

# Epidemiologic, Diagnostic, and Therapeutic Features of Urinary Stone Disease in Northern Benin from 2018 to 2023

Gandaho Isidore<sup>1</sup>, Sossa Jean<sup>2</sup>, Toré Sanni Rafiou<sup>1</sup>, Dènon Emmanuel<sup>1</sup>, Allodé Alexandre<sup>1</sup>, Avakoudjo Déjinnin Josué Georges<sup>2</sup>

<sup>1</sup>Département de Chirurgie et Spécialités Chirurgicales, Université de Parakou, Parakou, Bénin

<sup>2</sup>Faculté des Sciences de la Santé, Université d'Abomey-Calavi, Abomey-Calavi, Bénin

Email: jsossa.js@gmail.com

**How to cite this paper:** Isidore, G., Jean, S., Rafiou, T.S., Emmanuel, D., Alexandre, A. and Georges, A.D.J. (2024) Epidemiologic, Diagnostic, and Therapeutic Features of Urinary Stone Disease in Northern Benin from 2018 to 2023. *Open Journal of Urology*, **14**, 128-137.

<https://doi.org/10.4236/oju.2024.142013>

**Received:** January 14, 2024

**Accepted:** February 26, 2024

**Published:** February 29, 2024

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## Abstract

**Objective:** To determine the epidemiologic, diagnostic, and therapeutic features of urinary in northern Benin from 2018 to 2023. **Patients and Method:** The study was an observational and descriptive one. We exhaustively and retrospectively collected data from the medical records of the patients that were managed from February 1, 2018 to February 1, 2023 at the Department of Surgery of “Centre Hospitalier Universitaire Départemental Borgou-Alibori or CHUD-BA”. **Results:** Among the 4522 patients managed, 75% or 1.7% had urinary stone disease. Their mean age was 41 years. The sex ratio was 2.75, the males being predominantly affected. Of the 75 cases of urinary stone disease, 30.7% (n = 23) were renal, 46.7% (n = 35) were ureteral, and 22.7% (n = 17) were vesical. The patients came from variable geographical areas, ethnic groups, and professional sectors. Their main complaints were pain (57.3%), hematuria (14.7%), dysuria (12%), and fever (5.3%). 15 (20%) patients, *i.e.*, 7 renal stone and 8 ureteral stone patients, had an obstructive renal failure. The imaging tools available were ultrasonography, tomography and computed tomographic scan. 11 of the bladder stone cases (64.7%) were associated with a bladder outlet obstruction. Overall, 38.7% of the patients had either diabetes mellitus (6.7%), hypertension or high blood pressure (6.7%), benign prostate hyperplasia (8%), urinary schistosomiasis (6.7%), ureteral pelvic junction obstruction (2.7%), and prostate cancer (1.3%). Of the 19 patients whose dietary behavior was investigated 15 (79%), 11 (57.9%) et 11 (57.9%) demonstrated a diet which was respectively rich in milk, fromage and meat. 100% of bladder stones were removed through cystolithotomy. Renal stones were removed by pyelolithotomy (52.2%) and nephrolithotomy (21.7%). Ureteral stones were removed through ureterolithotomy (40%), expelled by means of alpha-blockers

(40%) or managed with ureteral pigtail stent (20%). **Conclusion:** The hospital prevalence of urinary stone disease was 1.7%. The mean age in urinary stone-affected patients was 41 years. The urinary stone predominantly affected male patients: the sex ratio was 2.75. The stones were mainly removed through open surgery.

## Keywords

Urinary Stone, Epidemiologic, Diagnostic, Therapeutic

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## 1. Introduction

Urinary stone disease results from an abnormal crystallization of urine components in the urinary tract [1]. That disease is more frequent in patients above the age of 60 years [2]. Still, it is more and more affecting younger populations [3] [4]. Its incidence is variable: 7% to 13% in northern America, 5% to 9% in Europe, and 1% to 5% in Asia [5]. In Burkina Faso, the prevalence of urinary stone disease is 12.5% [6]. Obesity, diet modifications, and climate changes make urinary stone disease increase in the world [7] [8] [9].

Computed tomography has dramatically bettered the diagnosis of urinary stone [9] [10] [11] [12] which treatment is turning mini-invasive by using extracorporeal shock wave lithotripsy, percutaneous nephrolithotomy, ureteroscopy, and cystolitholapaxy [13] [14].

Still, open surgery remains the main stone treatment modality in Benin and other developing countries.

Studies on urinary stone disease have been performed in Benin, [15] [16] but its overall status has not yet been evaluated.

## 2. Objective

This study aims to determine epidemiologic, diagnostic, and therapeutic features of urinary stone disease in northern Benin from 2018 to 2023.

## 3. Patients et Methode

We performed an observational and descriptive study. We retrospectively collected urinary stone data from medical records of patients managed from February 1, 2018, to February 1, 2023, in the Surgical Department of the “Centre Hospitalier Universitaire Départemental Borgou Alibori or CHUD-BA”. The CHUD-BA is the university teaching hospital in Parakou, the biggest town in northern Benin. We made an exhaustive census of patients and systematically collected data from their medical records. Were included patients with imaging-confirmed urinary stones. Were excluded, urinary stone patients with no confirmatory imaging or incomplete medical record.

Data collected were age, gender, ethnicity, provenance, profession, marital

status, dietary behavior, symptoms, history, type of imaging, stone location, type of treatment, treatment outcome.

Collected data were analyzed with Excel® 2019 and EPI Info 7.2. The means and the proportions were used to describe respectively the quantitative and qualitative variables.

#### 4. Results

4522 patients were managed in the Department of Surgery. 75 of them were urinary stone-affected, which yielded a hospital prevalence of 1.7%. Their age ranged from 9 to 80 years. Their mean age was 41 years (standard deviation = 3.98). Eight patients (10.7%) including 7 males and 1 female, were less than 20 years old. Among the 75 urinary stone-affected patients, there were 55 males (73.3%) et 20 females (26.7%). The sex ratio was 2.75.

**Table 1** presents the patients' profession, provenance, and ethnicity. Regarding the profession there were 20% public service officers, 14.7% craftsmen, 13.3% traders, and 9.3% students. Most of the patients, *i.e.*, 72%, came from Borgou, the geographical area sheltering the CHUD-BA hospital. The most frequent ethnic groups were the Fon (32%) and the Batonu (21.3%).

Stone locations and main symptoms in the patients are presented on **Table 2**. There were 23 (30.7%) renal, 35 (46.7%) ureteral, and 17 (22.7%) vesical stones. 43 patients (57.3%) complained about pain which was either lumbar (52%), iliac (4%), or pelvic (1.3%). 11 (14.7%), 9 (12%) et 4 (5.3%) patients had respectively a hematuria, a dysuria, and a fever. The stones' size ranged from 1 to 30 mm. Yet the main complaint varied according to the stone's location.

18 in the 23 patients with renal stone experienced pain as lumbar pain (47.8%) or renal colic (30.4%). The symptoms in the others were dysuria, hematuria,

**Table 1.** Number of patients according to the profession, provenance, and ethnicity (n = 75).

Profession		Provenance		Ethnicity	
Designation	Number (%)	Designation	Number (%)	Designation	Number (%)
Public servants	15 (20)	Borgou	54 (72)	Fon	24 (32)
Unemployed	15 (20)	Donga	6 (8)	Batonu	16 (21.3)
Crafts men	11 (14.7)	Alibori	3 (4)	Dendi	11 (14.7)
Traders	10 (13.3)	Atacora	3 (4)	Nago	7 (9.3)
Students/pupils	7 (9.3)	Collines	2 (2.7)	Lokpa	3 (4)
Retired	1 (1.3)	Littoral	1 (1.3)	Otamari	2 (2.7)
Non specified	16 (21.3)	Nigeria	1 (1.3)	Adja	1 (1.3)
Total	75 (100)	Unspecified	5 (6.7)	Peulh	1 (1.3)
		Total	75 (100)	Other	1 (1.3)
				Total	75 (100)

**Table 2.** Complaints and location of urinary stones (n = 75).

Complaints	Location of urinary stones						Total (N = 75)	
	Kidney (n = 23)		Ureter (n = 35)		Bladder (n = 17)		Number	%
	Number	%	Number	%	Number	%		
Lumbar pain	11	47.8	3	8.6	0	0	14	18.7
Renal colic	7	30.4	18	51.4	0	0	25	33.3
Iliac pain	0	0	3	8.6	0	0	3	4.0
Pelvic pain	0	0	1	2.9	0	0	1	1.3
Painful micturition	0	0	1	2.9	1	5.9	2	2.7
Dysuria	0	0	1	2.9	8	47.1	9	12.0
Hematuria	3	13.0	3	8.6	5	29.4	11	14.7
Pollakiuria	0	0	1	2.9	1	5.9	2	2.7
Fever	1	4.3	3	8.6	0	0	4	5.3
Incidental	1	4.3	1	2.9	0	0	2	2.7
CBRU*	0	0	0	0	1	5.9	1	1.3
Pyuria	0	0	0	0	1	5.9	1	1.3

\*CBRU = Complete Bladder Retention of Urine.

pollakiuria and painful micturition.

Among 35 patients with ureteral stone, 25 patients (71.4%) had a pain which was lumbar (60%), iliac (8.6%), and pelvic (2.9%). The pain was a renal colic type in 18 cases (51.4%) of ureteral stones. The other main complaints in ureteral stones patients were hematuria (14.7%), dysuria (12.0%), and fever (5.3%).

Of the 17 cases of bladder stones, 8 (47.1%), 5 (29.4%), 1 (5.9%), 1 (5.9%), 1 (5.9%) et 1 (5.9%) were respectively revealed by dysuria, hematuria, pollakiuria, painful micturition, complete bladder urinary retention and pyuria. 11 in the 17 bladder stone patients, *i.e.*, 64.7% had a bladder outlet obstructing disease: benign prostate hyperplasia (7 cases, *i.e.*, 41.2%), urinary schistosomiasis (3 cases, *i.e.*, 17.6%), prostate cancer (1 case, *i.e.*, 5.9%).

**Table 3** presents disease and dietary history in the stone-affected patients. 38.7% patients had some disease history: diabetes mellitus (6.7%), high blood pressure (6.7%), benign prostate hyperplasia (8%), urinary schistosomiasis (6.7%), ureteropelvic junction obstruction (2.7%), prostate cancer (1.3%). Dietary behavior was evaluated in 19 patients (25.3%). The diet in all 19 patients was rich in dairy products. 16 (84.2%), 10 (52.6%) et 6 (31.6%) of those 19 patients had respectively a diet rich in animal proteins (*i.e.*, meat, fish), hot drinks (*i.e.*, coffee, tea), and green vegetables (cabbage).

Imaging tools utilized to diagnose the stones were ultrasonography of the urinary system (69.3%), kidneys-ureters-bladder (KUB) non-contrast enhanced tomography (2.7%) and computed tomographic urography (37.3%). There were 1 to 2 stones in the upper urinary tract (kidney, ureter) and 1 to 10 stones in the

bladder. The stones size ranged from 1 to 30 mm.

Stone diagnostic imaging in 14 (60.9%), 8 (34.7%), and 1 (4.3%) patients were respectively ultrasonography, computed tomographic urography and KUB tomography. 6 patients (26.1%) had a calyceal stones, 5 patients (21.7%) had pelvic stones; intrarenal stone location was not specified in the other patients. Kidney stones were unilateral and obstructive in 60.9% of the patients, bilateral and obstructive with renal failure in 30.4% of the patients (**Table 4**).

For the diagnosis of ureteral stones, KUB tomography with or without ultrasonography and computed tomography were used respectively in 18 (51.4%) and 17 (48.6%) patients. Ureteral stone was bilateral and obstructive in 22.9% cases, unilateral and obstructive in 40% cases, unilateral and non-obstructive in 37.1% cases (**Table 4**). Among 40 affected ureteral units the stone location was lumbar, iliac, pelvic, and intramural respectively in 25% (n = 10), 5% (n = 2), 32.5% (n =

**Table 3.** Dietary behavior and disease history of the patients.

Dietary behavior (n = 19)		Disease history (n = 29, % = 38.7)	
Foods	Number (%)	Diseases	Number (%)
Milk	15 (79)	Diabetes mellitus	5 (6.7)
Cheese	11 (57.9)	Hypertension	5 (6.7)
Meat	11 (57.9)	Renal colic	4 (5.3)
Fish	5 (26.3)	BPH	6 (8.0)
Cabbage	6 (31.6)	Urinary schistosomiasis	5 (6.7)
Coffee	6 (31.6)	Urinary surgery	3 (4.0)
Tea	4 (21.1)	UPJO	2 (2.7)
		Urinary lithiasis	2 (2.7)
		Urinary infection	1 (1.3)
		Prostate cancer	1 (1.3)

BPH = Benign Prostate Hyperplasia – UPJO = Uretero-Pelvic Junction Obstruction.

**Table 4.** Characteristics of renal and ureteral lithiasis.

Characteristics	Stone location	
	Kidney (n et % patients)	Ureter (n et % patients)
Unilateral and obstructive	14 (60.9)	14 (40)
Unilateral and non-obstructive	0	13 (37.1)
Bilateral and obstructive	7 (30.4)	8 (22.9)
Bilateral and non-obstructive	0	0
Non specified	2 (8.7)	0
Total number of patients	23 (100)	35 (100)

13) et 15% (n = 6) cases. The stone's segmentary location was not indicated in 9 patients (22.5%).

The stone's treatment varied according to its location. Renal stones were treated by pyelolithotomy in 12 patients (52.2%), nephrolithotomy in 5 patients (21.7%), ureteral pigtail stent in 1 patient (4.3%). Ureteral stones were treated by alpha-blockers in 14 patients (40%), ureterolithotomy in other 14 patients (40%), and ureteral pigtail stent in 7 patients (20%). Each one of the 17 cases of bladder stone was treated by cystolithotomy.

Overall, 47 patients in 75 had received a medical therapy: alpha-blocker (29 cases, *i.e.*, 38.7%), non-steroidal anti-inflammatory drug (24 cases, *i.e.*, 32%), antispasmodic (2 cases, *i.e.*, 2.7%). The use of alpha-blocker aimed the medical expulsion of ureteral stone, but data were not available on the achieved rate of stone's expulsion.

## 5. Discussion

The hospital prevalence of stone disease was 1.7% in CHUD-BA *i.e.*, nearly half that of 3.7% computed at Cotonou in 2015 [16]. The difference may be linked to the fact that life standards are higher and the tendency to higher consumption of animal protein and dairy products in southern than in northern Benin. Besides, the climate is hot and humid in the south while it is hot and dry in the north: body hydration challenges are discrepant between the two regions.

The mean age was 41 years. It is similar to 39.6 ans [16], 47 ans [9], and 40.5 ans [17] found in other regional studies.

10.7% patients (7 males and 1 female) were less than 20 years old. Urinary stone disease is rare in childhood and adolescence where it is often associated with obstructive malformations of the urinary tract or genetic anomalies [18] [19] [20].

We observed a masculine predominance among the stone-affected patients. The sex ratio was 2.75. Several studies have demonstrated the masculine predominance in urinary stone disease with variable sex-ratio: 2 [21], 1.4 [22] and 1.61 [23]. The masculine predominance may be linked to the higher tendency to urinary tract obstruction in aging males or the estrogens' promoting effect on urine citrate's stone formation inhibiting activities [24] [25].

Most of the patients (72%) came from Borgou, the geographical area that sheltered the CHUD-BA. The remaining patients came from other neighboring areas with no urologist. The patients belonged to several ethnic and professional groups. Some professions such as craftsmen and agriculturalists which necessitate physical activity do contribute to body dehydration. Still, none of the patients were agriculturalists or herders despite the region was one of high animal and agricultural production activity. Some authors have founded that stone-affected patients were agriculturalists and students [26].

An obstructive uropathy was present in 18.7% of the patients: benign prostate hyperplasia (8%, n = 6), urinary schistosomiasis (6.7%, n = 5), ureteropelvic

junction obstruction (2.7%, n = 2), prostate cancer (1.3%, n = 1) [6] [27]. In several studies, benign prostate hyperplasia is the main urological disease associated with urinary lithiasis. According to Bah *et al.* [26], benign prostate hyperplasia (42.2%) and urethral stenosis are the main obstructive causes of urinary stone disease. Urological tumors especially prostate tumors are associated with urinary lithiasis in 31.4% cases [28]. 31.4% and 60.5% urinary stones cases are respectively associated with urological tumors, mainly prostate tumors [28], and with urogenital schistosomiasis [29].

Stone disease in our patients was diagnosed with ultrasonography (69.3%) and computed tomography (37.3%). Nowadays, non-contrast enhanced computed tomography of abdomen and pelvis is the gold standard imaging tool for the diagnosis of urinary stone. An alternative tool is the ultrasonography combined with KUB non-contrast enhanced tomography [24] [25]. The situation in CHUD-BA is similar to that in most of the sub-regional care units [6] [16] [26] [28] [30]. Often patients cannot afford the cost of computed tomography which limits its usage.

46.7%, 30.7% et 22.7% of the stones were respectively ureteral, renal, and vesical. In two other studies, there were 54.3% and 43.5% renal stones, 34.1% and 39.1% ureteral stones, 11.5% and 17.4% bladder stones [16] [30].

57.3% of the urinary stones were revealed by pain, 33.3% cases of which was a renal colic. Renal colic was present in 51.4% ureteral stones versus 30.4% renal stones. The pain is the main symptom according to several studies. Diallo *et al.* [9] have reported 94.9% pain, 28.8% of which being a renal colic. Renal colic reveals 67.5% [17] and 79.4% [16] of ureteral stones. The literature also signals 5% hematuria and 13% fever [31]. Complications of renal stones were hydronephrosis (60.9%) and obstructive renal failure (30.4%). That proportion of obstructive renal failure is higher than the ones observed elsewhere: 17.4% [32], 13.5% [9]. Voiding or storage troubles such as dysuria and pollakiuria were associated with bladder stones. That fact is also observed in several other studies [33] [34].

56 patients (74.7%) underwent a surgical treatment: 48 open surgeries (64%) and 8 drainages by pigtail ureteral stent (10.7%). Mini-invasive surgery is not yet introduced into CHUD-BA. Hounnasso *et al.* apply open surgery to 50.8% cases [16] and Coulibaly *et al.* perform open surgery in 100% cases [32].

We could not evaluate the expulsion rate of ureteral stone treated with alpha-blocker. Yet the efficacy of alpha-blockers as a medical expulsive therapy for ureteral stones have been demonstrated [35] [36] [37].

## 6. Conclusion

The prevalence of urinary stone disease was 1.7% at CHUD-BA, northern Benin in 2023. There was a masculine predominance: the sex ratio was 2.75. The patients' mean age was 41 years. Computed tomography was available, but its high cost hindered its usage. Open surgery was the only treatment tool available.

## Limitations

Some medical records were not available, some other were incomplete. Infrared cristallography or other tool being unavailable, it was impossible to determine the chemical composition of the urinary stones collected after their surgical removal.

## Ethical Considerations

The Ethics Committee in CHUD-BA had authorized the study to be performed.

## Conflicts of Interest

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

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