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Impact of Sociodemographic and Geographic Factors on Diagnostic Delay and Clinical Severity of Upper Urinary Tract Urolithiasis: A Study at a Referral Center in Chad

Saleh Abdelkerim Nedjim[1,2*], Adoumadji Kouldjim[1,2], Ndormadjita Allah-Syengar[1,3], Seid Younous Adoum[2], Moussa Kalli[3], Mahamat Ali Mahamat[3], Rimtebaye Kimasoum[3]

[1]Centre Hospitalier Universitaire La Renaissance, N'Djamena, Tchad
[2]Faculté de Médecine, Université d'Adamn Barka, Abéché, Tchad
[3]Faculté de Médecine, Université de N'Djamena, N'Djamena, Tchad
Email: *nedjimsaleh@gmail.com

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Abstract

Introduction: Urinary stone disease represents a growing public health problem, particularly in resource-limited countries where socioeconomic and geographic constraints contribute to delayed diagnosis and increased clinical severity. This study aims to analyze the impact of sociodemographic and geographic determinants on the clinical presentation of urinary stone disease in Chad. **Methods:** This is an observational, cross-sectional, descriptive study conducted in the urology department of La Renaissance University Hospital in N'Djamena, including consecutive patients aged 15 years and older treated for complicated urinary lithiasis. Sociodemographic, geographic, and clinical data were collected retrospectively and prospectively. Severity was defined as the presence, among these complicated cases, of a urological emergency (obstructive infection, acute renal failure). Statistical analysis was descriptive. **Results:** Thirty-three patients were included, with a mean age of 44 years and a predominance of males (72.6%). The majority came from disadvantaged backgrounds, with 63.6% residing outside the city where the center is located. The median time to consultation was 9 months. Complicated cases were dominated by obstructive pyelonephritis (30.3%) and acute renal failure (27.3%). Emergency urinary diversion was performed primarily via percutaneous nephrostomy (72.7%). Hemodialysis was required in 15.2% of patients. The overall mortality rate was 12.1%. In terms of treatment, 87.9% of patients underwent surgery, 89.7% of whom underwent open surgery. **Conclusion:** In Chad, urinary lithiasis is often diagnosed at an advanced stage, reflecting inequalities in

access to care. Improving early diagnosis, organizing the care pathway, and developing pediatric urology are priorities for reducing morbidity and mortality.

Keywords

Urinary Lithiasis, Diagnostic Delay, Sociodemographic Determinants, Access to Care, Sub-Saharan Africa

1. Introduction

Urinary stone disease is a growing global public health problem, particularly in low- and middle-income countries, where environmental, socioeconomic, and health system factors strongly influence its clinical presentation and management [1]. In sub-Saharan Africa, despite significant regional variations, the prevalence of urinary stone disease is steadily increasing [2]. In Nigeria, for example, Mungadi *et al.* [3] reported that upper urinary tract stones accounted for up to 10.3% of new diagnoses. This high prevalence may be explained by a combination of regional factors, such as a hot and arid climate, chronic dehydration, certain dietary habits, and endemic infections [1]. Socioeconomic determinants, such as low levels of education, modest incomes, and limited access to health insurance, are associated with a higher burden of urolithiasis at the time of consultation and delayed access to appropriate care [4] [5]. This delay results in complicated clinical presentations, including obstructive uropathy, urinary tract infection, pyelonephritis, urosepsis, and acute or chronic kidney failure [6]. In Cameroon, nephrolithiasis was responsible for obstructive uropathy in 35% of cases, and 19% of patients required emergency stenting [7]. In terms of surgical care, despite the growing adoption of minimally invasive endourological techniques in high-income countries, access to modern care remains limited in resource-constrained settings, often leading to delays in diagnosis and treatment [8] [9]. In Chad, access to urological care remains limited, with fewer than fifteen urologists for several million inhabitants and endourology services concentrated in a single public center. Geographical and structural constraints lead to diagnostic delays, exposing patients to complicated forms of urinary lithiasis that often require invasive surgery. Analysis of sociodemographic and geographic determinants is therefore essential to improve early diagnosis and the organization of care.

2. Methods

Study design, setting, and sampling: This is an observational, cross-sectional, descriptive study conducted in the Urology Department of La Renaissance University Hospital Center (CHU-RN) in N'Djamena. Data were collected over the study period from January 2024 to June 2026 (30 months), combining a retrospective chart-review phase and a prospective phase within this period. All patients aged

15 years or older who were treated for a complication of urinary lithiasis during the study period and who met the inclusion criteria were included consecutively and exhaustively, without additional sampling. Patients with incomplete records for the main study variables were excluded.

The variables collected focused on the patients' sociodemographic and geographic characteristics, namely age, sex, educational level, occupation, household income, distance between home and the hospital, and access to local healthcare facilities. Socioeconomic status was classified as "disadvantaged" when patients met at least one of the following criteria: informal/subsistence occupation, monthly household income below the Guaranteed Minimum Interoccupational Wage (SMIG), and absence of health insurance coverage; this composite classification was applied uniformly to all included patients. Clinical data included history of urinary lithiasis, presence of comorbidities, symptoms at the time of consultation, time from symptom onset to consultation, and size, number, and location of stones, as well as the presence of hydronephrosis or obstructive urinary tract infection and the need for surgical intervention. All patients included in this study had complicated urinary stones at the time of their visit. Severity was defined as the presence of a urological emergency requiring emergency surgical or interventional management.

Statistical analysis: The statistical analysis was descriptive. Results are presented as counts and percentages for categorical variables and as means (with range) or medians (with interquartile range) for continuous variables. No inferential/comparative statistical tests were performed in the present analysis; accordingly, no significance threshold was applied. Analyses were performed using IBM SPSS Statistics V. 30.

Ethics statement: This study received administrative authorization from the hospital's Research and Training Directorate. For the retrospective component, participants were exempted from the requirement of individual informed consent given the use of anonymized data from medical records; for the prospective component, written informed consent was obtained from all participants prior to administration of the questionnaire. All data were anonymized before analysis, in accordance with the Declaration of Helsinki.

3. Results

A total of 33 patients were included during the study period. The mean age of the patients was 44 years (range: 24 - 78 years), with a predominance of males (n = 24; 72.6%). The socioeconomic status of the patients was considered disadvantaged in more than half of the cases. Approximately 61% (n = 20; 60.6%) of the patients had a primary school education or lower, and 63.6% came from another city. Seventeen patients (51.5%) had consulted a healthcare professional at least once prior to admission. The median time between symptom onset and admission was estimated at 9 months (4 - 14 months). In terms of occupation, farmers were the largest group (n = 14; 42.4%), followed by livestock farmers (n = 6; 18.2%). **Table 1**

summarizes all patients along with their sociodemographic and occupational characteristics.

Table 1. Sociodemographic and occupational characteristics of patients.

Variable	n	%
Male sex	24	72.6
Mean age, years (range)	44 (24 - 78)	
Education level ≤ primary school	20	60.6
Residence outside the city of the treatment center	21	63.6
Previous medical consultation before admission	17	51.5
Occupation		
Farmers	14	42.4
Livestock breeders	6	18.2
Military personnel	5	15.2
Teachers	3	9.1
Others/unemployed	5	15.2

At admission, the clinical presentations were varied. Moderate to severe hydronephrosis was the most frequent finding (n = 14; 42.4%), followed by acute obstructive pyelonephritis, the most common infectious presentation (n = 10; 30.3%), and acute obstructive renal failure (n = 9; 27.3%). The other presentations were pyonephrosis, forniceal rupture with urinary extravasation, and obstructive urinary tract infection at admission, as shown in Table 2. Regarding stone location, ureteral stones were present in 18 patients (54.5%), renal stones in 15 patients (45.5%), and an associated bladder stone in 6 patients (18.2%); several patients had stones in more than one location, so the totals exceed the number of patients. The mean stone size was 18 mm, and 10 patients (30.3%) had a stone burden ≥ 2 cm, primarily observed in patients from rural areas and disadvantaged backgrounds (Table 2).

Table 2. Clinical presentation at admission and stone characteristics.

Variable	n	%
Clinical presentation		
Obstructive acute pyelonephritis	10	30.3
Obstructive acute renal failure	9	27.3
Pyonephrosis	5	15.2
Forniceal rupture with urinary extravasation	3	9.1
Moderate to severe hydronephrosis	14	42.4
Obstructive urinary tract infection at admission	7	21.2

Continued

Stone location		
Ureter	18	54.5
Kidney	15	45.5
Bladder (related)	6	18.2

Figure 1 shows some iconographies ((A) Major hydronephrosis with renal parenchymal destruction. (B) Pus drainage following percutaneous nephrostomy placement. (C) Double-J ureteral stent in place for bilateral ureteral calculi).

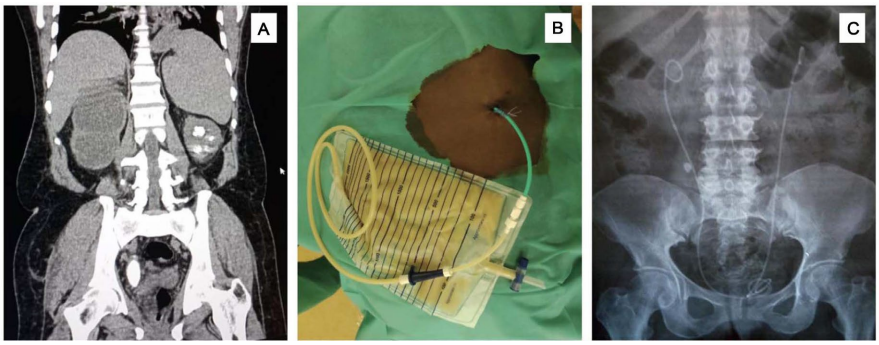

Figure 1. Iconographic aspects of lithiasic complications and their management.

Three patients (9.1%) required admission to the intensive care unit for severe sepsis associated with multiple organ failure. Among patients with acute kidney injury, 5 patients (15.2%) required temporary preoperative hemodialysis, indicated for life-threatening hyperkalemia and/or fluid and sodium overload. Regarding emergency management, the urinary diversion techniques used were primarily percutaneous nephrostomy (n = 24; 72.7%), followed by placement of a double-J ureteral stent (n = 9; 27.3%). Four deaths were recorded, representing an overall mortality rate of 12.1%, occurring in cases of complications. Regarding surgical treatment of urolithiasis, 29 of 33 patients (87.9%) underwent surgery at our center, the majority of whom (n = 26; 89.7%) via open surgery (Table 3).

Table 3. Severe forms, urinary diversion, and surgical management.

Variable	n	%
Severe forms		
Intensive care unit admission (severe sepsis)	3	9.1
Temporary preoperative hemodialysis	5	15.2
Emergency urinary diversion		
Percutaneous nephrostomy	24	72.7
Double-J ureteral stent	9	27.3
Surgical treatment (n = 29 operated patients)		
Open surgery	26	89.7
Minimally invasive technique	3	10.3
Deaths—overall mortality	4	12.1

4. Discussion

Environmental, socioeconomic, and health system factors strongly influence the clinical presentation and management of urinary stones, which represent a growing global public health problem, particularly in low- and middle-income countries [1]. In sub-Saharan Africa, despite significant regional variations, the prevalence of urinary stones is steadily increasing, reflecting an epidemiological transition associated with dietary changes, urbanization, and limited access to specialized care [3]. In our series, the high proportion of patients presenting late, with a median delay of 9 months, perfectly illustrates these structural challenges. This diagnostic delay is a major determinant of the observed clinical severity, as evidenced by the high rates of serious complications observed. These complicated forms may be correlated with the duration of the stone's presence and, above all, with lack of treatment, as reported by Recinos *et al.* [6].

Beyond the structural constraints of the healthcare system and the often prolonged course of the disease, our results confirm the significant impact of socioeconomic status on the severity of urinary lithiasis. In our cohort, the majority of patients came from disadvantaged backgrounds, characterized by low educational attainment and residence far from the referral center. These factors are widely described in the literature as independent determinants of the burden of urolithiasis and delayed consultation [4] [5]. In a multicenter U.S. cohort, Bayne *et al.* [4] demonstrated that patients from disadvantaged socioeconomic backgrounds living far from specialized centers presented with significantly larger stones (>2 cm), independent of biological factors. Similarly, Wymer *et al.* [5] demonstrated that inequalities in access to care influence not only the time to consultation but also the nature of care, with a higher proportion of complicated cases in resource-limited settings. In our Chadian context, these factors are exacerbated by the low density of urologists, inadequate technical facilities, and difficulties with medical transport, contributing to delayed and often suboptimal care.

The diagnostic delay observed in our series is the key factor explaining the severity of the clinical presentations. Most patients present at an advanced stage, with severe infectious and obstructive complications. These findings are comparable to those reported in West and Central Africa, where urolithiasis is frequently diagnosed only after complications have developed [8]. In PRFI, the lack of early screening and limited access to imaging explain this late presentation [1]. The severe infectious forms found in our series (pyelonephritis, pyonephrosis, urosepsis) are directly linked to prolonged obstruction. Urinary tract infection is a common cause of severe sepsis, and anatomical urological obstruction is a recognized risk factor for complications; the literature thus highlights that the obstruction-infection association represents a major determinant of morbidity and mortality in urology [10]. Following infectious complications related to chronic obstruction, acute obstructive renal failure was a common finding in our study (27.3%), leading to hemodialysis in 15.2% of patients. This finding is consistent with data in the literature indicating that prolonged stone-related obstruction can lead to re-

versible or irreversible impairment of renal function if not promptly treated [11] [12]. These clinical presentations may indicate the need for admission to an intensive care unit. Such situations are well described in the PRFI, where patients arrive late with severe systemic complications requiring intensive care, as reported by Almusafer *et al.* [1]. They underscore the importance of early diagnosis to prevent progression to critical conditions.

Certain professions, particularly farmers and livestock breeders, are particularly exposed to hot climatic conditions, chronic dehydration, and limited access to care. Furthermore, geographical factors such as climatic variations, precipitation, and temperatures play a decisive role in stone formation. These observations are consistent with data from the literature, which show that rural, physically active populations living in hot environments have an increased risk of stone formation due to insufficient hydration and working conditions that promote urinary concentration [13]. These findings align with those observed by Diagana *et al.* in Mauritania [14].

The management observed in our center reflects local structural constraints, with a still significant proportion of open surgery. In high-income countries, minimally invasive techniques have become standard, reducing morbidity and length of hospital stay. However, in low- and middle-income countries, these techniques remain limited by the cost of equipment, the scarcity of trained endourologists, and the lack of maintenance infrastructure, which explains the continued reliance on open surgery in our series and in comparable settings across the region.

4.1. Limitations

This study has several limitations. First, it was conducted at a single referral center with a small sample size (n = 33), which limits the statistical power of the analysis and the generalizability of the findings to other settings in Chad. Second, only patients with complicated urinary lithiasis were included, so the results describe determinants of severity within this complicated-case population and cannot be used to infer determinants of progression from uncomplicated to complicated disease. Third, the combination of retrospectively and prospectively collected data may have introduced information bias, particularly for socioeconomic variables that relied on patient recall and self-report during the prospective phase. Finally, the descriptive nature of the analysis does not allow for statistical inference or adjustment for confounding factors; larger, multicenter, and analytical studies are needed to confirm these findings.

4.2. Prospects

The observations made in this study point to public health strategies and actions that need to be implemented. It is important to strengthen early diagnosis by improving access to first-line imaging in rural areas and by training primary care providers to recognize complicated cases. Establishing faster referral pathways to specialized centers is also essential to reduce delays in care. Furthermore, building a

functional urological care network, supported by telemedicine and better coordination across different levels of care, is a priority. Capacity building in endourology, through training, equipment, and maintenance of technical facilities, is essential to reduce reliance on open surgery. Finally, targeted prevention efforts in rural areas and future multicenter studies will enable better adaptation of management strategies to the realities of resource-limited countries. Most of these recommendations have already been formulated by Chadian authors in a study on the burden of morbidity associated with urinary lithiasis in Chad, including its epidemiological, diagnostic, and therapeutic trends [15].

5. Conclusion

This study, conducted at a referral center in Chad, highlights that urinary stones are most often diagnosed at an advanced stage, when complications have already set in. Socio-geographic determinants (notably low educational attainment, distance from healthcare facilities, disadvantaged socioeconomic conditions, and limitations of the healthcare system) appear to be major factors contributing to delayed diagnosis and the observed clinical severity. In this context, urinary lithiasis goes beyond the scope of a simple common urological condition to become a true indicator of inequalities in access to specialized care. Improving early diagnosis, streamlining the care pathway, and strengthening endourology capacity are essential public health priorities in resource-limited countries. A global urology approach, based on training and partnerships, is essential to reducing this burden.

Conflicts of Interest

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

References

[1] Almusafer, M., Issa, H., Paraskevopoulou, M.E., Symeonidis, E.N., Bhatti, K.H., Moussa, M., *et al.* (2024) Unveiling the Burden of Nephrolithiasis in Low- and Lower-Middle Income Countries: A Review on Its Presentation, Risk Factors, Treatment Practices, and Future Directions. *Société Internationale d' Urologie Journal*, **5**, 361-370. https://doi.org/10.3390/siuj5050055

[2] Kassaw, A.B., Belete, M., Assefa, E.M. and 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**, Article No. 334. https://doi.org/10.1186/s12882-024-03780-y

[3] Mungadi, I.A. and Khalid, A. (2021) Spectrum of Urological Cases in a West African Tertiary Hospital. *Annals of African Medicine*, **20**, 14-18. https://doi.org/10.4103/aam.aam_7_20

[4] Bayne, D.B., Usawachintachit, M., Armas-Phan, M., Tzou, D.T., Wiener, S., Brown, T.T., *et al.* (2019) Influence of Socioeconomic Factors on Stone Burden at Presentation to Tertiary Referral Center: Data from the Registry for Stones of the Kidney and Ureter. *Urology*, **131**, 57-63. https://doi.org/10.1016/j.urology.2019.05.009

[5] Wymer, K.M., Boddu, S.P., Choudry, M., Narang, G., Heidenberg, D.J., Payne, N.G., *et al.* (2024) Access to Care and Health Care Utilization among Patients with Nephrolithiasis. *Urology*, **187**, 8-14. https://doi.org/10.1016/j.urology.2023.11.041

[6] Recinos, P.J.M. (2025) Possible Complications Associated to Renal Litiasis, a Brief Review. *International Journal of Medical Science and Clinical Research Studies*, **5**, 938-940. https://doi.org/10.47191/ijmscrs/v5-i06-20

[7] Halle, M.P., Toukep, L.N., Nzuobontane, S.E., Ebana, H.F., Ekane, G.H. and Priso, E.B. (2016) The Profile of Patients with Obstructive Uropathy in Cameroon: Case of the Douala General Hospital. *Pan African Medical Journal*, **23**, Article 67. https://doi.org/10.11604/pamj.2016.23.67.8170

[8] Cassell III, A., Jalloh, M., Ndoye, M., Mbodji, M., Gaye, O., Thiam, N.M., *et al.* (2020) Surgical Management of Urolithiasis of the Upper Tract—Current Trend of Endourology in Africa. *Research and Reports in Urology*, **12**, 225-238. https://doi.org/10.2147/rru.s257669

[9] Nedjim, S.A., Biyouma, M.D.C., Kifle, A.T., Ziba, O.J.D., Mahamat, M.A., Idowu, N.A., *et al.* (2024) Place of Urolithiasis in the Spectrum of Urological Pathologies, Practices and Use of Endourological Procedures in the Management of Calculi of the Upper Urinary Tract: Results of a Survey of Referral Centres in Africa. *Urolithiasis*, **52**, Article No. 26. https://doi.org/10.1007/s00240-023-01519-2

[10] Reyner, K., Heffner, A.C. and Karvetski, C.H. (2016) Urinary Obstruction Is an Important Complicating Factor in Patients with Septic Shock Due to Urinary Infection. *The American Journal of Emergency Medicine*, **34**, 694-696. https://doi.org/10.1016/j.ajem.2015.12.068

[11] Chávez-Iñiguez, J.S., Navarro-Gallardo, G.J., Medina-González, R., Alcantar-Vallin, L. and García-García, G. (2020) Acute Kidney Injury Caused by Obstructive Nephropathy. *International Journal of Nephrology*, **2020**, Article ID: 8846622. https://doi.org/10.1155/2020/8846622

[12] Gembillo, G., Spadaro, G. and Santoro, D. (2025) Link between Obstructive Uropathy and Acute Kidney Injury. *World Journal of Nephrology*, **14**, Article ID: 99120. https://doi.org/10.5527/wjn.v14.i1.99120

[13] Kale, S.S., Ghole, V.S., Pawar, N.J. and Jagtap, D.V. (2014) Inter-Annual Variability of Urolithiasis Epidemic from Semi-Arid Part of Deccan Volcanic Province, India: Climatic and Hydrogeochemical Perspectives. *International Journal of Environmental Health Research*, **24**, 278-289. https://doi.org/10.1080/09603123.2013.818105

[14] Diagana, M., Tfeil, Y., Boya, M.M. and Béchir, M.E. (2020) Urinary Lithiases: Epidemiological, Clinical and Therapeutic Aspects of 164 Cases at Sheikh Zayed Hospital in Nouakchott—Mauritania. *Open Journal of Urology*, **10**, 217-224. https://doi.org/10.4236/oju.2020.107025

[15] Nedjim, S., Mahamat, M., Kouldjim, A., Younous, S., Hagguir, H., Atti, O., *et al.* (2026) Burden of Urolithiasis in Chad: Epidemiological, Diagnostic, and Management Trends. *African Urology*, **6**, 45-51. https://doi.org/10.36303/auj.0268