

Urinary Excretion Of Calcium By Urinary Stone Disease Patients And Normal Subjects In Southeast Nigeria And Scotland

J. C. Orakwe

*Department Of Surgery Nnamdi Azikiwe University Teaching Hospital
Nnewi, Nigeria.*

ABSTRACT

To compare the urinary excretion of calcium by subjects in a known area of high incidence of urinary stone disease, and a known area of low incidence, 12 adult male patients with idiopathic calcigerous urinary stone disease in south-East Nigeria and 55 similar patients from Scotland, United Kingdom were analyzed thirty-six healthy subjects in Nigeria and 30 in Scotland were also analysed as controls. Twenty-four hour urinary excretion of calcium was higher in patients from Scotland (6.81 +0.48mmols/24 hours). It was also higher in control from Scotland (5.96+0.61 mmol/24 hours), than in controls from Nigeria (2.33+0.21mmols/24 hours), and the difference was statistically significant ($P < 0.001$), Calcium excretion was higher in patients than in controls in both centers. (*Nig J Surg Res 2000; 2: 1-5*)

KEY WORDS: *Calcigerous stone, disease, calcium excretion Nigeria, Scotland.*

Introduction

Hypercalcuria is a confirmed risk factor for calcigerous stone formation and the prevalence of stone disease correlates linearly with the urinary calcium excretion^{1,2}. Scotland is an area with a known high incidence of urinary stone disease^{3,4}, and Nigeria is an area of known low incidence of urinary stone disease^{5,6}. Comparison of calcium excretion between black Africans and white British was carried out by Widowson and McCance⁷ who found lower calcium excretion in Ugandan children in Kampala than in their counterpart British children in Cambridge. This finding was assumed to depict the trend in other parts of Black Africa. With the recent findings of a rising incidence of urinary stone disease in Nigeria over the past 10-15 years^{6,8} it is not certain that the situation has remained the same.

This study prospectively determines and compares urinary excretion of calcium by subjects in the known urinary stone forming population of Scotland and the known non-stone forming population of Southeast Nigeria. This will help elucidate the comparative state as it is currently in view of the recently observed changes in the epidemiology of urolithiasis.

Patients and Methods

Twelve adult male patients with idiopathic calcigerous urinary stone disease who presented at the surgery/urology clinics and the accident and emergency units of the University of Nigeria Teaching Hospital (U.N.T.H.) Enugu and the Nnamdi Azikiwe University Teaching Hospital, Nnewi, both in south-East Nigeria, and 55 similar patients who presented at the urology clinics of the Western General Hospital (W.G.H.) Edinburgh, Scotland, were used for

Reprint requests to: Dr. J. C. Orakwe

The Nigerian Journal of Surgical Research Volume 2 Number 1, 2000

URINARY EXCRETION OF CALCIUM IN STONE FORMERS AND NORMAL INDIVIDUALS

the study. Thirty-six adult males in Nigeria and thirty adult males in Edinburgh were used as controls. The control subjects were considered to be in good general health condition, without any known anatomical and functional abnormality of the urinary tract, without any metabolic disorder, or a history of urolithiasis or renal disease, and with normal renal function as judged by the blood creatinine and/or creatinine clearance. These included patients, hospital staffers and students.

One sample of a 24-hour urine was collected from each of the patients and the control subjects. The samples were collected from the patients on presentation while still ambulatory and on free diet. They were collected in large plastic containers made available to the patients at the time of the request. The 24-hour urine of both the patients and the controls were analyzed for volume and calcium concentrations.

In Nigeria, urinary calcium was measured by the Ethylenediamine tetra-acetic (EDTA) titrimetric method⁹ and in Edinburgh it was measured by the Atomic Absorption

spectrophotometry method.¹⁰ Statistical analysis used was the student t-test, with the Fishers' F-test of differences in variances being always applied before its use. If the F-test was significant, the modified Z-test and not the ordinary t-test were applied. Accepted level of significance was $P < 0.05$.

Results

The mean ages of the patients were 40.75 ± 16.8 years in Nigeria and 45.30 ± 15.76 years in Scotland. The mean ages of the control subjects were 35.72 ± 7.5 years in Nigeria and 47.79 ± 8.3 years in Edinburgh. The difference between the mean ages of the patients and those of the controls were not statistically significant in Nigeria ($P < 0.01$) and in Scotland ($P < 0.50$). The difference between the mean age of the patients in Nigeria and the patients in Scotland was not statistically significant ($P < 0.20$) but the difference between the mean ages of the controls from both centers was statistically significant ($P < 0.001$).

Table 1: Comparison Between Nigerian And Edinburgh Stone Disease Patients And Their Control

| Urine Excretion | Enugu | | | Edinburgh | | |
|--------------------------------|--------------------|---------------------|---------------------|--------------------|---------------------|---------------------|
| | Patients (n=12) | Control (n = 36) | "P" (< 0.05) | Patients (n=55) | Control (n = 30) | "P" (< 0.05) |
| 1. Volume (litres/24 Hours) | 2.31 \pm 0.15 | 1.77 \pm 0.14 | 0.025 | 2.28 \pm 0.13 | 1.92 \pm 0.10 | 0.05 |
| 2. calcium (mmols/24Hours) | 3.28 \pm 0.58 | 2.33 \pm 0.21 | 0.10 | 6.81 \pm 0.46 | 5.86 \pm 0.61 | 0.025 |

ORAKWE J. C.

Table 2: Comparison Between Patients Of Nigeria And Edinburgh And Controls Of Nigeria And Edinburgh

| Urine Excretion | Patients | | | Controls | | |
|-------------------------------|-------------------|-----------------------|----------------|-------------------|-----------------------|----------------|
| | Nigeria (n=12) | Edinburgh (n = 55) | “P” (<0.05) | Nigeria (n=12) | Edinburgh (n = 30) | “P” (<0.05) |
| 1. Volume (Litres/24Hours) | 2.31±0.15 | 2.28±0.13 | 0.50 | 1.76±0.14 | 1.92±0.10 | 0.20 |
| 2. calcium (mmols/24Hours) | 3.28±0.58 | 6.81±0.48 | 0.20 | 2.33±0.21 | 5.86±0.61 | 0.028 |

The value and comparisons of the 24-hour urine excretion are represented in details in Tables 1 and 2. In Nigeria, mean 24-hour urine volume of 2.31±0.15 liters and mean 24-hour calcium excretion of 3.28±0.58mmols in patients was higher than in the controls, which were 1.77±0.14litres and 2.33±0.21mmols respectively, but the difference was significant for the urine volume only (P<0.025). In Scotland corresponding values were significantly higher in patients than in controls (P<0.05 and P<0.025 respectively). Mean calcium excretion of 6.81±0.48mmols/24hours in Scottish patients was appreciably higher than the mean calcium excretion of 3.28±0.58mmol/24hours in Nigerian patients, though not statistically significant. But the difference in calcium excretion between the control subjects in Nigeria (2.33±0.21mmols/24hours) and in Scotland (5.86±0.61mmols/24hours) was statistically significant (P<0.001). The difference between the urine volumes of the controls in Nigeria and Scotland was also statistically significant (P<0.025), being higher in patients from Scotland.

Discussion

Urinary calcium is higher in all Scottish subjects, both patients and controls, than in the Nigerian subjects. The high mean calcium

excretion of 6.81mmols/24hours in patients and 5.86mmols/24hours in controls from Scotland are comparable with previous reports from Britain³. Low value for mean calcium excretion as obtained for Nigerian patients and their controls have been reported previously for black African populations in the West, Central, East and South Africa^{11,12}.

The range of normal urinary calcium excretion in developed countries of Europe and America varies between 5 - 7.5mmols/24hours^{13,14}. If the upper limit of 7.5mmol/24hours which is commonly applied to men in studies from Europe is also applied in this study, then 40% of the patients and 21% of the controls in Scotland are hypercalciuric, while only 8.33% of the patients and none of the controls in Nigeria are hypercalciuric. Idiopathic hypercalciuria has been found to be 31% - 35% in British subjects^{15,16} and 40% - 42% for North American patients¹⁷. An effort has been made previously to determine the range of normal values for urinary excretion of calcium for a Nigeria population¹⁸. It was found that the range of normal value was 1.91 - 2.75mmol/24hours. If this upper limit of normal of 2.75mmol/24hours is applied to the Nigerian patients in this study, then comparable values of 41.7% of patients and 36.8% of the controls will be hypercalciuric. These values may be tenable since normal ranges of urinary calcium excretion varies from

URINARY EXCRETION OF CALCIUM IN STONE FORMERS AND NORMAL INDIVIDUALS

one country to another and may also vary even within the same country¹⁹. Thus, it may be erroneous to apply the upper limit of normal in one country for the determination of hypercalciuria in another country. In absolute terms, therefore, urinary calcium level is higher in subjects from Scotland, but in relative terms, the same proportions of the patients and the controls may be hypercalciuric in both Nigeria and Scotland. Studies have even shown that absolute hypercalciuria is not a sine-qua-non for idiopathic calcigerous stone formation⁴. Rather, all idiopathic stone formers can be said to be relatively "hypercalciuric" in relation to their control population no matter the level of their calcium excretion^{2,10}.

The higher urinary excretion of calcium found in the patients than in the controls in both centers are consistent with reports from several investigations.

Acknowledgement

Prof A.C. J. Ezeoke of the University of Nigeria Teaching Hospital, Enugu, Nigeria and Dr. Horn of the Western General Hospital, Edinburgh, Scotland, supervised the laboratory analyses.

References

1. Robertson WE, Peacock M.A. Review of risk factors in calcium oxalate urolithiasis. *World J Urol* 1983; 1: 114-118.
2. Ljunghall S. Incidence and natural history of renal stone disease and its relationship to calcium metabolism. *Eur Urol* 1978; 4: 424 - 430
3. Currie WJC, Turner P. The frequency of renal stones within Great Britain in a gouty and non-gouty population. *Br J Urol* 1979; 51: 337.
4. Baker DJP, Donnan SPB. Regional variation in the incidence of upper urinary tract stones in England and Wales. *Br Med J* 1978; 1: 67
5. Esho JO. Experience with Urinary tract calculus disease in Nigeria as seen at the Lagos University Teaching Hospital. *Nig Med J* 1976; 6: 8-22.
6. Osegbe DN. Urolithiasis in urbanized Nigerians. *Nig J Surg* 1994; 1: 51 - 56
7. Widdowson EM, McCance RA. Use of random specimen of urine to compare dietary intakes of African and British children. *Arch Dis Child*. 1970; 545: 547-552
8. Duvie SOA, Endeley EMI, Sahniya MH. Urolithiasis in Maiduguri. The Nigerian Savana Belt experience *West Afr J Med* 1989; 7: 148-161.
9. Appleton HD, West M, Sala AM. The rapid Determination of calcium in biological material. *Clin Chem* 1965; 9: 102
10. Trudeau DL, Freier EP. Determination of calcium in urine and serum by atomic absorption spectrophotometry. *Clin Chem* 1967; 13: 101.
11. Kambal A, Mahab EMA, Khattah ANA, Zaki J. Urolithiasis in Sudan. Studies on a stone prone and a stone-free population *Br JUrol* 1981; 53:7-12. ORAKWE J. C.

12. Modlin M. The aetiology of renal stone: A new concept arising from studies on a stone-free population. *Ann R Coll Surg Engl* 1967; 40: 155-177.
13. Tiselius H, Almgard LE, Larson L, Sarbo B. A biochemical basis for grouping patients with urolithiasis. *Eur Urol* 1978; 4: 241-249.
14. Ljunghall S, Waern U. Urinary electrolyte in renal stone formers and healthy subjects. A population study of 60-year old men. *Scand J Urol Nephrol* 1977; (Suppl) 41: 55-75
15. William G, Chisolm GD. Stone screening: are follow-up are necessary? *Br J Urol* 1976; 47: 745-750
16. Robertson WG, Morgan DB. Distribution of calcium excretion in normal persons and stone formers. *Clin Chem Acta* 1972; 37: 503 – 508.
17. Coe FI, Parks JH, Moore ES. Familial Idiopathic hypercalcuria. *N Engl J Med* 1979; 300: 337.
18. Orakwe JC. A prospective and comparative study of the epidemiological and biochemical pattern of urolithiasis in adults at Enugu and Edinburgh. A dissertation submitted for the award of the fellowship of the National Postgraduate Medical College of Nigeria in Surgery, Lagos, 1988.
19. Rose GA. Renal calculus: formation, investigation and treatment. *Br J Hosp Med* 1968; 2: 1046