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CASE REPORT

# Burden of urolithiasis in Chad: epidemiological, diagnostic, and management trends

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**Introduction:** Urolithiasis is a common condition with a steadily increasing global prevalence. Its epidemiology varies across regions, influenced by multiple factors, and it represents a major public health problem due to its severe complications, impact on quality of life, and high economic burden. In sub-Saharan Africa, available data remain limited and likely underestimated, although the disease seems to occur more frequently. Hence, a better understanding of the urolithiasis burden and its determinants is essential to guide prevention and management strategies. This study aims to assess the situation in Chad by reviewing available data.

**Methods:** Study selection, in accordance with PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) guidelines, was based on searches in PubMed, Google Scholar, AJOL (African Journals Online), and manual screening without time restriction. Included studies addressed urolithiasis in Chad and were published in English or French, with standardised data extraction (population, diagnosis, and treatment). Data extraction was validated by two independent reviewers. Analyses were conducted according to data homogeneity, combining qualitative and quantitative approaches.

**Results:** An initial search identified 406 studies, from which 26 duplicates were removed. After applying the inclusion criteria, four articles published between 2015 and 2023 were included in the final qualitative synthesis. The mean urolithiasis prevalence was estimated at 4.6%. Overall, the review included 590 patients, with a mean age of 5.5–36 years and a male predominance (7.3:1 sex ratio). Dysuria was the main presenting complaint, while urinary tract infection was reported in 44.4% of patients. Plain radiography and ultrasound were the primary diagnostic modalities. Most stones were located in the lower urinary tract ($n$ = 496, 84.5%), and all interventions employed open surgery. Postoperative complications (wound suppuration and vesicocutaneous fistula) were reported across all studies, with rates varying among authors. One study reported a mean hospital stay of 18 days.

**Conclusion:** Urolithiasis in Chad predominantly affects young individuals, including children, with limited diagnostic resources and primarily invasive treatment. The high frequency of complications highlights the need to improve management. Further research is essential to optimise care and reduce the urolithiasis burden.

**Keywords:** urolithiasis, epidemiology, diagnosis, management trends

## Introduction

Urolithiasis, a condition characterised by stone presence anywhere in the urinary tract, is secondary to an imbalance between factors promoting crystallisation and natural inhibitors in urine.[1,2] Alongside serious complications, it is also responsible for significant morbidity and disability, permanently affecting patients' quality of life.[1,3] Urolithiasis is associated with high medical costs and represents a major economic burden worldwide.[3,4] Given these major clinical and socio-economic challenges, its management should be individualised, considering the stone characteristics specific to each patient. According to the 2024 European Association of Urology (EAU) guidelines, treatment is based on medical and surgical options.[5]

Beyond the clinical and therapeutic aspects, urolithiasis also represents a public health problem with significant epidemiological variations across different regions of the world.[6] Its prevalence is constantly increasing worldwide, posing a heavy health burden.[7] This burden varies according to geographical, socio-economic, and cultural factors.[8-10] In some Asian countries, high temperatures and water shortages directly affect stone formation.[11,12] In sub-Saharan Africa, data on the incidence of urinary lithiasis may be inaccurate due to underreporting and the lack of large-scale epidemiological studies.[13] It is also becoming more common in the sub-Saharan region due to rising global temperatures and lifestyle changes.[10] One of the inevitable factors affecting the epidemiology of urinary lithiasis is that a lower socio-economic status often correlates with a severe form at the time of medical intervention.[14]

Therefore, an accurate assessment of epidemiological indicators and disease trends is essential to prevent their progression and constant recurrence and, most importantly, to guide informed clinical decisions in resource-limited settings. Consequently, it is crucial to mobilise significant public health efforts to meet this challenge.[7] This study aims to assess the burden and determining factors of urinary lithiasis in Chad through a review, analysing the available data to optimise prevention and management strategies.

## Methodology

After approval by the ethics committee (number 19/MES/UNABA/FSSH/CEI/2025), and in accordance with PRISMA guidelines, the standardised study selection process was strictly followed.[15] First, the titles and abstracts of identified articles were screened to assess their relevance. Full texts of potentially eligible articles were then reviewed in detail. Duplicates were removed. The

databases consulted included PubMed, Google Scholar, and AJOL. Additionally, a supplementary manual search was conducted in the relevant literature. The keywords were: "urolithiasis", "urinary stones", "epidemiology", "diagnosis", "treatment", and "Chad", systematically combined with "urolithiasis" and/or "urinary stones" along with "Chad". No time restrictions were applied.

The inclusion criteria were studies conducted in Chad or containing data specific to Chad, with information on the epidemiology, diagnosis, or treatment options of urinary stone disease, and publications available in English or French with full-text access. Data were extracted using a standardised form, including characteristics of the study population (age, sex, risk factors), the diagnostic tools used (imaging, laboratory tests), and available treatment modalities (medical or surgical).

Each data extraction step was verified by two independent reviewers to ensure the reliability of the collected information. The extracted data underwent qualitative and quantitative analyses. When data were sufficiently homogeneous, quantitative analyses, such as weighted proportions or means, were performed. In cases of significant heterogeneity, only descriptive analyses were conducted.

## Results

The initial search identified 406 studies, of which four met the inclusion criteria and were included in the final qualitative synthesis.[16-19] The PRISMA flow diagram illustrates the study selection process (Figure 1). The studies selected for analysis were published between 2015 and 2023. All were single-centre studies with epidemiological, clinical, therapeutic, and postoperative data. Follow-up periods ranged from 44 to 84 months, and they used a variety of methodologies (prospective, retrospective, or mixed). Table I summarises the studies' main characteristics. The publications originated from two geographic areas in Chad, mapped in Figure 2.

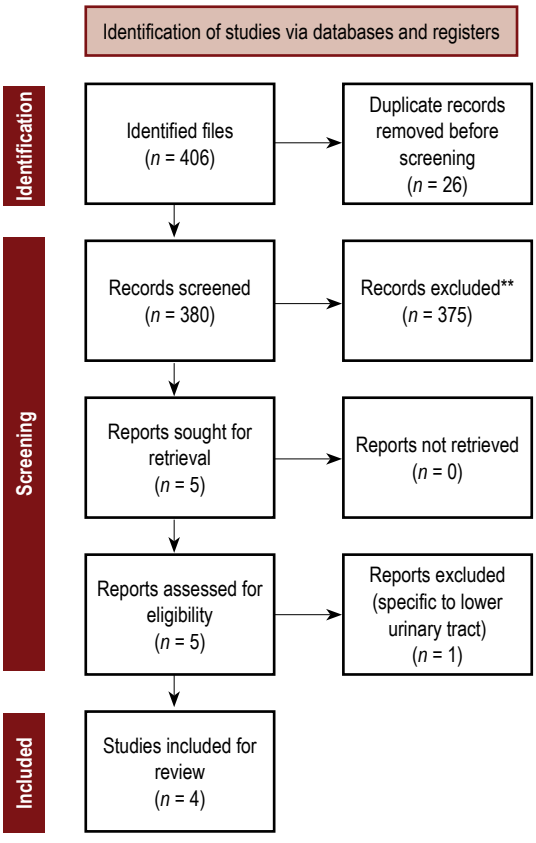


**Figure 1:** PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) flow diagram of the review

We included four studies in our review, representing 590 patients, mainly from N'Djamena.[16-19] Three studies focused exclusively on paediatric patients, confirming a strong predominance of young age groups, particularly those aged 0–5 years.[16-18] Overall, the data show a urolithiasis prevalence of 3.8–5.72%, with a reported average of 4.6%. The sex ratio was heavily skewed towards boys. Dysuria was the main reason for consultation, and urinary tract infections were common, found in several studies. Other risk factors and clinical characteristics are summarised in Table II. All studies mainly reported the use of standard radiography and ultrasound, sometimes in combination. No computed tomography (CT) scans were performed. The distribution of diagnostic modalities is illustrated in Figure 3.

Lower urinary tract stones accounted for 84.5% of cases throughout the review. Regarding the upper urinary tract, the kidney was the most affected organ ($n$ = 74, 12.6%). For the lower urinary tract, the bladder was predominantly involved ($n$ = 401, 68.3%). Adami et al.[18] reported three cases without a specified stone location. Moreover, Adami et al.[18] was the only author to report stone size, with a mean of 2.81 cm and extremes ranging from 1 cm to 5.5 cm.

All procedures were performed via open surgery, with no endoscopic or laparoscopic cases reported. Depending on the stone location, the interventions included nephrolithotomy, renal

**Figure 2:** Map of Chad with study areas (N'Djamena in green, Abéché in red)

Table I: Characteristics of the studies included in the review

| Authors | Title | Publication year | Language | Study design | Study duration (months) |
|---|---|---|---|---|---|
| Rimtebaye et al.[16] | Urolithiasis: diagnostic and therapeutic aspects in urology department of N'Djamena in Chad | 2015 | English | Prospective, descriptive, single-centre | 48 |
| Amine et al.[17] | Clinical and therapeutic characteristics of urinary lithiasis in Children at the Mother and Child Hospital in N'Djamena (Chad) | 2016 | French | Retrospective and prospective, single-centre | 44 |
| Adami et al.[18] | Aspects of urolithiasis in Chadian children: about of 191 cases collected at the Mother and Child University Hospital of N'Djamena (Chad) | 2022 | English | Retrospective and prospective, descriptive, cross-sectional, single-centre | 67 |
| Valentin et al.[19] | Urinary lithiasis in children at the Abeche Chu | 2023 | English | Retrospective, descriptive, single-centre | 84 |

Table II: Summary of the epidemiological, clinical, and diagnostic characteristics of the studies

| Authors | Rimtebaye et al.[16] | Amine et al.[17] | Adami et al.[18] | Valentin et al.[19] |
|---|---|---|---|---|
| **Prevalence (%)** | 5.72 | 3.8 | 4.3 | N/A |
| **Sample size** | 233 | 136 | 191 | 30 |
| **Mean age (years)** | 36 | 5.75 ± 3.50 | 5.86 | 5.5 |
| **Age range (years)** | 1.25–88 | 1–14 | 1–15 | 0–15 |
| **Most affected age group (years)** | 0–10 | 0–5 | 5–15 | 0–5 |
| **Sex (F/M)** | 42/191 | 6/130 | 19/172 | 4/26 |
| **Area of origin (%)** | N/A | Sahelian (91.2)<br>Desert (8.1) | N/A | Rural (62)<br>Urban (38) |
| **Main presenting complaint, *n* (%)** | Dysuria, 104 (44.6) | Dysuria, N/A | Dysuria, 85 (44.5) | Acute urinary retention, 16 (53.3) |
| **Risk factors** | Urogenital schistosomiasis, urinary infections, anatomical malformations, posterior urethral valves, familial lithiasis | Posterior urethral valves, post-traumatic urethral stricture | Schistosomiasis, urinary infections, congenital malformations | N/A |
| **Urinary infection (%)** | N/A | 26.4 | 26.9 | 80 |
| **Renal failure (%)** | N/A | 2.9 | None | 23.3 |
| **Imaging modalities, *n* (%)** | Ultrasound, 181 (55.7) | IVU, 66<br>Plain pelvic X-ray, 63<br>Plain abdominal X-ray, 15 | Pelvic X-ray, 124<br>Ultrasound + pelvic X-ray, 115<br>Plain abdominal X-ray, 36 | Plain abdominal X-ray, 183 (95.8)<br>Ultrasound + abdominal X-ray, 178 (93.2)<br>Plain abdomen, 17<br>Ultrasound, 15<br>IVU, 3 |

IVU – intravenous urography, N/A – not available

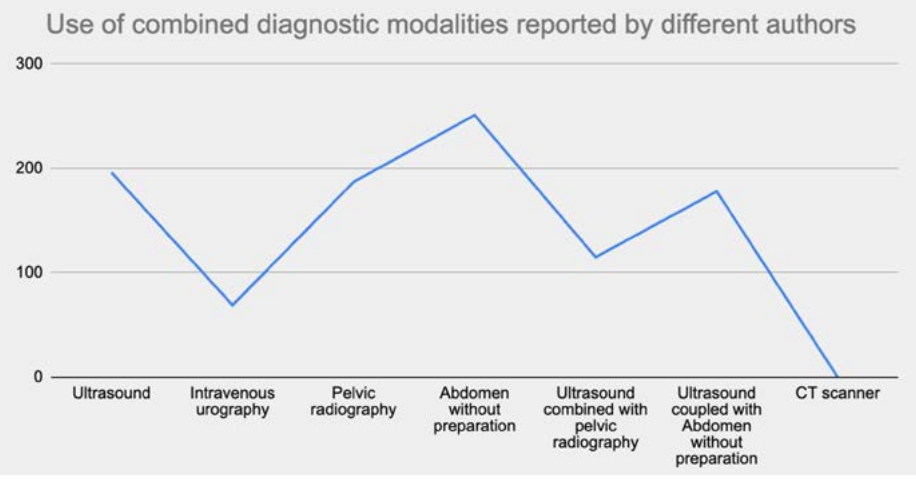


Figure 3: Various diagnostic modalities employed

Table III: Summary of review data regarding stone location, treatment, and complications

| | | |
|---|---|---|
| **Localisation, *n* (%)** | Upper urinary tract, 91 (15.5) | Kidney/pyelon, 74 (12.6) |
| | | Ureter, 17 (2.9) |
| | Lower urinary tract, 496 (84.5) | Bladder, 401 (68.3) |
| | | Urethra, 95 (16.2) |
| | Location not specified | 3 (0.5) |
| **Procedures, *n* (%)** | Open surgery, 588 (99.7) | Nephrolithotomy/pyelolithotomy, 74 (12.6)<br>Ureterolithotomy, 17 (2.9)<br>Cystolithotomy, 401 (68.3)<br>Ureterolithotomy, 95 (16.2) |
| | Endoscopy, 0 (0) | None |
| | Instrumental or manual extraction | 2 (0.3) |
| **Complications, *n* (%)** | Postoperative bleeding, 2 (0.3)<br>Infection or wound suppuration, 10 (1.7)<br>Vesicocutaneous fistula, 5 (0.8)<br>Death, 7 (1.2) | |

pelvic lithotomy, ureterolithotomy, cystolithotomy, urethrolithotomy, and meatolithotomy. No endourological or laparoscopic procedures were documented. Additional procedures associated with stone surgery included nephrectomy, prostate adenomectomy, ureterovesical reimplantation, and urethroplasty.

The authors reported various complications, differing across studies. Postoperative hospital stay was reported only by Valentin et al.,[19] with a mean of 18 days (range 9–30). Only one study reported cases of mortality (*n* = 7; 1.2%).[16] Table III provides a detailed summary of the reviewed data, highlighting the distribution of cases by stone location, therapeutic approaches, and reported complications.

## Discussion

This study highlights the epidemiological, diagnostic, and therapeutic characteristics of urolithiasis in Chad, providing an integrated perspective on this condition in our context for the first time, allowing comparison with trends observed in other regions of the world. It is important to recall that the epidemiology of urinary stones varies considerably by region.[20] This variation may be explained by several determinants, such as climate, hydration, diet, genetic factors, age, sex, and occupation, all of which influence occurrence.[21] Regardless of regional differences, a steady increase in urolithiasis incidence and prevalence has been observed, even in areas historically characterised by low rates of urinary stones.[4]

According to the Global Burden of Disease 2021 Urolithiasis Collaborators Report, 106 million incident cases were recorded in 2021 across 204 countries and territories.[22] In sub-Saharan Africa, epidemiological data remain limited or unrepresentative, with estimates often based on hospital admissions.[23] In a meta-analysis, Kassaw et al.[6] estimated the pooled prevalence of urolithiasis at 9.4% among patients attending healthcare facilities in the region. Based on this review, we can estimate the prevalence of urolithiasis in Chad at 4.6%, which is lower than reported by the aforementioned authors. Variations in data collection methods and population profiles may explain this difference.

Several studies report a marked male predominance in urolithiasis prevalence, which may primarily reflect anatomical differences in the lower urinary tract between sexes.[13,21,22,24] However, urolithiasis is often underestimated in children. Though rare in developed countries, it is increasingly common in developing countries, mainly due to urinary tract infections and dehydration. The mean age of affected children varies across series, and boys are more frequently affected than girls, with sex ratios differing by study, likely reflecting anatomical factors as in adults.

Bladder stones are the most frequent and may be primary (idiopathic or endemic), secondary, or migratory in origin.[25] In Amine et al.'s[17] study, bladder localisation represented approximately three-quarters of cases, which focused exclusively on the paediatric population.[26] In our review involving 590 patients, 357 were children, representing 60.5%. Stones observed in children from the Abéché region may be considered endemic, as this area faces water quality issues. In the absence of obstruction, infection, or neurogenic pathology, these stones frequently occur in areas where children suffer from malnutrition, diarrhoeal diseases, and/or chronic dehydration.[27]

In various non-African series, several risk factors for urolithiasis are reported.[28-30] A Mendelian randomisation study showed that high body mass index, elevated triglycerides, large waist circumference, increased adiponectin levels, high body fat percentage, and high alcohol consumption increase the risk of stone formation.[28] Furthermore, metabolic abnormalities, urinary tract malformations or anomalies (including obstruction, infection, and foreign bodies), certain medications, and a history of urological surgery are contributing factors.[29] Other recognised risk factors include central obesity, type 2 diabetes, gout, high sodium intake, high fructose consumption, and exposure to high temperatures.[30]

In sub-Saharan Africa, Cassell et al.'s[13] review of 15 regional studies identified multiple risk factors for urolithiasis: urethral stricture, family history of stones, urinary tract infections, ureteropelvic junction obstruction, dairy consumption, metabolic syndrome, urinary schistosomiasis, and sickle cell disease. Among the four Chadian publications analysed, the main reported risk factors were

previous urinary stones, urogenital schistosomiasis, and urinary tract infections. Congenital malformations, such as ureteropelvic junction obstruction, posterior urethral valves, and urethral stenosis, were also described.

Patients with urolithiasis are often asymptomatic. However, some may present with lumbar pain, dysuria, haematuria, sweating, pallor, vomiting, agitation, or urinary tract infection/obstruction.[2,6] In the sub-Saharan African literature, typical manifestations include renal colic, lower back pain, haematuria, dysuria, fever, urinary retention, and complications such as hydronephrosis and pyelonephritis.[13] In our review, the main reason for consultation was dysuria followed by urinary retention, reflecting the variability of clinical presentations according to the epidemiological context and stone location.

Metabolic evaluation is essential in stone formers, especially in children, due to the high frequency of metabolic abnormalities (hypercalciuria, hyperoxaluria, cystinuria, hyperuricosuria), justifying its use even after a first episode.[40] EAU guidelines recommend a complete evaluation after the acute phase, but access remains limited in resource-constrained countries.[5] Combining this evaluation with spectrophotometric analysis of stones enables preventive measures to be tailored and reduces recurrences.[41] Gradual integration of such protocols in Chad, even in a simplified form, could improve management and prevention, particularly in children, where recurrence risk and renal impact are high.

In certain sub-Saharan African regions where CT is unavailable, transabdominal ultrasound, intravenous urography, and plain abdominal radiography remain the main imaging modalities for stone diagnosis. This was also reported in the review by Cassell et al.[13] and the Modern Urology for Africa (MUfA) survey.[37] While non-contrast CT is now considered the imaging modality of choice for diagnosing urinary stones, especially in symptomatic patients, it is noteworthy that in our review, CT was not requested for any patient.[5]

Urinary stones can occur at any level of the urinary tract, may be bilateral, and can affect two organs simultaneously. In the sub-Saharan review by Kassaw et al.,[6] stone location was renal in 4.6%, ureteral in 1.8%, bladder in 2.0%, and urethral in 0.2% of cases. In Nigeria, Undie et al.[31] reported that among 153 patients, unilateral renal stones occurred in 80 patients (52.3%), ureteral in 33 (21.6%), bladder in 14 (9.2%), and urethral in two (1.3%). In a Somali study of 620 adults, the bladder was the most frequent site (*n* = 253, 40.8%), followed by the kidney (*n* = 223, 35.9%), and ureters (*n* = 144, 23.2%).[32] In our series, stones were predominantly located in the lower urinary tract (84.5%), with a clear predominance of bladder stones (68.3%).

In both adults and paediatric patients, the objectives of urolithiasis treatment are the same: achieve stone-free status while minimising complications, risks, and the number of interventions.[33] According to the American Urological Association (AUA), surgery is recommended for patients with symptomatic renal stones or ureteral stones unlikely to pass spontaneously or persisting despite conservative management.[34] Intervention choice depends on stone location, size, and composition, anatomical characteristics, comorbidities, risk factors, equipment availability, and practitioner preference.[33] In paediatric patients, three minimally invasive techniques are used: ureteroscopy (URS), shockwave lithotripsy, and percutaneous nephrolithotomy (PCNL). Compared with other techniques (open, laparoscopic, or robot-assisted surgery), these minimally invasive methods carry anaesthesia and radiation exposure risks but remain less invasive.[35]

In many developed countries, modern techniques have been established for several years and are part of routine practice. However, in Africa, they remain rare and even absent in some referral centres.[36] A 2024 survey of 46 referral centres across 27 African countries revealed that open surgery is still widely used for management (69.1%).[37] In the previously cited Somali review, open lithotomy was performed in 36.8% of patients.[24] PCNL was performed in 234 cases (22.1%), ureteroscopic pneumatic lithotripsy (URS) in 122 (11.5%), and retrograde intrarenal surgery in 199 (18%). In Nigeria, Aji et al.[38] reported that only 26/75 patients (34.2%) received endoscopic treatment. In another four-year Nigerian study (2015–2019) of 89 patients, open surgery was used in 98.5% of cases.[6] In a Congolese study of 167 patients, all underwent open surgery.[39]

This review highlights the current level of endoscopic management of urinary stones in Chad, as all procedures were performed via open surgery. Inquiries with urologists from the centres included in these publications confirmed that management practices had not changed; open surgery remains the method of stone removal regardless of stone location or size. In Africa, developing modern urology, particularly endourology, requires commitment from policymakers and specialists through training and demonstrating clinical and health-system impact.[37]

### *Study limitations*

This review has certain methodological limitations due to the number of studies included (*n* = 4), their single-centre nature, and geographical origin (mainly from one city). The predominance of paediatric populations in three studies may bias the estimation of prevalence and clinical characteristics in adults. Heterogeneous methods (prospective, retrospective, descriptive) and the absence of scan data reduce the comparability and data accuracy. Some key information (stone size, average hospital stay length, etc.) was only partially reported. In addition, the absence of data on endoscopic techniques prevents discussion of modern management approaches. Despite these limitations, this review provides an initial, integrated overview of urinary lithiasis in Chad that may guide policy on prevention, management, and future research.

### *Recommendations*

Strengthening the integrated management of urinary lithiasis in Chad involves several complementary approaches. It is necessary to strengthen local epidemiology through multicentre studies and the establishment of national registries. Improving diagnosis requires access to CT scans. Modernising surgical care by developing endourology and minimally invasive techniques, and by training practitioners, could reduce morbidity and shorten hospital stays.

In addition, metabolic assessment and prevention, particularly in children, through metabolic testing and spectrophotometric stone analysis, are essential to limit recurrence. Finally, awareness and prevention in public health must be strengthened.

## Conclusion

Urolithiasis in Chad mainly affects a young, predominantly male population, including a significant proportion of children, in whom metabolic evaluation and management have important specificities. Diagnosis relies mainly on basic imaging, such as radiography and ultrasound, due to limited CT access. Treatment is primarily open surgery, with no endoscopic techniques used, reflecting limitations in equipment and training. High rates of postoperative complications and prolonged hospital stays underscore the clinical challenges. In this context, research on urolithiasis is essential to better understand risk factors, optimise diagnosis, and adapt therapeutic strategies, particularly for the paediatric population. It also helps guide preventive policies and reduce the associated morbidity and socio-economic burden.

### *Conflict of interest*

The authors declare no conflict of interest.


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### *Ethical approval*

Approval was obtained from the Adam Barka University of Abéché Ethics Committee (number 19/MES/UNABA/FSSH/CEI/2025).


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