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Urinary calculous disease in South-Eastern Nigeria

PAUL D. EKWERE*

Urology Unit, Department of Surgery, College of Medical Sciences, University of Calabar, Calabar.

Summary

Prospective observations are reported on 96 South-Eastern Nigerians with urinary calculi, during a five year period. An overall hospital incidence of 19.1 per 100,000, and male: female ratio of 2.7:1, were obtained. There were 79% upper-urinary tract stones and 21% lower-tract stones. Thirty-two per cent of the patients were idiopathic stone formers. Other associated aetiologic factors include obstructive uropathy (29%), UTI (30%) prolonged catheterisation (9%), hyperuricaemia (6%), foreign body in the bladder (3.8%) and hyperparathyroidism (2.5%). The lower socio-economic group accounted for 55% of the patients. Fifty three (55%) stones were removed surgically whilst 38% (45%) were passed spontaneously. Mean size of the latter was 6.3 mm ± 1.6mm, and of the former 17.7mm ± 9.5mm. Five patients did not know when they passed the stones. Clinical features were similar to other reported series but six females had pyonephrosis, one with nephrocutaneous fistula. One urethral stone was recovered from a periurethral abscess. Infection and dietary intake appear to be important aetiologic agents. Ninety-eight per cent of stones contained calcium. Other components were similar to other reported series, but it was not possible to detect any case of cystinuria. The relatively high incidence in contrast to most other Nigerian centres may be due to high consumption of calcium/magnesium-rich sea foods and vegetables, as well as the soft water of the South-East. Endemic bladder stones were absent in the series. The close similarity with caucasian stone patterns is a curiosity and of particular interest, deserving further elucidation.

Résumé

Pendant une periode de cinq ans, on rapporte des observations en perspective surquatre-vingt-seize Nigérians de la région du sud-est du Nigéria qui ont des calculs urinaires. Une incidence d'hôpital totale de 19.1 pour 100000 et un rapport mâle/femelle de 2.7:1, ont été obtenus. Il y avait 79% de pierres de canal urinaire du'haut et 21% de pierres de celui du bas. 32% des malades étaient idiopathiques avec la tendance de former des pierres. D'autres facteurs étiologiques associés comprennet entre autres l'uropathie obstructive (29%), l'UTI (30%), le cathétérisme prolongé (9%), l'yperuricémie (6%), un corps étranger dans la vésicule (3.8%) et l'hyperparathyroidisme (2.5%). La plus basse couche socio-économique constitue 55% des patients. Cinquante-trois pierres (55%) ont été enlevées par intervention chirurgicale alors que trente-huit (45%) l'ont été spontanément. Les dernières avaient une grosseur moyenne de 6.3mm ± 1.6mm et les premières une grosseur moyenne de 17.7mm ± 9.5mm. Des traits cliniques etaient semblables a ceux d'autres séries qu'on a rapportée mais six femelles étaient atteintes de phyonéphrose, une de fistule néphrocutanée. On a découvert une pierre d'urètre dans un abscès périvrétral. L'infection et la consommation alimentaire (diète) semblent d'importants agents étiologiques. Quatre-vingt-dix-huit pour cent des pierres contenaient le calcium. D'autres constituants étaient semblables à d'autres séries qu'on a rapportées, mais il n'était possible de détecter aucun cas de cystinurie. L'incidence relativement élevée en contraste avec le plus grand mombre d'autres Nigérians, pourrait être due à la consommation de fruits marins et de légumes riches en calcium et en magnésium, et de l'eau non-calcaire de la région du sud-est. Les pierres vésiculaires endémiques étaient absentes. La similarité étroite aux types de pierres caucasiennes est quelque chose de curieux; elle est d'un intérêt particulier qui mérite plus de clarification.

Introduction

Urinary calculous disease has been recognised from early times. In 4800BC a bladder calculus was found among the pelvic bones of a young pre-dynastic

* Correspondence: Mr. Paul D. Ekwere, FRCS, P.O. Box 2144, Calabar, Nigeria.

Egyptian[1]. In 4200BC another stone, probably of renal origin, was also found and on analysis contained calcium carbonate, calcium phosphate and calcium oxalate[2]. Hippocrates was credited with being the first to suggest an aetiologic factor for stone formation by observing that many patients with urinary stones had sandy sediments in their urine. He attributed this to drinking muddy water[3]. Galen also recognised such risk factors as heredity, race, climate, diet, drinking water, incidence of gout and metabolic abnormalities. He believed that gouty arthritis and some renal calculi had the same origin[1].

Incidence of urinary calculus varies from country to country and between different regions of the same country[4]. It is therefore possible that in a country as vast and with such varied climatic and other conditions as in Nigeria, there may be variations in incidence of stone disease in different regions. The negroid race is credited with a low incidence of urinary stones[4]. Previous reports from Nigeria have confirmed this[5,6,7] as well as the regional variations. The report which follows is a record of the author's experience with urinary calculous disease at the University of Calabar Teaching Hospital (UCTH), Calabar, Nigeria in a five year prospective study.

Patients and methods

All patients presenting in UCTH, Calabar, with urinary calculus from October 1984 to October 1989 were entered in a register and observations made for age, sex, clinical features, aetiologic factors, management, compliations and recurrence rate. One hundred consecutive patients were recruited, including 4 foreigners (2 French, 1 Greek and 1 Equatorial Guinea national) who were excluded from the study. The remaining 96 Nigerians were investigated according to a protocol which included estimation of serum and urinary calcium, phosphates, uric acid and oxalates, whenever appropriate chemicals were available. Urine analysis, microscopy and bacteriological culture were also performed. Plain film of the urinary system (KUB), and intravenous urography (IVU) were routinely done. Quantitative test for cystinuria was usually not possible. Recovered stones were also analysed biochemically and by atomic absorption spectrophotometry. Clinical records were analysed and the overall incidence, age, sex and site frequencies were calculated.

Results

A total of 501,354 patients attended the out-patient services of UCTH, Calabar, in five years. Ninety-six South-Eastern Nigerians had urinary tract calculi, giving a hospital incidence of 19.1 per 100,000. Recurrent urolithiasis was recorded in 13 (13.5%) patients.

Table 1: Urinary calculi in South-Eastern Nigeria: Age-sex frequency

Age Group (Decades)	Number of patients		Total
	Males	Females	
0 - 9	9	0	9
10 - 19	1	3	4
20 - 29	13	4	17
30 - 39	26	6	32
40 - 49	8	8	16
50 - 59	8	4	12
60 - 69	4	1	5
70+	1	0	1
Total	70	26	96

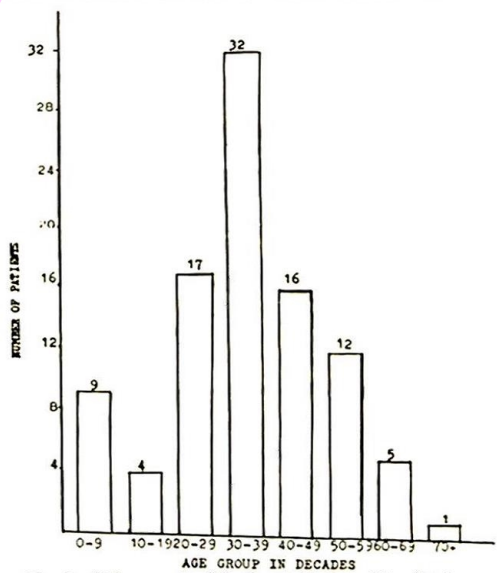

Fig. 1: Urinary calculi in South-Eastern Nigeria: Age distribution

Age

All age groups were affected by urinary calculi. Table 1 shows the age — sex distribution. The mean age was 35.4 ± 16.4 years (range 11 months to 75

years). The peak incidence was in the 20-49 age groups, accounting for 68% of all patients (Fig. 1). Nearly 14% were less than 20 years of age (Table 1). Five of the six patients with urethral stones were children aged 5 years or less. One of these, our youngest, was only 11 months old.

Sex

Males were affected more than females. The m:f ratio was 2.7:1.

Site incidence and presentation

Table 2 shows that 76 patients (79%) had upper-urinary tract stones, whilst only 20 (21%) had stones in the lower- urinary tract. All but one of these lower-tract stones occurred in males. The single female with bladder stone had had a caesarian section with prolonged catheterisation and infection with proteus organisms prior to detection of the stone. All the 21 patients with pelvic-ureteric junction stones presented with various degrees of hydronephrosis/ pyonephrosis, and renal damage. Six of these had pyonephrosis among whom were two perinephric abscesses. One patient with bilateral stones had aseptic destruction of one kidney with nephrocalcinosis. All the pyonephroses occurred in adult females. One of these presented with nephrocutaneous fistula. There were seven bilateral renal stones in the series.

Fig 3: Stone in ureterocoele

Fig 4: Mental stone

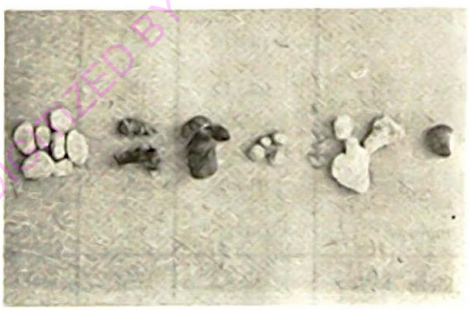

Fig 2: Upper urinary tract stones

Fig 5: Bladder calculi

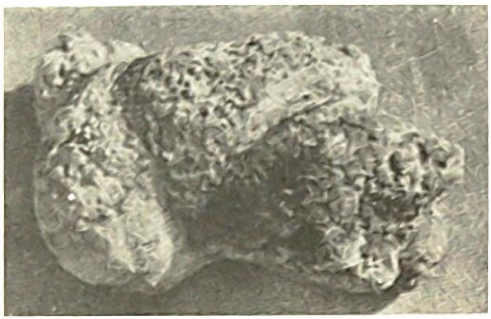

Fig 6: Staghorn calculus

Altogether, 47 patients had renal/pelvic-ureteric junction calculi, 29 ureteric, 12 bladder and 6 urethral calculi. Two patients had stone in an ureterocoele (Fig. 3). The urethral stones were stuck at the urethral meatus and three of these also had acute retention of urine (Fig. 4). Only one adult with uric acid stones had his calculus arrested in the urethra.

Mode of passage of stones

Fifty-three patients (55%) had their stones removed surgically. This consisted of 35 upper-tract stones (36%) and 18 lower-tract stones (19%). In only 41 stones were the sizes determined (24 renal/ureteric stones and 17 bladder/urethral stones). Surgically removed upper-tract stones had mean size of 17.7 ± 9.5mm, and lower-tract stones 27.9 ± 1.6mm.

Table 2: Urinary calculi in South-Eastern Nigeria: site incidence

Site	No. of patients	%
KIDNEY	47	
(a) Renal	26	49.0
(b) Pelvic-ureteric Junction	21	
URETER	29	30.2
BLADDER	14	14.6
(a) Ureterocoele	2	
(b) Bladder	12	
URETHRA	6	6.2
TOTAL	96	100.0%

Table 3: Urinary calculi in South-Eastern Nigeria: Aetiological factors in 80 patients

Factors	No. of cases	%
IDIOPATHIC	26	32.5
INFECTION	24	30
OBSTRUCTIVE UROPATHY	23	28.75
* BPH		
* BNS		
* Stricture		
* Ureterocoele		
* Urethral valves		
PROLONGED CATHETERIZATION	7	8.75
METABOLIC		
Hyperuricaemia	5	6.3
Hyperparathyroidism	2	2.5
FOREIGN BODY IN BLADDER	3	3.8

* Some patients had more than a single associated aetiologic factor.
* BNS = Bladder neck stenosis
* BPH = Benign Prostatic Hypertrophy

Table 4: Urinary calculi in South-Eastern Nigeria: Social class

Social Class	Salary Scale	No. of Patients	Percentage %
1	17	3	4.1
2	13 - 16	2	2.7
3	08 - 12	15	20.3
4	05 - 07	21	28.4
5	01 - 04	20	27.0
Unknown		13	17.5
Totals		74	100%

Table 5: Urinary calculi in South-Eastern Nigeria: indications for surgery in 33 patients

	No. of Patietns	%
1. ANATOMICAL		
(a) Hydronephrosis	15	45.5
(b) Pyonephrosis	6	18.2
(c) Bladder Outlet Obstruction	13	39.4
(i) BPH (6)		
(ii) BNS (4)		
(iii) Stricture (2)		
(iv) Posterior Urethral valve - (1)		
(d) Meatal Stenosis	6	18.2
(e) Ureterocoele	2	6.1
2. INFECTIVE UTI	15	45.5
3. OTHERS		
Non-progress of Stone in Ureter	2	6.1
Foreign Body in Bladder	2	6.1

*BNS = Bladder neck stenosis
NB = There was often more than one indication in one patient.

Aetiologic factors

Table 3 shows that 32.5% of all patients were idiopathic stone formers. Obstructive uropathy, infection, anatomical deformities (ureterocoele, posterior urethral valves), prolonged catheterisation, foreign body in the bladder and metabolic causes such as hyperuricaemia and hyperparathyroidism were considered to be of aetiologic importance to stone formation in this series. The lower social class accounted for 55.4% of all the patients (Table 4). Indications for surgery were related to the listed aetiologic factors (Table 5) and included non-progress of stone in ureter, stone blocking the urethral meatus, (Fig. 4) ureterocoele, (Fig. 3), foreign body in the bladder, infection and posterior urethral valves. More than a single indication was often found in the same patient.

Analysis of calculi

Most of the stones in this series (98.7%) were radio-opaque indicating high calcium content. Other components on both physical and chemical analyses included magnesium/ammonium phosphates, uric acid/urates and carbonates in the form of aragonites ($CaCo_3$). It was not possible to establish the true incidence of whewellite/weddelite stones because of lack of the appropriate chemicals for analysis, but at least 38% of the patients showed oxalate crystals in their urine sediments. Atomic absorption spectrophotometric analysis of the stones revealed levels of more than 100ppm of sodium in 83%, and of magnesium in 33% of samples.

Discussion

The Negroid race is usually credited with a low incidence of urinary calculi[4]. Caucasian populations have recorded incidence in excess of 68 per 100,000[8,9] and in Israel 1160 per 100,000[10]. This study gives an incidence of 19.1 per 100,000 to confirm the generally low incidence of black populations, but gives the second highest incidence of stone disease among the Nigerian reports [5,6,7,11]. Reasons for such variations are under active investigation in our centre. But they may be related to different environmental conditions peculiar to the South-Eastern region of Nigeria. The diet is substantially different. Reference to the food composition table for use in Africa reveals a high concentration of calcium in sea foods such as fish, crayfish, lobsters, crabs, scallops and periwinkle, eaten in relatively high quantities in this region[12]. This view was corroborated by Mba, A.U. 1980, who also independently demonstrated high concentrations of calcium in periwinkle (*P. byronensis*) crayfish and to a lesser extent, snails[13]. The staple energy-yielding foods of this region also contain calcium in levels which are comparable to populations elsewhere with high intake of dairy products[12]. It is noteworthy that 55% of our largely riverine patient population come from the lower socio-economic class which rely on these unusual sources of protein for their daily protein needs.

Our dietary vegetables such as pumpkins and talinum, are known to have high contents of oxalates

and may influence the pattern of stone disease observed in this series. A study to substantiate this view is being currently undertaken.

Previous studies have shown that 60% of all stones in the urinary tract are passed spontaneously with 30% requiring surgical intervention[14,15]. In this series, corresponding figures were 40% and 55% respectively. This however may not represent the true situation as many patients do not get to hospital. Ljunghall and Hedstrant (1975) have observed that less than a quarter of those with a history of urinary stones ever get referred to hospital[16]. The situation cannot be better in Nigeria with its grossly low health-conscious population. Sandegard (1956) also showed that nearly 40% of stones are passed unnoticed by the patient[15]. A large percentage of Nigerians indulge in self-medication without prescription; a lot patronise trado-medical practitioners also. It is possible that in the course of self-medication and/or patronage of trado-medical practitioners a lot of the stones get passed unnoticed. Only those patients whose stones fail to pass and in whom there is persistent pain, come to hospital. This suggestion is supported by the observation that 55% of our patients come from the lower socio-economic stratum. These also are possibly the best clients of the trado-medical practitioners, and the worst culprits of self-medication. The observed hospital incidence of 19.1 per 100,000 may be lower than the true incidence of urinary calculous disease in this environment.

The high surgical intervention rate in this series does not represent over-enthusiasm on the part of the surgeon, considering the mean size of surgically removed upper-tract stones of 17.7mm ± 9.5mm, which bears credence to this claim. These represent stones that would never pass spontaneously[15].

Table 6: Urinary calculi in South-Eastern Nigeria: Organisms associated with calculi in calabar

Organisms	No. of Patients(21)	%
Coliforms	5	23.8
Proteus spp.	3	14.3
Proteus rettgeri	1	4.8
Ps. aeruginosa	3	14.3
Staph. aureus	4	19.0
E. Coli	2	9.5
Klebsiella	3	14.3
	21	100

Infection, a well recognised enhancer of calculogenesis, was detected in 30% of our patient population. It is quite possible that the rate of infection was higher than the observed value. For instance, 71% of the patients had an infection or infection — inducing phenomenon such as obstructive uropathy, prolonged catheterisation or foreign body in the bladder (Table 3). Although it is not yet established whether infection is a pre-requisite for struvite stone formation in clinical stone disease, an observation that a good number of our specimens were the so-called infective stones $Ca_3(PO_4)_2$ and $(NH_4)_3PO_4$, and the spectrum of organisms isolated seem to suggest an aetiologic role (Table 6).

Stone formation may be secondary to metabolic abnormalities which may also be complicated by infection. Although only 6.3% hyperuricaemia and 2.5% hyperparathyroidism were observed in our series, a sizeable (38%) oxalluria was also observed, suggesting a metabolic aetiology in some of these cases. Some of the observed level of idiopathic stones (32.5%) may actually have an infection base which has been masked by high rates of antibiotic abuse. Biochemical, radiological and spectrophotometric analyses indicate that 98.7% of the stones contain calcium in varying concentrations. X-ray pictures showed that a number of these only had an outer coat of calcification with radioluscent centre core, strongly suggesting that calcium deposition was a secondary event in these stones, to further confirm infection as a very important aetiologic factor. Hypercalciuria is not always seen in stone formers. An interplay of infection and metabolic processes is seen as the most potent aetiologic factor among our patients. Five of them had uric acid stones; one amongst these had an attack of gouty arthritis whilst is hospital for urolithiasis. He responded to allopurinol and has not nad a recurrence in two years of regular treatment.

Results of stone analysis have revealed that 83% of the stones contained sodium at concentrations over 1000ppm whilst 33% contained magnesium in similar concentrations. Their high content in the stones is noted with interest and the significance of this finding is worthy of further study, as their concentrations may be significant in the low incidence of urinary calculous disease among blacks generally. The role of macro-molecules has not been studied because of lack of the appropriate chemicals.

European studies have shown that renal stones are more common in areas with soft water than where

the water is hard. Water in South-Eastern Nigeria is soft. It is possible that this as well as other environmental factors earlier discussed, may play a role in the relatively high incidence of stone disease as well as in the peculiar caucasian pattern observed in this study. Further work is continuing to elucidate these observations.

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