

Frequency and Characteristics of Urolithiasis Detected by Ultrasound and Radiography at the Cinquantenaire Hospital of Kisangani

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ABSTRACT

Introduction

Urolithiasis represents a growing public health concern in sub-Saharan Africa. In low-resource settings such as the Democratic Republic of the Congo (DRC), access to advanced imaging modalities – particularly non-contrast computed tomography (CT) – remains severely restricted. Consequently, ultrasonography and plain abdominal radiography (KUB) serve as primary diagnostic modalities despite inherent sensitivity limitations for small and distal ureteral calculi. Local data describing the frequency and radiological characteristics of urolithiasis remain scarce in northeastern DRC.

Purpose

This study aimed to determine the frequency of imaging-confirmed urolithiasis and evaluate its sociodemographic, clinical, and radiological characteristics at the Cinquantenaire Hospital of Kisangani.

Methods

A retrospective descriptive study was conducted among 303 consecutive patients presenting with suspected urolithiasis who underwent ultrasonography and/or KUB at the Cinquantenaire Hospital of Kisangani between January 2020 and December 2024. An exhaustive sampling method was utilized. Categorical variables were summarized as frequencies and percentages, and continuous variables were expressed as means and standard deviations ($M \pm SD$). Bivariate associations were evaluated using Pearson's chi-square test or Fisher's exact test. Odds ratios (ORs) with 95% confidence intervals (CIs) were computed, with statistical significance set at $p < 0.05$.

Results

Imaging-confirmed urolithiasis was identified in 159 of 303 evaluated patients, yielding a frequency of 52.5% (95% CI [46.9, 58.1]). The mean age was 41.9 ± 15.3 years, with a major representation among individuals aged 30–49 years (55.1%). Renal colic was the primary presenting symptom (89.1%). Nephrolithiasis accounted for the predominant anatomical localization (93.1%), and the majority of calculi measured ≤ 10 mm (84.3%). Multiple stones were more common than solitary stones (56.6% vs. 43.4%). Hydronephrosis was detected in 8.2% of confirmed cases. In bivariate analysis, age ($p = 0.047$), a personal history of urolithiasis (OR = 3.4, 95% CI [1.02, 4.39], $p = 0.030$), urinary tract infection (OR = 2.5, 95% CI [1.15, 5.50], $p = 0.012$), and diabetes mellitus (OR = 0.2, 95% CI [0.04, 0.81], $p = 0.015$) demonstrated statistically significant associations with urolithiasis status.

Conclusion

The frequency of imaging-confirmed urolithiasis was high among symptomatic patients evaluated in Kisangani. Ultrasonography remains indispensable as a first-line diagnostic modality in resource-constrained environments. Standardized ultrasound protocols, clinician training, and optimized clinical decision pathways are required to improve early detection and management.

INTRODUCTION

Urolithiasis represents a major global public health concern due to its rising incidence, substantial recurrence rates, and risk of severe obstructive and infectious complications (Daudon et al., 2008; Skolarikos et al., 2025). The global incidence of urinary stone disease has escalated in recent decades, driven by dietary changes, metabolic factors, rising global temperatures, and increased utilization of diagnostic imaging modalities (Akram & Somani, 2025; Kittanamongkolchai et al., 2018; Vera-Ponce et al., 2025).

In sub-Saharan Africa, although overall prevalence figures have historically remained below those reported in high-income industrialized nations, urolithiasis is increasingly recognized as an important clinical entity (Kassaw et al., 2024; Tzou et al., 2017). Regional epidemiological variations are governed by local dietary habits, regional climatic variations, hydration patterns, and variable healthcare infrastructure (Mbouche et al., 2023). Recent investigations in Central and West Africa highlight a steady surge in documented stone disease. In Cameroon, Mbouche et al. (2023) observed a high prevalence of radiopaque lithiasis among symptomatic patients. Similarly, Ondziel-Opara et al. (2022) described a clinical spectrum dominated by acute renal colic and chronic flank pain in the Republic of the Congo.

In the Democratic Republic of the Congo (DRC), studies conducted in Kinshasa reported a resurgence of urolithiasis characterized by metabolic risk factors and diverse biochemical stone compositions (Diasama Diangienda et al., 2021; Kuntima Diasama et al., 2021; Kuntima PD et al., 2019). These findings align with broader global evidence demonstrating that stone etiology and composition vary according to geographic region, climate, dietary practices, and systemic metabolic alterations (Daudon et al., 2016).

Diagnostic imaging forms the cornerstone of evaluation for suspected urolithiasis. Ultrasonography and plain abdominal radiography (KUB) are commonly used as initial diagnostic modalities in resource-limited settings because of their affordability and accessibility. Unlike radiography, ultrasonography does not involve ionizing radiation (Bourcier et al., 2021; Moore & Scoutt, 2012). However, major international guidelines, including those of the European Association of Urology (EAU) and the

American Urological Association (AUA), designate non-contrast computed tomography (NCCT) as the definitive gold standard for urolithiasis diagnosis due to its high sensitivity and specificity for stone detection, sizing, and obstruction characterization (Gupta et al., 2023; Skolarikos et al., 2025). In the DRC, financial constraints, technical maintenance burdens, and limited healthcare infrastructure hinder routine access to NCCT.

The Cinquantenaire Hospital of Kisangani is a primary referral center in Tshopo Province, serving urban, peri-urban, and rural populations in northeastern DRC. Despite handling a high volume of urological admissions, empirical data concerning the frequency, clinical patterns, and imaging features of urolithiasis in this regional context remain scarce. Therefore, this study aimed to determine the frequency of imaging-confirmed urolithiasis and to describe its sociodemographic, clinical, and radiological characteristics among patients managed at the Cinquantenaire Hospital of Kisangani.

METHODS

Study Setting

This study was conducted in the Department of Radiology and Medical Imaging at the Cinquantenaire Hospital of Kisangani, located in Tshopo Province, Democratic Republic of the Congo. The institution serves as a regional secondary referral hospital equipped with basic functional diagnostic imaging modalities, including grayscale ultrasonography and conventional digital radiography.

Study Design and Population

A retrospective descriptive study was conducted based on archived patient records from January 1, 2020, to December 31, 2024. The study target population comprised all patients referred to the radiology department for ultrasonography and/or KUB radiography for clinical indications suggestive of urolithiasis (e.g., renal colic, lumbar pain, hematuria, or dysuria).

An exhaustive sampling method was adopted. All consecutive patient records meeting the eligibility criteria during the 5-year study frame were included, yielding a total sample size of $N = 303$.

Eligibility Criteria

Inclusion Criteria

Medical records were eligible if they satisfied the following criteria:

1. Patients of any age and sex referred for ultrasonography and/or KUB radiography due to suspected urolithiasis.
2. Imaging procedures conducted at the Department of Radiology and Medical Imaging of Cinquantenaire Hospital of Kisangani between January 1, 2020, and December 31, 2024.
3. Availability of complete clinical documentation, readable diagnostic reports, and demographic data.

Exclusion Criteria

Medical records were excluded based on any of the following criteria:

1. Incomplete or uninterpretable imaging records or reports.
2. Absence of primary clinical or demographic data.
3. Duplicate records corresponding to identical clinical presentations.
4. Patient history of previous destructive renal surgery (e.g., radical nephrectomy).
5. Primary indications for imaging unrelated to urinary tract pathology.

Data Collection Procedure

Data were extracted from radiology registries, clinical logs, and archived medical charts using a standardized data abstraction form. The principal investigator (a radiologist) performed data collection according to predefined protocol standards. Equivocal radiology reports or clinical descriptors were reviewed alongside senior radiologists to ensure diagnostic consistency.

Extracted variables included:

- **Sociodemographic Characteristics:** Age, sex, occupation (categorized as sedentary vs. non-sedentary), and residential area (urban vs. peri-urban).
- **Clinical Variables and Comorbidities:** Primary imaging indication, presence of acute renal colic,

history of urolithiasis, symptoms of urinary tract infection (UTI), hematuria, hypertension, diabetes mellitus, obesity, and gout.

- **Radiological Features:** Diagnostic confirmation of urolithiasis, modality utilized (ultrasonography, KUB, or both), anatomical stone location (renal, ureteral, bladder), maximum stone size (≤ 10 mm vs. > 10 mm), stone multiplicity (solitary vs. multiple), presence of hydronephrosis, and radiographic opacity on KUB.

Diagnostic Imaging Assessment

Figure 1:

Ultrasound Image of the Urinary Bladder Demonstrating a Hyperechoic Intravesical Stone with Posterior Acoustic Shadowing (Cinquantenaire Hospital of Kisangani).



Figure 2:

Plain Abdominal Radiograph (KUB) Demonstrating Bilateral Radiopaque Lithiasis Opacities Overlying the Renal Fossa (Cinquantenaire Hospital of Kisangani)



Statistical Analysis

Data were verified, cleaned, and entered into Microsoft Excel before export to Stata Version 15.0 (StataCorp LLC, College Station, TX, USA) for analysis. Continuous variables were tested for normality and presented as means and standard deviations ($M \pm SD$). Categorical data were presented as absolute frequencies (n) and proportions (%).

Bivariate analyses comparing patients with and without imaging-confirmed urolithiasis were conducted using Pearson's chi-square test (χ^2) or Fisher's exact test when expected cell frequencies were < 5 . Crude odds ratios (ORs) and 95% confidence intervals (CIs) were computed to evaluate the strength of associations. Statistical significance was defined as a two-sided $p < 0.05$.

Ethical Considerations

This study was conducted in accordance with institutional guidelines and international ethical standards for medical research. Ethical approval was granted by the Ethics Committee of the University of Kisangani (Approval No.: UNIKIS/CE/KGB/004/07/2025). The requirement for individual informed consent was waived due to the retrospective design and the use of anonymized records. Confidentiality was maintained throughout data handling.

RESULTS

Sociodemographic Characteristics

A total of 303 patient records were evaluated. The mean age of the cohort was 41.9 ± 15.3 years (range: 12–78 years). Male patients represented 55.1% ($n = 167$) of the population, giving a male-to-female ratio of 1.23:1. The majority of participants engaged in non-sedentary occupational activities (59.7%), and 98.7% resided in urban districts (Table 1).

Table 1:
Sociodemographic Characteristics of Patients Evaluated for Suspected Urolithiasis (N = 303)

Characteristic	Category	n	%
Age (years)	$M \pm SD = 41.9 \pm 15.3$	—	—
	< 30	54	17.8
	30–49	167	55.1
	> 49	82	27.1
Sex	Male	167	55.1
	Female	136	44.9
Occupation	Sedentary	122	40.3
	Non-sedentary	181	59.7
Residence	Urban	299	98.7
	Peri-urban	4	1.3

Clinical Characteristics and Comorbidities

Acute renal colic was the primary clinical indication for imaging, documented in 89.1% of patients ($n = 270$). A prior clinical history of urolithiasis was noted in 5.9% ($n = 18$). Clinical indicators of UTI were recorded in 13.5% of cases ($n = 41$), whereas macro- or microscopic hematuria was recorded in 2.0% ($n = 6$). Regarding comorbidities, hypertension was present in 18.2% of patients ($n = 55$), diabetes mellitus in 4.9% ($n = 15$), and obesity in 7.3% ($n = 22$) (Table 2).

Table 2:
Clinical Presentations and Medical Comorbidities of the Study Cohort (N = 303)

Variable	Category	n	%
Clinical Presentation			
Prior urolithiasis history	Yes	18	5.9
	No	285	94.1
Acute renal colic	Yes	270	89.1
	No	33	10.9
Signs of UTI	Yes	41	13.5
	No	262	86.5
Hematuria	Yes	6	2.0
	No	297	98.0
Comorbidities			
Diabetes mellitus	Yes	15	4.9
	No	288	95.1
Hypertension	Yes	55	18.2
	No	248	81.8
Gout	Yes	3	1.0
	No	300	99.0
Body Mass Index (BMI)	Normal	203	67.0
	Overweight	78	25.7
	Obesity	22	7.3

Imaging Findings and Stone Characteristics

Urolithiasis was confirmed by imaging in 159 patients, establishing an overall diagnostic frequency of 52.5% (95% CI [46.9, 58.1]). Nephrolithiasis was the predominant stone location (93.1%, $n = 148$), followed by ureterolithiasis (8.2%, $n = 13$) and cystolithiasis (6.3%, $n = 10$). Hydronephrosis was detected in 8.2% of cases ($n = 13$).

Calculi measuring ≤ 10 mm comprised 84.3% of confirmed cases ($n = 134$). Multiple stones were identified in 56.6% of positive patients ($n = 90$), whereas 43.4% ($n = 69$) presented with solitary calculi. Plain KUB radiography was performed in a subset of 17 patients, revealing radiopaque stones in 58.8% ($n = 10$) and radiolucent stones in 41.2% ($n = 7$) (Table 3).

Table 3:

Radiological Characteristics and Features of Confirmed Urolithiasis Cases

Radiological Feature	Subcategory	n	%
Diagnostic Confirmation (N = 303)	Positive	159	52.5
	Negative	144	47.5
Anatomical Location (n = 159)*	Renal	148	93.1
	Ureteral	13	8.2
	Vesical	10	6.3
Hydronephrosis (n = 159)	Present	13	8.2
	Absent	146	91.8
Maximum Stone Size (n = 159)	≤10 mm	134	84.3
	> 10 mm	25	15.7
Stone Multiplicity (n = 159)	Solitary	69	43.4
	Multiple	90	56.6
Radiographic Opacity on KUB (n = 17)	Radiopaque	10	58.8
	Radiolucent	7	41.2

*Note: Proportions for anatomical locations exceed 100% due to overlapping stone distributions in patients with multifocal calculi.

Bivariate Analysis of Factors Associated with Urolithiasis

Bivariate statistical analysis revealed significant associations between imaging-confirmed urolithiasis and age group ($\chi^2 = 6.11$, $p = 0.047$), prior history of urolithiasis (OR = 3.4, 95% CI [1.02, 4.39], $p = 0.030$), clinical signs of

UTI (OR = 2.5, 95% CI [1.15, 5.50], $p = 0.012$), and diabetes mellitus (OR = 0.2, 95% CI [0.04, 0.81], $p = 0.015$). Patient sex, occupation, place of residence, acute renal colic, hypertension, BMI, and gout showed no statistically significant association with confirmed urolithiasis ($p > 0.05$) (Table 4).

Table 4:

Bivariate Analysis of Factors Associated with Imaging-Confirmed Urolithiasis (N = 303)

Variable	Category	Urolithiasis Present (n=159)	Urolithiasis Absent (n=144)	Crude OR	95% CI	p-value
Age (years)	< 30	28 (17.6%)	26 (18.1%)	Ref.	—	0.047*
	30–49	97 (61.0%)	70 (48.6%)	1.29	[0.69, 2.39]	
	> 49	34 (21.4%)	48 (33.3%)	0.66	[0.33, 1.32]	
Sex	Male	92 (57.9%)	75 (52.1%)	1.26	[0.78, 2.04]	0.313
	Female	67 (42.1%)	69 (47.9%)	Ref.	—	
Occupation	Sedentary	99 (62.3%)	82 (56.9%)	1.25	[0.77, 2.03]	0.346
	Non-sedentary	60 (37.7%)	62 (43.1%)	Ref.	—	
Residence	Urban	157 (98.7%)	142 (98.6%)	1.11	[0.08, 5.43]	1.000†
	Peri-urban	2 (1.3%)	2 (1.4%)	Ref.	—	
Prior Urolithiasis	Yes	14 (8.8%)	4 (2.8%)	3.38	[1.02, 4.39]	0.030†
	No	145 (91.2%)	140 (97.2%)	Ref.	—	
Acute Renal Colic	Yes	143 (89.9%)	127 (88.2%)	1.20	[0.54, 2.64]	0.627
	No	16 (10.1%)	17 (11.8%)	Ref.	—	
Signs of UTI	Yes	29 (18.2%)	12 (8.3%)	2.45	[1.15, 5.50]	0.012*
	No	130 (81.8%)	132 (91.7%)	Ref.	—	
Hematuria	Yes	5 (3.1%)	1 (0.7%)	4.64	[0.51, 221.1]	0.218†
	No	154 (96.9%)	143 (99.3%)	Ref.	—	
Diabetes Mellitus	Yes	3 (1.9%)	12 (8.3%)	0.21	[0.04, 0.81]	0.015†
	No	156 (98.1%)	132 (91.7%)	Ref.	—	
Hypertension	Yes	32 (20.1%)	23 (16.0%)	1.33	[0.71, 2.52]	0.349
	No	127 (79.9%)	121 (84.0%)	Ref.	—	
BMI Group	Normal	108 (68.0%)	95 (66.0%)	Ref.	—	0.117
	Overweight	44 (27.6%)	34 (23.6%)	1.14	[0.66, 1.95]	
	Obesity	7 (4.4%)	15 (10.4%)	0.41	[0.15, 1.08]	
Gout	Yes	1 (0.6%)	2 (1.4%)	0.45	[0.01, 8.74]	0.012†
	No	158 (99.4%)	142 (98.6%)	Ref.	—	

*Significant at $p < 0.05$. †Fisher's exact test p-value.**DISCUSSION**

This retrospective evaluation provides insights into the diagnostic frequency, clinical manifestations, and imaging

patterns of urolithiasis at a regional referral hospital in Kisangani, Democratic Republic of the Congo.

Sociodemographic Factors

The observed male predominance (55.1%, male-to-female ratio 1.23:1) aligns with regional sub-Saharan studies and global literature (Akram & Somani, 2025; Kassaw et al., 2024; Mbouche et al., 2023). Hormonal factors, particularly androgen-mediated increases in hepatic oxalate synthesis and lower urinary citrate concentrations in males, contribute to this sex disparity (Stamatelou & Goldfarb, 2023). Furthermore, a significant proportion of men in northeastern DRC engage in manual labor, transport, and agricultural work, which may increase heat exposure and dehydration risks.

The age distribution peaked between 30 and 49 years (55.1%), corresponding to the most economically active population segment. This peak age presentation is consistent with global epidemiological patterns, reflecting peak metabolic risk, occupational dehydration exposures, and dietary influences during mid-adulthood (Kittanamongkolchai et al., 2018; Ondziel-Opara et al., 2022).

Clinical Presentation and Comorbidities

Acute flank pain characteristic of renal colic was the primary indication for imaging in 89.1% of patients. This presentation aligns with studies in Central Africa identifying acute pain as the primary clinical trigger for diagnostic imaging in emergency and outpatient care (Diangienda et al., 2019; Ondziel-Opara et al., 2022).

Clinical signs of UTI were recorded in 13.5% of cases and demonstrated a statistically significant association with confirmed stone disease (OR = 2.5, $p = 0.012$). Uropathogens, particularly urease-producing organisms such as *Proteus*, *Klebsiella*, and *Pseudomonas* species, hydrolyze urea to ammonium, creating an alkaline urinary environment that promotes struvite (magnesium ammonium phosphate) and carbonate apatite precipitation (Alhakamy et al., 2025; Bargagli et al., 2025). Conversely, urinary obstruction caused by calculi promotes stasis and secondary bacterial colonization, creating a vicious cycle between infection and lithogenesis.

A personal history of urolithiasis was strongly associated with positive imaging findings (OR = 3.4, $p = 0.030$). This aligns with clinical evidence showing five-year recurrence rates approaching 50% in the absence of targeted metabolic

therapy or dietary changes (Bargagli et al., 2025; Skolarikos et al., 2025).

Imaging Features and Diagnostic Spectrum

Ultrasonography confirmed urolithiasis in 52.5% of evaluated patients. Nephrolithiasis accounted for 93.1% of all cases, whereas ureterolithiasis was identified in only 8.2% of patients, and hydronephrosis in 8.2%.

These radiological patterns differ from Western emergency department cohorts, where non-contrast computed tomography (NCCT) detects higher proportions of distal ureteral stones and acute hydronephrosis (Gupta et al., 2023; Orso et al., 2024). This divergence likely reflects diagnostic selection effects rather than distinct physiological stone distributions. Although ultrasonography offers high sensitivity ($\geq 90\%$) for identifying renal calculi and intrarenal collecting system dilation, its sensitivity for ureteral stones—especially small (≤ 5 mm) distal ureteral calculi—is lower (range: 19%–45%) due to bowel gas attenuation and patient habitus constraints (Bourcier et al., 2021; Skolarikos et al., 2025).

Consequently, non-obstructing or minimally obstructive ureteral calculi may go undetected on routine ultrasound in low-resource settings, leading to an overrepresentation of parenchymal and pelvicalyceal renal calculi. Furthermore, early or transient ureteral obstruction may not cause detectable hydronephrosis at the time of scanning (Orso et al., 2024).

The high prevalence of small calculi (≤ 10 mm, 84.3%) and multiple stones (56.6%) emphasizes the value of standardized ultrasound techniques. Multiple stones often indicate underlying metabolic abnormalities, such as hypercalciuria, hyperoxaluria, or hypocitraturia, which warrant further clinical evaluation (Daudon et al., 2016; Diasiama Diangienda et al., 2021).

Plain KUB radiography was performed in a minority of patients ($n = 17$), with 58.8% displaying radiopaque opacities. While KUB has limited diagnostic utility as a standalone modality for acute flank pain, it remains a useful, low-cost tool for follow-up of radio-dense calcium phosphate and calcium oxalate stones identified on prior imaging (Bhojani et al., 2022; Pearle et al., 2014).

Implications for Public Health and Clinical Pathways

These findings support the implementation of structured diagnostic algorithms tailored to resource-limited healthcare environments. Given the cost, equipment, and radiation burdens of NCCT, an "**ultrasound-first**" **triage pathway** offers a practical approach for regional referral centers (Bourcier et al., 2021; Skolarikos et al., 2025).

Under this clinical workflow:

1. **Initial Risk Stratification:** Patients presenting with acute flank pain undergo clinical assessment to rule out red flag symptoms (e.g., high fever, solitary kidney, known renal impairment, suspected sepsis, or severe refractory pain).
2. **First-Line Sonographic Evaluation:** Stable patients without red flag features undergo structured renal and pelvic ultrasonography. Standardized imaging protocols should assess stone location, stone diameter, acoustic shadowing, intrarenal Doppler indices, and urinary bladder jet signals (Orso et al., 2024).
3. **Targeted Escalation:** Patients with negative or equivocal ultrasound findings who exhibit persistent symptoms, complicated clinical presentations, or suspected distal ureteral obstruction are prioritized for low-dose NCCT (Gupta et al., 2023; Skolarikos et al., 2025).

Establishing formal sonographic training programs for emergency physicians and radiologists, alongside standardized reporting templates, could enhance diagnostic accuracy and patient outcomes in regional health networks.

Limitations

This study has several limitations:

1. **Retrospective Design:** Data collection relied on archived medical records, which may introduce information bias or miss unrecorded clinical data.
2. **Diagnostic Sensitivity Constraints:** The lack of routine NCCT as a reference standard likely resulted in underdetection of small distal ureteral stones, leading to potential overestimation of the proportion of renal vs. ureteral calculi.

3. **Single-Center Setting:** Conducted at a single regional hospital, the study findings may not fully generalize to the broader population of Tshopo Province or other geographical regions.
4. **Absence of Biochemical Analysis:** Quantitative stone composition analysis and 24-hour urine metabolic evaluations were unavailable, preventing classification by biochemical stone type.

CONCLUSION

This study demonstrates a high diagnostic frequency of urolithiasis (52.5%) among symptomatic patients evaluated by first-line imaging modalities at the Cinquanteaire Hospital of Kisangani. Nephrolithiasis and small calculi (≤ 10 mm) constituted the majority of radiological findings. Bivariate analyses identified age, prior urolithiasis history, urinary tract infections, and diabetes mellitus as significant factors associated with stone disease.

Ultrasonography remains an essential, practical initial diagnostic tool in resource-limited settings. Implementation of standardized ultrasound protocols, clinician training, and selective referral pathways for non-contrast computed tomography can help optimize urolithiasis diagnosis and management across referral centers in sub-Saharan Africa.

Use of Artificial Intelligence (AI) Declaration: The authors declare that no generative artificial intelligence (AI) tools were used to generate, modify, or manipulate the primary research data. The authors take full responsibility for the accuracy, integrity, and scientific content of the manuscript.

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Authors' Contributions

- i. **J.-P. Bambale Limengo:** Conceptualization, Methodology, Formal analysis, Data curation, Writing – original draft, Writing – review & editing.
- ii. **K. Lwanga Lwanga:** Formal analysis, Software, Writing – review & editing.
- iii. **L. Ahuka Longombe:** Methodology, Writing – review & editing.
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- ix. **Kayembe Tshilumba:** Conceptualization, Investigation, Supervision, Writing – review & editing.
- x. **A. Molua Aundu:** Conceptualization, Investigation, Supervision, Writing – review & editing.
- xi. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethical Approval: Ethical clearance for this study was granted by the Ethics Committee of the University of Kisangani (Approval No.: UNIKIS/CE/KGB/004/07/2025).

Informed Consent: The requirement for informed consent was waived by the relevant ethics committee due to the retrospective nature of the study and the use of anonymized patient data.

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REFERENCES

- Akram, M., & Somani, B.** (2025). Epidemiology and management of kidney stone disease – Current insights. *Research and Reports in Urology*, 17, 449–459. <https://doi.org/10.2147/RRU.S517758>
- Alhakamy, M., AlShoaibi, I., Abdo, B., Abdullah, M., Alzanen, K., Albadani, N., Ahmed, F., Al-Naggar, K., Aljuma'ai, N., Alnadhari, I., Al-Hagri, A., & Alareefi, F.** (2025). Prevalence of urolithiasis in adults of the Eastern Mediterranean region: A systematic review and meta-analysis. *Urological Science*, 36(4), 176–184. <https://doi.org/10.1097/us9.0000000000000076>
- Bargagli, M., Scoglio, M., Howles, S. A., & Fuster, D. G.** (2025). Kidney stone disease: Risk factors, pathophysiology and management. *Nature Reviews Nephrology*, 21(11), 794–808. <https://doi.org/10.1038/s41581-025-00990-x>
- Bhojani, N., Bjazevic, J., Wallace, B., Lee, L., Kaler, K. S., Dion, M., Cowan, A., Sultan, N., Chew, B. H., & Razvi, H.** (2022). Update – 2022 Canadian Urological Association guideline: Evaluation and medical management of the kidney stone patient. *Canadian Urological Association Journal*, 16(6), E310–E322. <https://doi.org/10.5489/cuaj.7872>
- Bourcier, J.-E., Gallard, E., Redonnet, J.-P., Abillard, M., Billaut, Q., Fauque, L., Jouanolou, A., & Garnier, D.** (2021). Ultrasound at the patient's bedside for the diagnosis and prognostication of a renal colic. *The Ultrasound Journal*, 13(1), Article 45. <https://doi.org/10.1186/s13089-021-00246-2>
- Daudon, M., Dessombz, A., Frochot, V., Letavernier, E., Haymann, J.-P., Jungers, P., & Bazin, D.** (2016). Comprehensive morpho-constitutional analysis of urinary stones improves etiological diagnosis and therapeutic strategy of nephrolithiasis. *Comptes Rendus Chimie*, 19(11–12), 1470–1491. <https://doi.org/10.1016/j.crci.2016.05.008>
- Daudon, M., Traxer, O., Lechevallier, E., & Saussine, C.** (2008). Épidémiologie des lithiases urinaires. *Progrès en Urologie*, 18(12), 802–814. <https://doi.org/10.1016/j.purol.2008.09.029>
- Diangienda, P. K. D., Moningo, D. M., Mafuta, E. M., Punga-Maole, A. M. L., Lufuma, S. L., & Daudon, M.** (2019). Profil épidémiologique des calculs urinaires aux Cliniques Universitaires de Kinshasa. *Annales Africaines de Médecine*, 12(2), e3220–e3228.
- Diasama Diangienda, P. K., Moningo, D. M., Sumaili, E. K., Mayindu, A. N., Lembe Punga-Maole, A. M., Haymann, J.-P., & Daudon, M.** (2021). Prevalence of metabolic abnormalities in patients with urolithiasis in Kinshasa, the Democratic Republic of Congo. *Pan African Medical Journal*, 40, Article 75. <https://doi.org/10.11604/pamj.2021.40.75.28349>
- Gupta, R. T., Kalisz, K., Khatri, G., Caserta, M. P., Catanzano, T. M., Chang, S. D., De Leon, A. D., Gore, J. L., Nicola, R., Prabhakar, A. M., Savage, S. J., Shah, K. P., Surabhi, V. R., Taffel, M. T., Valente,**

- J. H., Yoo, D. C., & Nikolaidis, P. (2023). ACR Appropriateness Criteria® acute onset flank pain-suspicion of stone disease (urolithiasis). *Journal of the American College of Radiology*, 20(11), S315–S328. <https://doi.org/10.1016/j.jacr.2023.08.020>
- Kassaw**, A. B., Belete, M., Assefa, E. M., & Tareke, A. A. (2024). Prevalence and clinical patterns of urolithiasis in sub-Saharan Africa: A systematic review and meta-analysis of observational studies. *BMC Nephrology*, 25(1), Article 334. <https://doi.org/10.1186/s12882-024-03780-y>
- Kaul**, I., Moore, S., Barry, E., & Pareek, G. (2023). Renal imaging in stone disease: Which modality to choose? *Rhode Island Medical Journal*, 106(11), 31–35.
- Kittanamongkolchai**, W., Vaughan, L. E., Enders, F. T., Dhondup, T., Mehta, R. A., Krambeck, A. E., McCollough, C. H., Vrtiska, T. J., Lieske, J. C., & Rule, A. D. (2018). The changing incidence and presentation of urinary stones over 3 decades. *Mayo Clinic Proceedings*, 93(3), 291–299. <https://doi.org/10.1016/j.mayocp.2017.11.018>
- Kuntima** Diasiama, P. D., Moningo Molamba, D., Makulo Rissasy, J.-R., Sumaili Kiswaya, E., Mafuta Musalu, É., Ngoma, A., Loposso Nkumu, M., Punga-Maole, A., Lwa Nkandi, S. L., Haymann, J.-P., & Daudon, M. (2021). Composition chimique des calculs urinaires et caractéristiques épidémiologiques associées en République Démocratique du Congo. *Néphrologie & Thérapeutique*, 17(6), 441–450. <https://doi.org/10.1016/j.nephro.2021.04.002>
- Kuntima**, P. D., Molamba, D., Musalu, E., Ngoma, A., Loposso Nkumu, M., Punga-Maole, A., Lwa Nkandi, S. L., Haymann, J. P., & Daudon, M. (2019). Profil épidémiologique des calculs urinaires aux Cliniques Universitaires de Kinshasa. *Annales Africaines de Médecine*, 12(2), e3220–e3225.
- Mbouche**, L. O., Mbassi, A. A., Eluondou, J. C. N., Aabe, J. A., Kamga, J., Fouda, P. J., & Angwafo III, F. (2023). Épidémiologie et diagnostic de la lithiase urinaire: Étude transversale dans une population camerounaise. *Pan African Medical Journal*, 45, Article 61. <https://doi.org/10.11604/pamj.2023.45.61.38677>
- Moore**, C. L., & Scoutt, L. (2012). Sonography first for acute flank pain? *Journal of Ultrasound in Medicine*, 31(11), 1703–1711. <https://doi.org/10.7863/jum.2012.31.11.1703>
- Ondziel-Opapa**, S. A., Atipo, A. M. O., Okemba, G. O., Mouss, R. B. B., Nyanga, Y. I. D., Odzebe, A. W. S., & Bouya, A. P. (2022). Epidemiological profile of patients suffering from urolithiasis in African urological environments from 2016 to 2020. *Open Journal of Urology*, 12(2), 157–167. <https://doi.org/10.4236/oju.2022.122016>
- Orso**, D., Peric, D., Di Gioia, C. C., Comisso, I., Bove, T., Ban, A., Fonda, F., & Federici, N. (2024). Renal and genitourinary ultrasound evaluation in emergency and critical care: An overview. *Healthcare*, 12(13), Article 1356. <https://doi.org/10.3390/healthcare12131356>
- Pearle**, M. S., Goldfarb, D. S., Assimos, D. G., Curhan, G., Denu-Ciocca, C. J., Matlaga, B. R., Monga, M., Penniston, K. L., Preminger, G. M., Turk, T. M. T., & White, J. R. (2014). Medical management of kidney stones: AUA guideline. *The Journal of Urology*, 192(2), 316–324. <https://doi.org/10.1016/j.juro.2014.05.006>
- Skolarikos**, A., Geraghty, R., Somani, B., Tailly, T., Jung, H., Neisius, A., Petřík, A., Kamphuis, G. M., Davis, N., Bezuidenhout, C., Lardas, M., Gambaro, G., Sayer, J. A., Lombardo, R., & Tzelves, L. (2025). European Association of Urology guidelines on the diagnosis and treatment of urolithiasis. *European Urology*, 88(1), 64–75. <https://doi.org/10.1016/j.eururo.2025.03.011>
- Stamatelou**, K., & Goldfarb, D. S. (2023). Epidemiology of kidney stones. *Healthcare*, 11(3), Article 424. <https://doi.org/10.3390/healthcare11030424>
- Tzou**, D. T., Usawachintachit, M., Taguchi, K., & Chi, T. (2017). Ultrasound use in urinary stones: Adapting old technology for a modern-day disease. *Journal of Endourology*, 31(S1), S89–S94. <https://doi.org/10.1089/end.2016.0584>
- Vera-Ponce**, V. J., Sanchez-Tamay, N. M., Ballena-Cacedo, J., Zuzunaga-Montoya, F. E., De Carrillo, C. I. G., & Poemape Mestanza, R. L. (2025). Global prevalence of urolithiasis: A meta-analysis accounting for methodological heterogeneity. *Frontiers in Urology*, 5, Article 1705953. <https://doi.org/10.3389/fruro.2025.1705953>