

# Surgical Treatment of the Upper Urinary Tract Lithiasis at the Urology Department of the Hopital General Idrissa Pouye

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## Abstract

Upper urinary tract lithiasis is a condition characterized by the presence of stones which is a stony concretion of crystallized substances in the kidney and/or ureter. **Objective:** The objective of this work is to study the epidemiological, clinical and therapeutic aspects of upper urinary tract stones on the one hand, then to compare the different types of surgical treatments and their results. **Materials and Methods:** This is a retrospective and descriptive study focusing on the surgical management of upper urinary tract stones, between January 2017 and December 2020, at the Urology department of the Hopital General Idrissa Pouye. **Results:** During the study period, 7.59% of surgical interventions performed were related to the treatment of upper urinary tract stones. Average age was  $45.20 \pm 16.4$  years, the age group [41 - 60] years was more affected with 42.68%. A history of urolithiasis was present in 25.52% of cases. Lower back pain was present in 97.48% of cases. On URO-CT scan, the stone was located more at the level of the ureter (49.57%). The size between 10 to 15 mm was more frequent (30.96%) and the density greater than 1000 HU was more frequent (33.47%). The most used therapeutic procedure was ureteroscopy (52.08%), followed by PCNL (40.83%) and open surgery (7.08%). The success rate (stone free) was 93.68% for the URS, 89.36% for the PCNL. The length of hospital stay for open surgery was  $6.76 \pm 4.25$ , for PCNL  $2.62 \pm 2$  days and for URS  $1.75 \pm 1.62$  days. Postoperative complications were present in 23.52% for open surgery, 11.22% for PCNL and 8% for URS. **Conclusion:** Urolithiasis is constantly growing in our regions. Effective endourological treatment is increasingly replacing open surgery. However, global access to these new techniques in our regions is slow to be effective.

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## Keywords

Endo-Urology, Open Surgery, Renal Lithiasis, Ureteral Lithiasis, URO-CT Scan

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## 1. Introduction

Lithiasis of the upper urinary tract is a condition characterized by the presence of one or more stones in the kidney and/or ureter.

The word lithiasis comes from the Greek word “lithos” which means “stone”, the word calculus comes from the Latin “calculus” [1] [2]. Lithiasis is a stony concretion formed by a compact cluster of one or more crystallized substances.

It is a common condition that affects 5% to 10% of the population in industrialized countries [3]. It occurs at all ages, and its incidence is steadily increasing in developing countries as a result of a change in dietary and occupational habits affecting an increasingly young population [4].

Its major symptomatology is renal colic and its diagnosis is based on computed tomography that will give the location, size and density of the lithiasis. These different characteristics of the lithiasis are necessary to establish the operative indication.

Treatments of urolithiasis and endo-urology have experienced a real revolution worldwide with the advent of modern and minimally invasive techniques: percutaneous nephrolithotomy (PCNL), ureterorenoscopy (URS) and extracorporeal shock waves lithotripsy (ESWL). This minimally invasive surgery has practically replaced conventional open surgery in developed countries. However, open surgery is performed in our context of developing countries due to limited access to minimally invasive equipment.

The aims of our study were to report the epidemiological, clinical aspects of upper urinary tract stones and to describe the treatment options and outcome at the Hospital General Idrissa Pouye (HOGIP). It is a level 3 public health establishment, located in the suburbs of Dakar (Senegal). Its urology department is a reference center in the sub-region for stone treatment.

## 2. Patients and Methods

This was a descriptive and comparative study of 239 patients who underwent surgery for upper urinary tract lithiasis between January 1<sup>st</sup> 2017 and December 31<sup>st</sup> 2020.

All patients operated on in the urology department of the HOGIP during the study period and with complete and available medical record were included in the study.

The different variables studied were: demographic (age, gender and geographical origin), history of lithiasis, symptoms characteristics of the lithiasis, type of treatment, treatment outcomes expressed as the presence of absence of

residual fragment (stone free) after radiological examination at three (3) months and six (6) months, post-operative complications and length of hospitalization.

We computed mean, standard deviation and median analyses for quantitative variables; qualitative variables were studied in terms of frequencies. Data analysis was carried out in “Epi info 7”. The statistical significance was accepted for  $\alpha < 0.05$ .

### 3. Results

During the study period, 3149 patients were operated in the urology department including 403 patients for urolithiasis (7.59%) of whom 239 cases were operated for lithiasis of the upper urinary tract (59.3%).

The mean age in our cases was 45.20 years  $\pm$  16.41 and median was 45 years (Range: 2; 82 years).

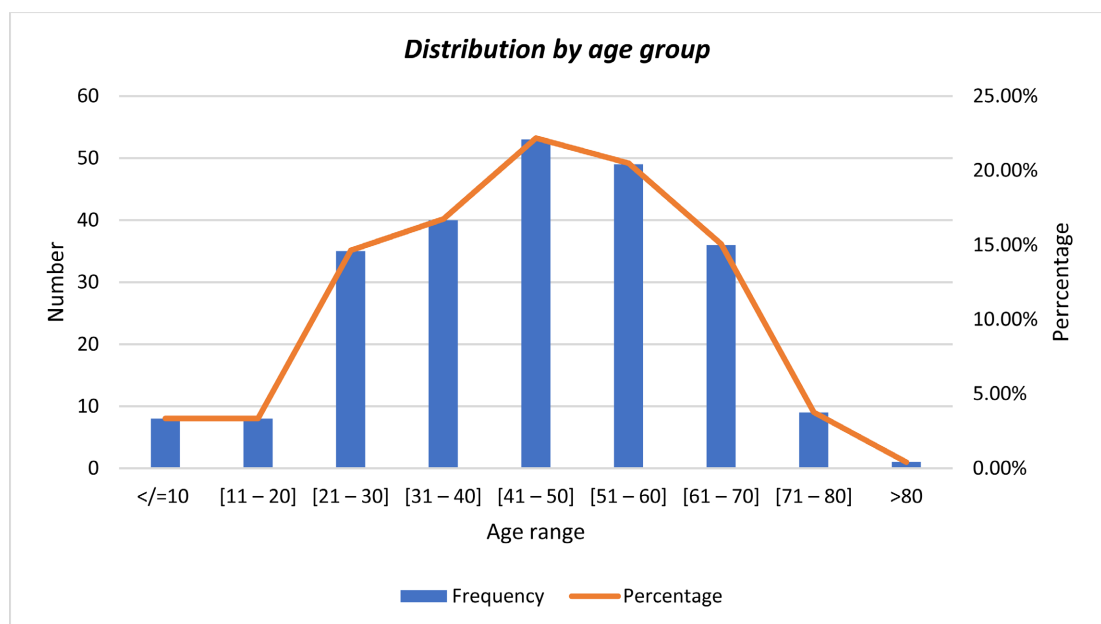
The distribution of patients by age is represented by **Figure 1**.

The age group 41 - 50 years was most frequent (22.18%) followed by the group 51 - 60 years (20.50%).

The reported medical history included 41 cases of hypertension (17.15%), 20 cases of diabetes (8.37%) and 14 cases of urinary tract malformations (5.85%) including 8 cases of ureteropelvic junction obstruction. Sixty-one (61) cases had a history of urolithiasis (25.52%). Surgical history was represented by Ureterscopy (8.37%), double-J stent placement (5.44%), open nephrolithotomy (4.18%) and PCNL (3.77%).

The commonest symptoms were atypical lumbar pain and renal colic which accounted respectively 48.95% and 48.53% of cases (**Figure 2**). Hematuria followed in 7.53% of cases. Incidental finding by imaging occurred in 2 cases (0.84%).

Urine culture was performed in 165 cases. No infection was found in 72.73%



**Figure 1.** Age distribution.

of cases. *Klebsiella pneumoniae* was the most frequent germ with 7.88% of cases, followed by *Escherichia Coli* (6.06%) and *Pseudomonas aeruginosa* (5.45%).

URO-CT scan was performed in 234 cases (97.9%) indicating the following findings:

- **Location of the lithiasis (Table 1)**

Ureteral localization was the most frequent in our series with 49.57% of cases, followed by caliceal localization with 38.89% and pelvic in 33.76% of cases (Table 1). A staghorn lithiasis was noted in 8.55% of cases.

- **Size (Figure 3)**

The most frequent lithiasis size range was 10 - 15 mm (30.96%), followed by the group 5 - 10 mm (25.1%) and the group > 20 mm (17.57%) while small lithiasis < 5 mm accounted for 2.51% of cases. In 7.11% of cases, the size of the calculations was not specified. Figure 3 shows the distribution of the size of the lithiasis.

- **Density of lithiasis**

The density was specified in 141 cases (59%) indicating the density > 1000 HU

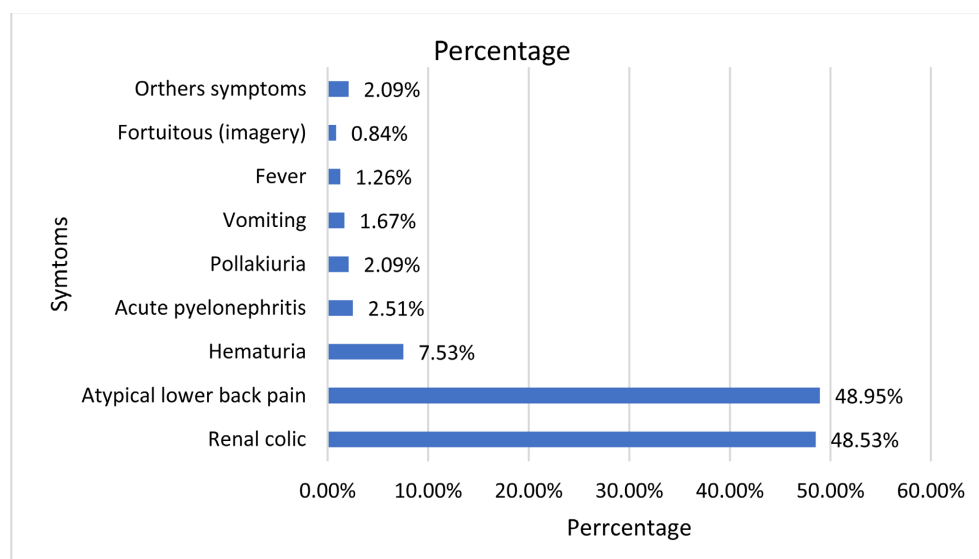
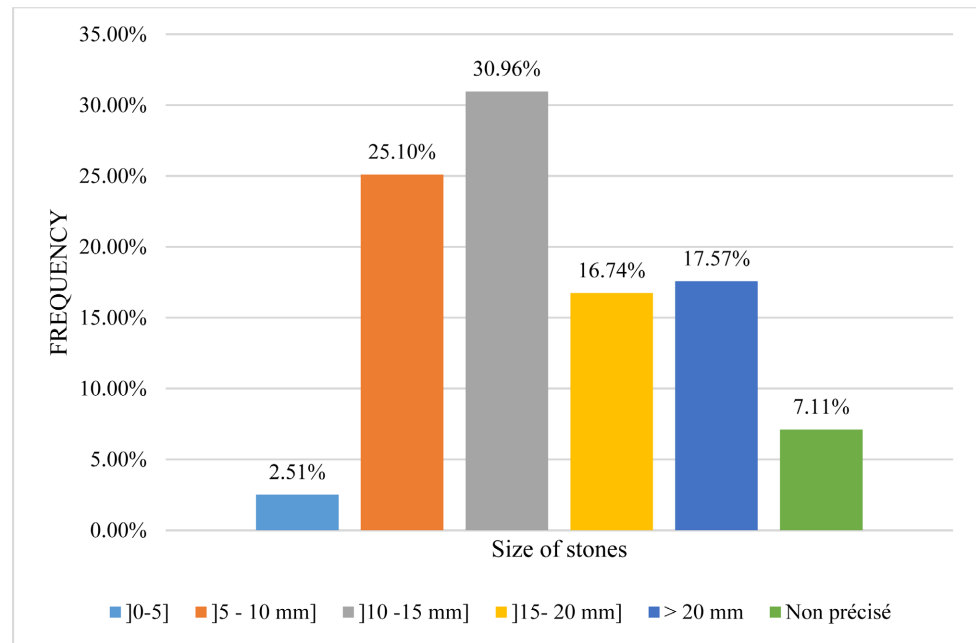


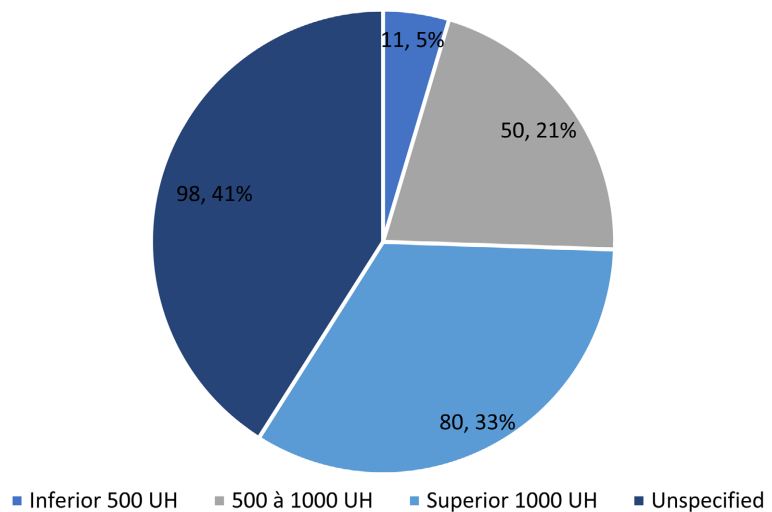
Figure 2. Distribution of patients by symptoms.

Table 1. Breakdown by location of calculations.

| Location    | Headcount   | Percentage |        |
|-------------|-------------|------------|--------|
| Total       | 91          | 29.73%     |        |
| Superior    | 15          | 16.48%     |        |
| Calyx       | Average     | 18         | 19.78% |
|             | Inferior    | 44         | 48.35% |
|             | Unspecified | 14         | 15.38% |
| Bassinet    | 79          | 25.81%     |        |
| Ureter      | 116         | 37.9%      |        |
| Coralliform | 20          | 6.5%       |        |



**Figure 3.** Distribution of the patients by the size of the lithiasis.



**Figure 4.** Distribution by lithiasis density.

as the most frequent (33.47%). **Figure 4** shows the distribution by density.

Ureteroscopy was the most used therapeutic means, performed in 125 cases (52.08%), followed by PCNL (40.83% of cases). Only 17 cases were treated with open surgery (7.08%).

Nephrectomy was performed in 05 cases (4 cases of pyonephrosis and 1 case of nephrocalcinosis).

A case of left PCNL combined with left ureteroscopy was carried out in a case of ureteral and ureteropelvic location.

The overall success rate (stone free) was 100% for open surgery, 93.68% for URS and 89.36% for PCNL.

**Table 2** shows the breakdown by “stone free” outcome by type of intervention.

**Table 2.** Breakdown by “stone free” outcome by type of intervention.

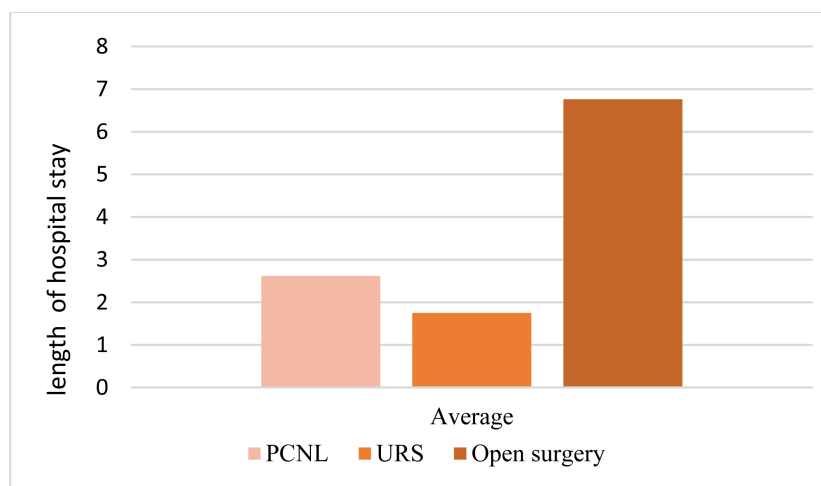
| Intervention             | Stone free |     | Percentage<br>“Stone free” |
|--------------------------|------------|-----|----------------------------|
|                          | Yes        | Non |                            |
| PCNL (n = 94)            | 84         | 10  | 89.36%                     |
| URS (n = 95)             | 89         | 6   | 93.68%                     |
| Nephrolithotomy (n = 3)  | 3          | 0   | 100 %                      |
| Pyelolithotomy (n = 6)   | 6          | 0   | 100%                       |
| Ureterolithotomy (n = 3) | 3          | 0   | 100%                       |
| Total (201)              | 185        | 16  | 92.04%                     |

No lithiasis was noted in 19 cases including 15 cases at ureteroscopy and 4 cases at PCNL. Failure was noted in 14 cases of ureteroscopy where the lithiasis could not be extracted. The causes of failure were: ureteric stenosis (6 cases), fine ureter (2 cases), bleeding preventing vision (2 cases), no progression of the guidewire without a precise obstacle (1 case), ureteral meatus not seen (1 case), a migration of the lithiasis to the lower calyx (1 case), a pyonephrosis (1 case).

Overall average hospital stay was  $2.46 \pm 2.42$  days (Range: 1; 16 days) for Ureteroscopy and PCNL. However, for open surgeries, the average hospital stay was  $6.76 \pm 4.25$  days versus  $2.62 \pm 2.02$  days for PCNL and  $1.75 \pm 1.62$  days for Ureteroscopy. **Figure 5** shows the distribution of length of hospital stay and type of treatment.

In our series, postoperative complications rate was 11.22% for PCNL and 8% for URS. Complication rate was higher for open surgery with an overall rate of 23.52%. Thus, for ureterolithotomy, we had 33.33% complications, 16.66% for pyelolithotomy. No complications were noted for nephrolithotomy.

**Table 3** shows the distribution of post-operative complications according to Clavien Dindo and by type of intervention.



\*Open surgery = nephrolithotomy + pyelolithotomy + ureterolithotomy.

**Figure 5.** Distribution by length of hospital stay and type of treatment.

**Table 3.** Distribution of post-operative complications according to Clavien Dindon.

| Type of intervention | Complication (grade according to Clavien Dindon) |   |                                 | Total              |
|----------------------|--|---|---------------------------------|--------------------|
|                      | Grade I  | Grade II                                      | Grade III                       |                    |
| PCNL                 | N = 2<br>- Hematuria (1)<br>- Vomiting (1)       | N = 9<br>- Urinary infection (7)<br>- PNA (2) | N = 0                           | N = 11<br>(11.22%) |
| URS                  | 2<br>- Hematuria (1)<br>- Peritonitis (1)        | 8<br>- Urinary infection (3)<br>- APN* (5)    | 0                               | 10<br>(8%)         |
| Open Surgery         | 1  | 1   | 2                               | 23.52%             |
| Ureterolithotomy     | 0  | 1<br>- APN*                                   | 0                               | 1<br>(33.33%)      |
| Pyelolithotomy       | 0  | 0   | 1<br>- Ureterocutaneous fistula | 1<br>(16.66%)      |
| Nephrolithotomy      | 0  | 0   | 0                               | 0                  |
| Nephrectomy          | 1<br>- Intestinal sub-occlusion                  | 0   | 1<br>- Stercoral peritonitis    | 2<br>(40%)         |

\*APN: Acute pyelonephritis.

Post operative follow up was made at 3- and 6-months post-surgery. At 3 months, 71 patients underwent CT that showed a residual lithiasis in 8 cases. At 6 months, out of 30 patients who underwent imaging at 3 months pos-surgery, 5 had a residual fragment.

At three months, we had a residual fragment in 3.1% of cases for PCNL and 1.13% for URS.

At 6 months, a residual fragment was present in 1.8% and 0.84% respectively for PCNL and URS.

There was no residual lithiasis at 3 and 6 months for all cases of open surgery.

## 4. Discussion

### Types of interventions

Ureteroscopy was the most frequent intervention, performed in 125 cases (52.08%), followed by PCNL (40.83%). Thus, endourological treatment account for 92.91% of cases. This is in line with current practices in developed countries where open surgery is exceptional, less than 1% [5]. In our series, 17 cases were treated by open surgery (7.08%). In developing countries, open surgery is widely used because of a limited access to endo-urologic equipment. As evidenced by Diallo *et al.* [6] who reported 34% ureteroscopy and 66% ureterolithotomy in a series of 63 cases of ureteral lithiasis in Senegal, and Tayabi [7] who reported 6.7% PCNL against 70% of open surgery in Morocco. Most authors in the Sub-Saharan Africa region reported a high rate of open surgical treatment, that is case of Kambou *et al.* [8] in Burkina Faso, Ondziel *et al.* [9] in Congo, Abago

*et al.* [10] in Togo, Kassogu  *et al.* [11] in Mali.

Those findings in other Sub-Saharan Africa are in contradiction with our study that indicates a good implementation of minimally invasive surgery (MIS). This is explained by the longer experience in MIS at HOGIP [12] characterized by regular replacement of open surgery by MIS since 2004.

#### Treatment results

The overall success rate was 89.36% for PCNL, 93.68% for ureteroscopy and 100% for open surgery. These results are in line with those reported in the literature, notably Osman *et al.* [13], Muslumanoglu *et al.* [14] and Mbodji *et al.* [15] who respectively reported a rate of “no fragment” of 73.5%, 94.9% and 94% for PCNL. Niang *et al.* [16] reported a success rate of 85.7% for ureteroscopy and Berthe H. [17] a success rate of 92.8%. However, Palmero X [18] did not note a difference in the overall efficiency between ureteroscopy and PCNL, although PCNL yields a higher efficacy for lithiasis greater than 2cm with a success rate of 61.1% vs 34.6% for ureteroscopy.

In our series, 29.7% of cases underwent CT imaging 3 months and 12.6% at 6 months. We had a residual fragment at 3 months in 42.85% of cases for PCNL and 31.42% for URS. No fragment was found in the group of open surgery. Osman *et al.* [13] reported 33% recurrence at 1 month for PCNL, then 3.5% after a second treatment. Complementary therapeutic options to achieve stone free have the advantage of reducing the complications compared to insisting to achieve stone-free in one attempt. However, Benchkroun [19] reported recurrence in 8% of cases. For ureteroscopy, Fall B. [20] and Niang *et al.* [16] reported a residual fragment rate of 28.3% and 12.1% respectively at 3 months. In general, 50% of urolithiasis are exposed to recurrence [21].

#### Duration of hospitalization

The average length of hospitalization was much longer for open surgery,  $6.76 \pm 4.25$  days, while it was  $2.62 \pm 02$  days for PCNL and  $1.75 \pm 1.62$  days for ureteroscopy. These results are consistent with those in the literature. Odzebe [22], Kambou [8] and Ondziel [9] reported a respective hospitalization duration of 15, 13.5 and 8.17 days for open surgery. For ureteroscopy, Niang *et al.* [16] reported an average hospitalization duration of 2 days, and Berthe [17] reported 2.5 days. For PCNL, Palmero [18] noted an average hospitalization duration of 8 days while it was 1.95 days for Imad Soussou [23].

MIS consistently reduces the duration of hospitalization and complications.

#### Post-operative complications

Post-operative complications rates were 11.22% for PCNL and 8% for URS compared to 23.52% for open surgery. Muslumanoglu [14] reported a post-operative complication rate of PCNL of 10.9%, thus close to our findings; Mbodji [15] reported complications rate of 16%. Palmero [18], in a study comparing PCNL and ureteroscopy noted complications of 19.4% for PCNL compared to 6.6% for ureteroscopy. Our complications rate for URS was much lower than most of those found in the literature, such as Niang *et al.* [16] who reported a post-operative complication rate of 19.8% and Lechevallier [24] in Mauritania,



reported 10% of postoperative complications.

For open surgery, Diabong [25] noted a complication rate of 22.85% close to ours. The complications in our series were mostly infections with 8 cases of acute pyelonephritis and 10 cases of urinary infections detected at urine culture. Fall B [20] noted 50% of infections.

Overall, open surgery presents greater morbidity compared to endourology, limiting its indications in favor of PCNL, URS and ESWL. It's rare indications concern failures of endoscopic treatment, treatment of associated anatomical anomalies or a destroyed kidney. However, it remains widely used in underdeveloped countries due to the lack of modern technical platforms.

## 5. Conclusions

Upper urinary tract lithiasis is a condition characterized by the presence of one or more stones in the kidney and/or in the ureter. Due to the change of lifestyle, its frequency is increasing in our context reducing the gap of prevalence compared of developed countries.

Access to minimally invasive surgery has improved the therapeutic arsenal and reduced morbidity compared to open surgery. Percutaneous nephrolithotomy and ureteroscopy are integral parts of the management of upper urinary tract lithiasis at HOGIP.

## Ethics Approval and Consent to Participate

This study was approved by the ethics committee of Hospital General Idrissa Pouye de Grand Yoff.

## Conflicts of Interest

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

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