





Research Article

# Place of Holmium Laser Ureteroscopy in the Management of Upper Urinary Tract Stones: Results About 82 Cases

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## Abstract

**Introduction:** Laser ureteroscopy is an effective method in the treatment of upper urinary tract stones. Our hospital is equipped with semi-rigid and flexible uretoscopes, equipped with a 35-watt Storz calculase III holmium laser generator. The objective of this study is to evaluate the results of laser ureteroscopy. **Materials and methods:** The study was carried out in the urology department of the Pr Bocar Sidy Sall University Hospital in Kati. It was a prospective study, which took place from December 1, 2023 to March 31, 2024. Included in our study were patients diagnosed with renal and proximal or distal ureteral lithiasis and operated by flexible or semi-rigid laser ureteroscopy. The parameters studied were: sociodemographic data, reason for consultation, urological history, number, size and topography of stones, type of urethroscopy performed, postoperative follow-up, length of hospitalization. A survey form was established for data collection. Data analysis was done on Word 2016, Excel 2016 and SPSS version 23.0 software after data verification. The anonymity of patients was guaranteed with their consent for the use of personal data. **Results:** We performed 82 cases of laser ureteroscopy. The average age was 36.60 years with extremes from 7 to 79 years. The male sex was the most represented (57% of cases). Renal colic was the most frequent reason for consultation (82.9%). The insertion of a double J ureteral catheter was the most represented urological antecedent in 15.9% of cases. The left lumbar ureter was the most represented side (28% of cases). In the majority of cases, the size of the stone varied between 18-28 mm (37.8%). The urine culture was positive in 18% of cases and E. coli represented 35%. Flexible laser ureteroscopy was the most performed (75.6% of cases). The stone-free rate "without residual fragment" was successful in 69 patients, or 84.1% of cases, and revision surgery was performed in 13 patients, or 15.9% of cases. The hospital stay was 1 day in 90.2% of cases. **Conclusion:** Laser ureteroscopy is the treatment of choice for upper urinary tract stones. The challenge lies primarily in urologists mastering this technique and acquiring the necessary equipment.

## Keywords

Stone, Upper Urinary Tract, Laser Ureteroscopy

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## 1. Introduction

The development of ureteroscopy with miniaturized flexible instruments associated with the Holmium: YAG laser has made it possible to broaden the indications and to propose this technique as a first-line treatment for urinary tract stones of the excretory tract. This technology is currently installed in our center and its sustainability must be encouraged in order to improve the quality of treatment of upper urinary tract (UUT) stones. The appearance of second-generation ureteroscopes and the evolution of the surgical technique make flexible laser ureteroscopy (FLU) an effective and safe method in the treatment of upper urinary tract stones [1]. Ureteroscopy with the use of laser energy has become one of the standards in the treatment of upper urinary tract stones [2-4]. The therapeutic choice in the treatment of UUT stones depends on several parameters (location, size, diameter, biochemical nature of the stones, associated comorbidity factors, symptoms). Flexible laser ureteroscopy (FLU) stands out as a life-saving method in the treatment of this type of stone. Its low morbidity leads some urologists to prefer several FLU sessions to percutaneous nephrolithotomy (PCNL) when the stone size exceeds 20 mm [3]. Mali, where Holmium YAG laser ureteroscopy debuted in 2018, is no exception. [4, 5]. Our hospital is equipped with urethoscopes (semi-rigid, flexible), with a 35-watt holmium laser generator, type Storz calculasse III. The objective of this work is to evaluate the results of laser ureteroscopy in the department.

## 2. Materials and Methods

**Study Setting and Location:** The study was conducted in the Urology Department of the Pr Bocar Sidy Sall University Hospital in Kati.

**Study Type and Period:** This was a prospective study, which took place from December 1, 2023, to March 31, 2024, over a period of sixteen (16) months, on the first series of flexible laser ureteroscopy at the Bocar Sidy Sall University Hospital in Kati.

**Study Population:** All patients diagnosed with upper urinary tract stones and treated with laser ureteroscopy in the department.

**Inclusion Criteria:** Our study included patients diagnosed with renal and proximal or distal ureteral stones and operated on by flexible or semi-rigid laser ureteroscopy. Preoperative assessment: Stone characteristics were determined by computed tomography in all patients. A basic preoperative assessment was performed for each patient before each procedure.

**Type of Anesthesia:** General anesthesia or spinal anesthesia were used depending on the location of the stones after a pre-anesthetic consultation. Antibiotic prophylaxis with a third-generation cephalosporin was routinely administered to all patients with a negative urine culture.

### Equipment Used During the Procedure:

A Storz-type video endoscope column, a cystoscope box, a flexible or semi-rigid ureteroscope, a 230  $\mu$ m laser fiber, a 35-watt laser generator (Storz Calculase III type), a mobile fluoroscope, a hydrophilic Terumo-type guidewire, and ureteral stents.

### Typical Surgical Technique

The patient is positioned supine in the lithotomy position: the ipsilateral hip on the side to be operated on in extension and the ipsilateral hip in forced flexion and abduction. Sampling: A comprehensive sample was drawn from the first series of laser ureteroscopy procedures at Pr Bocar Sidy Sall Kati University Hospital.

The parameters studied were: sociodemographic data, reason for consultation, urological history, additional examinations, number, size, and location of stones, type of urethroscopy performed, postoperative progress and follow-up, and length of hospital stay. A survey form was established for data collection, consisting of patient medical records, the surgical report register, and the hospitalization register. Data analysis: Data analysis was performed using Word 2016, Excel 2016, and SPSS version 23.0 software after data verification. Only means, standard deviations, frequencies, and extremes were determined.

**Ethical considerations:** Patient anonymity was guaranteed with their consent for the use of personal data.

## 3. Results

We performed 82 cases of laser ureteroscopy during this study period. The mean age was 36.60 years with a standard deviation of 16 years, ranging from 7 to 79 years (Table 1). Males were the most common sex (57% of cases). The sex ratio was 1.3. Renal colic was the most common reason for consultation (82.9% of cases) (Table 2). Double J ureteral catheter insertion was the most common urological history in 15.9% of cases (Table 3). The left lumbar ureter was the most common side, representing a frequency of 28% of cases (Table 4). In the majority of cases, the stone size ranged between 18 and 28 mm (37.8% of cases) (Table 5). The urine culture was positive in 18% of cases and E. coli represented 35% (Figure 1). Flexible laser ureteroscopy was the most commonly performed, i.e., 75.6% of cases (Table 6). Figure 2 illustrates the intraoperative image of a flexible laser ureteroscopy and Figure 3, the endoscopy room. The stone-free rate "without residual fragment" was successful in 69 patients, i.e., 84.1% of cases, and revision was performed in 13 patients, i.e., 15.9% of cases. The hospital stay was 1 day in 90.2% of cases (Table 7).

**Table 1.** Distribution of patients by age group.

Age group	Effective	Percentage (%)
7-23	17	20.7
24-40	30	36.6
41-56	25	30.0
57-72	8	9.8
73-79	2	2.4
Total	82	100

The 36.6-year age group was the most represented.

**Table 2.** Distribution of patients according to the reason for consultation.

Reason for consultation	Effective	Percentage (%)
Renal colic	68	82.9
Low back pain and urinary symptom	7	8.5
Low back pain + hydronephrosis without obstruction	5	6.1
Low back pain + hydronephrosis with obstruction	2	2.4
Total	82	100

Renal colic was the most frequent reason for consultation, at 82.9%.

**Table 3.** Distribution of patients according to urological history.

Urological history	Effective	Percentage (%)
The rise of the JJ probe	13	15.9
Flexible laser ureteroscopy	7	8.5
Percutaneous nephrolithotomy	4	4.9
Schistosomiasis urinary	2	2.4
Semi-rigid Laser ureteroscopy	1	1.2
Extracorporeal shock wave lithotripsy	1	1.2
Upper Prostatectomy	1	1.2
None	53	64.6
Total	82	100.0

The rise of JJ was the most represented urological antecedent in 15.9% of cases.

**Table 4.** Distribution of patients according to the topography of the stones.

Topography of the stones	Effective	Percentage (%)
Left lumbar ureter	23	28.0
Right renal	21	25.6
Left renal	14	17.1
Left pelvic ureter	11	13.4
Left iliac ureter	4	4.9
Left PU junction	2	2.4
Bilateral renal	2	2.4
Right PU junction	1	1.2
Right lumbar ureter	1	1.2
Right iliac ureter	1	1.2
Total	82	100

The left lumbar ureter was the most represented side, representing a frequency of 28% of cases.

**Table 5.** Distribution of patients according to stone size.

Size of the stone(s) (mm)	Effective	Percentage (%)
7-17	30	36.6
18-28	31	37.8
29-39	12	14.6
40-50	8	9.8
Over 50	1	1.2
Total	82	100

Stone size ranged from 18 to 28 mm in 37.8%.

**Table 6.** Distribution of patients according to the type of ureteroscopy performed.

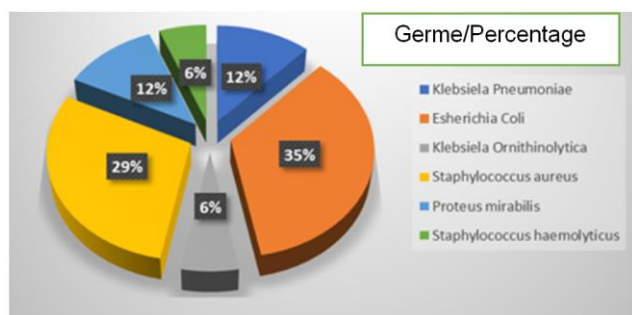
Type of ureteroscopy	Effectifs	Percentage (%)
Flexible laser ureteroscopy	62	75.6
Semi-Rigide laser ureteroscopy	20	24.4
Total	82	100

Flexible laser ureteroscopy was the most commonly performed, accounting for 75.6% of cases.

**Table 7.** Distribution of patients according the duration of hospitalization.

Duration of hospitalization	Effectifs	Pourcentage (%)
1 day	74	90.2
2 days	7	8.5
5 days	1	1.2
Total	82	100

The duration of hospitalization was 1 day in 90.2% of cases.

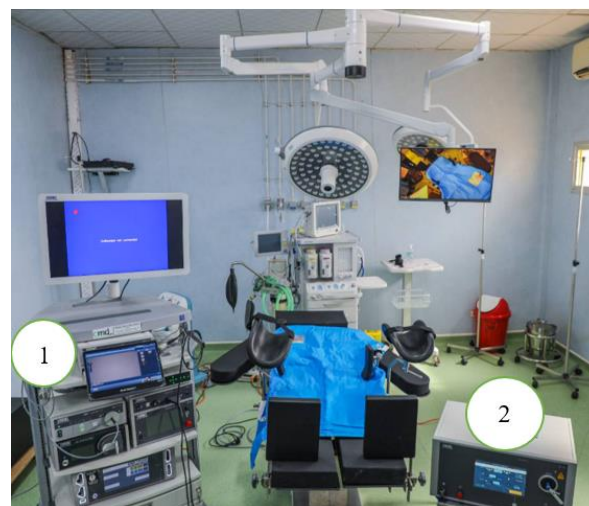


**Figure 1.** Distribution of patients according to the germ isolated in the urine.

Urine culture was positive in 18% of cases, and *E. coli* represented 35%.



**Figure 2.** Intraoperative image of a flexible laser ureteroscopy.



1-Endoscopy colonne, 2-35-watt holmium laser generator.

**Figure 3.** Endoscopy room, Urology Department, Kati university hospital Pr Bocar Sidy SALL.

## 4. Discussion

Lithiasis pathology mainly affects young people; the average age in our study was 36.60 years, ranging from 7 to 79 years. Renal colic was the most common reason for consultation, at 82.9%. Flexible laser ureteroscopy was performed in 62 cases, at 75.6%, and semi-rigid ureteroscopy in 20 cases. Niang et al. [6] performed semi-rigid ureteroscopy in 43 cases, flexible ureteroscopy in 15 cases, and rigid ureteroscopy in 9 cases. In our study, we did not perform rigid ureteroscopy.

Upper urinary tract stones are common. The routine practice of ureteroscopy poses a challenge for urologists in sub-Saharan Africa and has become the treatment of choice for upper urinary tract stones [6]. In the study by Mbaeri TU [7], the average length of hospital stay for patients was  $3.31 \pm 1.45$  days. The length of hospital stay was 1 day in 90.2% of cases in our study. The stone clearance rate in their study was 90.3%, similar to the overall success rate (fragment-free) in the study by Berthe et al., i.e. 92.8% [4]. Postoperative complications accounted for 53.1%, including 40.6% postoperative fever that resolved with antibiotics. Similar to the study by Fall [8], all grades combined, postoperative complications were infectious in 50% of cases. He highlights the advantage of ureteroscopy, being performed through a natural orifice, being less painful, reducing the risk of serious bleeding, irreversible loss of renal parenchyma and requiring a short hospitalization [7]. The mean length of hospital stay was  $1.2 \pm 0.73$  days with extremes ranging from 1 day to 6 days [9] and vaporization without residual fragment which is successful was 78.46% in their study.

In the work of Chunlin Y [10], on the analysis of the effectiveness of holmium laser and pneumatic ballistics in the treatment of impacted ureteral stones, he reports that there were no significant differences in the complications of local mucosal injury, hematuria, febrile urinary tract infection,



ureteral perforation and urinary sepsis in the 2 groups ( $P > .05$ ).

URSS-L is a method as effective as it is safe in the treatment of UUT stones, motivating us, despite its cost, to broaden its indications as a first-line treatment when the stones meet the selection criteria [1]. The durations of URSS-L reported in the literature are extremely variable but it generally takes 60 min to fragment a 10 mm stone [11]. For selected patients with multiple intrarenal stones, flexible ureteroscopy with holmium laser lithotripsy may represent an alternative therapy to extracorporeal shock wave lithotripsy or shock wave lithotripsy, with acceptable efficacy and low morbidity [12]. Repeated laser ureteroscopy is also possible to completely clear the kidney in 2 or 3 stages.

The treatment of kidney stones, however, represents one of the major indications for the technique, particularly in cases of stones in the lower pole of the kidney, complex stones, anatomical anomalies or failure of other treatments (ESWL and PCNL) [3, 13]. According to Faï PO et al. [12], the overall success rate is 65 to 85%, the success rates for the upper calyces and renal pelvis are 60 to 100%, and 60 to 80% for the lower calyx. The overall morbidity of ureteroscopy is 5 to 10%. The risk of major complications (avulsion, perforation) is 1% [14].

Our perspective is the search for a thulium laser to improve and adapt the management of stones of the upper urinary tract. The preliminary study on the results of the analysis of urinary stones by infrared spectrophotometry carried out by Kassogue et al., [15] concludes that the whewellite type stones C1 and C2 were the most represented. The results of a prospective comparative study by Delbarre B [16], between thulium and holmium laser lithotripsy for the treatment of upper urinary tract stones reveals that TFL and Ho:YAG lithotripsy are comparable in terms of stone-free rate and safety for the treatment of upper urinary tract stones. According to this same study, for a cumulative stone size of 1 to 2 cm, thulium is more effective than Holmium: YAG.

## 5. Conclusion

Laser ureteroscopy is the treatment of choice for upper urinary tract stones, especially for upper urinary tract stones. The challenge lies primarily in urologists' mastery of this technique and in acquiring the necessary equipment. Our perspective also includes the search for a thulium laser to improve and adapt the management of upper urinary tract stones.

## Abbreviations

LASER	Light Amplification by Stimulated Emission of Radiation
UUT	Upper Urinary Tract
FLU	Flexible Laser Ureteroscopy
SR-LU	Semi-Rigid Laser ureteroscopy
YAG	Yttrium-Aluminum-Garnet

PCNL	Percutaneous Nephrolithotomy
ESWL	Extracorporeal Shock Wave Lithotripsy
AVH	Upper Prostatectomy

## Conflicts of Interest

The authors declare no conflicts of interest.

## References

- [1] Padja E, Ibarra VA, Lmezguidi K, Janane A, Ghadouane M, Ameur A, Abbar M. Flexible laser ureteroscopy in the treatment of upper urinary tract stones: results about 166 interventions. *Pan Afr Med J* 2015; 8: 22: 13. <https://doi.org/10.11604/pamj.2015.22.13.7591>
- [2] Lechevalier E, Saussine C, Traxer O. Ureteroscopy for upper urinary tract stones. *Prog. Urol.* 2008; 18(12): 912-916. <https://doi.org/10.1016/j.purol.2008.09.022>
- [3] Traxer O, Lechevallier E, Saussine C. Flexible ureteroscopy with Holmium laser: The tools. *Prog. Urol.* 2008; 18(12): 917-928. <https://doi.org/10.1016/j.purol.2008.09.038>
- [4] Berthe HJG, Cisse D, Diallo MS, Kassogue A, Diarra A, Coulibaly MT, Yattara I, Kouldjim A, Diakite ML, Tembely A. Our first experience of ureteroscopy with Holmium-YAG laser in the treatment of lithiasis of the upper urinary tract. *Uro' Andro* 2020; 2(3): 108-111.
- [5] Kassogue A, Sissoko I, Sangare D, Diallo MS, Sylla H, Traore M, Coulibaly B, Coulibaly S, Diakite M, Togola M, Tall F, Guindo I, Kamel BN, Diakite ML. Ureteroscopy with Holmium: YAG Laser-A Initial Study in the Urology Department of the Pr Bocar Sidy Sall University Hospital of Kati. *Open Journal of Urology* 2024; 14: 207-216. <https://doi.org/10.4236/oju.2024.144021>
- [6] Niang L, Pare, AK, Ndoye, M, Samassékou, A, Avakoudjo, DJG, Agoukpé MM, Jalloh, M, Ndiaye, A, Labou, I. and Gueye, S. M. Retrograde Ureteroscopy: Experience of the Grand Yoff General Hospital in Dakar. *African Journal of Urology* 2016; 22: 110-114. <https://doi.org/10.1016/j.afju.2016.01.002>
- [7] Mbaeri TU, Onu OA, Odo C, Nwadi UV. Ureteroscopy and Holmium:YAG Laser Lithotripsy For Upper Tract Stones in a New Urology Centre: Our Initial Experience. *Niger Med J* 2023; 64(2): 259-2676.
- [8] Fall B., Mouracade, P., Bergerat, S. and Saussine, C. Flexible Ureteroscopy and Laser Lithotripsy for Kidney and Ureter Stone: Indications, Morbidity and Outcome. *Prog. Urol.* 2014; 24: 771-776. <https://doi.org/10.1016/j.purol.2014.06.007>
- [9] Yameogo CAMKD, Ky B, Ouattara A, Kiraoya B, Kabore A. Holmium Laser Ureteroscopy in the Treatment of the Upper Urinary Tract Stones: Concerning 54 Cases in the Surgical Department of the Saint Camille Hospital of Ouagadougou (Burkina Faso). *Open Journal of Urology* 2020; 10(2): 17-24. <https://doi.org/10.4236/oju.2020.102003>

- [10] Chunlin Y, Wanlin D, Jinhua D. Analysis of the efficacy of holmium laser and pneumatic ballistic in the treatment of impacted ureteral calculi. *Medicine* 2020; 99(36): 1-5. <https://doi.org/10.1097/MD.00000000000021692>
- [11] Carpentier X, Meria P, Bensalah K, Chabannes E, Estrade V, Denis E, Yonneau L, Mozer P, Hadjadj HA. Update for the Management of Kidney Stones in 2013. *Stone Group Comity of the French Association of Urology. Prog. Urol.* 2014; 24: 319-326. <https://doi.org/10.1016/j.purol.2013.09.029>
- [12] Breda A, Ogunyemi O, Leppert JT, Schulam PG. Flexible ureteroscopy and laser lithotripsy for multiple unilateral intrarenal stones. *Eur Urol* 2009; 55(5): 1190-6. <https://doi.org/10.1016/j.eururo.2008.06.019>
- [13] Ben Saddik, MA, Al-Qahtani Sejiny S, Ndoye M, Gil-diez-de-Medina S, Merlet B, Thomas A, Haab F, Traxer O. Flexible Ureteroscopy in the Treatment of Kidney Stone between 2 and 3 cm. *Prog. Urol.* 2011; 21: 327-332. <https://doi.org/10.1016/j.purol.2010.07.012>
- [14] Faï PO, Albert T, Gaillet, S. Flexible Ureteroscopy with Laser for Upper Urinary Tract Stone. *Prog. Urol.* 2011; 21: 811-815. <https://doi.org/10.1016/j.purol.2011.10.001>
- [15] Kassogue A, Diarra A, Traore I, Djiguiba K, Diallo MS, Sissoko I, Traoré M, Guindo I, Coulibaly S. Preliminary Study on the Results of the Analysis of Urinary Stones by Infrared Spectrophotometry in the Urology Department of the Pr BSS University Hospital in Kati. *International of clinical urology* 2025; 9(1): 49-54. <https://doi.org/10.11648/j.ijcu.20250901.18>
- [16] Delbarre B, Baowaidan F, Culty T, Khelfat L, Brassier M, Ferragu M, Magnier A, Secourgeon A, Tariel F, Lebdaï S, Bigo P. Prospective Comparison of Thulium and Holmium Laser Lithotripsy for the Treatment of Upper Urinary Tract Lithiasis. *European urology open science* 2023; 51: 7-12. <https://doi.org/10.1016/j.euro.2023.02.012>