



Research Article

Contribution of Computed Tomography to the Diagnosis of Urinary Lithiasis at the Ouahigouya Regional University Hospital Center: A Study of 128 Cases (Burkina Faso)

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Abstract

Objectives: To assess the diagnostic contribution of computed tomography (CT) in urinary stone disease at the Ouahigouya Regional University Hospital Center (CHUR-OHG), Burkina Faso, from May 2021 to December 31, 2024. **Materials and Methods:** We conducted a descriptive retrospective study over approximately four years, from May 1, 2021, to December 31, 2024. We reviewed the CT examinations performed for suspected urinary stone disease during the study period. **Results:** A total of 128 CT examinations were included. The male-to-female ratio was 1.97, and the mean age was 42.02 years. Renal colic was the most common indication for CT (42.19%). Stones were most frequently located in the ureter (36.72%). The main complications were ureterohydronephrosis (39.85%) and calyceal dilatation (20.32%), whereas no complications were observed in 37.50% of cases. CT most frequently identified calcium oxalate and uric acid stones, accounting for 29.68% and 28.13% of cases, respectively. Stone location was significantly associated with urinary tract obstruction or dilatation ($p < 0.001$), but not with stone composition ($p = 0.746$). Prostatic hypertrophy was the most common organic risk factor, identified in 11.71% of cases, whereas no organic risk factor was identified in 77.34% of cases. **Conclusion:** Computed tomography plays a central role in the diagnosis and therapeutic management of urinary stone disease. It provides valuable information on stone location, composition, and associated urinary tract complications.

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Keywords

Computed Tomography, Urinary Stone Disease, Urinary Lithiasis, Diagnosis, CHUR-OHG, Burkina Faso

1. Introduction

Urinary lithiasis is a common and potentially serious condition characterized by a high risk of recurrence. It may remain asymptomatic for prolonged periods or present as an acute condition requiring emergency care. Its prevalence varies substantially across regions, ranging from 7% to 13% in North America, 5% to 9% in Europe, and 1% to 5% in Asia, with an overall increasing trend worldwide [1]. In the United States, approximately one in eleven individuals develops urinary stones during their lifetime, with a notable increase in incidence among women, children, and populations historically considered to be at lower risk [2, 3]. Studies from Europe and Asia, particularly Italy, Japan, and Saudi Arabia, have likewise reported increasing incidence rates [4-6]. In West Africa, studies conducted in Mali and Burkina Faso have reported substantial hospital-based prevalence rates of 16.67% and 18.87%, respectively, highlighting the growing burden of urinary lithiasis in the subregion [7, 8].

Computed tomography (CT) has become a key imaging modality for the diagnosis and management of urinary lithiasis. According to the recommendations of the Société Française de Médecine d'Urgence, first-line imaging may consist of either a combination of plain abdominal radiography and ultrasonography or non-contrast abdominopelvic CT [9].

CT offers comprehensive assessment of urinary stones, including their location, size, and associated urinary tract abnormalities, and can therefore contribute to therapeutic decision-making.

CT was recently introduced at the Ouahigouya Regional University Hospital Center (CHUR-OHG). However, no local study had yet evaluated its diagnostic contribution to urinary lithiasis. This gap in local evidence provided the rationale for the present study, which aimed to assess the contribution of CT to the diagnosis of urinary lithiasis at CHUR-OHG.

2. Materials and Methods

2.1. Study Design and Period

We conducted a descriptive cross-sectional study with retrospective data collection from May 1, 2021, to December 31, 2024, in the Department of Medical Imaging at the CHUR-OHG, Burkina Faso.

2.2. Study Population, Inclusion and Exclusion Criteria

We included all cases of urinary lithiasis diagnosed by CT during the study period. We excluded patients whose diagnosis was established by ultrasonography and/or plain radiography of the urinary tract, as well as cases for which the CT report was unavailable.

2.4. Data Collection and Sources

Data were collected using an electronic data collection form developed in KoboToolbox. The variables collected included sociodemographic characteristics (age in years, sex, and referring clinical department), clinical characteristics (indication for CT), and CT findings, including stone location, shape, number, laterality, impact on the urinary tract, composition, size, and associated organic risk factors. Data were entered, cleaned, and analyzed using STATA version 16.

2.5. Ethical Considerations

Data confidentiality was ensured by anonymizing the data collection forms. The study was conducted in accordance with applicable ethical principles and institutional requirements.

3. Results

3.1. Sociodemographic and Clinical Characteristics

A total of 128 patients were included, comprising 85 men (66.41%) and 43 women (33.59%). The mean age was 42.02 ± 17.02 years (range, 4–85 years). The most common indication for CT was renal colic, reported in 54 patients (42.19%), followed by lumbar pain in 36 patients (28.13%) and obstructive syndrome with no identifiable cause on ultrasonography in 17 patients (12.87%).

3.2. Computed Tomography Findings

Stones were most frequently located in the ureter (43.71%), followed by the renal calyces (41.41%), renal pelvis (24.22%), and bladder (10.16%). The median number of stones was 1, and a single stone was identified in 58.59% of patients.

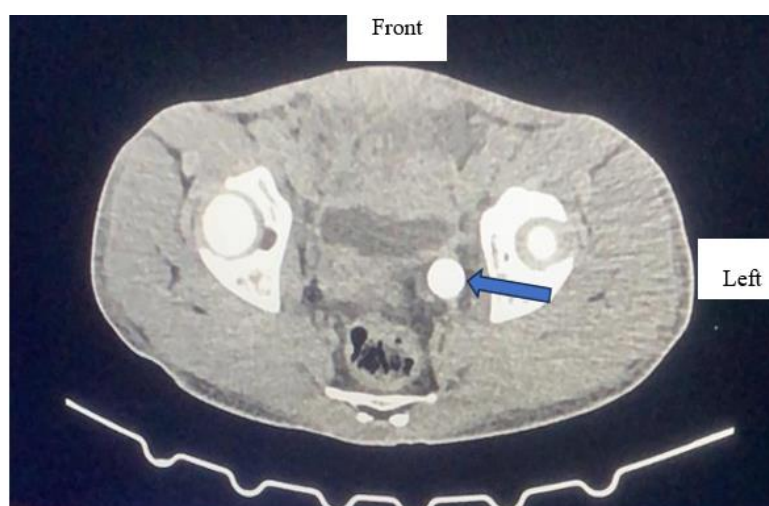


Figure 1. Axial CT urogram, parenchymal window: left ureteral meatal stone.

Right-sided involvement was the most common pattern, occurring in 53 patients (41.40%).

Stone size was reported for all analyzed stones ($n = 150$). Most stones, 91 (71.09%), measured 0–15 mm. Stones measuring 15–30 mm accounted for 42 cases (32.81%), whereas 9 stones (7.03%) measured 30–45 mm and 8 stones (6.30%) measured more than 45 mm.

Urinary tract abnormalities related to stone disease were identified in 80 patients (62.50%). Ureterohydronephrosis was the most frequent finding, occurring in 51 patients (39.85%), followed by calyceal dilatation in 26 patients (20.32%) and

hydronephrosis in 3 patients (2.34%). No urinary tract abnormalities were identified in 48 patients (37.50%).

Stone composition was not specified in 26 cases (20.31%). Among stones with an identified composition, calcium oxalate dihydrate was the most common, accounting for 38 cases (29.68%), followed by uric acid stones in 36 cases (28.13%). Struvite (magnesium ammonium phosphate) stones accounted for 23 cases (17.97%), while calcium phosphate stones accounted for 5 cases (3.91%).

There was a statistically significant association between stone location and urinary tract impact ($\chi^2 = 23.81$; $p < 0.001$), as shown in Table 1.

Table 1. Topography of stones according to their impact on the urinary system.

Topography (n= 128)	With impact n (%)	Without impact n (%)	P value
Pyelic	12 (48.00)	13 (52.00)	< 0.0001
Calicial	19 (43.18)	25 (56.82)	
Ureteral	42 (89.36)	5 (10.64)	
Bladder	7 (58.33)	5 (41.67)	

No statistically significant association was observed between stone composition and stone location ($p = 0.746$) as Table 2.

Table 2. Nature of stone based on its location.

Topography	Nature (n=128)					P value
	Uric acid	Not specified	Calcium oxalate	Calcium phosphate	Magnesium Ammonium Phosphate	
Calicial n (%)	15 (34.09)	10 (22.73)	12 (27.27)	1 (2.27)	6 (13.64)	0,746

Topography	Nature (n=128)					P value
	Uric acid	Not specified	Calcium oxalate	Calcium phosphate	Magnesium Ammonium Phosphate	
Pyelic n (%)	4 (16.00)	5 (20.00)	6 (24.00)	2 (8.00)	8 (32.00)	
Ureteral n (%)	14 (29.79)	8 (17.02)	16 (34.04)	2 (4.26)	7 (14.89)	
Bladder n (%)	3 (25.00)	3 (25.00)	4 (33.33)	0 0.00	2 (16.67)	

Organic risk factors identified on CT were relatively uncommon. Prostatic hypertrophy was the most frequently identified organic risk factor, occurring in 15 patients (11.71%). Pyeloureteral junction syndrome, a porcelain bladder, and

horseshoe kidney were each observed in 4 patients (3.12%). A bifid ureter was identified in 2 patients (1.56%). No organic risk factor was identified in 99 patients (77.34%) as [Table 3](#).

Table 3. Organic risk factors identified on CT.

Risk factor	Number (n=128)	Percentage (%)
Pyeloureteral junction syndrome	4	3.12
Prostatic hypertrophy	15	11.71
Porcelain bladder	4	3.12
Horseshoe kidney	4	3.12
Bifid ureter	2	1.56
None	99	77.34

4. Discussion

As with any retrospective study, our study had several limitations, including missing or insufficient information for some variables, which may have introduced information bias. Nevertheless, the available data allowed us to characterize the clinical and CT features of urinary stone disease in our setting and to compare our findings with those reported in the literature.

The mean age of patients in our study was 42.02 ± 17.02 years, which was close to the 39 years reported by Some et al. [10] in Burkina Faso in 2024. However, our mean age was higher than the 18.21 ± 21.86 years reported by Traore et al. [7] in Burkina Faso in 2018 and the 33.85 years reported by Traore I. [8] in Mali in 2019. These differences may reflect variations in the demographic characteristics of the study populations, recruitment settings, and inclusion criteria.

We observed a predominance of men, who accounted for

66.41% of the study population, with a male-to-female ratio of 1.97. This finding is consistent with that reported by Daudon et al. in France in 2008 [11]. It was also comparable to the 65.7% reported by Kabore et al. [12] in Burkina Faso in 2013 and close to the 59.1% reported by Opara et al. [13] in Congo-Brazzaville. The male predominance observed in our study is consistent with the higher incidence of urinary stone disease traditionally reported in men. Several factors may contribute to this sex difference, including differences in hormonal, metabolic, dietary, and behavioral factors. In addition, organic conditions that may promote urinary stasis, such as prostatic hypertrophy, are more common in men. However, the mechanisms underlying the observed sex disparity are multifactorial and cannot be attributed solely to anatomical differences in the urinary tract.

Renal colic was the leading indication for CT in our study, accounting for 42.19% of cases. Similarly, Some et al. [10] Burkina Faso and Opara et al. [13] in Congo-Brazzaville reported renal colic as the most common indication, accounting for 28.2% and 59.16% of cases, respectively. In contrast,

Odzebe et al. [14] in Congo-Brazzaville reported acute urinary retention as the main presenting feature. These differences may reflect variations in the clinical characteristics of patients referred for imaging and in the anatomical location of the stones. Clinical manifestations of urinary stone disease vary according to stone location, size, and degree of urinary tract obstruction, with distinct presentations depending on whether the upper or lower urinary tract is involved.

The ureter was the most common site of stone localization in our study (43.75%), followed by the renal calyces (41.41%), whereas bladder stones accounted for 10.16% of cases. These findings are consistent with previous studies reporting the upper urinary tract as the predominant site of urinary stone formation [8, 10]. The predominance of ureteral stones in our series may partly reflect the clinical context in which CT was requested, particularly the high frequency of renal colic.

Right- and left-sided involvement were relatively similar, occurring in 41.40% and 40.62% of cases, respectively, while bilateral involvement was observed in 17.98%. A similar distribution has been reported in other African studies [10, 15, 16]. In the absence of unilateral urinary tract abnormalities, there is no established anatomical or biological mechanism that would consistently favor stone formation on one side. The relatively balanced distribution observed in our study therefore appears consistent with the bilateral nature of the underlying metabolic and environmental risk factors for urinary stone disease.

Urinary tract impact was identified in 62.50% of patients, whereas 37.50% had no associated urinary tract abnormalities. Ureterohydronephrosis was the most frequent finding (39.85%), followed by calyceal dilatation (20.32%) and hydronephrosis (2.34%). In contrast, Benchouk [17] reported hydronephrosis as the most common complication, occurring in 75.9% of cases. Differences in the distribution of complications may be related to variations in stone location, size, duration of obstruction, and the characteristics of the populations studied. In our study, the significant association observed between stone location and urinary tract impact ($\chi^2(3) = 23.81$; $p < 0.001$) further supports the importance of anatomical location in the development of obstructive urinary tract abnormalities. However, the cross-sectional nature of our data does not allow causal relationships to be established.

No statistically significant association was observed between stone composition and stone location ($p = 0.746$). This finding suggests that stone composition was not significantly related to its anatomical location within the urinary tract in our study population. Thus, the location of a stone in the renal calyces, renal pelvis, ureter, or bladder did not appear to be associated with a specific chemical composition. This finding is consistent with the multifactorial nature of urinary stone formation, which is influenced by metabolic, dietary, infectious, genetic, and environmental factors rather than by anatomical location alone. Stone location primarily reflects the site of formation, migration, and potential urinary obstruction. Therefore, anatomical location alone is unlikely to reliably predict

stone composition [11].

Overall, our findings highlight the value of CT in the comprehensive assessment of urinary stone disease. Beyond detecting the presence of stones, CT provides information on their anatomical location, number, size, composition, and associated urinary tract abnormalities. These features are particularly relevant for assessing the severity of obstruction and informing therapeutic management.

5. Conclusions

Computed tomography plays a central role in the diagnosis and management of urinary stone disease. In our study, patients had a mean age of 42.02 ± 17.02 years, and renal colic was the most common indication for CT. Overall, CT reports provided the key information required to diagnose urinary stones and assess their anatomical location and associated urinary tract abnormalities. However, reporting was often incomplete regarding important characteristics such as stone density, morphology, and associated urinary tract malformations. Improving the standardization and completeness of CT reporting could enhance diagnostic characterization and support more appropriate therapeutic decision-making.

Abbreviations

CHUR-OHG	Ouahigouya Regional University Hospital Center
CT	Computed Tomography

Author Contributions

Milckisedek Judicael Marouruana Some: Conceptualization, Data curation, Formal Analysis, Methodology, Validation, Writing – original draft

Siebou Hien: Conceptualization, Data curation, Formal Analysis, Methodology, Validation

Ahryno Amad Yassine Diallo: Data curation, Formal Analysis, Methodology

Wendiwoumyam Judicael Congo: Data curation

Kouka Francois Dassis Tonde: Data curation

Tieoule Mamadou Traore: Visualization

Sore Moussa Zanga: Supervision

Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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