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CHEMICAL COMPOSITION OF URINARY STONES IN PATIENTS REFERRED TO GEZIRA HOSPITAL FOR RENAL DISEASES AND SURGERY IN GEZIRA STATE CENTRAL SUDAN

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ABSTRACT

Objective: The purpose of this study was to perform the chemical analysis of stones to know the pattern of biochemical composition of stones in Sudanese subjects.

Methods: 169 renal stones were analyzed during the period from February to December 2008. 96 patients were referred to Gezira Hospital for Renal diseases and Surgery (GHRDS), Gezira state, central Sudan. The stones were analyzed by semi quantitative method in the Gezira central laboratory. Kits were used for chemical analysis of stones. Calcium, phosphate, oxalate, uric acid, carbonate and cystine were determined.

Results: Male to female ratio was 2:1. Calcium, oxalate and uric acid were the most common forms of stones (90.5%), followed by phosphate (4.7%), carbonate (3.0%) and cystine which accounted for 1.8% of the study subjects.

Conclusion: The relative frequency of calcium oxalate stones in our study about 65.1%, outnumbers other types which is compatible with the international

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literature. While there is relative high percentage of uric acid stones which can be explained by the high animal protein consumption in Sudan together with the hot weather which can be a cause of a highly concentrated urine . Other types phosphates (4.7%), carbonate (3.0%), and cystine which account only (1.8%).

Keywords: urinary stones, composition, epidemiology

INTRODUCTION

Urolithiasis is a common urologic disease. Stones may occur in the kidney, ureter, urinary bladder, prostate, or urethra. Urolithiasis mainly affects adults, predominantly male. The types of stone formed depend mainly on the urine composition, which, in turn, reflects the type of diet consumed. It is estimated that approximately 2% of the population had renal stone disease at sometimes in their life with a male to female ratio of 2.1. The peak incidence is observed in 2nd and 3rd decades of life. Renal calculi are characterized clinically by renal colic as they pass down along the ureter and manifest as haematuria (1). There are four types of calculi. Most stones about 75% are calcium containing composed 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% are made up of cystine stones (2). In Sudan, urolithiasis is very frequent, but stone analysis is not routinely performed. The aim of this study is to perform the chemical analysis of stone in Central Sudan in order to know the pattern of biochemical composition.

MATERIALS AND METHODS

This is a cross-sectional descriptive, hospital based study involved 96 consecutive Sudanese patients, aged between 7 to 83 years, seen at Gezira hospital for renal diseases and surgery (GHRDS) in the period from February to December 2008. GHRDS is the only specialized hospital outside Khartoum the capital serving a large population from Gezira state.

Each patient was subjected to full clinical history and complete examination. The appropriate investigations necessary for diagnosis were performed (i.e. urine analysis, ultra-sound, IVU, and CT.) . The proper management of patients was done according to the European Association of Urology (EAU) guidelines (3). The stones were sent to Gezira central laboratory for chemical analysis. These stones were either removed surgically (20%), by extracorporeal shock wave lithotripsy (ESWL) (35%) or using endoscopy (15%) and some of these stones were passed spontaneously (30%). The stones were washed in distilled water grinded and powdered in a mortar and were analyzed by semi-quantitative method

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(4). Kits purchased from Mascia Brunell S.P.A (Italy) were used for chemical analysis of stones as described before (5). The synthetic standard was used along with the test samples as control. The powdered stones and standard were analyzed for calcium, oxalate, magnesium, carbonate, phosphate, uric acid and cystine contents.

RESULTS

The overall male to female ratio was 2:1. The age distribution of both sexes ranged from 7 to 83 years, and more than half (58.3%) the study subjects referred to the hospital were from the Gezira state (Table 1).

Table 1. Patient's demographic analysis

	Male	Females	Ratio
Sex	66	30	2.2:1
Age (mean±SD)	35.2±16.6	21.3±13.3	
No. of Stones	128	37	3.5:1
Residency			
Gezira state	45	11	4:1
Other states	21	19	1:1

Table 2 shows the percentage of various stone components as determined by chemical analysis. Calcium, oxalate and uric acid were by far the most common form of stones (90.5%), followed by phosphate (4.7%), carbonate (3.0%) and cystine which account only 1.8 % of the study subjects.

Table 2. Types of stone composition

Composition	No. of stones	%
Calcium	56	33.1
Oxalate	54	32.0
Uric Acid	43	25.4
Phosphate	8	4.7
Carbonate	5	3.0
Cystine	3	1.8
Total	169	100

Thirty five percent of the patients underwent extracorporeal shock wave lithotripsy (ESWL), while 30% of the stones had been passed spontaneously and 20% were treated with open surgery after ESWL failure (**Table 3**).

EDITORIAL**Table 3:** Clinical data of the patients referred to the Gezira Hospital for Kidney Disease and Surgery.

Characteristics	%
ESWL	35
Open surgery	20
Endoscopic	15
Spontaneous passage	30

ESWL; extracorporeal shock wave lithotripsy

DISCUSSION

Urolithiasis affects about 10% of the worldwide population and is increasing in prevalence. Urine stone formation is known to be regulated by many factors, such as urinary stone-forming constituents, urinary pH, inhibitor and promoter of crystallization and crystal aggregation. The presence of stones may be asymptomatic, symptomatic, or discovered when the patient suffers complications. Recurrences are common in 30–50% of men, with the formation of another stone occurring within 5 years of first stone incidence. To decrease the likelihood of stone recurrence, patients are routinely advised to increase their urine volume by increasing their fluid intake ⁽⁶⁾. The aim of this study is to analyze the components of urolithiasis in order to obtain data about stone formation and the possible ways of prevention and selecting treatment. In this study we found calcium, oxalate and uric acid stones were the most common, and less phosphate, carbonate and cystine. In Sudan, uric acid and uric acid dehydrate stones were more often seen in adults, while ammonium urate is often common in Sudanese children ⁽⁷⁾. Almost similar findings were reported by Khan et al., 2004 ⁽⁵⁾; Abdul Haleem et al., 1993 ⁽⁸⁾; and Al-Rasheed et al., 1995 ⁽⁹⁾ who found that the majority of the stones were composed of calcium followed by uric acid and phosphate, however, they didn't find cystine stones. In another study done by Chao et al., 2007 ⁽¹⁰⁾ fewer cystine stones were found and a similar incidence of uric acid and calcium phosphate. The exact pathogenesis of urolithiasis is unknown, however the nutritional and environmental factors may contribute to the development of stone formation. For example oxalate rich diet (rice, tomatoes, salad and Coca-Cola group of drinks) may play contributory role in the formation of calcium oxalate stones, and high animal protein consumption may be one of the reasons of uric acid stone formation. The choice of management of ureteric stones depends on the size of the stone and laterality of the stone. Open surgery for kidney stones was required for 20% of cases, and extracorporeal shock wave lithotripsy was done in 35% of cases and 15% underwent endoscopy. The presence of minimally invasive procedures for stone retrieval (ESWL, endoscopy)

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which comprise about 50% of the surgical intervention indicates a good advance towards a better management of stone removal, with less dependence on open surgical procedures which are now indicated in certain conditions ⁽¹¹⁾. Full understanding of the mechanism of stone formation requires further investigation in addition to the nutritional, environmental factors may play a role in the occurrence of stones among Sudanese subjects.

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