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# Management of urinary stone disease in a resource limited tertiary hospital.

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***Abstract***
***Background****:Urine stone disease is increasingly becoming a common diagnosis in Sub-Saharan Africa. Different factors have been outlined as the cause. The incidence of associated renal function loss is also on the increase. Different management protocols and techniques have been proposed. Availability of newer technological adjuncts is not universal.*
***Aim:*** *to present management of urinary tract stones in a resource limited centre.*
***Material and methods:*** *A ten-year retrospective study of patients treated for urolithiasis was conducted in the University of Port-Harcourt teaching hospital from Jan 2007 to Nov 2017. Data on the age, sex, underlying clinical condition, location of the stone as well as surgical procedures done were collected. Qualitative analysis of the stones was carried out. Data was analysed with SPSS version 20.0*
***Results:*** *Eighty-nine patients were treated with urinary calculi within the study period. The occurrence of urinary tract stones was found to be greater in males with a proportion of 77.53%, than in females 22.47%. Stones were commonest in the 31-40 years age group. Stones were most commonly located in the kidneys, followed by the bladder and least in the ureter .loin pain was the commonest complain by the patient. There was no identifiable cause for urinary stone in majority of the cases (idiopathic, 64%). Seventy three cases of urinary stone disease were treated surgically, with majority of case treated with open procedures. Combinations of procedures were necessary in a selected number of cases. Endoscopic procedures were mainly carried out in the lower urinary tract. Majority of the stones were calcium based stones.*
***Conclusion****: The diagnosis of urinary tract stone disease is increasing in our environment with a male preponderance. Mainly open surgical procedures are carried out in our environment. Acquisition of modern therapeutic options is necessary.*
***Running title****: urinary tract stones.*
*Key words: Urinary tract stones, urolithiasis, risk factors, Nigeria.*

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## I. Introduction

The presence of stones in any part of the urinary tract is a major disease entity that physicians and urologists have to tackle globally. The major function of the urinary tract is production of urine (an effluent containing metabolic waste and ions), and excretion of the urine[1]. Different parts of the urinary tract have mechanism that prevents precipitation of molecules in the urine ensuring open passage ways[1,2]. The mechanisms include the flow pattern and peristaltic movements, the intrinsic constituents of urine and the ability of the tract to create supersaturated solutions. However, when there are intrinsic failures of the mechanisms or external factors overwhelming these protective mechanisms, a calculus is formed in the urinary tract. The calculi formed can be passed out, propagate and increase in size, and/or cause obstruction. These lead to different disease conditions of the tract and can bring about severe morbidity and mortality to the affected individual[1,2].

The diagnosis and treatment of urinary calculi has undergone major advances over the years in different part of the world[3,4]. The aetiology, risk factors, precipitating factors and symptomatology is now better understood. This has led to an increasing number of diagnoses of urinary stones compared to what was seen in previous documentation[5]. There is also now a wide range of diagnostic tools available as an adjunct to clinical diagnosis and novel treatment methods[6].

Urinary stone disease was initially documented to be rare in Africans[7]. Previous studies indicate a higher incidence in Europe and United States of America with lower stone rates in African Americans[8,9,10]. However, more recent studies are showing increasing rates all over the world including sub-saharan Africa[11,12]. There has also been reported differences in gender occurrence and presentation, sex and, geographical

differences [11,12]. There has been a lot of advances in treatment options for urinary tract stones, however practice in Nigeria has lagged behind [12,13,14]. In our centre, urinary stone disease was consider relatively uncommon. This was attributed to a variety of factors with no clear consensus. However in the last ten years, there has been an upsurge in urinary stone disease in our centre. This has coincided with improved health seeking behaviour, better diagnostic facilities, increased westernized diet amongst other factors[15,16]. There is gradual introduction ofmodern treatment methods especially the use of minimal access based treatment that was before now not available.

The growing incidence of urinary tract calculi in our centre necessitated a review of our cases seen over the last ten years, with emphasis on presentation and treatment options available. Thechemical components of the stones found was also assessed as a basis for a more detailed research into the chemical composition of the stone found in our sub region

## II. Materials And Methods

This study was carried out with patients from the urology unit of University of Port Harcourt Teaching hospital, a tertiary hospital in Port Harcourt, Niger Delta, Nigeria. Approval for the study was obtained from the institution's research ethics committee.

A retrospective study of all patients treated for urinary tract stone from 2007 to 2017 was conducted. Data was retrieved from the clinic, theatres and wards. The age, sex, clinical diagnoses, location of stone as well as treatment and outcome of treatment were reviewed. The diagnosis of urinary tract calculi was made based on the history, physical examination and an imaging study, either an abdominopelvic scan, plain abdominal radiograph, intravenous urogram, computed tomography or a combination of these as deemed necessary. Patients who met the indications for surgery (features of obstruction, deranged electrolytes or who presented with pain) and consented to surgery were operated upon. Renal stones were treated with open pyelolithotomies,open nephrolithotomy,or nephrectomy (performed on a patient with non-functional kidney). Open cystolithotomy as part of transvesical prostatectomy was also performed. Endoscopic procedures performed included cystolitholapaxy. Stones obtained were subsequently analyzed. Stone was washed in water and stored in sterile container. Patient's name, age, sex, and underlying condition were recorded. Stone's number, size, consistency, cut surface, weight and colour were recorded. Each stone was cut, a portion saved and the other portion was subjected to qualitative chemical analysis calcium oxalate, phosphate, ammonium, carbonate, uric acid, magnesium, xanthine, and cysteine. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows (Version 20.0).

## III. Results

Eighty nine patients were treated with urinary tract calculi within the study period.The occurrence of urinary tract stones was found to be greater in males with a proportion of 77.53%, than in females 22.47% giving a male to female ratio of 3.45:1 Stones were commonest in the 31-40 years age group, 31.46% and least ≤ 20years old, 2.25% (table 1). The mean age was 45.07±13.029 years.

In this study, stones were most commonly located in the kidneys(n=32, %), followed by the bladder(30) and least in the urethra (8)(Figure 1).

Abdominal pain was the commonest symptom from the patient, depending on the site of the stone. Eight of the respondents had haematuria and two (2) presented in acute urine retention. Other symptoms elucidated include fever, urgency, dysuria, stone particles in urine etc (Table 2).

There was no identifiable cause for urinary stone in majority of the cases(idiopathic, 64%) with benign prostatic hyperplasia forming being the most prevalent identifiable aetiology (Table 3).

A solitary stone was diagnosed in 62.92% of cases with others being multiple. Only one case of a staghorn calculus was seen in this series(Table 4, figure 2). Seventy three cases of urinary stone disease were treated surgically, with majority of case treated with open procedures. Combinations of procedures were necessary in a selected number of cases. Endoscopic procedures were mainly carried out in the lower urinary tract(Table 5). Fifty-four of stones recovered from the various surgical procedures were analyzed for its constituents. Fifty-three stones (98.1%) of the stones removed were calcium containing stones. Only one stone (1.9%) contained ammonium phosphate. Cysteine and uric acid were not identified in any of the stones(figure 3)

## IV. Discussion

. There is a paucity of recent research into the pattern, aetiology and treatment in South South, Nigeria[11,17] . However, preliminary reports in different parts of the country show a changing trend in the occurrence of stone disease and increasing availability of novel treatment approaches. Monu noted the incidence of urolithiasis to be 6.3 per 100,000 in a study in Benin City done in 1989[17]. A more recent study in South eastern Nigeria and Northern Nigeria showed an overall hospital incidence of 19.1 and 25.75 respectively per 100,000 admissions buttressing the rising incidence [11,18]. . Coastal cities in Nigeria are noted to have a higher

incidence than more inland cities[11].The rising incidence may be attributed to dietary changes, increased use of calcium based supplements, increasing co-morbidities like obesity, diabetes, and general rise in climate temperature all over the world[19].

The incidence of stone disease has being noted to be higher in males than females in previous studies[8,15,16,17]. This study also noted a male to female ratio of 3.5: 1. The reason for the male preponderance is not fully known, but it has been found that testosterone increases endogenous oxalate leading to oxaluria, and women have a lower rate of secretion of citrate than men and this may confer some additional risk to men[15]. Men have also been found to drink less water than women.

The most affected age group with urolithiasis was the 31-40 years age group. This was the similar finding of Mbonu et al who reported 41percent of cases occurring in the same age group[20]. This may result from factors of increased activity with reduced rehydration[7,8]. There is also a slight increase in diagnosis of urolithiasis in pregnant women compared to non pregnant females and this is due to some anatomic and pathophysiologic changes seen in pregnancy[19].

Abdominal pain was the commonest symptom of urinary calculus disease elicited in this study. The characteristic and location of the pain was dependent on the location of the stone, size of stone and patients' general perception of pain. Portis et al noted that the presence of abdominal pain in urolithiasis may be confused with other differential diagnoses such as acute appendicitis, diverticulitis, cholecystitis and even some gynaecological conditions like torsion of ovarian cyst[21]. This is important to note because only a detailed history with high index of suspicion and/or investigative adjuncts will help clinch the correct diagnosis[21].

The presence of macroscopic haematuria can help with the diagnosis however only 7.14 percent of cases had this symptom. Lallas et al reported the occurrence of microscopic haematuria in 45.9 percent of cases analyzed, and there was positive correlation with occurrence of abdominal pain[22]. Spivacow et al reported that the macroscopic haematuria was the initial symptom of urolithiasis in 21.4 percent of 245 adult respondents[23]. The presence of micro trauma associated with attempts at peristaltic movement of the stone through the narrow tract and infection due to stasis, are reasons for the haematuria. The other symptoms seen in this study were those of complicating urinary tract infection or primary cause of urinary tract obstruction such as lower urinary tract symptoms(LUTS) in patients with prostatic enlargements.

Fifty six out of the eighty nine analyzed cases revealed single urinary calculi on radiological assessment (intravenous urogram). This is similar to a study done by Ferrandino et al who reported a mean stone number of 1.7[24]. Tzou et al also noted occurrence of a single stone in 63% of 219 patients been assessed for correlation of radiologic diagnosis and urological findings[25]. Assessment of stone number is important in the choice of treatment options. Stone number does not have any clear correlation with aetiology and some stones may have been passed out unnoticed by the patient[24].

Abdominopelvic ultrasound was used in the initial diagnosis of the stones, especially, renal and vesical stones. The major investigative modality used for confirmation of stones in this study was intravenous urogram(IVU) at the onset. The choice of IVU study was due to availability and cost considerations. However, more recently computerized tomography scan (CTscan) is now used as they have become available. Previously, IVU was the gold standard in assessing the urinary tract for stones. However over the last two decades, noncontract computed tomography(NCCT) is now considered the gold standard and has taken over from intravenous urogram[26,27]. Intravenous urogram has a lot of draw backs including being unable to assess parenchymal stones, non-functional kidneys etc. However it still has a role especially in low resource setting where computed tomography may not be widely available[28].

The options of treatment included open surgical and endoscopic techniques. Open procedures were most commonly used and the frequency was based on the location of the stone. Some patients required combined endoscopic and open procedures to handle the etiology and remove the offending stone. The size of the stone, financial capability of the patient, availability of endoscopic facilities all were factored in the choice of the procedures. The 2016 European association of urologist guidelines show limited indications for open and laparoscopic techniques. The major treatment modalities being advocated include extracorporeal shockwave lithotripsy, ureteroscopy and percutaneous nephrolithotomy[29].

In this study due to lack of equipment , all the renal and ureteric stones were treated by open surgeries, except for small stones that benefitted from medical expulsive therapy with spontaneous passage of stone. The only endoscopic stone management was cystolitholapaxy. Open surgery for stone is associated with increased morbidity, and prolonged hospital stay. Despite some of the limitations of open surgeries, the outcome of treatments was generally satisfactory in this study. The first shock wave lithotripsy centre in Nigeria was closed as a result of the non-economic benefit of the centre[13]. However, recently, few centres have acquired more technologically advanced treatment options for urinary tract stones.

Seventy nine patients in this study did not have any complications, with good postoperative outcomes. The stone clearance rates were not assessed due to poor compliance to long term follow up by patients. Four patients reported to have residual stones. Different urolithiasis scoring systems have been proposed to help

assess outcome of stone surgery[32]. These scoring systems are adapted for percutaneous nephrolithotomy and include Guy Stone score, S.T.O.N.E, etc.

The most common complication of stone disease is recurrence. Understanding the chemical composition of these stones will help to determine the risk factors which will in no small way proffer solutions to the problem of recurrence.Various physical and chemical methods have been used for both the qualitative and quantitative analysis of stones. The method for analysis will be determined by many factors; including availability of equipment and chemicals. In this study, qualitative stone analysis was conducted because our centre lacked the equipment for quantitative analysis. Majority of the stones assessed (98.1%) were calcium containing stones. This is in keeping with findings by Madhudsudan et al[30].

## V. Conclusion.

Urinary tract stones are longer not uncommon in this environment. Males were more commonly affected. Stones were more commonly located in the upper urinary tract. Mainly open surgical procedures were offered due to limited scope of armamentarium. Endourological and minimal access procedures for stones need to be improved upon. Where minimal access surgery and upper tract endoscopy are not fully established, open surgery still has a place in treatment of stones. More detailed qualitative stone analysis will determine the composition of the stones to guide preventive measures.

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**Table 1**.showing age and sex distribution of the patients

| Age Group | Frequency n=89 | Percentage (%) |
|---|---|---|
| ≤ 20 years | 2 | 2.25 |
| 21-30 years | 8 | 8.99 |
| 31-40 years | 28 | 31.46 |
| 41-50 years | 21 | 23.60 |
| 51-60 years | 16 | 17.98 |
| ≥ 60 years | 14 | 15.73 |
| ***Mean age*** | | ***45.07 ± 13.29*** |
| | | |
| **Sex** | | |
| Male | 69 | 77.53 |
| Female | 20 | 22.47 |

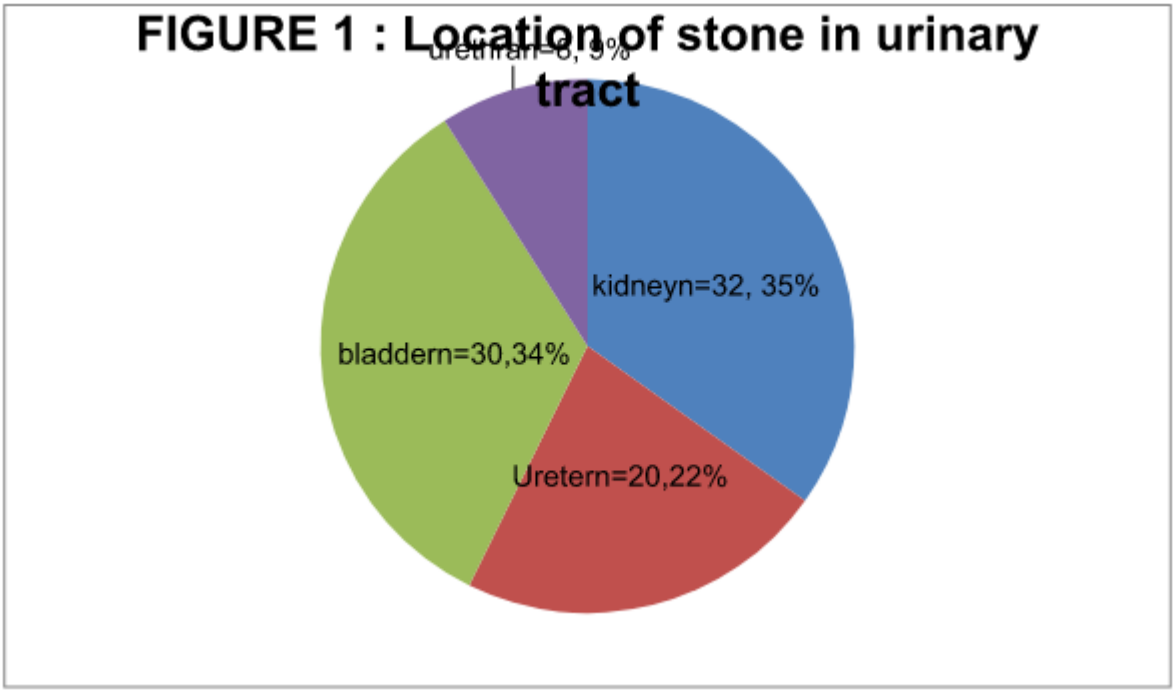


**Table 2:** Presenting complaints.

| Presenting complaint | No | % |
|---|---|---|
| Pain | 26 | 23.21 |
| LUTS with suprapubic pains | 14 | 12.50 |
| Dysuria | 12 | 10.71 |
| Renal pain | 10 | 8.93 |
| Haematuria | 8 | 7.14 |
| Flank pain | 7 | 6.25 |
| Abdominal pain | 6 | 5.36 |
| Fever | 5 | 4.46 |
| Suprapubic pain | 4 | 3.57 |
| Ureteric colic | 4 | 3.57 |
| Particles in Urine | 3 | 2.68 |
| Straining | 3 | 2.68 |
| Lower urinary tract symptoms | 2 | 1.79 |
| Acute urinary retention | 2 | 1.79 |
| Colicky pain | 1 | 0.89 |
| Difficulty passing urine | 1 | 0.89 |
| Groin pain | 1 | 0.89 |
| Staghorn calculus | 1 | 0.89 |
| Urethral pain | 1 | 0.89 |
| Urgency (Urge incontinence) | 1 | 0.89 |

**TABLE 3:** Aetiology of stone disease

| Aetiology | No | % |
|---|---|---|
| Idiopathic | 64 | 71.11 |
| Benign prostatic hyperplasia | 12 | 13.33 |
| Urethral Stricture | 7 | 7.78 |
| Post-herniorraphy | 1 | 1.11 |
| Prostate cancer | 1 | 1.11 |
| Familial | 1 | 1.11 |
| Foreign Body(IUCD) | 1 | 1.11 |
| STENT | 1 | 1.11 |
| Ureterocoele | 1 | 1.11 |

**Table 4:** Number of stones at time of diagnosis(radiological investigation)

| Number of Stones | no | % |
|---|---|---|
| One | 56 | 62.92 |
| Two | 9 | 10.11 |
| Three | 4 | 4.49 |
| ≥ Four | 19 | 21.34 |
| Staghorn | 1 | 1.12 |

**Figure 2**.staghorn calculus from a patient.

**TABLE 5:** Surgical procedure carried out

| Surgery | | |
|---|---|---|
| Pyelolithotomy | 24 | 26.97 |
| Ureterolithotomy | 23 | 25.84 |
| Cystholithotomy | 14 | 15.73 |
| Nephrolithotomy | 8 | 8.99 |
| Cystolithlapaxy | 4 | 4.49 |
| TURP + Cystolitholapaxy | 4 | 4.49 |
| DVIU + Cystolithlapaxy | 3 | 3.37 |
| Open prostatectomy + Cystolithotomy | 3 | 3.37 |
| DVIU | 1 | 1.12 |
| DVIU + Cystolithotomy | 1 | 1.12 |
| Right Nephrectomy + Left Pyelolithotomy | 1 | 1.12 |
| Nil | 3 | 3.37 |

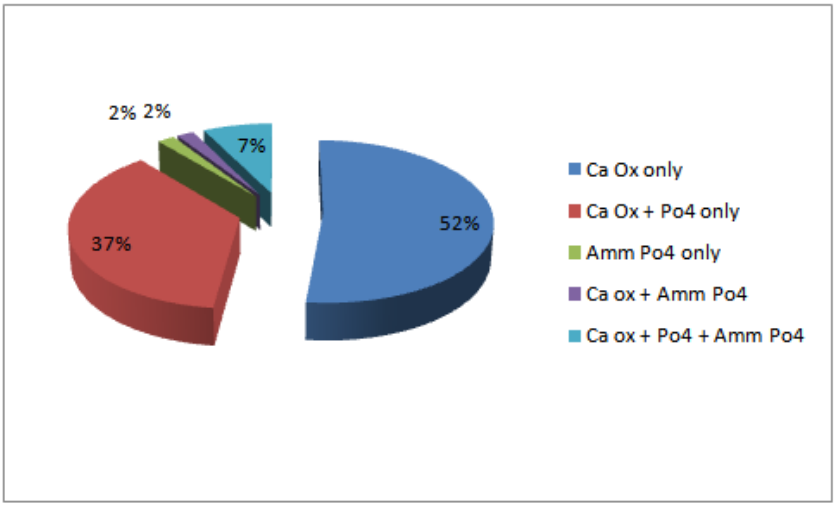
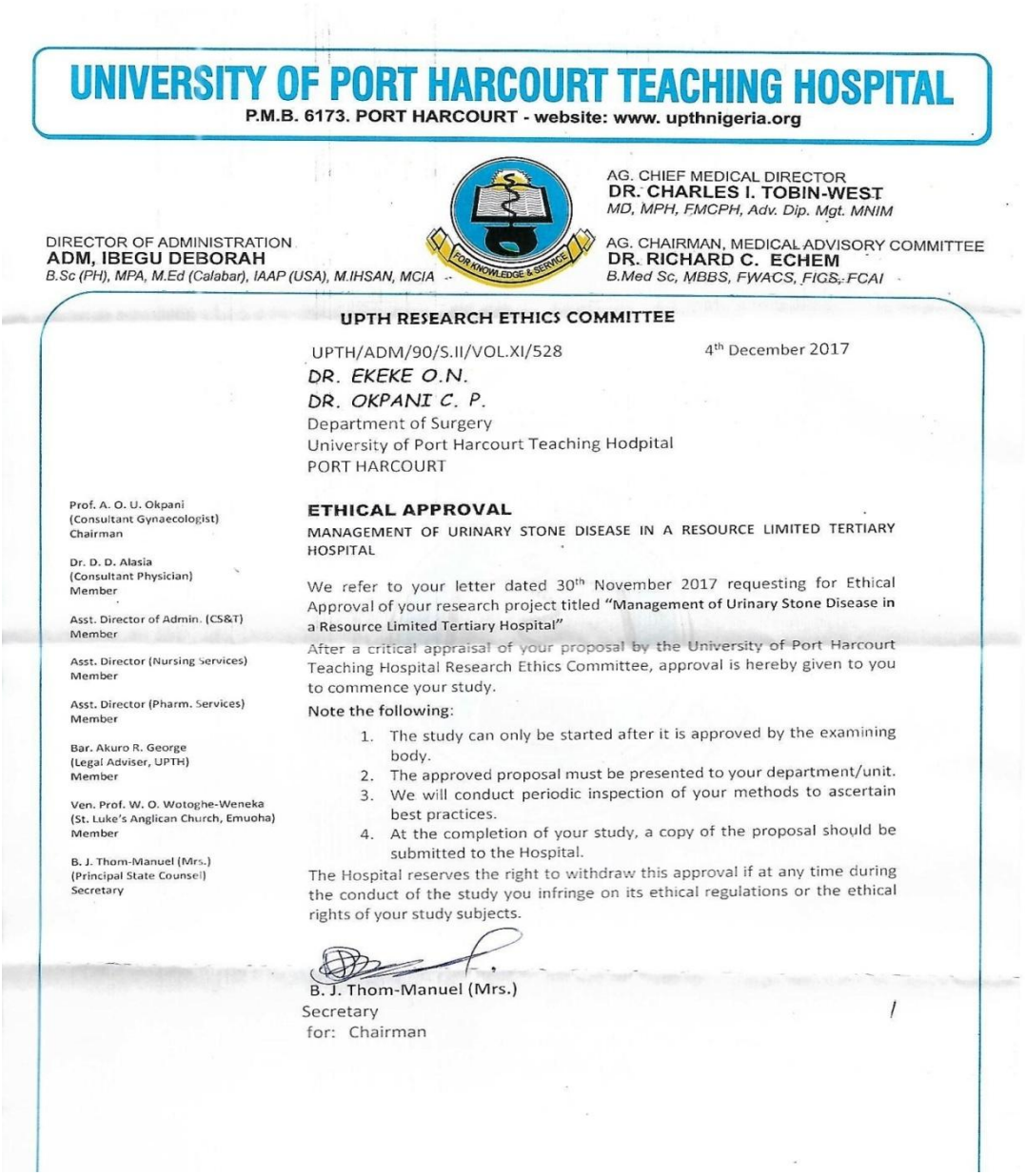



**Figure 3.**Chemical composition of stones.

Legend . ca = calcium; ox = oxalate; po4= phosphate; amm = ammonium



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**ETHICAL APPROVAL**

MANAGEMENT OF URINARY STONE DISEASE IN A RESOURCE LIMITED TERTIARY HOSPITAL

We refer to your letter dated 30th November 2017 requesting for Ethical Approval of your research project titled **"Management of Urinary Stone Disease in a Resource Limited Tertiary Hospital"**

After a critical appraisal of your proposal by the University of Port Harcourt Teaching Hospital Research Ethics Committee, approval is hereby given to you to commence your study.

Note the following:

1. The study can only be started after it is approved by the examining body.
2. The approved proposal must be presented to your department/unit.
3. We will conduct periodic inspection of your methods to ascertain best practices.
4. At the completion of your study, a copy of the proposal should be submitted to the Hospital.

The Hospital reserves the right to withdraw this approval if at any time during the conduct of the study you infringe on its ethical regulations or the ethical rights of your study subjects.

B. J. Thom-Manuel (Mrs.)
Secretary
for: Chairman

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