AFRICAN JOURNAL OF MEDICINE and medical sciences

VOLUME 34 NUMBER 2 JUNE 2005

ISSN 1116—4077

Afr. J. Med. med. Sci. (2005) 34, 185-188

Chemical composition of urinary calculi in Maiduguri, Nigeria.

DS Mshelia*, BM Gali*, HU Naaya* and SA Habu*
*Department of *Chemical Pathology and *Surgery, University of Maiduguri Teaching Hospital, Maiduguri, Nigeria*

Summary
Urolithiasis is a common disorder in Maiduguri and constitutes a significant proportion of surgical diseases in Nigerian Hospitals today. Although, the analysis of the stones is an integral part of the assessment of stone formers, earlier report in Maiduguri did not dwell well on it. We therefore, carry out this study to report on the composition of urinary tract calculi removed during surgery at the University of Maiduguri Teaching Hospital and to find out if stone composition in the area changes with time. Fourty-nine urinary tract calculi removed in the surgery unit of the Hospital in 2003 were chemically analyzed in the Department of Chemical Pathology of the same Hospital. We also retrieved results of stones analyzed in 1989 (41) and 1999 (21) and compared the results with the 49 analyzed in 2003. The results showed a male preponderance with male: female ratio 12:1, and the calculi occurred more in the upper part of the tract (70.9%) than the lower part of the tract (29.1%). Calcium containing stones constituted the majority; 76.9%, uric acid/urate was associated with 16.3% of the stones while struvite constitutes 4.3%, xanthine 1.7% and cystine 0.9%. There was subsequent reduction of struvite stones with time. Urinary tract stone is common in Maiduguri. There is need for identification of risk factors of calculi formation in the environment to enable the health care providers plan preventive measures in order to reduce the high incidence in the area.

Keywords: *Urolithiasis, calculi composition, Maiduguri.*

Résumé
L'urolithiasie est un désordre commun a Maiduguri et constitue une proportion significative des maladies chirugicales dans les hopitaux Nigéria. Bienque l'analyse des cailloux est une partie intégrale de l'évaluation des cailloux precédent non-investigué. Le but de cette étude est de rapporter la composition des calciles de la trachée urinaire et d'urée avec le temps enlevée durant la chirugie au centre Universitiare Hospitalier de Maiduguri. Quarante neuf calciles (49) de la trachée urinaire enlevée en 2003 étaient chimiquement analysées dans le département de pathologie-chimique dans cette hopital. Nous avons revu les anlyses de 41 cailloux en 1989, 21 en 1997 et comparée en 2003. Les résultats montraient une proportion propondérante aux males qu'au females 1.2 :1 et les calciles apparaient plus nombreux dans la trachée supérieure 70.9% qu'inférieure(29.1%). Du calcium contenant les cailloux consistaient la majorité de 76.9%, l'acide urique était associé avec 16.3% des cailloux alorsque la strutite constitue 4.3%, xanthine 1.7% et 0.9% de cysteine. Il y avait une réduction de cailloux strutite avec le temps. Déterminer les facteurs a risque de la formation des calciles dans l'environement pourrait aider les experts de soins de santé preventive a améliorer l'incidence des cailloux dans l'urée.

Introduction.

Urolithiasis is a common disorder in Maiduguri with an incidence rate of 32 per 100,000 [1]. This is higher when compared to the reported incidence of 7 per 100,000 in Lagos [2] (45 patients over eleven years period). Osegbe in 1987 [3] drew the attention of the medical community to the rising rate of urinary stone disease in Nigeria, where the stone incidence increased from 7/100,000 in 1976 to 34/100,000 in 1987 in Lagos. Osegbe again reported a rising trend in urbanized Africans [4]

Although, Mbibu, *et al* [5] reported that urolithiasis did not constitute frequent surgical burden to the Nigerian surgeons, it accounted for 2 % of the total major surgical admissions in Maiduguri [1]. Therefore, urolithiasis constitutes a significant proportion of surgical disease in Nigerian hospital today. Apart from the surgical trauma, complications and cost of stone treatment, the presence of stone leads to other medical complications most especially chronic renal failure. It has also been reported that the recurrence rate increases with years of the first incidence and can be as high as 95-100% at 20 to 25 years of the first incidence [6] Preventive measures are therefore highly recommended especially in this part of the world with high incidence rate and abject poverty.

The analysis of the stones passed or removed during surgery has become an integral part of assessment of stone formers because risk factors are often unique for different types of stones [6] and previous report of stone in this environment did not dwell on the stone compositions. We therefore, carried out this study to report on the chemical composition of stones removed during surgery in UMTH, Maiduguri, and to determine if stone compositions in this area changes with time.

Materials and methods

Fourty-nine of the urinary tract stones removed during surgery from the surgical unit of the University of

Correspondence: Dr. D.S. Mshelia, Department of chemical Pathology, University of Maiduguri Teaching Hospital, P.M.B. 1414, Maiduguri, Nigeria.

Maiduguri Teaching Hospital from January to December 2002 were analyzed in the Chemical Pathology Department of the same hospital. Results of stones analyzed previously in the department in 1989 and 1999 were also retrieved. These have also been collected for a period of one year each. There were 41 and 27 stones analyzed in these years respectively. These were not all the stones removed in each year but only those that were analyzed. The total number of stone used for the study is 117. All stones were analyzed by chemical methods of Henry [7] and Valey [8]. The age and sex of patients were recorded. Stones were weighed before analysis.

We therefore determined the stone composition for each year and for the total stones. We also compared the stone composition in each year to see if there were variations in the composition of stones in response to the changes in environment such as types of foods.

Statistical methods.

Percentage is used in comparing data between the 3 years in the study.

Results.

A total of 117 stones were analyzed for the study, 41 in 1989, 27 in 1999, and 49 in 2002. The age of the stone formers ranged form 2 to 89 years with mean±SD of 39.0±22.9 years. The spectrum of the age is illustrated in figure 1. There were 108 males (92.3%) while females were 9(7.7%) with male: female ratio 12:1.

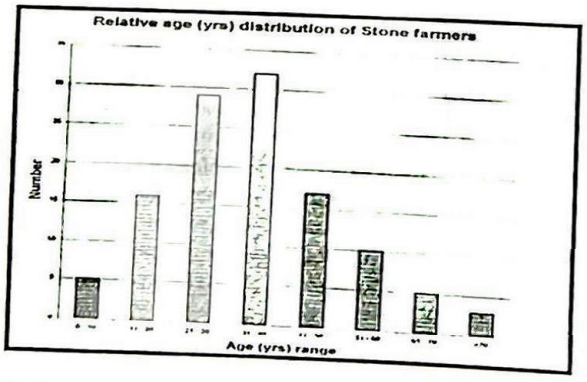

Fig. 1:

Urinary calculi occurred more in the upper tract vis kidneys and ureters in 83 cases (70.9)% and in the lower tract vis bladder and urethra in 34 and (29.1%), (table 1). The weight of stones ranged from 0.003 to 250.0gm with a mean (SD) 16.11 (44.6) gm.

Table 1: Anatomical sites of stones in Maiduguri.

Site	1989	1999	2002	No.	Percentage.
Kidney	17	18	29	64	54.7%
Ureters	7	2	10	19	16.2%
Bladder	14	4	10	28	23.9%
Urethra	2	3	0	5	2.8%
Others (prostate)	1	0	0	1	0.6%
Total	41	27	49	117	100.0%

The chemical composition of the 117 stones is detailed in table 2. Calcium oxalate (23.9%), calcium carbonate (24.8%) and calcium oxalate/carbonate/phosphate (28.2%). Thus, calcium stones constituted 76.9% of the total stones in the study, while struvite stone formed 4.3%, xanthine 1.7% and cystine 0.9%. There were more struvite stones in 1989(4), compared to none in 2002 stones. Uric acid/urate was 16.3% of the total stones analyzed.

Table 2: Chemical compositions of stones in Maiduguri.

Stone type	1989	1999	2002	No.	%
Calcium oxalate	11	7	10	28	23.9%
Calcium carbonate	7	9	13	29	24.8%
Ca ox/co3-/phos.	13	6	14	33	28.2%
Ca/ox/co3-/urate	3	2	7	12	10.3%
Ca/MAP	4	1	0	5	4.3%
Ca/uric acid/urate	2	1	4	7	6.0%
Xanthine	0	1	1	2	1.7%
Cystine	1	0	0	1	0.9%
Total	42	27	49	117	100.0%

Discussion

There seems to be raising trend in the incidence of urolithiasis in Maiduguri. Duvie, [1] reported an incidence of 32/100,000 about 20 years ago. However, stones formers were from the two referral hospitals in the place serving the populations of Maiduguri yet the number of stones were 125 over two years period. The stones analyzed in this study excluded patients attending the State Specialist Hospital, the ever-increasing number of private hospitals and all the general hospitals in Local Government Areas. All these will substantially reduced the proportion of stones that were removed and analyzed at UMTH.

There was male preponderance of stone formers in the study with male: female ratio of 12:1. This may be because the men are more exposed to the harsh weather, and also they are engage in more active work which make them sweat a lot more than the females. Males in this environment also take more roasted meat (suya), which contains both high animal protein and sodium, two of the major factors that predispose to urolithiasis [9-10].

Urolithiasis is more frequent in the age range 31 to 40 years followed by 21 to30 years. These two age ranges accounted for 52.1% of total stones in the study with only 4.3% below 10 years, a figure similar to Osegbes finding in Lagos [4]. However, earlier report in Maiduguri indicated that the peak age of stone formers was 20 to 30 followed by those below 10 years [1]. Similarly, in contrast to Duvies [1] and Osegbes [2] reports, there is increased number of stone formers found in the age range 11 to 20 years. This may be explained by increased involvement of this vulnerable age group hawking on the street. This exposes them to the harsh weather conditions with consequent tendency to increase synthesis of vitamin D with consequent calcium absorption in the gut, and excessive sweating leading to decrease urinary volume.

Calcium oxalate, calcium carbonate and calcium oxalate/carbonate/phosphate (the major calcium containing stones) constituted 76.9% of the total stones in our study. This is similar to findings in other studies [1,2,11]. This environment is associated with many of the risk factors for calcium stones. Although, none of the stone formers were evaluated for hyperparathyroidism, the plasma calcium (2.42±0.09mmol/L) of all the patients were within the hospital reference range (2.2-2.7mmol/L). It has been found in this environment that 24 hour urinary calcium excretion is higher in patients (3.72+1.97mmol/L) than controls (2.34+1.20mmol/L), (unpublished data). High intake of roasted meat (suya) in this environment, which has high contents of animal protein and sodium chloride can predisposes to calcium stone formation [9,10,12,13]. Similarly, the exposure of the body skin to harsh sunlight in this environment is likely to lead to increased synthesis of vitamin D and subsequent increase intestinal calcium absorption resulting in hypercalciuria [14]. . Vegetables (spinarch, surreal, salad) commonly consumed in this area are good sources of oxalate and can cause hyperoxaluria and calcium-oxalate precipitation in the urinary tract [15,16]

Struvite stones, which were not mentioned in Duvies earlier report [1], constituted 4.3% of stones analyzed in this study. This is higher than that found in Osegbes study of 3% [4]. However, there was subsequent reduction in number of struvite stones from 1989 to 2002 as shown in table 2. Usually, struvite stones are associated with chronic urinary tract infections (UTIs) [17] consequently, the reduction may be as a result of health awareness, improvement in the quality of health services in the area, early report to hospital by patients, or use of specific antimicrobials in treatment of UTI. Stones associated with uric acid/urate are more in our study than what Osegbe found in Lagos [4]. There are three major factors that promote supersaturation of uric acid in urine; uric acid production rate, urinary flow rate, and urinary pH. Two of which are likely to be associated with this environment; this include high rate of meat consumption in the area resulting in increased rate of uric acid production and excessive sweating in most period of the year causing reduction in urinary flow rate may explain the high rate of uric acid stones in our study.

Xanthine stones are usually rare [6], but accounted for 1.7% of stones in this study. It is usually inherited and hence may be consequent to consanguineous marriages common among the major tribes in the area of study. Both uric acid/urate and xanthine stones are radiolucent and are likely to be missed on plain x-rays [4]. However, patients with hereditary xanthinuria have extremely low serum uric acid and this may form a good diagnostic parameter necessary in evaluating this type of stones.

In this environment, management of stone formers are mainly by the surgeons and previous reports had pay less emphasis on the predisposing risk factors such as diets, investigating other family members, evaluation for hyperparathyroidism and hypervitaminosis D, and measurement of plasma contents of other risk factors.

The long-term management of metabolically active patient requires close association with a physician who is prepared to monitor stone formation, appropriate risk factors, and the progress of those risk factors over an extended time since urolithiasis management may be lifelong for most patients. Although, this is a large economic commitment, it has been calculated that failure to carry out this responsibility is even larger economic burden for patients and society [6]. With aggressive risk factor management and follow-up, 95% of patients can become metabolically inactive [6]. Teamwork in the management of stones is therefore very necessary in achieving long-term reduction in the incidence of stones in the area. There is need therefore to include the measurement of these risk factors in our laboratory repatriates.

In conclusion, urinary calculi are common in Maiduguri with decreasing incidence of struvite stones. There is need for teamwork in further management of the disease in order to evaluate the risk factors common to the area. This will give a guided preventive measures in reducing the incidence.

References.

1 Duvie, SOA., Endeley, EML., and Danniya, MH. Urolithiasis in Maiduguri: The Nigerian Savannah belt Experience, West Afri. J. Med.1988; 7:148-161.

2 Esho. JO. Experience with urinary calculus disease in Nigeria as seen at Lagos University Teaching Hospital. Nig. Med. J.1976; 1:18-22.

3 Osegbe, DN. The rise in urolithiasis in Nigeria. BMJ.1987;295:1654.

4 Oesgbe, DN. Urolithiasis in Urbanized Nigerians. Nig. J. Surg.1994; 1:51-56.

5 Mbibu, NH., Nwofor, AME. and Khalid, L. Spectrum of urologic disease in the West African subregion. Ann. Afri. Med.2002; 1:44-52.

6 David, MW. Clinical and Laboratory Evaluation of Renal Stone Patients. Endo. and Metab. Clinic of North America 1990; 19:773-803.

7 Henry, RJ. Clinical Chemistry: Principles and Technics. Harper and Row, New York. 1966; 922-923.

8 Valey, H. Practical Clinical Biochemistry Heinemann, London 1976; 719-720.

9 Kok, DJ., Iestra, JA., Doorenbos, CJ., and Papapoulos, SE. The effects of dietary excesses in animal protein and in sodium on the composition and crystallization kinetics of calcium oxalate monohydrate in urines of healthy men. J. Clin. Endocrinol. Metab. 1988; 71:861-869.

10 Muldowney, FP., Freaney, R., and Moloney, MF. Importance of dietary sodium in the hypercalciuria syndrome. Kid. Int. 1982; 22:292-299.

11 David, JN. and Christopher, PP. Renal function and nitrogen metabolites. In: Carl, AB. And Edward, RA. Tietz Textbook of Clinical Chemistry, 3rd ed. W.B. Saunders Company, 1999; 1204-1270.

12 Breslau, NA., Brinkley, L., Hill, KD., and Pak, CYC. Relationship of animal protein-rich diet to kidney stone formation and calcium metabolism. J. Clin. Endocrinol. Metab. 1988; 66:140-145.

13 Muldowney, FP., Freaney, R., and Barnes, E. Dietary chloride and urinary calcium in stone disease. QJM. 1994; 87:501-507.

14 Pak, CYC. Etiology and treatment of urolithiasis. Am. J. Kidney Dis. 1991; 18:624-628.

15 Holmes, RP., Goodman, HO and Assimos DG. Contribution of dietary oxalate to urinary oxalate excretion. Kid. Int. 2001; 59:270-274.

16 Stanley, G. The role of diet in the pathogenesis and therapy of nephrolithiasis. Endo. Metab. Clin. North Am. 1990; 19:805-820.

17 Muldoon, LD and Resnick, MI. Secondary urolithiasis. Endo. Metab. Clin. North Am. 1990; 19:909-918.

Received: 13/07/04
Accepted: 25/04/05