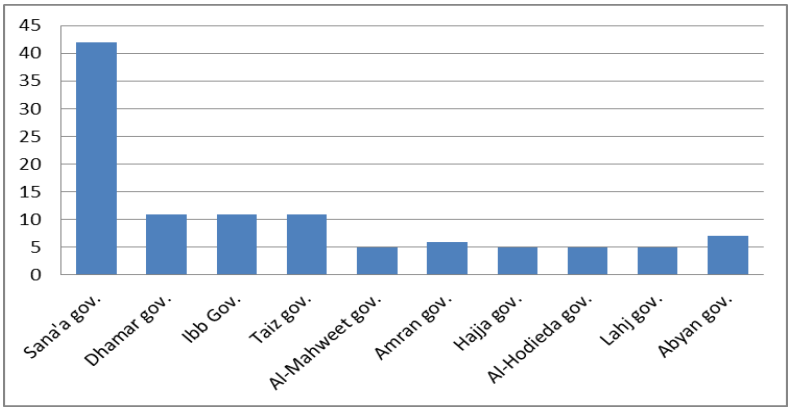
The association between gender and biochemical composition of renal stones were positive and statistically significant ($\chi = 19.072$, $P = 0.025$). Table2.

Table2. Relation between gender and biochemical compositions of renal stones

	biochemical compositions of renal stones* **										T	χ	p.
	Uric acid	Calcium+ oxalate	Calcium+ oxalate+phosphate	Magnesium+ calcium+oxalate	Calcium+oxalate +ammonia+uric acid	Calcium+ oxalate+uric acid	Calcium+ oxalate+amonia	Ammonia+ uric acid+oxalate	Calcium+ phosphate+uric acid	Carbonate+ calcium+uric acid			
M	1	54	5	0	2	26	1	1	2	2	94		
F	1	6	0	2	1	4	0	0	0	0	14		
T	2	60	5	2	3	30	1	1	2	2	108	19.072	0.025

*** M = Male, F = Female, T = total, χ = Chi square test, P = p – value < 0.05 significant.

Most patients were from Sana'a governorate 38.9% as shown in the graph 3.



Graph3. Distribution of urolithiasis according to the patient's place of residence

DISCUSSION

Analysis of urinary calculi is an essential step in the examination and initial treatment of the patient with kidney stones (urolithiasis). Knowledge of the composition of calculi yield fundamental information concerning the pathogenesis of the disease, including metabolic abnormalities, presence of infection, possible artifacts and even drug metabolism [8].

The present study shows that majority of stones were composed of calcium oxalate (55.6%) followed by uric acid (27.8%) . Almost similar observations were made from studies done in Saudi Arabia and Sudan [12, 13, and 14]. This might be due to the large consumption of meat and poultry by the people here. These types of food tend to increase the amount of acid in the urine. These stones are formed in acid urine called primary stones. On other hand secondary stones are formed in alkaline urine as a result of infection and compromise of magnesium ammonium phosphate [9]. In our study 4.6% of stones

composed of calcium oxalate mixed with phosphate followed by magnesium mixed with calcium oxalate 1.9 %.

The exact pathogenesis of urolithiasis is not known. A number of promoters, inhibitors and predisposing factors can contribute to the development of stone formation. From the above results it appears that nutritional and environmental factors play a role in the pathogenesis of urolithiasis in Yemen.

The male to female ratio in this study was 6:1. Most studies reported that it is 5 times more in male than females [15]. Alhadramy MS has reported that, it is 2-4 times more in males as compared to females [15,16]. These findings are in close proximity to our reports

The disease affected all age groups from less than 1 year old to more than 70; however the increased incidence of recurrence in patients in the older age may be contributed to the influence of aging and diet. In our study the mean age of the participants included in the analysis was 29.65 ± 11.36 and these findings support other observations done in the literatures [3,12,13,15,17].

Increased incidence in males has been attributed to increased dietary protein intake ,which increases urinary excretion of phosphates and magnesium and reduced urinary citrate concentration . The lower risk of stone formation in women was attributed initially to increased urinary citrate concentrations due to the lower urinary saturation of stone forming salts ,while later reports indicated that endogenous estrogen and estrogen treatment in postmenopausal women may decrease the risk of stone recurrence by lowering urinary calcium and calcium oxalate saturation [3]. In this study there were 94 (87%) stones belonged to males and 14 (13%) stones to female. This finding indicate positive association between gender and biochemical compositions of renal stones ($\chi = 19.072$, $P = 0.025$).

The effect of geography on the incidence of stone formation may be direct, through its effect on temperature,high temperatures increase perspiration ,which may result in concentrated urine ,which in turn promotes increased urinary crystallization .In our study 87% of participants were from different part of the country working in the military in different local environment - extreme heat and dryness, lack of rehydration , dietary habits, etc. These findings support other observations done in the previous studies [3, 4,6, 10, 17].

CONCLUSION

From the study we can conclude that:

- Renal stone disease in Yemini was not uncommon .The majority were calcium oxalate, followed by uric acid stones.
- The relative increased frequency of stones in Yemen, which is a part of Mediterranean region, indicates that nutritional, environmental and genetic factors play a role in the occurrence of stones.
-

RECOMMENDATION

It is stated that nutritional and environmental factors seem to play a role in stone formation. Hence dietary intervention on a large scale and health education in this regard may be helpful on the preventive side.

Ethics consideration: no need

Funding: no funding

Competing interests

The authors declare that they have no competing interests.

Authors' contributions:

All authors attest to having contributed substantially to conception and design and acquisition of data and drafting the article and revising it critically for important intellectual content. All authors give approval of the final version to be published.

ACKNOWLEDGMENT

The researcher's thanks all staff, physicians, nurses and laboratory technician's in the 48 Model Hospital and Central Lab. in Sana'a for their kindly help during the field work and also the authors thank all patients , who participate in this research.

REFERENCES

[1] lancinaMartin JA, Rodriguez-Rivera GI,Novas Castro S, Rodriguez Gomez I, fernandez Rosado E, Alvarez Castelo L.(2002). Metabolic risk factors in calcium urolithiasis according to gender and age of the patients. Actas Urologicas Espaniolas.**26**: 111-120.

[2] Stamatiou KN, Karanasiou VI, Lacroix RE, Kavaouras NG, Papadimitriou VI, Chlopsios C, Lebren FA, Sofras F.(2006). Prevalence of urolithiasis in rural Thebes, Greece. Rural and remote Health . 8 December, available from : http://rrh.deakin.edu.au

[3] Sandhya Abbagani , Sandhya Devi Gundimeda, Seredevi Varre, Deepika Ponnala , Hema Prasad Mundluru (2010). Kideny stone disease : etiology and evaluation. International Journal of Applied Biology Pharmaceutical Technology. May-July, **1** :175-182.

[4] Rennke H. Urolethiasis. In: Cotran RS, Kumar V, Collins T, Eds (1999). Robbins Pathologic Basis of Disease. 6th ed., Philadelphia WB. Saunders company, 989-90.

[5] Ekane S, Wildschutz T, Simon J, Schulman CC (1997).Urinary lethiasis : epidemiology and physiopathology. Acta Urologica Belgica, **50** : 504-507

[6] Pak CY, Resnick MI, Perminger GM.(1989). Ethnic and geographic diversity of stone disease .Urology **14**1 :707.

[7] Winer (1959) .Practical value of analysis of calculi. J.A.M.A, **169**: 1715

[8] Robert A. R, Birdwell Finlayson(ed) (1959). Clinical management of urolithiasis . International Perspectives in Urology ,**6**, Williams and Wilkins, Baltimore, 1983.

[9] Shabsoug B.(2003). Qualitative analysis of kidney stones by one wet chemical method for patients in Al-Qasseem Area in Kingdom of Saudi Arabia. Jour.Chem.Soc.Pak.;**25**,No.4 :

[10] Scheriner GF.(1991). Renal Calculi In : Kissane JM Ed. Anderson Pathology: 9th ed., New Delhi: Jaypee Brothers,840-41.

[11] Beeler MF, Zeith DA, Morris RH, Biskin GR.(1964). Calculus semiquantitative tests on composition of urinary calculi analysis. Am J Clinical Pathology 41-55.

[12] Abdul-Haleem RE, Al-Sibaai A , Baghlafao AO.(1993) Ionic associations with in 460 non-infection urinary stones. Quantitative chemical analytic study, applying a new classification. Scand J urol Nephrol **27**(2):155-62.

[13] Al-Rasheed SA; Elfaqish SR, Hussain I, Almugerin Mm. (1995).The etiological and clinical pattern of childhood urolithiasis in Saudi Arabia. International Urology Nephrol **27**(4):349-55.

[14] Kambal A, Wahab EM, Khattab AH.(1979). Composition of Urinary stones in Sudan. Br J Urol **51**(5):342-4.

[15] khan AS, Rai ME, Gandapur, Pervaiz A, Shah AH, Hussain AA, Siddiq M. (2004). Epidemiological risk factors and composition of urinary stones in Riyadh Saudi Arabia. J Ayub Med coll abbottabad. Jul-Sep; 16(3) : 56-8. available in www.Ncbi.nih.gov\Pubmed.

[16] Alhadramy MS-(1997). A retrospective study on urolithiasis. J Pak Med Assoc; 11(47); 281-4.

[17] Abdulkareem O Alsuwaida, Yousef M.K.Farag, Abdulla A. Alsayyari, Dujanah Mousa, Fayez Alhejaili, Ali Al- harbi, Abdulrahman Housawi, Bharative V Mital, Ajay K. Singh.(2010).

[18] Epidemiology of Chronic Kidney disease in the kingdom of Saudi Arabia(SEEK-Saudi investigators- a pilot study. Saudi journal of kidney Disease and Transplantation 21 issue 6; 1066-1072.

التركيبة الكيميائية لحصوات المسالك البولية

طاهر يحيى عيظه و احمد علي قايد ثابت و خالد باكر و سعيد البهلولي

كلية الطب – جامعة ذمار

ملخص

المداخلة – معرفة تركيب حصوات الكلى والمسالك البولية مهمة جدا لمعرفة الوقاية والعلاج. وهذه الدراسة هي لتحليل الحصوات ومعرفة التركيبة الكيميائية في اوساط المرضى اليمنيين

طرق التحليل .ارسلت الحصوات الى مختبرات الصحة المركزية ومختبرات مستشفى 48 في صنعاء العا صمة اليمنية.وتم تحليلها للمركبات الكيمياءية التالية. 1.يوريك اسيد 2.سيستين 3.اكسالات 4.كوربونات 5.فوسفات 6 .امونيا 7. كالسيوم 8. ماغنيسيوم.

وتم تحديد الجنس—العمر—العمل—و مكان الاقامة واستخدمت احدث طرق الحاسوب spss وغيرها للوصول الى ادق النتائج

النتائج. تم اجراء تحاليل ل 108 حصوات خلال الفترة 1 يناير2010 ------30 اكتوبر 2011 م وكان جميع المرضى يمنييون ومن مناطق مختلفة ووصلنا الى النتائج التالية .. الذكور94 =87% الاناث 14=13% أي بنسبة 6 الى 1 اما التركيبة الكيميائية ظهرت كالتالي.. 60حصوة = 55,6% كالسيوم اكسالات و30 حصوة =27.8% يوريك اسيد مع كالسيوم اكسالات و كذالك 5 حصوات= 4.6% فوسفات مع كالسيوم اكسالات.

الخلاصة..حصوات الكلى والمسالك البولية شائعة في اوساط اليمنيين وغالبيتها كالسيوم اكسالات يتبعها يوريك اسيد انتماؤنا الى شرق البحر الابيض المتوسط من حيث البيئة . التغذية وعوامل الجينات التي تلعب دورا في ظهور الحصوات.