

Management of Upper Urinary Tract Stones by Ureteroscopy in the Urology Department of the Nord Franche Comte Hospital

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Abstract

Introduction: European association of urology (EAU), American Urology Association (AUA) and French Association of Urology (AFU) recommend either Extracorporeal Lithotripsy or Ureteroscopy for the surgical management of stones smaller than 2 cm in size. The aim of this study was to analyse the management of upper urinary tract stones by ureteroscopy in the urology department of the Nord Franche Comte Hospital. **Methods:** This was a prospective, descriptive, single-centre study lasting seven (07) months from 02 November 2021 to 31 May 2022 and involving 71 patients treated for lithiasis of the upper urinary tract by ureteroscopy. The preoperative, preoperative and postoperative characteristics of the patients and the disease, including the radiological control results, were studied. **Results:** One hundred and four stones were treated, the mean age was 55.94 ± 17.22 years, the sex ratio M/F 1.84; the circumstances of discovery were renal colic in 73.2%. The mean size of the stones was 9.12 mm; mean density 951.45 HU; the left side was most affected in 54.93% of cases. The stone was unique in 69.01% of cases. The preoperative Cytobacteriological urine exam (CBUE) was positive in 15.5% of patients. Pre-stenting was performed in 84.5% of patients. We performed 45.1% rigid Ureteroscopy and 39.4% flexible Ureteroscopy. The average duration of the procedure was 46.63 min. Monobloc stone extraction was 35.2%, laser fragmentation 31%. Drainage was not performed in 50.7% of patients. The

outpatient and postoperative complication rates were 87.3% and 9.86%, respectively. The stone-free rate was 90.1%. **Conclusion:** This initial evaluation of Ureteroscopy at Nord Franche Comte Hospital (HNFC), although based on a small sample, is satisfactory and in line with the literature.

Keywords

Ureteroscopy, Lithiasis, Hospital, Nord, Franche, Comte

1. Introduction

The incidence of urinary lithiasis is increasing in developed countries, where it has tripled since the 20th century [1]. Its prevalence is 10% in France and one person in eleven in United States, *i.e.* 9.09% [2] [3]. Until the end of the 19th century, stones were mainly found in the bladder and were either phosphatic or uric in nature. Today, most stones are found in the kidneys and are oxalocalcic in 70% to 80% of cases. In over 80% of cases, the stones are from metabolic origin. It affects approximately two men for every woman, most often between the ages from 20 to 60. Upper urinary tract stones are revealed 80% of the time in renal colic (1% to 2% of emergency cases) [4].

Management is medico-surgical. The rate of spontaneous expulsion of the stone varies according to its size and location. Stones in the distal ureter measuring 4mm have a 90% chance of being eliminated within 40 days of a renal colic attack, whereas 8 mm stones are not eliminated spontaneously, leading to recourse to Extracorporeal Lithotripsy and/or surgery. The overall spontaneous expulsion rate is 65% - 70% [4] [5]. The surgical management of lithiasis has evolved considerably over the last 40 years, with the advent of flexible ureteroscopes in the 1980s and the development of medical lasers in the 1990s [6]. The EAU, AUA and AFU recommend ECL or Ureteroscopy as part of the surgical management of stones smaller than 2 cm [7]. In France, Ureteroscopy plays an important role in the management of stones of the upper urinary tract, some of which are larger than 2 cm, even if they have to be treated in several stages due to the absence of ECL (1700 to 2000 procedures per year in France) in several health structures, and also of radioembolization platforms (necessary for the management of certain serious hemorrhagic complications inherent in LEC). In fact, Ureteroscopy is the only therapeutic alternative for upper urinary tract stones when extracorporeal lithotripsy has failed or is contraindicated in the urology department of the Nord Franche Comte Hospital.

The aim of this study was to analyze the management of upper urinary tract stones by ureteroscopy in the urology department of the Nord Franche Comte Hospital.

2. Materials and Methods

This was a single-center prospective descriptive study lasting seven (07) months,

from 02 November 2021 to 31 May 2022, which included all patients treated by rigid and/or flexible ureteroscopy for stones of the upper urinary tract, and who had an imaging check at three (03) months postoperative.

Flexible digital and fibered ureteroscopes, rigid ureteroscopes, a continuous isotonic saline irrigation system with free-flow return, the evacuated contents of which are aspirated and quantified using a Tune aspirator with a capacity of 24 liters, a laser generator with a 200-micron laser fiber, a pneumatic lithotripter, an image intensifier and consumables (a three- or four-wire Dormia basket, a ureteral access sheath, a Boston ureteral dilator, a guide wire, a ureteral catheter, contrast medium and a double-J catheter) were used to perform the procedures.

The evaluation covered preoperative, intraoperative and postoperative patient data.

The preoperative assessment focused on the patient (age, sex, body mass index, ASA score, antiplatelet or anticoagulant therapy, comorbidities, previous stone surgery) and the disease (circumstances of discovery, time between diagnosis and management, characteristics of the stone(s): location, number, size, density; Cytobacteriological urine exam).

The Cytobacteriological urine exam was analyzed 10 days before the operation, positive ECBUs were treated in accordance with the antibiogram for at least 07 cumulative days before and after the operation and no additional controls were carried out. All patients received Cefazolin-based antibiotic prophylaxis in accordance with the AFU protocol. Patients' anticoagulation was switched to Enoxaparin at a preventive dose 72 hours before the operation and for 10 days afterwards. The acetylsalicylic acid-based anti-platelet agent was continued in the perioperative period.

The intraoperative evaluation focused on: the type of anesthesia; the experience of the surgeon, which was greater than or equal to 50 procedures for the experienced surgeons and less than 50 procedures for the beginners; the pre-stinting, whether it was put in place during emergency management or in the event of failure of the procedure in the case of a spastic ureter; whether or not a ureteral access sheath was used, the number of sessions and the time between sessions; the type of treatment: monobloc extraction, fragmentation, popcorn, dusting, duration of the procedure from insertion of the endoscope to its final removal, including fitting of the drainage system (for multiple procedures in the same patient), this was the cumulative duration of the different procedures; the volume irrigated and volume collected, intraoperative incidents, whether or not a drainage system was fitted at the end of the procedure (double J catheter, ureter catheter).

Postoperative evaluation focused on whether or not the procedure was performed on an outpatient basis, duration of hospitalization for non-ambulatory cases; duration of catheter use (for patients who had a multiple procedure, only the duration of the last drainage was counted); postoperative complications according to Clavien's classification; results of radiological check-up at three months, divided into stone free (absence of stones or stones smaller than 3 mm)

and residual stones; size and location of residual stones; results of spectrophotometric analysis of stones. The data was collected using Kobotoolbox software. Univariate data analysis was performed using R software 4.4.2.

3. Results

Frequency and patient characteristics:

Seventy-one patients were managed and 104 stones were treated. The mean age of our patients was 55.94 ± 17.22 years (min 17 years, max 86 years). Men were the most affected with 46 (64.79%) cases, *i.e.* a sex ratio of 1.84; 25 (35.21%) patients were overweight, while 19 (26.76%) patients were obese. ASA scores, comorbidities and patient histories are presented in **Table 1**.

Table 1. Patient characteristics.

Features	Number of employees (n)	Percentage (%)
Sample size	71	
Number of Stone	104	
Gender M/F	46/25 (1.84)	
ASA		
1	36	50.70
2	21	29.58
3	14	19.72
Comorbidities	35/71	49.29
HTA	8	11.3
Diabetes	1	1.4
Hypertension + Diabetes	4	5.6
HTA + Other	6	8.5
Diabetes + Other	2	2.8
HTA + Diabetes + Other	5	7.0
Other	9	12.7
Anticoagulant/anti-aggregant	17/71	23.9
History of stones treatment	17/71	23.9
ECL	9	12.7
ECL+ Ureterscopy Rigid	2	2.8
Ureterscopy Rigid	3	4.2
Ureterscopy flexible	3	4.2

Preoperative disease characteristics:

Fifty-two patients (73.2%) were found to have renal colic and 19 (26.8%) had pyelonephritis. The characteristics of the stones are described in **Table 2**: 49 patients (69.01%) had a single stone and 22 (30.99%) had multiple stones. The pre-operative ECBU was positive in 11 patients (15.5%), *Escherichia coli* being the

most frequent germ (see **Table 3**).

Table 2. Stone characteristics.

Stone characteristics	Average	sd	Extremes
Size (mm)	9.12	4.06	5 et 28
Density (UH)	951.45	308.99	326 et 1594
Side affected			
Right side	28 (39.44%)		
Left side	39 (54.93%)		
Bilateral	4 (5.63%)		
Location			
Kidney	16 (22.54%)		
Kidney + ureter	13 (18.31%)		
Ureter	42 (59.15%)		

Table 3. Germs isolated at Cytobacteriological urine exam.

Germs	Frequency	Percentage %
E coli	3	27.28
<i>E. coli</i> + Klebsiella Oxytoca	1	9.09
Enterococcus faecalis	2	18.18
Klebsiella pneumoniae	1	9.09
Proteus mirabilis	1	9.09
Staphylococcus agalactiae	1	9.09
Staphylococcus aureus	1	9.09
Staphylococcus épidermidis	1	9.09
Total	11	100%

Intraoperative and postoperative characteristics:

General anesthesia was the only mode of anesthesia in this study, the surgeon's experience was over fifty (50) cases in 47 (66.2%) patients and under fifty (50) cases in 27 (33.8%) patients. Pre-stinting was performed in 60 (84.5%) patients and ureteral meatus dilatation in 8 (11.3%). Rigid URS was performed in 32 patients, flexible URS in 28 patients and rigid + flexible URS in 11 patients. The ureteral access sheath was used in all patients who had a simple flexible Ureteroscopy and in 10 (90.9%) patients who had a rigid + flexible Ureteroscopy. A single Ureteroscopy session was performed in 64 (90.1%) patients, while 7 (9.9%) patients received two (2) sessions. For patients who received two (2) sessions, the average time between the two (2) sessions was 5.86 weeks and the median time was 5 weeks, with extremes of 2 and 12 weeks. The mean duration of the procedure was 46.63 ± 47.32 min, with extremes of 8 and 220 min. Irrigation was

virtually non-existent in all patients. Monobloc stone extraction by dormia was performed in 25 patients, laser fragmentation in 29 patients, dusting in 6 patients and lithoclast fragmentation in 11 patients. We recorded one intraoperative incident (ureteral wound). Drainage with a double JJ catheter was performed in 33 (46.5%) patients, while a ureteral catheter was inserted in 2 (2.8%) patients; however, 36 (50.7%) patients did not receive drainage. The mean duration of postoperative drainage was 11.77 ± 6.17 days, with extremes of 2 and 33 days. The procedure was performed on an outpatient basis in 62 (87.3%) patients, and the average hospital stay was 2 days, with extremes of 1 and 4 days. We recorded postoperative complications in 7 (9.86%) patients. These complications were either pyelonephritis or sepsis. They are summarized according to Clavien's classification in **Table 4**. Stone free was obtained in 64 (90.1%) patients, 7 (9.9%) patients had 1 or 2 residual stones, *i.e.* a total of 9 stones ranging in size from 3 to 15 mm. Five of these stones were smaller than 5 mm, 3 stones were between 5 and 10 mm and one stone was 15 mm in size. All the residual stones were caliceous. Spectrophotometric analysis of the stone was performed in 66 (92.96%) patients, and the stones were pure in 16 (22.53%) patients. In stones with a mixed composition, the oxalocalcic component was the most frequent (see **Table 5**).

Table 4. Postoperative complications N = 7.

Clavien	Type of complication	Frequency	Percentage %
Grade 1	Post-op pain	1	14.29
Grade 2	Pyelonephritis	2	28.57
Grade 3a	Pyelonephritis	1	14.29
Grade 3b	Sepsis	3	42.85
	Total	7	100

Table 5. Nature of the stone.

Nature of stone	Frequency	Percentage %
Whewellite + Weddellite + Carapatite	12	18.18
Weddellite + Whewellite+ Carapatite	3	4.55
Carapatite + Whewellite + Weddellite	3	4.55
Whewellite + Carapatite	13	19.70
Whewellite + Weddellite	11	16.67
Acide urique + Whewellite	6	9.09
Acide urique	5	7.57
Whewellite	11	16.67
Brushite + Weddellite	1	1.51
Cystine + Carapatite	1	1.51
Total	66	100

4. Discussion

Since the first ureteroscopes were developed in 1982 by Martinez-Pineiro and Perez-Castro, they have continued to evolve thanks to their miniaturization, robustness, improved visibility and endocorporeal lithotripsy methods [8]. This has led to a constant improvement in the management of upper urinary tract stones over the last twenty (20) years. The diversification of indications for ureteroscopy, its efficacy in the treatment of stones, its repetitive nature and its morbidity, which is more tolerable than Percutaneous nephrolithotomy, have meant that it has supplanted ECL and Percutaneous nephrolithotomy in stone management procedures over the last ten (10) years in France. According to the EAU, CLAFU and AUA recommendations, in addition to LEC, ureteroscopy is indicated for the management of stones less than or equal to 20 mm in the index patient. NLPC is indicated for the management of stones larger than 20 mm, as well as coralliform stones. In cases where LEC and/or Percutaneous nephrolithotomy are contraindicated in the management of kidney stones (major obesity, coagulation disorders, horseshoe kidney, pelvic kidney, cystine stones), it is the real therapeutic alternative [1] [9] [10]. In this study, age, ASA score, BMI and the existence of comorbidities were independent of ureteroscopy. The mean size of stones managed in our study was comparable to that reported in the literature, where it ranged from 8 to 10.62 mm [11]-[13]. The type of ureteroscopy depends on the location of the stone; rigid and semi-rigid ureteroscopy are performed for stones in the ureter, with a preference for distal locations. For proximal stones, the rigid ureteroscope should be used with caution to avoid ureteral damage. In addition to its indication for kidney stones, flexible ureteroscopy remains an alternative for proximal ureteral stones. [9] [10] [14]. We performed 45.1% and 39.4% rigid and flexible ureteroscopy respectively in our series. Prestinting or dilatation of the ureteral meatus should not be performed systematically, as it is not recommended. Dilatation should be reserved for uncomplicated ureteral meatus and prestinting for spastic ureters or when managing a stone-related emergency. [9] [16]. Our rate of prestinting was higher than those found in the literature where it varied between 26.9% and 77% [9] [11] [12] [16]. This high rate is due to emergency drainage of stone-related complications. Although the use of a ureteral access sheath is safe and may be useful for large and multiple renal stones or if a prolonged procedure time is planned, it should not be used routinely [9]. Sometimes the use of the ureteral access sheath depends on the operator's experience; it was almost systematic in all our patients who underwent flexible ureteroscopy, but varied according to the size of the stone in the study by Guido Guisti *et al.*, 90.4% for stones smaller than or equal to 1 cm and 100% for those larger than or equal to 3 cm [15], 100% in the study by YM Kotob *et al.* [13] and 54.4% in the study by K Adoumadiji *et al.* [11]. The objective of URS is the complete elimination of stones. Smaller stones/fragments can be extracted using dormia baskets. Dusting appears to be the best strategy and should be limited to the treatment of large stones [17]. In our series, Dormia's extraction of the stone in a single block was the most frequent,

accounting for 35.2% of cases, followed by fragmentation (31%). These rates are much higher than those reported by K Adomadjì *et al.* [11], which were 20% for monobloc extraction and 8% for fragmentation. Compared with fragmentation, dusting was rarely performed in our study, which is usually due to the operator's experience or impatience. As in the EAU recommendations [9], the insertion of a postoperative double J catheter was not systematic in our study. It was performed in 46.5% of our patients. This rate is lower than those found in the literature 95% for K Adamoudji *et al.* [11], 59.2% for E Bosquet *et al.* [18], 86% for N. Abid *et al.* [12]. Abid *et al.* [12]. This low rate in our study can be explained by the simplicity of the surgical procedure, thanks to good preparation of the excretory tract. The duration of a procedure should not exceed 90 minutes, the ideal duration being 60 minutes, beyond which the risk of infection is increased [19]. The ability to perform the procedure within these defined limits may be due to the experience of the operator, and the size and location of the stone. In all cases, it is important to know how to stop in order to limit the duration of the procedure, and to plan a second look if necessary. The average duration of the procedure in our series was less than that of many data in the literature: 59.5 min for YM Kotb *et al.* [13], 72.6 min for Guido Giusti *et al.* [15], 65.1 min for Alberto Breda [7]. This particularity of time management in our study can be explained by the fact that several procedures were carried out by operators with more than fifty cases of experience, but also by the high rate of extraction of stones in monobloc thanks to good preparation of the ureter prior to the procedure.

Outpatient ureteroscopy has become the norm in France, with recommendations for outpatient surgery published in 2013 by the AFU [20]. Outpatient surgery has increased significantly during the Covid period. Because of its low morbidity, outpatient ureteroscopy considerably reduces the cost of patient management [18]. The outpatient rate in our series was close to those in the literature, 94.8% for E Bosquet *et al.* and 92% for K Adamoudji [11]. Post URS complications in the literature range from 3.6% to 11.5% [21] [22], which corroborates the result of our series which was 9.86% of complications. However, the majority of complications were classified as Clavien grade 3. The severity of the complications in our series may be due to the serious co-morbidities of some of our patients. The final objective of ureteroscopy is stone-free. The stone-free rate in this study reflects the data in the literature: 92.2% in the series by Alberto Breda [7], 82% in the series by N Abid [12], 90.4% in the series by K Adamoudji and 69.5% in the series by E Bosquet [18]. This is a good performance, although it should be put into perspective in view of the small sample size and the widespread use of ureteroscopy.

5. Conclusion

Ureteroscopy is a minimally invasive surgical technique, and in recent years, it has become the mainstay of lithiasis management in France, to the detriment of NLPC and LEC. This first overall evaluation of the procedure in our facility shows a satisfactory overall result, with limited morbidity and a good stone-free rate. This

study paves the way for more specific studies with more representative samples.

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Conflicts of Interest

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

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