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Original Article

Chemical Analysis of Uroliths: A Two-Center Study of Doctors' Practice and Perspective in South-East, Nigeria

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Abstract

Introduction: Urolithiasis is a global disease condition secondary to a variety of factors, and sometimes associated with serious complications. Determination of stone composition is important in delineating causative factors. Knowledge of causative and precipitating factors aids patient management and prevention of recurrence. **Objective:** The authors' aim was to evaluate the practice and perspective of doctors regarding chemical analysis of stones in management of urolithiasis. **Materials and Methods:** This comparative cross-sectional study was done between December 2016 and May 2017 in two teaching hospitals in South-East, Nigeria. Data were collected using self-administered questionnaires. **Results:** In all, 88 doctors with mean (standard deviation) age of 37.3 (9.5) years participated in the study. Urinary bladder stones were the most frequently managed, 51 (58.0%); 45 (51.1%) participants do not routinely send stones for chemical analysis. All respondents (100%) agreed that stone analysis is beneficial to patient management. **Conclusion:** This study showed that in spite of all respondents affirming that chemical analysis of uroliths is beneficial to patient management, more than half of respondents do not routinely send stones for analysis.

Keywords: *Doctor, laboratory, perspective, practice, urinary calculi*

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Introduction

Urolithiasis is a disease which occurs globally and places an appreciable morbidity on people affected.[1,2] Stones in the renal pelvis, ureter, bladder, and urethra all constitute the entity known as urolithiasis. In the past 20 years, considerable increase in global incidence has been reported.[3] According to the National Health and Nutrition Examination Survey,[4] as of 2012, 10.6% of men and 7.1% of women in the United States are affected by renal stone disease, compared with just 6.3% of men and 4.1% of women that were affected in 1994. In Nigeria, an increase in prevalence has also been reported[5-7] by different researchers. This increase in prevalence has also been reported even among children.[8]

Stone formation is thought to be secondary to a range of factors which include urinary stasis and infection,[9] dietary factors,[10] supersaturation of urine,[11] metabolic disorders,[11] prior occurrence,[12] family history,[12] and climate.[13]

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Pain associated with renal colic can be severe and quite debilitating. Recurrences are common and may range from 10% to 23% per year to 50% in 5 years.[14] Urolithiasis may also be associated with complications, sometimes as serious as chronic kidney disease.[15,16]

More modern forms of treatment currently used include extracorporeal shock wave lithotripsy, percutaneous nephrolithotomy, and ureteroscopy. However, in resource-limited countries like Nigeria, patients with urolithiasis requiring surgery still undergo open surgical form of treatment because the more modern treatment methods are still not widely available.

The nature of the formed stones has significant implications in both individualized management of stone disease and prevention of recurrence. The treatment

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of uric acid stones consists not only of hydration (urine volume above 2000 mL daily) but also mainly of urine alkalinization,[17] and also use of xanthine oxidase inhibitors as an adjunct.[18] For calcium-containing stones, hypocitraturia is a proven risk factor[19] and there is evidence that the degree of hypercalciuria is worsened by high dietary sodium intake, high animal protein intake, and loop diuretics.[20] For optimal individualized patient management, stone analysis is expected to form part of the tests performed on every stone disease patient.

Chemical stone analysis is a qualitative method of determining the chemical composition of uroliths. It is generally considered to be the traditional gold standard.[21] More modern methods which have been developed include X-ray diffraction, infrared spectroscopy, thermogravimetry, optic polarizing microscopy, and scanning electron microscopy, among others. Chemical analysis, however, is one method which is simple, affordable, available, and adaptable to most routine laboratories in resource-limited countries like Nigeria. Hence, it is widely used as the more modern methods are beyond the capacities of most routine laboratories in Nigeria.

The purpose of determining the chemical composition of uroliths is to enhance the understanding of the pathophysiology and institute proper management modalities and effective patient counseling, all geared toward restoring optimal patient's state of health and prevention of recurrence.

Indeed, prevention of recurrence should be of utmost importance to both the attending physician and the patient with stone disease especially one undergoing surgery as is the case in resource-limited countries like Nigeria. This is to prevent the patient from a repeat experience of the debilitating pain and other symptoms of renal colic coupled with possible complications of surgery such as excessive blood loss, inadvertent injury to contiguous tissues, scar formation, complications, and side effects of anesthetic medications.

The authors undertook this study to determine the proportion of doctors among the study population in the practice of routinely requesting for chemical analysis of uroliths and their perspective toward the investigation. A review of available literature by the authors revealed a dearth of data on this topic. This study therefore will contribute to provision of much-needed information on this topic.

Materials and Methods

Study location

This comparative cross-sectional study was carried out in University of Nigeria Teaching Hospital (UNTH), Enugu, Enugu State, and Federal Teaching Hospital, Abakaliki, Ebonyi State, both in South-East, Nigeria, between December 2016 and May 2017.

Study design

Study population was recruited using a total population sampling of all doctors who work in Surgery and Internal Medicine departments of the two institutions. The purpose of the data was explained to them and confidentiality of data assured. A total of 88 consenting doctors were included in the study. The participants were then interviewed using self-administered semi-structured questionnaires. The questionnaire was pretested using nine doctors for feasibility and acceptability, which were then examined by the clarity of questions, appropriate response options, proportion of missing item responses, time spent in filling the questionnaire, and ease of administration. The study questionnaire assessed sociodemographic characteristics which included age, sex, professional cadre, department, and unit within the department. Practice was assessed using nine questions, whereas perspective was assessed using three questions.

Inclusion criteria

Consenting doctors who have managed patients with any form of urinary stone were included in the study.

Exclusion criteria

Health workers who are not doctors, doctors who have not managed patients with urinary stone, and doctors declining consent were excluded.

Statistical analysis

Data were analyzed using Stata version 13 (Stata Corp., USA). Continuous variables were presented as mean [standard deviation (SD)], number, and percentages, while categorical variables were presented only as counts (number) and percentages. Chi-square (χ^2) and Fisher's exact probability tests were used to compare categorical proportions (Fisher's exact was used when the expected cell values were less than 5). All *P* values were bidirectional, and a *P* value <0.05 was considered statistically significant.

Ethical considerations

Ethical clearance was obtained from UNTH Health Research Ethics Committee after review and approval of study proposal. Informed consent was obtained from participants after the purpose of the study was explained to them.

Results

A total of 88 consenting doctors were included in the study. The mean (SD) age of participants was 37.3 (9.5)

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years ranging from 22 to 60 years. The results showed a sex preponderance with males accounting for 84.1% of respondents and giving a male-to-female ratio of 5.3:1. Most respondents 37 (42.1%) were from general surgery. Urology and pediatric surgery units constituted 23 (26.1%) each, whereas respondents from internal medicine constituted 5 (5.7%). Age and sex distribution is shown in Table 1. Figure 1 shows a box plot of participants' age. According to professional cadre, more resident doctors 51 (57.9%) participated in the study as shown in Figure 2.

Table 1: Age and sex distribution

Age group (years)	Male, *n* (%)	Female, *n* (%)	Total, *n* (%)
21-30	16 (21.6)	11 (78.6)	27 (30.7)
31-40	27 (36.5)	0 (0.0)	27 (30.7)
41-50	27 (36.5)	2 (14.3)	29 (32.9)
51-60	4 (5.4)	1 (7.1)	5 (5.7)
Total	74 (100.0)	14 (100.0)	88 (100.0)

Table 2: Anatomical locations of stones managed

Anatomical location	*n* (%)
Ureter	16 (18.2)
Urinary bladder	51 (58.0)
Renal	36 (40.9)
Urethra	4 (4.5)
Gall bladder	42 (47.7)

Total above 100% due to individuals having managed stones from multiple locations

Table 3: Estimated frequency of stone surgical removal

Frequency	*n* (%)
One patient per month	13 (14.8)
One patient in 2 months	20 (22.7)
One patient in 6 months	29 (33.0)
One patient in 1-3 years	26 (29.5)
Total	88 (100.0)

All participants who responded admitted to having managed at least one form of stone disease. Urinary bladder stones 51 (58.0%) were the most frequent forms managed by respondents. This is shown in Table 2.

The majority 83 (94.3%) of the respondents indicated that open surgery was the definitive management for the cases they treated, 14 (15.9%) indicated medical management, whereas 0 (0.0%) indicated lithotripsy.

The majority of the respondents 29 (33.0%) indicated "once in 6 months" as the estimated frequency for surgical removal of stones in their units, as depicted in Table 3. A greater percentage of the doctors 45 (51.1%) were not in the practice of routinely sending stones for chemical analysis. Among those who do not send, all the consultants involved and 40.0% of the residents felt the test was not necessary.

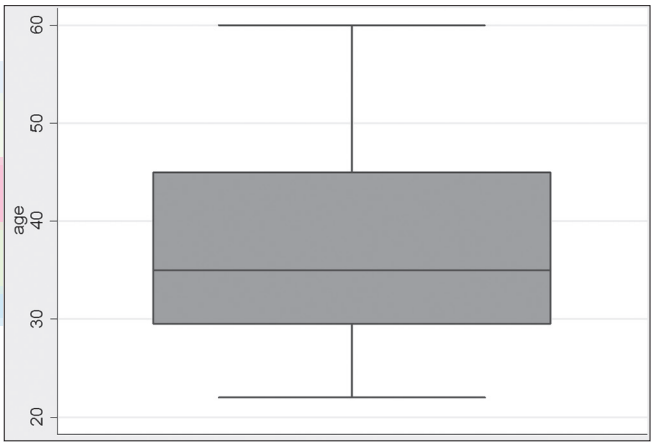

Figure 1: Box plot of participants' age

Table 4: Assessment of practice

Practice questions	Responses	Consultants (*n*=19), *n* (%)	Residents (*n*=51), *n* (%)	Interns (*n*=18), *n* (%)	Total, *n* (%)	*P*
Do you routinely send stones for chemical analysis?	Yes	7 (36.8)	30 (58.8)	6 (33.3)	43 (48.9)	0.09#
	No	12 (63.2)	21 (41.2)	12 (66.7)	45 (51.1)	
If no, why?	a) Doctor felt it was not necessary	9 (75.0)	8 (38.1)	6 (50.0)	23 (51.1)	0.469^
	b) Patient refusal	0 (0.0)	2 (9.5)	0 (0.0)	2 (4.4)	
	c) Lack of funds	2 (16.7)	5 (23.8)	4 (33.3)	11 (24.4)	
	d) Unavailability of lab facility	1 (8.3)	6 (28.6)	2 (16.7)	9 (20.0)	
If yes, do you see the result?	Yes	7 (100.0)	18 (60.0)	0 (0.0)	25 (58.1)	0.001^
	No	0 (0.0)	11 (36.7)	6 (100.0)	17 (39.6)	
	Not always	0 (0.0)	1 (3.3)	0 (0.0)	1 (2.3)	
Does result influence further management?	Yes	6 (85.7)	11 (57.9)	0 (0.0)	17 (65.4)	0.53^
	No	1 (14.3)	7 (36.8)	0 (0.0)	8 (30.8)	
	Not sure	0	1 (5.3)	0 (0.0)	1 (3.8)	

#Chi-square test, ^Fisher's exact test

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Table 5: Assessment of perspective

Questions	Responses	Consultants (*n*=19), *n* (%)	Residents (*n*=51), *n* (%)	Interns (*n*=18), *n* (%)	Total, *n* (%)	*P*
Do you personally think stone chemical analysis is beneficial?	Yes	19 (100)	51 (100)	18 (100)	88 (100)	1.00^
	No	0 (0)	0 (0)	0 (0)	0 (0)	
Should all doctors be encouraged to send stones for chemical analysis?	Yes	19 (100)	35 (68.6)	18 (100)	72 (81.8)	<0.001^
	No	0 (0)	16 (31.4)	0 (100)	16 (18.2)	
Should the laboratories be better equipped with more modern facilities for stone analysis?	Yes	19 (100)	51 (100)	18 (100)	88 (100)	1.00^
	No	0 (0)	0 (0)	0 (0)	0 (0)	

^Fisher's exact test

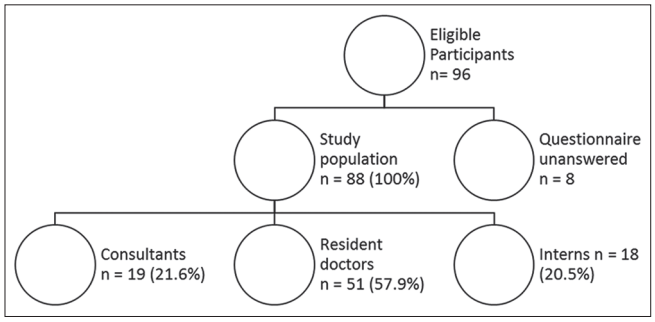

Figure 2: Flow chart and professional distribution of participants

Among those who routinely send stones for analysis, there was a significant association between professional cadre and practice of seeing the result of the analysis. All the consultants indicated that they see the results of the analysis, whereas only 18 (60.0%) of residents and 0 (0.0%) of interns endeavor to see the results. Still out of those who see the results, the majority 17 (65.4%) indicated that the results influenced further management. Table 4 depicts the assessment of practice.

In terms of perspective, all the respondents agreed that stone analysis is beneficial to patient management, and that the laboratories should be better equipped with more modern facilities for stone analysis. However, a significant proportion of residents (31.4%) felt that doctors should not be encouraged to send stones for chemical analysis. This is shown in Table 5.

Discussion

Stone disease remains a significant cause of morbidity both in Nigeria and indeed globally. Hence, efforts aimed at proper management and reduction of recurrence should be greatly encouraged. And doctors definitely should be at the forefront of this crusade, hence this study was conducted among doctors who manage stone disease patients.

The preponderance of male respondents in this study may not be unconnected to the fact that surgery is a male-dominated area of specialty in medical practice. This male domination may be attributed to gender bias and dearth of same-sex (female) role models in surgical practice among other reasons. The mean age observed in this study is comparable to 35.3 years reported by a study[22] conducted among resident doctors in surgery departments in South-East, Nigeria. The slightly higher mean age of 37.3 years in this study might be due to inclusion of consultants, whereas the previously mentioned study included only resident doctors. Another reason might be the currently competitive nature of residency program, creating a long waiting time for some doctors before being admitted into residency training.

Urinary bladder stones were the commonest form of stones managed by respondents. This is in line with previous studies[23,24] which reported high prevalence of bladder stones in Nigeria.

Currently, most stone disease cases in Nigeria are managed by open surgery. This is reflected in the responses of majority 83 (94.3%) of the participants who indicated surgery as the definitive management for the cases managed. This, however, differs from the practice in Western countries where most stone diseases are treated by less invasive methods.[25,26] This may be attributed to the unavailability of these less invasive methods in many health facilities in Nigeria. High cost of the procedure compared with open surgery is another factor reported by a study[27] which led to discontinuation of the extracorporeal shock wave lithotripsy where it was earlier used. This is understandable because of the nonoptimal form of health insurance operative in Nigeria, and thus most patients have to make out-of-pocket payment for healthcare.

More than half of the respondents 55 (62.5%) were shown to have managed at least a patient between every 6 months and 3 years. Despite the reported increase in prevalence of stone disease in Nigeria, it is still lower than reported prevalence in other parts of the world. Available evidence shows that in 1995, while a hospital incidence of 19.1 per 100,000 was reported in Nigeria,[6] an incidence of 68.9 per 100,000 was reported in Japan.[28] Available data comparing stone disease prevalence between races in the United

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States noted that prevalence and incidence rates were highest for Whites, followed by Hispanics, Blacks, and Asians.[28]

In this study, a greater proportion of the participants 45 (51.1%) were not in the practice of sending stones for analysis. Most of those who do not send 23 (51.1%) reported that they felt the test was unnecessary. This is worrisome because most patients look up to the doctor for medical guidance. In a resource-limited country like Nigeria where more modern methods of stone analysis are largely unavailable, chemical analysis remains virtually the only method of determining the composition of uroliths. Knowledge of the stone composition helps elucidate the causative factors of the disease. Depending on the cause of stone formation, further management may then be tailored with the goal of providing individualized therapy toward optimizing the quality of life and prevention of recurrence. This may be in the form of antibiotic therapy toward complete eradication of the offending organism in cases of struvite (infection) stones, counseling the patient with regard to diet in case of oxalate and/or calcium-containing stones, urine alkalization, and medications for uric acid stones, and generally educating the patient appropriately with regard to understanding his condition and taking steps to minimize recurrence.

The pattern seen among those who send stones for analysis and endeavor to see the result may be due to experience gained through years of practice, as all the consultants see the need of looking at the analysis results. Furthermore, majority 6 (85.7%) of the consultants affirmed that the results influenced further management.

Conclusion and Recommendation

All respondents affirmed that chemical stone analysis is beneficial to patient management. However, a greater proportion of the participants were not in the practice of routinely sending stones for analysis. The authors therefore recommend further strengthening of doctors' knowledge in the use of information contained in the results of chemical analysis of uroliths in patient management.

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Conflicts of interest

There are no conflicts of interest.

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