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Ureteroscopy with Holmium: YAG Laser—A Initial Study in the Urology Department of the Pr Bocar Sidy Sall University Hospital of Kati

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Abstract

Introduction: Ureteroscopy is a minimally invasive endoscopic surgery which provides access to the ureter, pyelon and calyceal cavities via the urethra and the bladder. Laser ureteroscopy uses the laser as an energy source to treat the stone and eliminate it naturally. Minimally invasive endoscopic methods are struggling to become popular in sub-Saharan African countries, especially for the upper urinary tract. The objective of our work was to report the results of our first laser ureteroscopy experience in the department. Materials and Methods: This was a prospective and descriptive study running from December 1, 2023 to February 19, 2024. Included in our study was any case of upper urinary tract stone operated by Laser ureteroscopy. The characteristics of the lithiasis were determined by CT scan. Sterilization of urine was verified by carrying out a cytobacteriological examination of urine. Ureteral lithiasis was approached by semi-rigid ureteroscopy. Renal lithiasis was immediately addressed by flexible ureteroscopy. Ureteroscopy was coupled with a Holmium YAG laser. A double J ureteral catheter was placed after the operation. A 230 µm laser fiber was used in each case with a generator with a power of 35 watts (Storz Calculase III type). An access sheath was used in all cases of flexible ureteroscopy. The parameters studied were: sociodemographic characteristics, lithiasis (site, size, number, density, topography), type of anesthesia, duration of laser use, duration of intervention, postoperative outcomes. Data entry and analysis were carried out using the software (Word 2016 and SPSS). Result: We collected 30 cases of laser ureteroscopy. The average age was 37

years with extremes of 9 and 79 years. The male gender was more represented. The most common age group was 24 - 39 years old. Renal colic was the most frequent reason for admission, 12 patients (40%). On physical examination, lumbar tenderness was present in 47% (14 patients). ECBU was positive in 4 patients (13%). CT scan was performed in all our patients before the intervention. The average stone size was 12 mm and the largest was 23 mm. The majority of stones, *i.e.* 59% (18 patients), had a density greater than 1000 HU. The stone was unique in 19 patients (63%). The location of the stone was pyelic in 8 patients or 27%. An impact on the upper urinary tract was found in 16 of our patients or 53%. General anesthesia was used in 25 patients (83%). A digital flexible ureteroscopy was used in 24 patients and a semi-rigid ureteroscopy (URS) in 6 patients. Full-course fragmentation was the most used therapeutic method, 9 patients or 32%. The average duration of interventions was 61 minutes. Drainage by double J catheter at the end of the procedure was performed in all our patients. The length of hospitalization was 24 hours. Only one case of failure in the USSR was recorded, and one case of failure was in the semi-rigid URS. Conclusion: Laser ureteroscopy is an effective minimally invasive surgery in the management of lithiasis of the upper urinary tract. It significantly reduces the length of hospitalization. Mastery of this technique and the acquisition of the equipment necessary for its implementation is an undeniable asset in the management of renal and ureteral lithiasis.

Keywords

Ureteroscopy, Semi-Rigid, Flexible, Holmium YAG Laser

1. Introduction

Ureteroscopy is a minimally invasive endoscopic surgery which provides access to the ureter, pyelon and calyceal cavities via the urethra and the bladder. Laser ureteroscopy (URS) uses the laser as an energy source to treat the stone and eliminate it naturally. The development and distribution of flexible ureteroscopes, associated with laser fragmentation of stones, have revolutionized the management of lithiasis of the upper urinary tract [1]. This technology is currently being installed in our country and its sustainability must be encouraged to improve the quality of treatment of lithiasis of the upper urinary tract. The appearance of 2nd generation ureteroscopes and the evolution of operating technique make flexible-Laser ureteroscopy (URSS-L) an effective and safe method in the treatment of upper urinary tract stones [2].

Ureteroscopy with the use of laser energy has become one of the standards for the treatment of lithiasis of the upper urinary tract [3] [4] [5]. Minimally invasive endoscopic methods are struggling to become popular in sub-Saharan African countries, especially for the upper urinary tract. Our hospital center is equipped with ureteroscopes (semi-rigid, flexible), with a holmium laser generator with a power of 35 watts, type Storz calculase III in November 2023 and we report our initial experience in this work. The objective of our work

was to report the results of our first laser ureteroscopy experience in the department.

2. Materials and Methods

This was a prospective and descriptive study running from December 1, 2023 to February 19, 2024. Included in our study was any case of upper urinary tract stone operated by Laser ureteroscopy in the department. The questionnaire developed included sociodemographic data, clinical data; additional examinations; expansion reports; the treatment received, the operating report. Data were collected from hospitalized patient registers and hospitalized patient files; registers of operating reports. The characteristics of the lithiasis were determined by CT scan in all patients. Sterilization of urine was verified by carrying out a cytobacteriological examination of urine. Ureteral lithiasis was approached by semi-rigid ureteroscopy. Renal lithiasis was immediately addressed by flexible ureteroscopy. In all cases, a safety guide wire was put in place at the start of the procedure. Ureteroscopy was coupled with a Holmium YAG laser for stone fragmentation.

After destruction and fragmentation of the stone, small stones were extracted directly with basket forceps. A double J ureteral catheter was placed after the operation to allow urine to drain and minimize the risk of stenosis linked to inflammation.

In all cases, the procedure took place under double visual video control in all cases and fluoroscopic in some. A 230 µm laser fiber was used in each case with a generator with a power of 35 watts (Storz Calculase III type). An access sheath was used in all cases of flexible ureteroscopy (45 cm in men and 35 cm in women). The parameters studied were: sociodemographic characteristics of the patients, lithiasis (site, size, number, density, topography), the type of anesthesia used, the course of the procedure, the average duration of laser use, the duration of intervention, operative consequences. Patient consent was obtained before the intervention. The data was collected from medical records, the operating report register, the consultation register, and the hospitalization register. They were entered and analyzed using software: Word 2019, Excel 2019 and SPSS version 25.0. Epi info version 3.53. The statistical comparison test was the Chi2 with a risk $p < 0.05\%$ considered to be statistically significant.

3. Results

We collected 30 cases of laser ureteroscopy during this study period. The average age was 37 years with extremes of 9 and 79 years. The male gender was more represented (**Figure 1**). The most common age group was 24 - 39 years old (**Table 1**). The majority of our patients came from Bamako, 25 patients or 83% (**Figure 2**). Renal colic was the most frequent reason for admission, 12 patients or 40% (**Table 2**). Lombotomy was the most common urological antecedent, found in 6 patients (20%) (**Table 3**). Physical examination was normal in 16

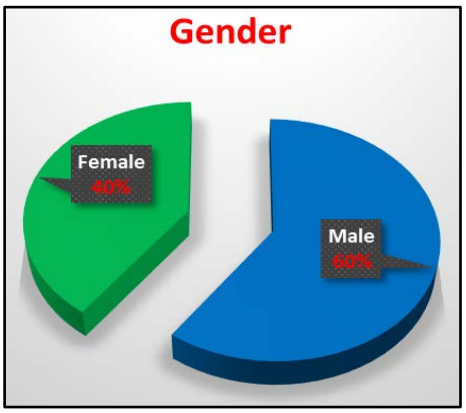

Figure 1. Distribution of patients according to gender. The male gender was more represented.

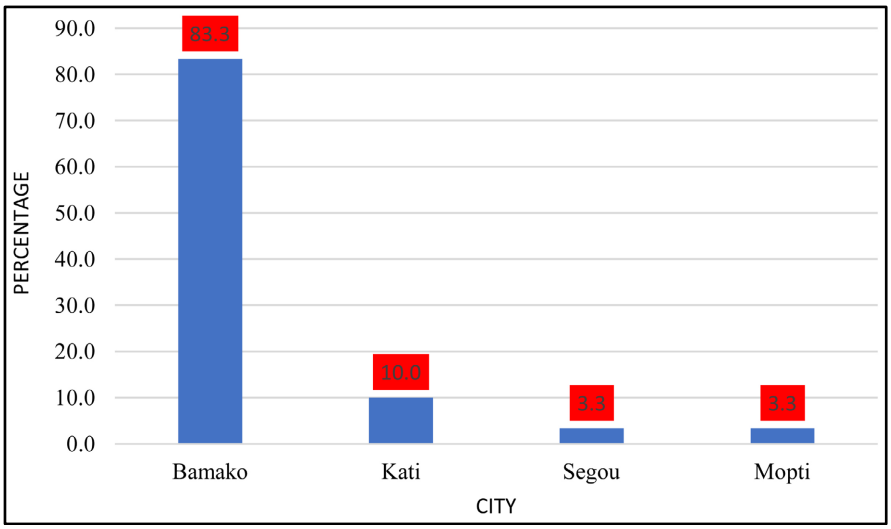

Figure 2. Distribution of patients according to origin. The majority of our patients came from Bamako, 25 patients (83%).

Table 1. Distribution of patients according to age group.

Age group	Number	Percentage (%)
<24	5	17
[24 - 39]	13	43
[39 - 54]	9	30
[54 - 69]	2	7
≥69	1	3
Total	30	100

The most common age group was 24 - 39 years old.

patients (53%) and lumbar tenderness was present in 47% (14 patients). ECBU was negative in 26 patients (87%) and positive in 4 patients (13%). The germs found were: *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella* spp. Renal function was normal in 23 patients (77%). CT scan was

Table 2. Distribution of patients according to reason for admission.

Reason for admission	Number	Percentage (%)
Renal colic	12	40
Low back pain/UHN without obstacle to ultrasound	10	33
Low back pain/UHN with obstacle to ultrasound	7	23
Low back pain + LUTS	1	4
Total	30	100

Renal colic was the most frequent reason for admission, 12 patients (40%).

Table 3. Distribution of patients according to urological history.

Urological history	Number	Percentage (%)
Lombotomy	6	20.0
Urinary bilharzia	2	6.7
Percutaneous nephrolithotomy	2	6.7
Extracorporeal lithotripsy	1	3.3
Semi-rigid ureteroscopy	1	3.3
Without urological history	18	60.0
Total	30	100

Lombotomy was the most common urological antecedent, found in 6 patients (20%).

performed in all our patients before the intervention. The average stone size was 12 mm and the largest was 23 mm. The majority of stones, *i.e.* 59% (18 patients), had a density greater than 1000 HU. The stone was unique in 19 patients or 63% (**Table 4**). The location of the stone was in 8 patients or 27% (**Table 5**). The stones were located on the right in 18 patients (60%) followed by the left side in 7 patients (23%) and bilateral in 5 patients (17%). An impact on the HAU was found in 16 of our patients, *i.e.* 53%, distributed as follows: pyelic 10 cases of dilation of the pyelocalicial cavities and 6 cases of ureterohydronephrosis. The type of anesthesia used was: general anesthesia with curarization in 25 patients (83%) and regional anesthesia in 5 patients (5%). The type of ureteroscope used was: a digital flexible ureteroscopy (URSS) in 24 patients and a semi-rigid ureteroscopy (URS) in 6 patients (**Figure 3**). The access sheath was used in all our flexible ureteroscopies, namely 45 cm (men) and 35 cm (women). Full-course fragmentation was the most used therapeutic method, 9 patients or 32% (**Table 6**). The average duration of laser use was 1365 seconds. The average duration of interventions was 61 minutes. The use of extraction means was not necessary in 24 of our patients (80%). In the rare cases where we used them, it was dormia which was used the most. We have not recorded any incidents or accidents during our various procedures. Drainage by double J catheter at the end of the procedure was performed in all our patients. Postoperatively, the length of hospitalization was 24 hours. Overall, only one case of failure in URSS was recorded, due to

Table 4. Distribution of patients according to the number of stones.

Number of stones	Number	Percentage (%)
Unique	19	63
Multiple (≥2 stones)	11	37
Total	30	100

The stone was unique in 19 patients (63%).

Table 5. Distribution of patients according to the site of the stones.

Site of the stones	Number	Percentage (%)
Renal (pyelic)	8	27
Renal (upper calyceal group)	4	13
Renal (middle calyceal group)	5	17
Renal (lower calyceal group)	2	7
Ectopic kidney	1	3
Lumbar ureter	4	13
Iliac ureter	2	7
Pelvic ureter	4	13
Total	30	100

The location of the stone was pyelic in 8 patients or 27%.

Table 6. Distribution of patients according to the therapeutic method of stones (n = 28).

Therapeutic method of stones	Number	Percentage (%)
Fragmentation alone	9	32
Pulverisation	8	29
Fragmentation then extraction of fragments	7	25
Pop-corn	4	14
Total	28	100

Fragmentation alone was the most used therapeutic method, 9 patients (32%).

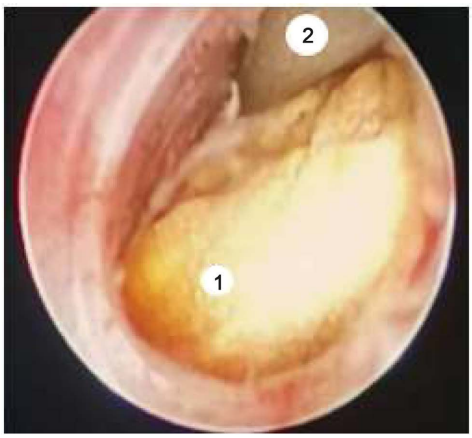

Figure 3. Endoscopic view of a stone encrusted in the pelvic ureter in ureteroscopy. 1—Stone; 2—Guide wire.

difficulty due to the rise of the access sheath in the patient with ectopic pelvic kidney and only one case of failure in semi-rigid URS due to bladder calcifications (sequelae of urinary bilharzia).

4. Discussion

Semi-rigid ureteroscopic stone extraction and holmium: YAG laser lithotripters remain safe and effective treatment alternatives for the management of upper ureteral stones [6]. With the acquisition of a 35 watt holmium laser generator, the perpetuation of this technique in our center will make it possible to strengthen the quality of care.

The indication for rigid/semi-rigid ureteroscopy for stones depends on the location and size of the stone. The location of the stone was pyelic in 8 patients or 27%. For small proximal stones, the first-line treatment is extracorporeal lithotripsy (LEC). For large or distal stones, ureteroscopy is the most effective treatment. However, ureteroscopy is more morbid than LEC. Ureteroscopy must be performed with caution, sterile urine, under scopic control, with an intrarenal safety guide [3]. Four cases of urinary infection were detected and successfully treated before the intervention was carried out.

At the end of the operation, we placed a double J ureteral catheter. This double J ureteral catheter was removed within 3 weeks to 1 month. For Lechevalier E *et al*. [3], ureteral drainage is not essential in the case of easy and rapid one-piece extraction of a small, unimpacted stone, otherwise ureteral drainage is more prudent. The success rate of ureteroscopy is 65% - 90%. The risk of stenosis is 1% [3]. We had a success rate of 93%, all cases of ureteroscopy combined.

According to the study by Chen S *et al*. [7], Holmium YAG laser lithotripsy and pneumatic lithotripsy are the most commonly used procedures in the treatment of ureteral stones. Ureteral stones can provide a shorter average operating time and a better early elimination rate. The average duration of laser use was 1365 seconds with an average duration of interventions of 61 minutes in our study.

Fall B *et al*. [8], reports that URSS-laser is increasingly used as first-line treatment due to its low morbidity and its excellent results, especially for the treatment of kidney stones less than 20 mm and ureteral stones. It constitutes a quality alternative to percutaneous nephrolithotomy (PCNL) in kidney stones larger than 20 mm. The average stone size was 12 mm and the largest was 23 mm in our study and the majority of stones had a density greater than 1000 HU. The treatment of kidney stones, however, represents one of the major indications for the technique, particularly in cases of stones of the lower pole of the kidney, complex stones, anatomical anomalies or failure of other treatments (LEC and PCNL) [9] [10]. Laser ureteroscopy is a technique that is effective and minimally traumatic with fewer complications. It is the treatment of choice especially for stones in the upper excretory tract when the diameter is less than 20 mm [11].

According to Faïs PO *et al*. [12], the overall success rate is 65% to 85%, the

success rates for the upper calyces and the 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% [12]. In our study, overall only one case of failure in flexible URS was recorded, due to a difficulty linked to raising the access sheath in the patient with an ectopic pelvic kidney and only one case of failure in semi-rigid URS due to bladder calcifications (sequelae of urinary bilharzia). The success rate was 93% overall.

Regarding the use of thulium laser compared to Holmium for kidney stones, some authors Øyvind Ulvik *et al*. [13], reported that the operating time was significantly shorter and there were significantly fewer intraoperative complications associated with the use of thulium in our study. The results of their randomized trial support thulium laser as the laser of choice for endoscopic lithotripsy of kidney stones [13]. The study conducted by Chandramohan V *et al*. [14] concluded that the thulium laser is more efficient and faster than the Holmium: Yag laser. Our hospital center does not have a thulium laser but constitutes our perspective in the management of renal lithiasis.

Financial implications: Berthé *et al*. [5], reported that access to ureteroscopy using the Holmium laser, however, remains limited due to the direct costs of acquisition and operation of the equipment, which is particularly fragile. At the start of the experience, the management of materials and consumables and the regularity in the supply of these materials remain a challenge in our context.

Niang *et al*. [11] estimated the average cost of a ureteroscopy at 632,000 CFA (964 euros). According to Berthé *et al*. [5], the relatively high cost of this activity must be put into perspective when we take into account the complications linked to open surgery for lithiasis of the upper urinary tract. Indeed, laser ureteroscopy makes it possible to significantly reduce the length of hospitalization which was 24 hours in our study, a rapid return to the patient's activities, and fewer hemorrhagic and infectious complications.

Accessibility challenges and potential barriers to the sustainability of this technology in our resource-limited settings exist. The advantage of laser ureteroscopy will allow us to overcome these difficulties.

The limitation of our study: the size of our sample is small, *i.e*. 30 cases of Laser ureteroscopy, which does not allow us to draw sufficient conclusions to establish the effectiveness and safety of the procedure in a larger population. A larger sample size could potentially reveal a broader range of outcomes and complications that were not observed in this admittedly encouraging initial study.

5. Conclusion

Laser ureteroscopy is an effective minimally invasive surgery in the management of lithiasis of the upper urinary tract. It significantly reduces the length of hospitalization. Mastery of this technique and the acquisition of the equipment necessary for its implementation is an undeniable asset in the management of renal

and ureteral lithiasis. These preliminary results reassure us in the management of lithiasis of the upper urinary tract by laser ureteroscopy.

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Barbier, E., Statouaa, M., Mazdar, A., Hollarda, D., Houndetea, F. and Hubert, J. (2015) Initial Experience of First 225 Flexible Ureteroscopy with Laser Lithotripsy in a Primary Care Hospital. *Progrès en Urologie*, **25**, 336-341. https://doi.org/10.1016/j.purol.2015.02.001

[2] Padja, E., Ibarra, V.A., Lmezguidi, K., Janane, A., Ghadouane, M., Ameur, A. and Abbar, M. (2015) Urétéroscopie souple laser dans le traitement des calculs du haut appareil urinaire: résultats à propos de 166 interventions. *Pan African Medical Journal*, **22**, 13. https://doi.org/10.11604/pamj.2015.22.13.7591

[3] Lechevalier, E., Saussine, C. and Traxer, O. (2008) Urétéroscopie pour calcul du haut appareil urinaire. *Progres en Urologie*, **18**, 912-916. https://doi.org/10.1016/j.purol.2008.09.022

[4] Traxer, O., Lechevallier, E. and Saussine, C. (2008) Flexible Ureteroscopy with Holmium Laser: The Tools. *Progrès en Urologie*, **18**, 917-928. https://doi.org/10.1016/j.purol.2008.09.038

[5] Berthe, H.J.G., Cisse, D., Diallo, M.S., Kassogue, A., Diarra, A., Coulibaly, M.T., Yattara, I., Kouldjim, A., Diakite, M.L. and Tembely, A. (2020) Our First Experience of Ureteroscopy with Holmium-YAG Laser in the Treatment of Lithiasis of the Upper Urinary Tract. *Uro'Andro*, **2**, 108-111.

[6] Yuksel, O.H., Akan, S., Urkmez, A., Uruc, F. and Verit, A. (2015) Efficacy and Safety of Semirigid Ureteroscopy Combined with Holmium: YAG Laser in the Treatment of Upper Urinary Tract Calculi: Is It a Good Alternative Treatment Option of Flexible Ureteroscopy for Developing Countries? *Journal of the Pakistan Medical Association*, **65**, 1193-1196.

[7] Chen, S., Zhou, L., Wei, T., Luo, D., Jin, T., Li, H. and Wang, K. (2016) Comparison of Holmium: YAG Laser and Pneumatic Lithotripsy in the Treatment of Ureteral Stones: An Update Meta-Analysis. *Urologia Internationalis*, **98**, 125-133. https://doi.org/10.1159/000448692

[8] Fall, B., Mouracade, P., Bergerat, S. and Saussine, C. (2014) Flexible Ureteroscopy and Laser Lithotripsy for Kidney and Ureter Stone: Indications, Morbidity and Outcome. *Progrès en Urologie*, **24**, 771-776. https://doi.org/10.1016/j.purol.2014.06.007

[9] Traxer, O., Lechevallier, E. and Saussine, C. (2008) Flexible Ureteroscopy with Holmium Laser: Technical Aspects. *Progrès en Urologie*, **18**, 929-937. https://doi.org/10.1016/j.purol.2008.09.034

[10] Ben Saddik, M.A., Al-Qahtani Sejiny, S., Ndoye, M., Gil-diez-de-Medina, S., Merlet, B., Thomas, A., Haab, F. and Traxer, O. (2011) Flexible Ureteroscopy in the Treatment of Kidney Stone between 2 and 3 cm. *Progrès en Urologie*, **21**, 327-332. https://doi.org/10.1016/j.purol.2010.07.012

[11] Niang, L., Pare, A.K., Ndoye, M., Samassékou, A., Avakoudjo, D.J.G., Agounkpé, M.M., Jalloh, M., Ndiaye, A., Labou, I. and Gueye, S.M. (2016) Ureteroscopie Retrograde: Expérience de l'Hôpital Général Grand Yoff de Dakar. *African Journal of*

Urology, **22**, 110-114. https://doi.org/10.1016/j.afju.2016.01.002

[12] Faïs, P.O., Albert, T. and Gaillet, S. (2011) Flexible Ureteroscopy with Laser for Upper Urinary Tract Stone. *Progrès en Urologie*, **21**, 811-815. https://doi.org/10.1016/j.purol.2011.10.001

[13] Ulvik, Ø., Æsøy, M.S., Juliebø-Jones, P., Gjengstø, P. and Beisland, C. (2022) Thulium Fibre Laser versus Holmium: YAG for Ureteroscopic Lithotripsy: Outcomes from a Prospective Randomised Clinical Trial. *European Urology*, **82**, 73-79. https://doi.org/10.1016/j.eururo.2022.02.027

[14] Chandramohan, V., Siddalinga Swamy, P.M., Ramakrishna, P., Ganesan, S., Babu, M., Anandan, H. and Panda, R. (2023) Ureteroscopic Lithotripsy by Thulium Fiber Laser versus Holmium Laser: A Single-Center Prospective Randomized Study. *Urology Annals*, **15**, 285-288. https://doi.org/10.4103/ua.ua_115_22