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Epidemiological, Clinical and Therapeutic Aspects of Urinary Stones at the Regional Annex Hospital of Yagoua

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Abstract

Background: Urinary lithiasis affects 4% - 12% of the population in industrialized countries and is more frequent in tropical and arid regions such as northern Cameroon. **Objective:** To describe the epidemiological, clinical and therapeutic aspects of urinary lithiasis at the Regional Annex Hospital of Yagoua. **Methods:** A cross-sectional study with prospective data collection was conducted over four months among patients diagnosed with urinary lithiasis. Data were collected using questionnaires and analyzed with SPSS version 23. Qualitative variables were expressed as frequencies and percentages, while quantitative variables were described using measures of central tendency. **Results:** Of 2412 patients, 216 (8.95%) had urinary lithiasis. Most were men (61.11%), aged 21 - 30 years (35.19%), single (53.70%) and from rural areas (61.11%). Renal colic was the main symptom (70.83%). Average daily water intake was low (1227.74 ± 524.73 ml). Diagnosis relied mainly on ultrasound. Treatment was primarily medical, while surgery (21.30%), mainly cystolithotomy, was limited. **Conclusion:** Urinary lithiasis is common in young rural men, highlighting the need for improved prevention and healthcare resources.

Keywords

Urinary Lithiasis, Epidemiology, Clinical Features, Management

1. Introduction

Urolithiasis is defined as the result of abnormal precipitation of the normal constituents of urine within the urinary tract; it is a common condition that affects 4% to 12% of the population in industrialized countries [1] [2]. It is a multifactorial pathology that is due to very diverse causes: metabolic, nutritional, infectious, anatomical and/or drug-related, the identification of which requires clinical and biological investigations. It is a cosmopolitan condition that represents a major public health challenge due to the increase in its prevalence in recent decades in all industrialized and developing countries [3]. In Southeast Asia, its prevalence remains high (2 to 3 cases per 1,000 inhabitants) [4], more frequent in developing countries than in developed countries; thus, the endemic lithiasis of Southeast Asian or African countries is opposed to the sporadic lithiasis of Western countries with a higher standard of living [5] [6]. In Morocco, a study carried out in the urology department of the Mohammed VI University Hospital Center (CHU) in Marrakech between January 2003 and December 2012 recorded 417 cases of urolithiasis during this period [7]. Mali at the national level does not have epidemiological data but has hospital frequencies. At the CHU Pr Bocar S Sall in Kati, the frequency was 20.35% [8] and it represented about 17% of the surgical activities of the urology department of the CHU du Point G between January 2009 and December 2011 [9]. The diagnosis of urolithiasis is retained in the presence of a picture of pain in the form of renal colic associated with signs of urinary irritation, such as burning micturition, pollakiuria and especially high fever (parenchymal involvement) and episodes of hematuria. The clinical diagnosis retained can be confirmed by additional imaging tests, including ultrasound, which shows dilation of the pyelocaliceal cavities and a hyperechoic area with a posterior acoustic shadow [10]. Treatment is varied and depends not only on the nature of the stone but also on its size and location. The aim of the treatment is to clear the urinary tract and promote normal urine flow. Currently, the therapeutic methods for urolithiasis have been revolutionized by the advent of endocorporeal and extracorporeal lithotripsy [11]. According to Michel B. [12], it reduces the role of open surgery, especially in developed countries. Complications are rare after appropriate management, but the risk of recurrence is not negligible. In low-income countries, the resurgence of certain specific conditions such as urinary schistosomiasis or urogenital tuberculosis, exposure to a hot and dry environment, as well as diet and hydration, play a major role in the formation of urinary crystals and stones [3]. In the face of complications, management is multidisciplinary involving urologists, nephrologists, biologists, radiologists and nutritionists [13]. In Cameroon, the majority of individuals with urolithiasis are essentially from the North and Far North regions [14]. Indeed, the prevalence of urinary stones is higher in tropical, arid and mountainous regions [8]. The northernmost part of Cameroon, presenting all these socioeconomic and climatic particularities, thus exposing the population to develop lithiasis, has led us to conduct this study in order to fill the very great

rarity of literature data on urolithiasis in Cameroon.

2. Method

We conducted a cross-sectional study descriptive study. The study was carried out at the Yagoua Regional Annexe Hospital. It is a public third-category hospital, located in the Far North Region of Cameroon in the Mayo Danay Department, a hot and arid area. Our study took place over a period of 4 months from January 10 to May 10, 2023. All patients in whom the diagnosis of urinary lithiasis was made, symptomatic or not, and confirmed by ultrasound or scanner or even a plain abdominal X-ray (plain abdominal X-ray) were included. The sampling was consecutive. The size of our sample according to the LORENTZ formula calculated with a prevalence of urinary lithiasis of 16.67% according to IDRISSA Traoré *et al.* in 2013 [15] was 213. The study had received the approval of the Ethics Committee of the University of Douala and an administrative authorization. The data collection was carried out using a questionnaire composed of sociodemographic characteristics, medical and urological history, dietary habits, clinical data, paraclinical and therapeutic data.

You can clarify the participant selection and reduce ambiguity as follows:

2.1. Participant Selection

All patients presenting to the emergency department or outpatient clinic with clinical suspicion of urinary lithiasis were initially screened. Suspicion was based on symptoms such as renal colic, flank or iliac fossa pain, dysuria, or hematuria. These suspected cases underwent diagnostic confirmation using abdominal ultrasound or a plain abdominal X-ray (KUB). Only patients with imaging-confirmed urinary lithiasis who provided informed consent were enrolled in the study.

Exclusion criteria included: 1) patients with suspected urinary lithiasis but negative imaging results; 2) patients who declined to participate or did not provide informed consent; 3) patients with incomplete clinical or paraclinical data; and 4) patients with other confirmed causes of abdominal or flank pain unrelated to urinary lithiasis.

During the study period, 2412 patients were screened, among whom 216 cases were confirmed to have urinary lithiasis and were subsequently included in the analysis. This approach ensured that only confirmed cases with complete information were retained for the final study population. These patients were interviewed according to our survey forms and any additional tests that could provide us with more information were requested, and as for those of fortuitous discovery, they were interviewed once they agreed to participate in the study. The study obtained the approval of the Ethics Committee of the University as well as administrative authorizations. The confidentiality of the data was ensured by the principal investigator through limited access to the study database.

2.2. Statistical Analysis

The frequency of urinary lithiasis among patients received in the emergency department or outpatient clinic was calculated by dividing the number of confirmed urinary lithiasis cases during the study period by the total number of patients received during the same period. Data were entered and analyzed using SPSS software version 23.0 (Statistical Package for the Social Sciences, IBM Corp., Armonk, NY, USA). Qualitative variables were summarized using frequencies and percentages, while quantitative variables were described using measures of central tendency and dispersion (mean ± standard deviation, median, and mode when appropriate). For key proportions, 95% confidence intervals (95% CI) were calculated to estimate the precision of the results. Missing data from questionnaires or laboratory tests were handled by complete-case analysis; only available data were analysed for each variable, and cases with missing information were excluded from the specific analysis concerned but retained for other variables where data were complete.

3. Results

During our study period, we admitted 2,412 patients in the outpatient clinic and emergency department, of which 216 patients had urinary lithiasis, representing a hospital frequency of 8.95% (Figure 1).

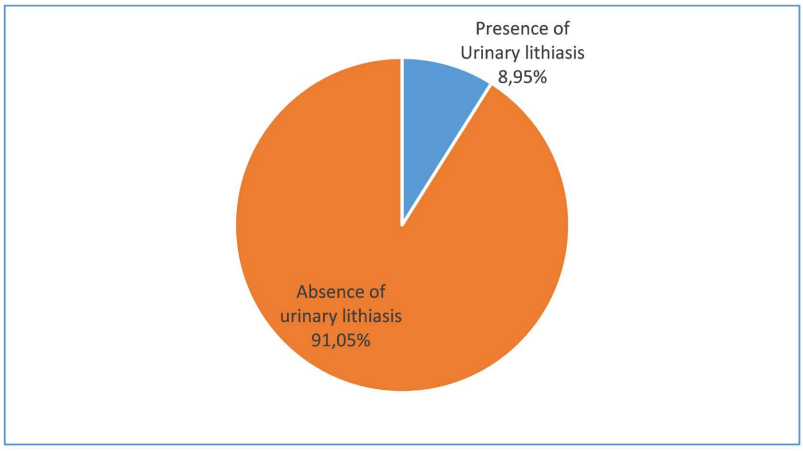

Figure 1. Hospital frequency of urinary stone disease in outpatient consultations and in the emergency department at the Yagoua Regional Annex Hospital.

The mean age was 31.0 ± 15.5 years. Table 1 shows that the most represented age groups in these patients with urinary lithiasis were [21, 30] years (76 cases, 35.19%) followed by [31, 40] years (36 cases, 16.67%); the male sex was the most represented (132 cases, 61.11%); in terms of occupation, the majority were unemployed (70 cases, 32.41%) followed by informal/agricultural sector jobs (54 cases, 25.00%); a predominance of single people (116 cases, 53.70%) followed by married people (90 cases, 41.67%) was observed. The majority of these patients, or 61.11% of cases, resided in rural areas.

Table 1. Distribution of urinary lithiasis cases received in outpatient and emergency departments of the Yagoua Regional Annex Hospital from January 10 to May 10, 2023 according to their sociodemographic characteristics.

Sociodemographic characteristics	Number (n)	*Frequency* (%)
Age group (Years)		
[0, 10]	03	1.39%
[11, 20]	51	23.61%
[21, 30]	76	35.19%
[31, 40]	36	16.67%
[41, 50]	22	10.19%
[51, 60]	14	6.48%
[61, 70]	07	3.24%
[71, 80]	07	3.24%
Gender		
Male	132	61.11%
Female	84	38.89%
Occupation		
Unemployed	70	32.41%
Informal Sector and farmer	54	25.00%
Retired	30	13.89%
Public Sector Employee	35	16.20%
Private Sector Employee	17	7.87%
Student	10	4.63%
Marital Status		
Single	116	53.70%
Married	90	41.67%
Widow	10	4.63%
Area of Residence		
Rural	132	61.11%
Urban	184	38.89%

According to Table 2, the most frequent medical histories were renal colic (94 cases, 43.52%) and hypertension (14 cases, 6.48%); the most frequent urological histories were urinary tract infections (126 cases, 58.33%) and urinary lithiasis (105 cases, 48.61%); and the most frequent family histories were family history of lithiasic diseases (89 cases, 41.20%).

According to Table 3, patients frequently consume fish (65.7%), milk (40.3%), meat (35.7%), coffee (30.6%) and tomatoes (30.1%), but have a low frequent consumption of cheese (0.9%), tea (6.5%) and chocolate (5.1%).

Table 2. Distribution of urinary lithiasis cases received in the outpatient clinic and emergency department of the Yagoua Regional Annex Hospital from January 10 to May 10, 2023, according to their history.

	Number (n)	*Frequency* (%)
Medical history		
Renal colic	94	43.52%
Hypertension (HTA)	14	6.48%
Diabetes	13	6.02%
Gout	11	5.09%
Ulcer	11	5.09%
Urological history		
Urinary tract infection	126	58.33%
Urinary lithiasis	105	48.61%
Urinary schistosomiasis	79	36.57%
Family history		
Family history of lithiasis	89	41.20%

Table 3. Distribution of patients with urinary lithiasis based on their dietary habits.

Food item	Total n (%)	Often n (%)	Rarely n (%)
Milk	124 (57.4%)	87 (40.3%)	3 (1.4%)
Cheese	17 (7.9%)	2 (0.9%)	76 (35.2%)
Meat	133 (61.6%)	77 (35.7%)	5 (2.3%)
Fish	72 (33.3%)	142 (65.7%)	1 (0.5%)
Cabbage	13 (6.0%)	-	78 (36.1%)
Tomatoes	147 (68.1%)	65 (30.1%)	2 (0.9%)
Coffee	138 (63.9%)	66 (30.6%)	10 (4.6%)
Tea	166 (76.8%)	14 (6.5%)	35 (16.2%)
Chocolate	138 (63.9%)	11 (5.1%)	54 (25.0%)

Figure 2 is a box plot which reveals that the daily water consumption of patients with urinary lithiasis seen in the outpatient clinic and emergency department had an average of 1227.74 ± 524.73 ml of water/24h; which was lower than the recommended norm (2 to 3 L) for the prevention of urinary lithiasis; with a minimum of 600 ml, a maximum of 2550 ml, a median of 1189.84 ml and an interquartile range of 850 to 1500, or 650 ml (Figure 2).

According to Table 4, the most frequent reasons for consultation were renal colic (153 patients, 70.83%), iliac fossa pain (126 patients, 58.33%), fever (111 patients, 51.39%) and pain in the right lumbar fossa (110 patients, 50.93%), while the most frequent associated signs were nausea (149 patients, 69.01%), physical asthenia (124 patients, 57.41%), anorexia (134 patients, 62.04%) and abdominal pain (101 patients, 46.76%).

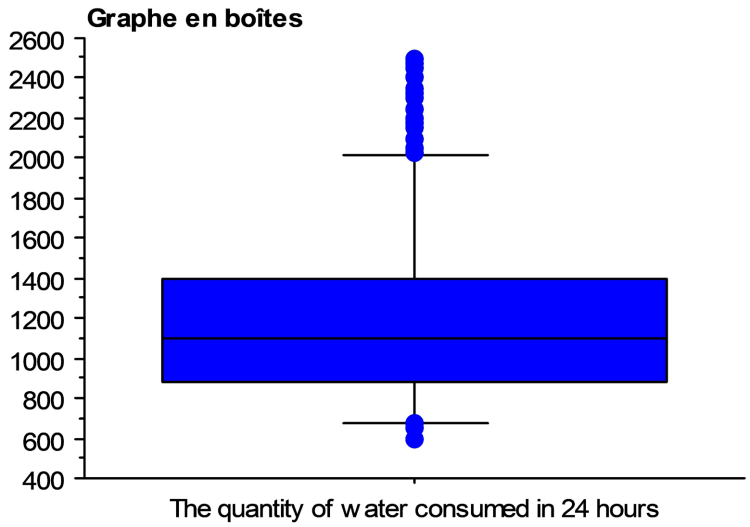

Figure 2. Distribution of patients with urinary lithiasis based on their daily water consumption habits.

Table 4. Distribution of patients with urinary lithiasis based on their clinical information.

Clinical information	Number of Patients	Proportion (%)
Reason for Consultation		
Renal Colic	153	70.83%
Iliac Fossa Pain	126	58.33%
Fever	111	51.39%
Right Lumbar Pain	110	50.93%
Incidental Discovery	80	37.04%
Left Lumbar Pain	68	31.48%
Hematuria	46	21.30%
Dysuria	37	17.13%
Pelvic Pain	36	16.67%
Acute Urinary Retention	28	12.96%
Pollakiuria	5	2.31%
Urinary Urgency	3	1.39%
Pyuria	1	0.46%
Associated Signs		
Nausea	149	69.01%
Vomiting	37	17.13%
Weight Loss	48	22.22%
Abdominal Pain	101	46.76%
Physical Asthenia	124	57.41%
Anorexia	134	62.04%

Table 5 presents the results of the biological tests performed on the 216 patients with urinary lithiasis: for urine culture, 131 patients (60.65%) had a positive culture,

while 85 patients (39.35%) had a sterile culture; regarding urinary sediments, 125 patients (57.87%) had the presence of crystals, while 91 patients (42.13%) did not.

Figure 3 presents the rate of performance of morphological examinations useful for the diagnosis of urinary lithiasis in our series. According to this table, 78.70% of patients underwent only a renal ultrasound, while 18.52% also underwent an AUSP (plain abdominal radiograph) and only 2.31% underwent an ultrasound + abdominal CT scan.

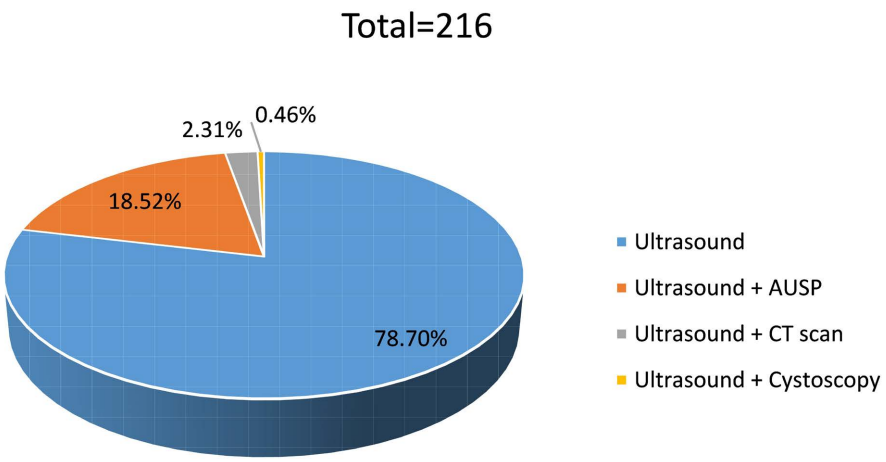

Figure 3. distribution based on morphological workup.

Table 5. Distribution of patients with urinary lithiasis based on their biological examinations.

Biological Examinations	Number (N = 216)	Proportion (%)
Urine Culture		
Positive	131	60.65%
Sterile	85	39.35%
Urinary Sediments		
Presence of Crystals	125	57.87%
Absence of Crystals	91	42.13%

Table 6 shows that the most frequent anatomical sites of urinary lithiasis are the ureter (100 patients, 46.30%), the renal calyces (80 patients, 37.04%), the renal pelvis (67 patients, 31.02%), the bladder (36 patients, 16.67%) and the urethra (3 patients, 1.39%).

Table 6. Distribution of patients with urinary lithiasis based on the Anatomical sites of lithiasis.

Anatomical sites of lithiasis	Number (n)	Proportion (%)
Ureteral	100	46.30%
Renal Calyceal	80	37.04%

Continued

Renal Pelvic	67	31.02%
Bladder	36	16.67%
Urethral	3	1.39%

Table 7 presents the different therapeutic modalities used in patients with urinary lithiasis, with medical treatment representing 100% of cases, mainly composed of hygienic-dietary measures (98.15%), analgesics (97.69%), antispasmodics (92.13%), urine alkalinization (92.13%), antibiotics (62.04%) and anti-inflammatory drugs (39.35%), while surgical treatment concerned only 21.30% of patients, notably with cystolithotomies (87%) followed by urethrolothotomy (10.87%), ureterolithotomy (4.35%) and never pyelolithotomy, nephrolithotomy and double-J Stent. Furthermore, there was never any extracorporeal lithotripsy, ureteroscopy and nephroscopy.

Table 7. Distribution of patients with urinary lithiasis based on the treatment modalities.

Treatment modalities	Number (n)	Proportion (%)
Medical treatment	216	100%
Dietary & Lifestyle Measures	212	98.15%
Analgesics	211	97.69%
Antispasmodics	199	92.13%
Urine Alkalinization	134	92.13%
Antibiotics	130	62.04%
Anti-inflammatory	85	60.19%
Surgical Treatment	46	21.30%
Cystolithotomy	40	87%
Urethrolothotomy	5	10.87%
Ureterolithotomy	1	4.35%
Nephrolithotomy	0	0
Pyelolithotomy	0	0
Double-J Stent	0	0
Other (*extracorporeal lithotripsy, ureteroscope, nephroscope, …*)	0	0

Table 8 presents the distribution of patients with urinary lithiasis according to the characteristics of the stones. It is observed that the majority of stones are dark yellow-brown in color, representing 12.50% of cases, followed by light yellow-brown (5.56%) and dark brown (3.24%) stones. No white stones were identified. In terms of consistency, hard stones are the most frequent, representing 14.81% of cases, while soft stones represent 5.09% of cases and stones of indeterminate consistency, 1.39%.

Table 8. Distribution of patients with urinary lithiasis according to the characteristic of the stone.

Characteristics of the urinary stones	Number (n)	Proportion (%)
Color		
Dark yellow-brown	27	12.50%
Light yellow-brown	12	5.56%
Dark brown	7	3.24%
White	0	0%
Consistency		
Hard	32	14.81%
Soft	11	5.09%
Undetermined	3	1.39%

4. Discussion

4.1. Frequency of Urinary Lithiasis in Hospitals

During our study, we recorded 2,412 patients who were seen in outpatient clinics and emergency departments, of whom 216 patients presented with lithiasis pathologies, corresponding to a hospital frequency of 8.9%. This result is lower than the findings of studies in Mali by MOUSSA SAMAKE 2021 and IBRAHIMA YATARA 2021 *et al.*, who reported 21.03% and 15.6% of cases, respectively [16] [17]. This can be explained by the fact that their studies were conducted in specialized urological centers. In our series, the most common age group was 21 - 30 years, with 35.2%, a result similar to those of studies in Mali conducted by Cheick Abou Traoré in 2022 and MOUSSA SAMAKE in 2021, who reported 24.3% and 35.09%, respectively [16] [18]. These results indicate that the age group most frequently affected by urinary lithiasis is between the 3rd and 5th decades. This allows us to conclude that a large number of urinary lithiasis cases form during the period of genitourinary and social activity, highlighting the importance of urogenital infections.

In our series, a marked male predominance was observed, with a frequency of 61% of cases; the sex ratio was 1.54 in favor of men. These frequencies are similar to those reported by Yacouba Namako TRAORE in 2012 and KEITA.O. in 2006 and collaborators, who reported 65% and 68.5% male predominance, respectively [9] [19]. The higher frequencies in men than women can be explained by environmental factors; since in this area, the majority of daily tasks and activities are performed by men, they are exposed to extreme climatic conditions that promote dehydration and are associated with recurrent urinary tract infections.

Unemployed individuals represented the largest group in our study population, with 32.41% of cases, compared to Tounkara [20], who found a frequency of 38.1% among herders. This diversity of frequencies shows that lithiasis pathology is not necessarily related to occupation, provided that it does not have a concom-

itant lithogenic factor.

Patients residing in rural areas were the majority, accounting for 61.11% of our series. This result is consistent with previous studies conducted in South Africa, Nigeria, and Ethiopia, which have also shown higher rates of urinary lithiasis in rural areas compared to urban areas. The main explanatory factors are dietary habits and hydration. In rural areas, the consumption of foods high in oxalate and sodium, as well as low water intake, are key elements that promote the formation of kidney stones [21]. Indeed, in the northern region of Cameroon, the population faces a chronic water shortage, contributing to lower hydration and higher concentrations of stone-forming substances [21]. Additionally, potential exposure to pesticides and other chemicals used in agriculture may also play a role [21]. Finally, more limited access to specialized healthcare in rural areas can delay the diagnosis and appropriate management of urinary lithiasis [21]. Given these results, it would be important to implement awareness programs on the importance of good hydration and a balanced diet, particularly in hot and arid rural regions like northern Cameroon. Moreover, better access to specialized healthcare in these areas could enable early detection and management of urinary lithiasis.

4.2. Clinical Characteristics of Urinary Lithiasis

The most frequent reason for consultation was renal colic, accounting for 70.8% of cases. Our proportions were similar to those reported in studies conducted in Mali by Cheick Abou Traoré and Borghi, L *et al.* [18] [22], who found 72.07% and 69% respectively, and in Togo by Abago B. *et al.* [3] who found 82.3%, as well as in Morocco by Dami *et al.* [23] who reported 62% of cases. All our results are quite typical and demonstrate that the most common clinical symptomatology of urinary lithiasis is renal colic.

The average water consumption of patients in this study, 1227.74 ± 524.73 ml/day, is below the recommended range to prevent the formation of kidney stones, which is generally 2 to 3 liters per day [23] [24]. This clearly indicates that many patients do not have adequate hydration, which could promote the formation of kidney stones, as mentioned in the study. There is also significant variability, with a minimum of 600 ml and a maximum of 2550 ml, highlighting heterogeneous behaviors in terms of hydration. The median of 1189.84 ml and the interquartile range of 850 to 1500 ml suggest that the majority of patients do not meet the recommendations for hydration. This can be explained by the fact that the study was conducted both in outpatient clinics and in the emergency department, where patients may have different profiles in terms of the severity and management of their lithiasis. Moreover, the geographical context of the northern region, a hot and arid region, as well as the fact that the majority of patients reside in rural areas, may also contribute to this relatively low water consumption. These results contrast with those reported by other studies, such as that of Idrissa Traoré (2013), who observed an average water consumption of 1800 ml/day in his patients [15]. This difference can be explained by geographical, socio-economic, and

cultural factors influencing water consumption habits, particularly the lack of access to water in some arid regions. In summary, although the average water consumption is within the norms, the observed variability and the lower median suggest that many patients with urinary lithiasis in this region do not have adequate hydration. This underscores the importance of strengthening educational and awareness efforts on the importance of adequate hydration to prevent the recurrence of kidney stones, taking into account the geographical and socio-economic specificities of the region.

The results show that these patients frequently consume certain foods rich in calcium and oxalate, such as fish (65.7%), milk (40.3%), and tomatoes (30.1%), which can contribute to the formation of kidney stones. Indeed, a high consumption of dietary calcium and oxalate is recognized as a major risk factor for urinary lithiasis [25] [26]. However, the frequent consumption of meat (35.7%) and coffee (30.6%) can also be a risk factor, as these foods are respectively rich in purines and caffeine, two elements that can promote lithogenesis [27]. Conversely, the low consumption of cheese (0.9%), tea (6.5%), and chocolate (5.1%) is more positive, as these foods are known to have a high oxalate content, a lithogenic compound [28] [29]. These results are partially in agreement with other studies on the dietary habits of lithiasic patients. For example, a study conducted in Mali by Traoré (2013) also reported a high consumption of fish (70.5%) and milk (37.5%) among his patients [15]. However, this study observed a lower consumption of meat (20.9%) and coffee (16.9%), as well as a higher consumption of tea (27.5%). These differences can be explained by geographical, cultural, and socio-economic variations influencing the dietary habits of the studied populations. It is also possible that the patients included in the present study have a different perception or representation of their own dietary habits. In summary, the results show that patients with urinary lithiasis in this region have dietary habits that can promote the formation of kidney stones, with a high consumption of foods rich in calcium and oxalate, as well as meat and coffee.

4.3. Diagnostic and Paraclinical Characteristics of Urinary Lithiasis Cases

In addition to demographic and clinical data, clinically relevant characteristics of urinary stones were recorded because they influence therapeutic management. These included stone size, stone location, the presence of hydronephrosis or urinary tract obstruction on imaging, and renal function status when laboratory data were available. Stone size was categorized as <5 mm, 5 - 10 mm, and >10 mm based on ultrasound or plain abdominal X-ray findings. Hydronephrosis was documented when dilation of the renal collecting system suggestive of obstruction was observed on ultrasound. Renal function impairment was defined as an elevated serum creatinine level above the laboratory reference range or clinical evidence of acute kidney injury.

The vast majority (98.6%) of the stones were visualized on ultrasound, with the

majority (48.2%) being located in the lumbar region. This result is higher than those found by Idrissa TRAORE, who reported that ultrasound was able to detect 82.7% of the stones, and those reported by Abderrahmane M. C. in 2018, who found 55.1% [15] [30]. This shows that ultrasound is the most commonly used confirmatory diagnostic examination due to its availability and lower cost for our patients. In our study, CT scan is the gold standard, but only 2.31% of cases underwent this examination, though not within the hospital structure. In contrast, Idrissa TRAORE [15] reported that 65.4% of patients underwent CT scan, which confirmed the diagnosis. These results indicate that our study lacked a diagnostic element, but nevertheless, ultrasound allowed us to establish the diagnosis.

In our study, 60.7% of the urine cytobacteriological examinations performed were positive, in contrast to the study by Ibrahim Yattara [17], which found positive cultures in 23.7% of patients. Indeed, urinary stones play a major role in the occurrence of urinary tract infections. On the one hand, stones can be the cause of urinary tract infections, as they serve as an infectious focus [31]. On the other hand, urinary tract infections can also promote the formation of stones, as they provide a favorable environment for bacterial growth [32]. Thus, urinary stones and urinary tract infections maintain a vicious cycle, with each one being the cause or the consequence of the other.

4.4. Therapeutic Modalities for Urinary Lithiasis Cases

Therapeutic decisions were guided by these parameters. Medical management (analgesics, antispasmodics, hydration, and hygiene-dietary measures) was primarily indicated for stones ≤ 10 mm without significant obstruction or renal impairment, as these stones have a higher probability of spontaneous passage. Surgical management was considered for stones > 10 mm, persistent obstruction with hydronephrosis, recurrent or uncontrolled pain, associated infection, or evidence of renal function deterioration. In our setting, the main surgical procedure performed was cystolithotomy, reflecting the limited availability of minimally invasive techniques such as lithotripsy or ureteroscopy.

The results of our study show that the hygieno-dietary regimen was the most common medical therapeutic modality, used in 98.2% of patients. This approach based on modifications of dietary habits and hydration is indeed recognized as the first-line non-invasive treatment for urinary lithiasis [33] [34]. This corroborates the observations of Moussa Samake [16] in Mali, who reported that all his patients with kidney stones had been advised to drink at least 2 liters of water per day, apart from periods of renal colic. Increased diuresis is indeed essential to dilute lithogenic substances in the urine and prevent crystallization [24] [34]. During renal colic episodes, your study showed that the treatment included a reduction in fluid intake, the use of analgesics and antispasmodics. This acute management is also in line with the recommendations, aimed at relieving pain and ureteral spasms, while avoiding fluid overload that could worsen the symptoms [10] [11]. Other studies have also reported similar results regarding the importance of the hygieno-

dietary regimen in the management of urinary lithiasis. For example, a systematic review of the literature conducted by Pearle *et al.* (2014) concluded that increased fluid intake was the most effective dietary measure to prevent the recurrence of kidney stones [33]. Similarly, a randomized prospective study by Borghi *et al.* (1996) showed that an increase in diuresis to more than 2 liters per day significantly reduced the risk of lithiasis recurrence in patients [23]. In summary, our results, as well as those of other studies, underline the paramount importance of the hygieno-dietary regimen, and in particular abundant hydration, in the management of urinary lithiasis. This conservative approach should be systematically proposed as the first-line treatment to patients, before considering other more invasive treatments.

The most common surgical therapeutic modality was cystolithotomy in 87% of cases. Similarly, Ngaroua *et al.* in 2017 [35] found 56.52% of cases. In contrast, TRAORE, M.Y.N. *et al.* [9] reported that nephrolithotomy was the most commonly used surgical technique in 31% of patients.

Our study reveals that surgical treatment was necessary for only 21.30% of patients, with a clear predominance of simpler techniques such as cystolithotomy (87%), ureterolithotomy (10.87%) and urethral lithotomy (4.35%). No patient required pyelolithotomy, nephrolithotomy or double-J stent placement, and no modern techniques such as extracorporeal shock wave lithotripsy, ureteroscopy or percutaneous nephrolithotomy were used. This finding can be explained by several factors related to the context of our healthcare facility: the lack of qualified personnel. Our study suggests that your facility did not have sufficiently trained and experienced personnel to perform these more complex surgical techniques; the lack of modern equipment as our facility does not have the most recent medical equipment, such as those necessary for extracorporeal shock wave lithotripsy, ureteroscopy or percutaneous nephrolithotomy; and the high cost of new techniques: The high cost of these modern techniques for the treatment of urinary stones can be a barrier in some healthcare facilities, particularly those located away from urban centers. These results are consistent with other studies conducted in resource-limited settings, highlighting the common challenges faced by healthcare facilities in middle- and low-income countries in providing optimal care to patients with urinary lithiasis. For example, studies conducted in Senegal and sub-Saharan Africa have also shown a predominant use of more traditional surgical techniques, due to the lack of equipment and trained personnel for the most recent procedures.

4.5. Microbiological Findings and Antibiotic Strategy

Urine culture was performed in patients presenting with signs suggestive of urinary tract infection. In this study, urinary tract infection (UTI) was defined by the presence of compatible clinical symptoms (such as dysuria, fever, flank pain, or urinary frequency) associated with a positive urine culture showing significant bacterial growth. In contrast, asymptomatic bacteriuria was defined as a positive

urine culture in the absence of urinary symptoms and was not systematically treated unless clinically indicated.

The most frequently isolated microorganism was *Escherichia coli*, which is consistent with the usual bacterial profile of urinary tract infections associated with urinary lithiasis. Other organisms were less commonly identified. Antibiotic susceptibility testing revealed that many isolates showed resistance to commonly used antibiotics, highlighting the importance of culture-guided therapy.

Consequently, the antibiotic strategy was based primarily on the results of the antibiogram, allowing targeted antimicrobial therapy. Empirical antibiotic therapy was initiated when clinically necessary and subsequently adjusted according to culture and sensitivity results to improve treatment effectiveness and limit the development of antimicrobial resistance.

5. Conclusion

The study revealed that the hospital frequency of urinary lithiasis was 8.95%, with a predominance observed in young men, in this hot and arid region of Cameroon. Renal colic was the main reason for consultation, and the average daily water consumption was below the recommended standards for the prevention of this condition. The hygienic-dietary regimen, particularly hydration, was the main non-invasive modality used. There is a scarcity of advanced modern surgical techniques and equipment in this context of low-income setting.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Johnson, C.M., Wilson, D.M., O'Fallon, W.M., Malek, R.S. and Kurland, L.T. (1979) Renal Stone Epidemiology: A 25-Year Study in Rochester, Minnesota. *Kidney International*, **16**, 624-631. https://doi.org/10.1038/ki.1979.173

[2] Stamatelou, K.K., Francis, M.E., Jones, C.A., Nyberg, L.M. and Curhan, G.C. (2003) Time Trends in Reported Prevalence of Kidney Stones in the United States: 1976-1994. *Kidney International*, **63**, 1817-1823. https://doi.org/10.1046/j.1523-1755.2003.00917.x

[3] Abago, B., Toyi, T., Agbéko, D.K., Liganimpo, D., Dzidzonu, N.K., Odilon, B.L., Awalou, D.M. and Kégdigoma, K.L. (2021) Lithiase urinaire: Aspects epidemiologiques, cliniques et thérapeutiques au centre hospitalier universitaire Sylvanus Olympio de Lomé. *RAFMI*, **8**, 31-38.

[4] Dembélé, S.B. (2006) Lithiase urinaire chez les enfants de 0-15 ans. Thèse Med. (Master), University of Bamako, No. 123, 95 p.

[5] Moscovici, J., Salamare, E. and Deluros, P. (1994) Embryologie anatomie et physiologie de l'uretère. Sauramps médical Montpellier, 9-23.

[6] Alessandrini, P. and Palix, C. (1993) Lithiase urinaire chez l'enfant-Editions techniques Encycl. Méd. Chir. (Paris France), Néphrologie-urologie, 18-114-A-10. Pédiatrie, 4-086-A-10, 5 p.

[7] Oulghoul, M.O. (2015) Prise en charge diagnostique et thérapeutique de la lithiase

urinaire au service d'urologie de CHU Med VI Marrakech: Expérience de 10 ans. Thèse Med (Master), Unibersity of Marrakech, N° 87, 194 p.

[8] Kassogué, A., Diarra, A., Berthé, H.J.G. and Diallo, M.S. (2020) Aspects cliniques et thérapeutiques de la lithiase urinaire au service d'urologie du CHU Pr Bocar S Sall de Kati/Mali. *Annals of African Medicine*, **13**, e3632-e3637.

[9] Traore, M.Y.N. (2012) Étude des lithiases de l'appareil urinaire dans le service d'urologie du CHU du point «G»: À propos de 100 CAS. Thèse Med. (Master), Université des Sciences, des Techniques et des Technologies de Bamako (USTTB).

[10] Türk, C., Knoll, T., Petrik, A., Sarica, K., Skolarikos, A., Straub, M. and Seitz, C. (2016) Guidelines on Urolithiasis. European Association of Urology, 1-108.

[11] Preminger, G.M., Tiselius, H., Assimos, D.G., Alken, P., Buck, C., Gallucci, M., *et al.* (2007) 2007 Guideline for the Management of Ureteral Calculi. *Journal of Urology*, **178**, 2418-2434. https://doi.org/10.1016/j.juro.2007.09.107

[12] Michel, B. (1990) La lithiase urinaire. Endo-urologie. Payot, 1261, 158 p.

[13] Odzebe, A.S.W., Bouya, P.A., Berthe, H.J.G. and Omatassa, F.R. (2010) Chirurgie à ciel ouvert de la lithiase urinaire au chu de Brazzaville: Analyse de 68 cas. *Mali Médical*, **25**, 32-35.

[14] Zoung-Kanyi, J. and Sow, M. (1990) La lithiase urinaire au Cameroun considérations éti-opathogéniques, clinique et thérapeutique. A propos de 118 cas. *Médecine d'Afrique Noire*, **37**, 176-182.

[15] Traoré, I. (2013) Profil épidémiologique, clinique, paraclinique et thérapeutique des lithiases urinaires au CHU Gabriel Touré. Thèse de Médecine (Master), Université des Sciences, des Techniques et des Technologies de Bamako.

[16] Samaké, M. (2021) Prise en charge des lithiases urinaires dans l'unité d'urologie CSREF CV. USTTB.

[17] Yattara, I. (2021) Les lithiases urinaires de l'adulte dans le service d'urologie du CHU de Point G: Aspects épidémiologiques, cliniques, para cliniques et thérapeutiques. Thèse Med. (Master), Université des Sciences, des Techniques et des Technologies de Bamako (USTTB).

[18] Cheick Abou Traoré, P.M.L. (2023) Aspects épidémiologique, clinique et thérapeutique des lithiases urinaires à l'hôpital Fousseyni Daou de Kayes, à propos de 111 cas. https://bibliosante.ml/bitstream/handle/123456789/6004/23M75.pdf?sequence=1

[19] Keita, O. (2006) Etude de la lithiase urinaire infectée au service d'urologique du Centre Hospitalier Universitaire du Point «G». Thèse Med. (Master), Université des Sciences, des Techniques et des Technologies de Bamako (USTTB), No. 13, 3134.

[20] Tounkara, A., Diallo, D. and Sidibe, S. (2006-2007) Faculté de médecine, de pharmacie et d'odonto-stomatologie année universitaire. Thèse Med. (Master), Université Cheikh Anta Diop (UCAD) de Dakar.

[21] Goldenberg, N.M., Dunmore, G., Naimark, D.M.J., Ruzycki, S.M., Milne, B. and Karreman, E. (2018) Water Security Challenges in Northern Cameroon: The Human Costs of Inadequate Water Access. *Canadian Medical Association Journal*, **190**, E938-E939. https://doi.org/10.1503/cmaj.180215

[22] Borghi, L., Meschi, T., Amato, F., Briganti, A., Novarini, A. and Giannini, A. (1996) Urinary Volume, Water and Recurrences in Idiopathic Calcium Nephrolithiasis: A 5-Year Randomized Prospective Study. *Journal of Urology*, **155**, 839-843. https://doi.org/10.1016/S0022-5347(01)66321-3

[23] Dami, F., Chouhani, B., Elhabbani, R., Tazi, N., Kabbali, N., Arrayhani, M., *et al.* (2015) Profil épidémiologique des patients lithiasiques. *Néphrologie & Thérapeutique*, **11**, 406.

https://doi.org/10.1016/j.nephro.2015.07.418

[24] Curhan, G.C. (2007) Epidemiology of Stone Disease. *Urologic Clinics of North America*, **34**, 287-293. https://doi.org/10.1016/j.ucl.2007.04.003

[25] Curhan, G.C., Willett, W.C., Rimm, E.B. and Stampfer, M.J. (1993) A Prospective Study of Dietary Calcium and Other Nutrients and the Risk of Symptomatic Kidney Stones. *New England Journal of Medicine*, **328**, 833-838. https://doi.org/10.1056/NEJM199303253281203

[26] Taylor, E.N. and Curhan, G.C. (2013) Dietary Calcium from Dairy and Nondairy Sources, and Risk of Symptomatic Kidney Stones. *Journal of Urology*, **190**, 1255-1259. https://doi.org/10.1016/j.juro.2013.03.074

[27] Rodgers, A. (1999) Effect of Cola Consumption on Urinary Biochemical and Physicochemical Risk Factors Associated with Calcium Oxalate Urolithiasis. *Urological Research*, **27**, 77-81. https://doi.org/10.1007/s002400050092

[28] Shuster, J. and Finlayson, B. (1974) Uric Acid Lithiasis. *Kidney International*, **5**, 418-431.

[29] Holmes, R.P. and Assimos, D.G. (1998) Glyoxylate Synthesis, and Its Modulation and Influence on Oxalate Synthesis. *Journal of Urology*, **160**, 1617-1624. https://doi.org/10.1016/S0022-5347(01)62363-2

[30] Abderrahmane, M.C. (2018) Les complications rénales de la lithiase urinaire (À propos de 98 cas). Thèse Med. Fès (Master), Université Sidi Mohamed Ben Abdellah (USMBA) de Fès, No. 78, 121 p.

[31] Daudon, M., Jungers, P. and Bazin, D. (2008) Type 2 Diabetes Increases the Risk for Uric Acid Stones. *Journal of the American Society of Nephrology*, **19**, 421-423. https://journals.lww.com/jasn/abstract/2006/07000/type_2_diabetes_increases_the_risk_for_uric_acid.36.aspx

[32] Schwaderer, A.L. and Wolfe, A.J. (2017) The Association between Bacteria and Urinary Stones. *Annals of Translational Medicine*, **5**, 32. https://doi.org/10.21037/atm.2016.11.73

[33] Pearle, M.S., Goldfarb, D.S., Assimos, D.G., Curhan, G., Denu-Ciocca, C.J., Matlaga, B.R., *et al.* (2014) Medical Management of Kidney Stones: AUA Guideline. *Journal of Urology*, **192**, 316-324. https://doi.org/10.1016/j.juro.2014.05.006

[34] Siener, R. (2006) Impact of Dietary Habits on Stone Incidence. *Urological Research*, **34**, 131-133. https://doi.org/10.1007/s00240-005-0025-1

[35] Ngaroua, Md., Djibrilla, Y., Padouli, H., Mbo, A. and Eloundou, N. (2017) Epidemiological Profile of Patients Operated for Urinary Lithiasis at the CMAO Hospital of Meskine-Maroua: A Report of 46 Cases. *Health Sciences and Diseases*, **18**, 92-96.