Analysis, treatment modality and demographic characteristics of urolithiasis patients visiting Korle-Bu Teaching Hospital in Ghana

Abstract

Background: Globally urolithiasis is on the rise and gradually becoming a public health concern due to the associated complications. This study reviewed the demographic characteristics, the chemical composition of stones, treatment modality and duration of hospitalisation of urolithiasis patients at Korle-Bu Teaching Hospital, Accra, Ghana. **Materials and Methods:** This was a retrospective study conducted between March 2019 and April 2022. Data from consecutive patients treated for urolithiasis were used for this study. Data on demographic characteristics, stones chemical composition, urine factors, urolithiasis treatment modality and duration of hospital stay after therapy were collated and analysed using descriptive and inferential approaches. **Results:** The age of the patients ranged from 2 to 75 years with a mean of 45 (±13.4). The predominant age group for stone formation was 30–39 years – 52(26.3%). Urolithiasis was common among patients in the formal employment sector: 81(40.9%). All stones had two or more chemical compositions, with the combination of calcium oxalate monohydrate, calcium oxalate dihydrate and uric acid being the predominant stone type: 88(57.5%). Ureteroscopy with semi-rigid and Percutaneous nephrolithotomy were the predominant treatment modalities: 105(53.0%) and 74(37.4%), respectively. Escherichia coli was responsible for most urinary tract infections in urolithiasis patients 8(4.0%) and the least duration of hospital stay after the procedure was associated with the use of semi-rigid ureteroscope as the treatment modality with a median duration of 2 days (1–2 days) with $P < 0.0001$. **Conclusions:** Urolithiasis was predominant among professionals in the formal sector. All stones were mixed with Calcium oxalate monohydrate, calcium oxalate dihydrate, and uric acid combination being the majority. Ureteroscopy with semi-rigid and percutaneous nephrolithotomy were the common treatment modality.

Keywords: *Chemical composition, treatment modality, urolithiasis*

Evans Ametefe Akpakli, Emmanuel Asante[1], Matthew Yamoah Kyei[2], Kenneth Klufio, Bernard Toboh, James Edward Mensah[2]

Department of Surgery, Korle-Bu Teaching Hospital, [1]Department of Surgery, University of Ghana Medical Centre, [2]School of Medicine and Dentistry, College of Health Sciences, Accra, Ghana

Background

Urolithiasis is the presence of stones in the urinary system, which can present with severe colicky pain, haematuria, recurrent urinary tract infections and renal failure, which may occur when the stones obstruct the kidneys. Urolithiasis is a urologic emergency and requires prompt diagnosis and treatment to prevent associated morbidities. In addition, it is gradually becoming a public health concern in Ghana due to the increasing number of patients reported with urolithiasis.

The incidence and prevalence of Urolithiasis vary geographically, racially, gender-wise and with age.[1,2] The reported incidence of urinary stone disease is 5%–9% in Europe, 13%–15% in the USA and the highest 20%–25% in the Middle East attributable to it hot climatic conditions.[3] The incidence of urinary stone disease is on the rise globally, with approximately 50% rise in cases diagnosed over the past 10 years[3,4] and Africa is no exception due to the adoption of a westernised lifestyle. The prevalence of stone disease is higher in males than females; this also increases with age, with peak incidence occurring between 40 and 49 years.[4] Although the general belief is that urolithiasis is commoner among Caucasians than Africans, anecdotal evidence suggests that many cases of Urolithiasis are being managed in clinics across Africa. The increasing incidence of Urolithiasis globally can become a challenge in African countries that may not have the requisite equipment to treat this condition.

Numerous risk factors have been associated with Urolithiasis, including

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Address for correspondence:
Evans Ametefe Akpakli, Department of Surgery, Korle-Bu Teaching Hospital, Accra, Ghana.
E-mail: aaevansus25@gmail.com

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metabolic anomalies like hypercalciuria, hyperoxaluria, hyperuricosuria, cystinuria and hypocitraturia are reported to be a predisposition to stone formation, and stone chemical composition.[5-7] Inadequate fluid intake, dehydration and low urine volume or concentrated urine are additional risk factors for Urolithiasis.[2] High ambient temperatures have been associated with an increased risk of Urolithiasis,[8,9] especially in tropical West Africa, where loss of body fluid through sweating and respiration leads to dehydration and urine production concentrated with lithogenic solutes, eventually forming stones in the urinary tract. Recurrent urinary tract infections, dietary habits and variation in urine pH also play major role in kidney stone formation.[10,11]

The diagnosis of Urolithiasis is usually based on the clinical presentation of the patient, physical examination and imaging studies such as abdominopelvic ultrasonography (USG), kidney–ureter–bladder X-ray (KUB X-ray), and non-contrast abdominopelvic computed tomography (CT) scan. Although CT scan has high sensitivity and specificity (more than 95%) in diagnosing Urolithiasis,[12] it cannot detect pure matrix and protease inhibitor stones.[13,14] The management of kidney stones depend on the size and location of stones, with extracorporeal shock wave lithotripsy (ESWL), ureterorenoscopy (URS) and percutaneous nephrolithotomy (PCNL) being used to treat stones less than or greater than 2cm. Laparoscopic and open surgeries are both viable options for treating kidney stones.

This study provides information on demographics, treatment options, urine characteristics, and the stones' chemical makeup of patients managed for Urolithiasis in Ghana.

Materials and Methods

This retrospective study was conducted at Korle-Bu Teaching Hospital, Accra, Ghana, between March 2019 and April 2022. The clinical records of all patients who visited the Korle-Bu Teaching Hospital with CT-confirmed diagnosis of Urolithiasis over the study period were collected. All patients with Urolithiasis involving the upper tracts who had treatment and the chemical analysis of stone were included in this study. In addition, data relating to demographic characteristics, urine characteristics, treatment modalities, duration of hospitalisation post-procedure and stone chemical composition were collected.

Patients with distal ureteric or non-obstructing ureteric stones were given a trial of medical expulsive therapy using Tamsulosin and NSAID. However, those with high-grade obstruction, impaired renal failure, sepsis, persistent flank pain or vomiting had double J (DJ) stent insertion to relieve their symptoms for at least two weeks before stone fragmentation was done. All patients had urine urinalysis, culture and sensitivity done prior to stone fragmentation. Those with confirmed UTI were treated with the appropriate antibiotics before the fragmentation of stones.

Stones in the ureter or renal pelvis without hydronephrosis had URS done with a semi-rigid ureteroscope and Holmium Laser or Swiss LithoClast Master (EMS) pneumatic energy fragmentation of stones. Stones less than 15mm in diameter in the upper or middle calyces were assessed using a flexible ureteroscope through an access sheath and the stone fragmented with Laser and stone fragments were retrieved with a stone basket. Patients with impacted stones or ureteric trauma during URS had DJ stents passed for two weeks post-procedure. Large stones, usually greater than 20 mm, or stones in the lower calyx of the kidney were assessed and removed using standard PCNL through a 24Fr Amplatz sheath or a Mini-PCNL using a 17.5Fr sheath. For standard PCNL, the stones were fragmented with EMS ultrasound or pneumatic energy and stone fragments were retrieved with a stone grasper. With Mini-PCNL, stones were fragmented with Laser energy and fragments were retrieved with a stone basket. For standard PCNL, a nephrostomy tube was placed for at least 24 h post-procedure before removal. Every patient with stones that were fragmented had prophylactic antibiotics prior to stone fragmentation.

All retrieved stones were sent for stone analysis at MDS Lancet Laboratories where the stones were analysed using Thermo Scientific, Nicolet iS10 FT-IR (Fourier transform infrared) spectrometer.

The data were analysed using Statistical Package for Social Scientists (SPSS, version 26.0). Continuous variables were summarised as means (±SD) and categorical variables were summarised as percentages and presented in a table or graph. The chi-square test was used to determine the association between stone composition and demographic characteristics such as sex and age. In addition, median (IQR) duration of stay was compared between the various treatment modalities using the Kruskal–Wallis test. A value of $P < 0.05$ was concluded as statistically significant.

Results

Over the study period, 198 patients presented with upper tract urolithiasis for treatment, out of which 153 patients had their stones analysed. A total of 124 (62.6%) of the cohorts were males giving a male to female ratio of 1.7:1.

The mean age of the studied population was 45 (±13.4), and the age range was 2 to 75 years. Most of the patients treated for stone disease 52 (26.3%), were in the age group of 30-39 years, and those less than 20 years constituted the group with the least incidence of stone disease: 5 (2.5%) as shown in Table 1. The majority of the study population 81 (40.9%) were employed in the formal sector, followed by traders 19 (9.6%) and artisans 16 (8.1%). Sixty-two (31.3%) patients never declared their occupational status [Table 1].

Out of the 153 analysed stones, the majority contained calcium oxalate monohydrate (CaOM) 128 (83.7%), calcium

Table 1: Demographic characteristics of patients

Characteristics	Descriptive (%)
Sex	
Male	124(62.6)
Female	74(37.4)
Age, mean (±SD)	45 (±13.4)
Age group	
<20	5(2.5)
20–29	17(8.6)
30–39	52(26.3)
40–49	50(25.3)
50–59	45(22.7)
60–69	23(11.6)
≥70	6(3.0)
Occupation	
Professional	81(40.9)
Artisan	16(8.1)
Trader	19(9.6)
Student	6(3.0)
Unemployed	2(1.0)
Retired	8(4.0)
Other	4(2.0)

Table 2: Chemical composition of kidney stones

Composition	*n* (%)
Calcium oxalate monohydrate	128(83.6)
Calcium oxalate dihydrate	113(73.9)
Uric acid	111(72.5)
Calcium apatite	9(5.9)
Matrix (unknown)	23(15.0)
Amorphous calcium phosphate carbonate	9(5.9)
Carbonate apatite	15(9.8)
Ammonium urate	6(3.9)
Brushite	11(2.3)
Cystine	5(7.2)
Xanthine	1(0.7)
Sodium urate monohydrate	3(2.0)
Struvite	6(3.9)

oxalate dihydrate (CaOD) 112 (73.9%) and uric acid (UA) 111 (72.5%). A breakdown of the chemical compositions is as shown in Table 2. Matrix (unknown) as a chemical component was found in 15% of the stones presented for analysis. The least chemical components of the analysed stones were xanthine, sodium urate monohydrate (NaUM) and cysteine, constituting 0.7%, 2% and 3.3%, respectively, as displayed in Table 2.

All stones analysed comprised two or more chemical components, as there were no pure stones (single component) among the cohort, as shown in Table 3. The predominant stone types comprised a combination of CaOM, CaOD and UA, forming 57.5% of all the stones formed by the study population. As shown in Table 3, one patient formed a stone of as many as six chemical constituents. The most common chemical constituents of stone formed by both males and females were CaOM, CaOD and UA, as revealed in Table 4. For most of the stones presented, there were no gender variations in chemical composition. However, there were statistically significant gender variations with the stones' chemical components of CaOD and calcium apatite with $P = 0.037$ and < 0.017, respectively, as shown in Table 4.

The distribution of some stone chemical components is associated with age variation. Uric acid stones were commoner in adults aged 30 or older with $P = 0.02$, as shown in Table 5. Other chemical components like ammonium urate and xanthine showed a strong age correlation with a significant statistical difference of P-values <0.003 and 0.026, respectively. Both chemical components are most likely to be found in stones formed by young patients [Table 5]. The calcium oxalate dihydrate chemical component was associated with a significant statistical difference with age with $P = 0.012$.

Most patients with stone disease, 105 (53%), had treatment of their stones using semi-rigid and 10 (5%) with flexible URS with Laser fragmentation of stones and Dormian basket for retrieval of stone fragments as shown in Figure 1. Percutaneous nephrolithotomy treatment modality constitutes about 37.4% of all patients treated for stone conditions in our institution. Six (3%) of our patients had treatment of their stones through an open surgical approach, and 3 (1.5%) passed their stones spontaneously with expulsive medical therapy (MET) [Figure 1].

The duration of hospital stay after treatment of Urolithiasis was found to be significantly associated with the treatment modality with $P < 0.0001$ as shown in Table 6. The shortest hospital stay after the procedure was associated with using semi-rigid and flexible URS. The most extended duration of stay was associated with open surgical procedures with median duration of 2 and 18 days respectively, as exhibited in Table 6. A total of 26 (13.2%) of our patients with stone diseases had urinary tract infections (UTI) prior to fragmentation of their stones. The most common organisms associated with UTI in our cohort were Escherichia coli (E. coli) 8 (4%) and the next predominant organism was Klebsiella pneumoniae as shown in Figure 2. Eight (4%) of our patients presented with obstructive uropathy and had sessions of haemodialysis prior to the treatment of their stones. There was one mortality post treatment of stone condition (data not included).

Discussion

Urolithiasis is rising globally due to lifestyle changes, dietary habits and obesity.[4,15-17] Unfortunately, the condition is also associated with severe morbidities such as colicky flank pain, renal failure when the kidneys are obstructed by stones, recurrent urinary tract infections due to stones[18,19] and comorbidities such as hypertension, type 2 diabetes and myocardial infarction.[20-22] It is therefore imperative to make early diagnosis and prompt treatment of Urolithiasis to avert the myriad of associated comorbidities.

Table 3: Chemical composition of each kidney stone

Combined stone composition	n(%)
Calcium oxalate monohydrate+ calcium oxalate dihydrate + uric acid	88(57.5)
Calcium oxalate monohydrate + uric acid+ matrix (unknown)	4(2.6)
Calcium oxalate monohydrate+ ammonium urate	1(0.7)
Calcium oxalate monohydrate+ brushite	1(0.7)
Calcium oxalate monohydrate+ calcium oxalate dihydrate + matrix (unknown)	12(7.8)
Calcium oxalate monohydrate+ calcium apatite+ matrix (unknown)	2(1.4)
Calcium oxalate monohydrate+ calcium oxalate dihydrate + ammonium urate	2(1.4)
Calcium oxalate monohydrate+ calcium oxalate dihydrate + calcium apatite	2(1.4)
Calcium oxalate monohydrate+ calcium oxalate dihydrate + cysteine	2(1.4)
Calcium oxalate monohydrate+ calcium oxalate dehydrate+ carbonate apatite	4(2.6)
Calcium oxalate monohydrate+ calcium apatite+ amorphous calcium phosphate carbonate	1(0.7)
Calcium oxalate monohydrate+ amorphous calcium phosphate carbonate	1(0.7)
Calcium oxalate monohydrate+ matrix (unknown)+ carbonate apatite	1(0.7)
Calcium oxalate monohydrate+ calcium oxalate dihydrate	1(0.7)
Calcium oxalate monohydrate+ calcium oxalate dehydrate+ sodium urate monohydrate	1(0.7)
Calcium oxalate monohydrate+ calcium oxalate dihydrate	1(0.7)
Calcium oxalate monohydrate + uric acid+ matrix (unknown)+ calcium oxalate dehydrate+ calcium oxalate dehydrate+ brushite	1(0.7)
Calcium oxalate monohydrate+ calcium apatite+ carbonate apatite	1(0.7)
Calcium oxalate monohydrate+ ammonium urate + sodium urate monohydrate	1(0.7)
Uric acid+ brushite	8(5.2)
Calcium oxalate monohydrate+ xanthine+ struvite	1(0.7)
Amorphous calcium phosphate carbonate+ carbonate apatite+ struvite	2(1.4)
Calcium apatite+ brushite	1(0.7)
Calcium oxalate dihydrate+ calcium apatite+ carbonate apatite	1(0.7)
Matrix (unknown)+ cysteine	3(2.1)
Matrix (unknown)+ cysteine+ sodium urate monohydrate	1(0.7)
Amorphous calcium phosphate carbonate+ carbonate apatite+ struvite	1(0.7)
Calcium apatite+ carbonate apatite+ struvite	1(0.7)
Calcium apatite+ carbonate apatite	1(0.7)
Uric acid+ amorphous calcium phosphate carbonate	4(2.6)
Uric acid+ struvite	1(0.7)
Total	153(100)

Table 4: Chemical composition of kidney stones for male and female

Composition	Male: n(%)	Female: n(%)	P Value
Calcium oxalate monohydrate	80(52.3)	48(31.4)	0.176
Calcium oxalate dihydrate	74(48.4)	39(25.5)	0.037*
Uric acid	67(43.8)	44(28.8)	0.925
Calcium apatite	2(1.3)	7(4.6)	<0.017*
Matrix (unknown)	13(8.5)	10(6.5)	0.701
Amorphous calcium phosphate carbonate	4(2.6)	5(3.3)	0.322
Carbonate apatite	6(3.9)	9(5.9)	0.094
Ammonium urate	5(3.3)	1(0.7)	0.236
Brushite	6(3.9)	5(3.3)	0.700
Cystine	3(2.0)	2(1.3)	0.995
Xanthine	1(0.7)	0(0.0)	<0.414
Sodium urate monohydrate	1(0.7)	2(1.3)	0.338
Struvite	3(2.0)	3(2.0)	0.605

n = number chemical components of stones
*Statistically significant ($P < 0.05$)

Our study confirmed the male preponderance of Urolithiasis with a male to female ratio of 1.7:1 as observed in other investigations.[10,23,24] Urolithiasis is one condition which affects all age groups: children and adults. This has been confirmed in our study where the youngest patient was 2 years and the oldest 75 years. Other studies in Africa have

Table 5: Chemical composition of kidney stones by age

Composition	Age (years): *n*(%)							*P* Value
	<20	20–29	30–39	40–49	50–59	60–69	≥70	
Calcium oxalate monohydrate	3(2.3)	12(9.4)	31(24.2)	36(28.1)	28(21.9)	15(11.7)	3(2.3)	0.308
Calcium oxalate dihydrate	2(1.8)	10(8.8)	29(25.7)	35(31.0)	21(18.6)	14(12.4)	2(1.8)	0.012*
Uric acid	1(0.9)	7(6.3)	22(19.8)	32(28.8)	28(25.2)	16(14.4)	5(4.5)	0.020*
Calcium apatite	0 (0.0)	1(11.1)	2(22.2)	4(44.4)	2(22.2)	0(0.0)	0(0.0)	0.878
Matrix (unknown)	1(4.3)	3(13.0)	6(26.1)	3(13.0)	8(34.8)	1(4.3)	1(4.3)	0.342
Amorphous calcium phosphate carbonate	0(0.0)	1(11.1)	2(22.2)	2(22.2)	2(22.2)	1(11.1)	1(11.1)	0.767
Carbonate apatite	0(0.0)	2(13.3)	6(40.0)	6(40.0)	1(6.7)	0(0.0)	0(0.0)	0.185
Ammonium urate	2(33.3)	2(33.3)	1(16.7)	0(0.0)	1(16.7)	0(0.0)	0(0.0)	0.003*
Brushite	0(0.0)	0(0.0)	2(18.2)	1(9.1)	6(54.5)	1(9.1)	1(9.1)	0.222
Cystine	0(0.0)	0(0.0)	1(20.0)	1(20.0)	3(60.0)	0(0.0)	0(0.0)	0.773
Xanthine	1(100)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0.026*
Sodium urate monohydrate	1(33.3)	0(0.0)	1(33.3)	0(0.0)	1(33.3)	0(0.0)	0(0.0)	0.149
Struvite	1(16.7)	1(16.7)	2(33.3)	1(16.7)	1(16.7)	0(0.0)	0(0.0)	0.327

*$P < 0.05$ = statistically significant

also established that Urolithiasis occurs in both children and adults as reported by Alaya *et al*.[25,26] However, the peak age of incidence of stone disease among our study population was in the age group of 30-39 years. Romero *et al*. reported a slightly higher age group of 40-49 years as the peak incidence of stone disease in Iranian, Japanese and Americans in their study.[4] As shown in Table 1, most of our patients with Urolithiasis were professionals in the formal sector. This is not surprising since this group of patients was likely to adopt westernised dietary and lifestyle habits. These patients are likely to eat fast foods laden with sodium, high animal proteins and fizzy drinks which are associated with hypercalciuria. In addition, they are likely to work in air-conditioned offices with cold temperatures reducing sweating and inadequate water intake due to reduced thirst, eventually producing urine concentrated with lithogenic solutes. These conditions will ultimately increase their chances of stone formation.

Most of the stones in our study contained CaOM and CaOD chemical components, constituting 83.7% and 73.9% of the analysed stones respectively, as shown in Table 2. This is consistent with other literature which established that calcium oxalate stones are the most common upper tract stones.[18,27,28] Uric acid constituted about 72.5% of stones in this study which was surprisingly very high since UA stones form about 5-10% of all urinary stones globally.[29,30] The high proportion of UA in the analysed stones in our study suggests UA might be acting as a nidus for calcium oxalate stone formation through a process of salting-out. All the 153 stones analysed in our study were mixed component stones; non were pure (single component) as exhibited in Table 3. The commonest stone type 88 (57.5%) were stones consisting of a combination of CaOM+CaOD+UA. Eighty per cent of patients with hyperoxaluria and 85% of hypercalciuria form CaOM and CaOD stones respectively. Therefore, a mixture of CaOM and CaOD stones is associated both hyperoxaluria and hypercalciuria.[31] Most of our patients probably excreted excess oxalate and calcium in their urine, resulting in an admixture of CaOM+CaOD stones. This study, however, cannot ascertain this association since the 24-hour urine study was not a factor considered for analysis. Therefore, it will be imperative to consider 24-hour urine study in future studies to determine the associations between urine factors and stone type.

There was no gender variation with respect to most of the chemical components of the stones, as exhibited in Table 4. However, there was significant gender variation in chemical components CaOD and calcium apatite with *p*-values of 0.037 and < 0.017, respectively. Females were more likely to form calcium apatite stones than males from our study. 'It's been reported that male patients who formed calcium apatite stones were prone to excreting large amounts of calcium, oxalate and phosphate in their urine while their female counterparts have hypoxaluria.[32] It is plausible that

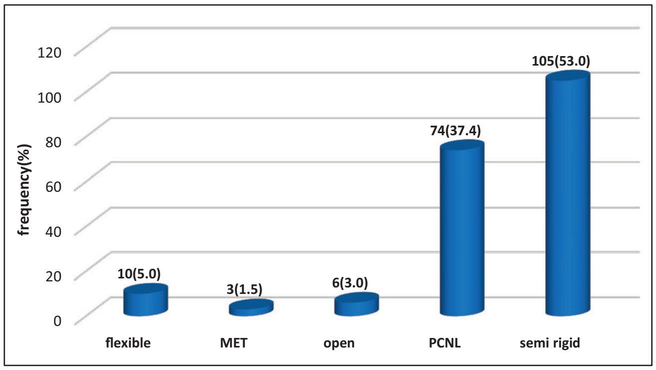

Figure 1: Treatment modalities used for stone diseases

Table 6: Median duration of hospital stay by patients after treatment of stone disease

	Median (IQR)	*P Value*
Flexible URS	2(2–3.0)	<0.0001
Open	18(4.0–30.0)	
PCNL	3(2.0–4.0)	
Semi Rigid URS	2.0(1.0–2.0)	

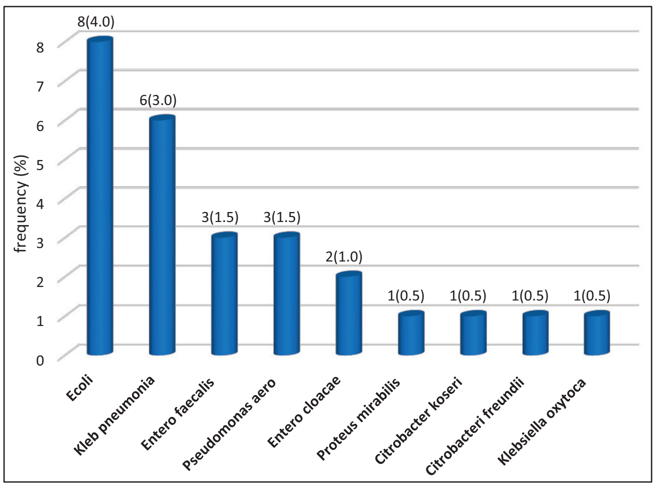

Figure 2: Organisms causing urinary tract infection in patients with urolithiasis

the gender variation in calcium apatite component stones might be associated with variation in urine factors.

Our study showed a statistically significant difference in UA component stones and age groups with *p*-value of 0.020 with these stones components more likely to be formed in adults. This finding is consistent with Abou-Elela, who reported that uric acid stones distribution varies with age and is more common in adults.[29] This study also revealed that ammonium urate and xanthine component stones were more common among the young population than adults with a significant statistical difference (*P*-<0.003 and *P*-0.026 respectively). Xanthine stones are uncommon and often associated with an inborn error of metabolic disorder such as hereditary xanthinuria due to deficiency in the enzyme xanthine oxidase. The defective enzyme is unable to catalyse the conversion of xanthine to uric acid leading to hypouricemia, hypouricosuria and increased serum and urine levels of xanthine.[33] Since xanthine is highly insoluble in urine, the sequelae of xanthinuria are xanthine stones formation which are likely to occur early in childhood.

Our study's most common treatment modality of Urolithiasis was ureterorenoscopy (URS) with semi-rigid ureteroscope 105(53.0%), followed by PCNL 37.4%, flexible ureteroscope 5% and open surgical approach 3% as shown in Figure 1. All stones in the ureter and renal pelvis without hydronephrosis were accessed using the semi-rigid ureteroscope. Stones fragmented with Laser energy and stone fragments were retrieved with a dormia stone basket. The flexible ureteroscope was only used to access stones in the upper pole, middle calyces and hydronephrotic pelvis. Flexible ureteroscopes are very delicate, expensive, and have a high maintenance cost. Hence, to increase its lifespan and avoid unnecessary cost of replacement, we use it in only cases where the semi-rigid is unlikely to access the stone in the renal pelvis and calyces. Therefore, we recommend using semi-rigid ureteroscope when possible and flexible URS be reserved for exceptional cases especially in low-resource countries. As reported by ElGanainy *et al.* semi-rigid ureteroscope is safe and offers satisfactory results when used to treat upper tract stones.[34] Standard PCNL in our settings was used to treat large renal stones and mini-PCNL to treat small stones in the lower pole and in the calyceal diverticulum. In addition, we used mini-PCNL for small lower pole kidney stones as a means of protecting and ensuring the durability of our flexible ureteroscope. Although open surgical treatment options for Urolithiasis are now considered obsolete due to miniaturised endoscopic urological instruments and the availability of minimally invasive surgical approaches to treating Urolithiasis, it's still relevant. It can be used in cases of lack of requisite instruments, lack of necessary skills to use endoscopic instruments and in cases of anomalous urinary tract system.[23]

Twenty-six (13.2%) of our patients presenting with Urolithiasis had urine cultures positive for UTI. A higher UTI rate of 52.8% was recorded by Kaestner *et al.*[35] This was not unexpected in their study since the study was focused on struvite stones which are mainly infection stones. The commonest organism causing UTI as shown in Figure 2 was *Escherichia coli* (E. coli) 8 (4.0%), followed by Klebsiella pneumoniae 3.0%, and Enterobacter faecalis/ Pseudomonas aeruginosa 1.5%. Escherichia coli being the most common isolate causing UTI in our study is not astonishing since E. coli is the major organism responsible for UTI in the general population. Other studies have also reported E. coli as the predominant organism causing UTI in patients with Urolithiasis.[35,36]

Our study demonstrated that the duration of hospitalisation post-treatment of Urolithiasis was strongly associated with the treatment modality with a *p*-value of <0.0001 as shown in Table 6. Furthermore, URS with a semi-rigid/flexible ureteroscope was associated with the least days spent in the hospital (2 days), while open surgical retrieval of stones was linked with a longer hospital stay (18 days). This is not unanticipated since open surgical procedures are beset with significant morbidities.

Conclusion

Males were the predominant stone formers, with a male-to-female ratio of 1.7:1, and professionals employed in the formal sector were most likely to form kidney stones. All analysed stones were admixtures of two or more chemical components, with CaOM, CaOD and UA being the principal constituent of stones. Most stones were treated using semi-rigid URS and PCNL. These techniques can be used to treat most stones safely and effectively. In addition, URS and PCNL for removing upper tract stones are associated with a short hospital stay after treatment; hence, using these techniques when available is appropriate.

Authors' contribution

EAA and JEM conceived and formulated this study. All authors participated in drafting the manuscript, as regards literature search, data analysis and interpretations and final preparation of the paper for submission. The final paper was read and approved by all authors.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Data availability statement

The data supporting this manuscript are available in Figshare repository (https://figshare.com/articles/dataset/Data_for_Paper_Analysis, Treatment Modality and Demographic Characteristics of Urolithiasis Patients Visiting Korle-Bu Teaching Hospital in Ghana/22258948).

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