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Evaluation of the results of flexible ureterorenoscopy by retrograde nephrolithotripsy by laser at Le Van Viet Hospital from 2022 to 2025

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ABSTRACT

Introduction: The study evaluated the results and factors related to the treatment of kidney stone patients undergoing retrograde nephrolithotripsy by flexible ureterorenoscopy with Holmium laser at Le Van Viet Hospital from August 2022 to July 2025. Methods: A retrospective, cross-sectional, descriptive study. Results and discussion: The study included 34 patients: 21 males (61.8%) and 13 females (38.2%). The average age of patients was 53.8 ± 13.2 years. The common reason for hospitalization was low back pain, which accounted for 55.8%. 4.7% of patients had hypertension, 23.6% had diabetes, and 11.8% had both conditions. 15 patients (44.12%) underwent surgery for urinary stones with a total of 21 times, the proportion of ureteroscopy (URS) and percutaneous nephrolithotomy (PCNL) was 57.15% and 23.81% respectively. Mean size stone: 15.76 ± 6.56 mm (6 - 35 mm). Stent DJ (JJ) used in all patients for at least 2 weeks, and they had urine cultures free of infection before flexible ureterorenoscopy. The average surgery time was 74.71 ± 26.88 minutes, the success rate was 97.1% and the average hospital stay was 6.56 ± 1.62 days. Conclusion: Treating kidney stones undergoing retrograde nephrolithotripsy by flexible ureterorenoscopy with Holmium laser is a safe and effective method with a high stone clearance rate. In our study, with a procedure involving the placement of a stent at least 2 weeks before surgery, the results showed 47.1% stone-free after 1 month, 79.5% after 3 months, and 97.1% after 6 months.

Keywords*: ureterorenoscopy, kidney stones, retrograde nephrolithotripsy*

1. INTRODUCTION

Urinary stones are solid crystals formed due to the precipitation and crystallization of substances dissolved in urine, appearing at any location within the urinary system (kidneys, ureters, bladder, urethra). If not detected early, stones can cause severe pain, obstruct urine flow, and even lead to kidney damage or failure [1, 2].

The prevalence of urinary stones ranges from about 2 - 14% worldwide (10 - 20% in men; 4 - 10% in women), varies by geographic region, and the incidence increases with age [2 - 5]. Vietnam is one of the countries with a high rate of urinary stones, located in the "Stone belt" accounting for more than 50% of patients coming to the Urology department [4, 5].

The retrograde ureteroscopic method using a flexible ureteroscope with laser lithotripsy for the kidney has been proven to achieve stone-free rates of up to 93% in studies published worldwide, as well as in Vietnam [3 - 5].

At Le Van Viet Hospital, since August 2022, we have implemented the application of retrograde ureteroscopic techniques using flexible ureteroscopes with Laser lithotripsy for kidney stones. After nearly three years of implementation, we have treated 34 patients and conducted a study titled: "Evaluation of the results of flexible ureterorenoscopy by retrograde nephrolithotripsy by Laser at Le Van Viet Hospital from 2022 to 2025" with two objectives:

1. To evaluate the treatment outcomes of kidney stones through retrograde ureteroscopy using flexible ureteroscopes with Holmium Laser lithotripsy.

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2. To assess certain factors related to the treatment outcomes of kidney stones using flexible ureteroscope lithotripsy techniques.

2. METHODS

2.1. Study design

A retrospective, cross-sectional, descriptive study.

2.2. Study period and location

At Le Van Viet Hospital from June 1, 2025, to August 31, 2025.

2.3. Study subjects

All patients with kidney stones who underwent retrograde ureteroscopic lithotripsy using a flexible ureteroscope with laser at Le Van Viet Hospital from August 2022 to July 2025.

Sample size: 34 patients with complete medical records documenting all study parameters.

2.4. Data collection and processing methods

Survey by extracting medical records on: General characteristics: Sex, age, BMI, medical history, and treatment of urinary stones, medical history of concomitant diseases; clinical and paraclinical symptoms: Reason for hospital admission, complete blood count, creatinine, urinalysis, ultrasound, KUB, and/or abdominal CT scan. The data was entered using Excel software and analyzed with SPSS 27.0.

3. RESULTS

3.1. General characteristics of the study subjects

There were 34 patients in the study, including 21 males (61.8%) and 13 females (38.2%), with an average age of 53.8 ± 13.2 years, the youngest being 21 years old and the oldest being 78 years old. 55.8% were hospitalized for lower back pain, 44.1% had a follow-up visit; 61.8% were overweight or obese, and 2.9% were underweight.

In our study, we also recorded the history of comorbidities and BMI of the patients: 14.7% had hypertension, 23.6% had diabetes, and 11.8% had both diseases. Of the 12 diabetic patients, 10 (83.3%) still had uncontrolled blood glucose, with blood glucose levels higher than 8 mmol/L. There were 61.8% of patients who were overweight or obese, and 2.9% were underweight.

Fifteen patients (44.12%) had a history of urinary stone surgery, with a total of 21 times: 38.1% had right ureteral stone lithotripsy, 19.05% had left; 9.52% had bladder stone lithotripsy, 9.52% underwent right flexible ureteroscopy for kidney stones, and 23.81% had percutaneous lithotripsy.

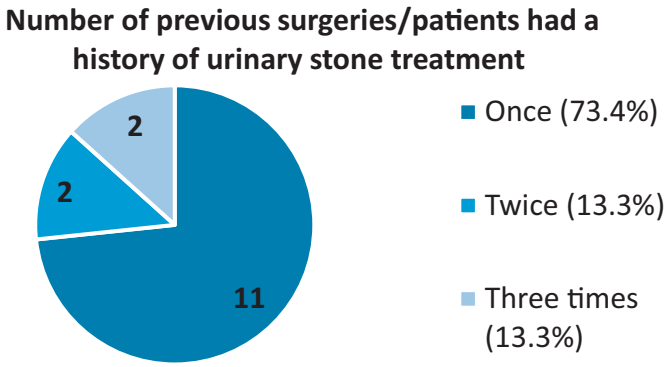

Figure 1. Number of previous surgeries/patients had a history of urinary stone treatment

Up to 79.4% of patients undergoing ultrasound had hydronephrosis from grade I or higher, specifically: Grade II hydronephrosis accounted for the highest proportion at 38.2%, grade I accounted for 29.4%, and grade III accounted for 11.8%.

Table 1. The patient's degree of hydronephrosis

Hydronephrosis	Value (n = 34)	Percentage
No hydronephrosis	7	20.6
Grade I hydronephrosis	10	29.4
Grade II hydronephrosis	13	38.2
Grade III hydronephrosis	4	11.8

Among the 34 patients in our study group, 55.9% had 1 stone, 20.6% had 2 stones, and 23.5% had more than 3 stones. One patient had 5 stones measuring 10 - 12 mm, and one patient had 8 stones, but the sizes were small, only 2 - 6 mm.

In our study, the most common stone size was in the 10 - 20 mm group (70.6%), followed by those < 10 mm, accounting for 14.7%, and 21 - 30 mm, accounting for 11.8%. There was one patient with 4 stones, including one stone measuring 35 mm, and the remaining 3 stones measuring ≤ 10 mm.

Regarding urinary system anatomy, we recorded 2 cases with calyceal neck stenosis, of which 1 case had a bent and very tortuous calyceal neck, which was also the case where the technique failed. There were 2 cases of ectopic left kidneys; however, the stones were located in the right kidney.

Table 2. Characteristics of kidney stones and urinary anatomy of patients

Characteristics	Classification	Value (n = 34)	Percentage
The average number of stones per patient was 1.88 ± 1.25, with the maximum being 8 stones	1 stone	19	55.9
	2 stones	7	20.6
	3 stones	3	8.8
	4 stones	3	8.8
	≥ 5 stones	2	5.9
The average stone size was 15.76 ± 6.56 mm, with the smallest being 6 mm and the largest 35 mm	< 10 mm	5	14.7
	10 - 20 mm	24	70.6
	21 - 30 mm	4	11.8
	> 30 mm	1	2.9
Abnormal anatomy	No	32	94.1
	Calyceal neck stenosis	2	5.9

In the urinalysis, we observed that 38.2% had leukocytes in the urine, and 70.6% had red blood cells in the urine. The proportion of patients with decreased estimated glomerular filtration rate (eGFR) was 85.3%. Since there was no baseline creatinine recorded previously, we temporarily categorized them according to chronic kidney disease (CKD) stages based on KDIGO 2024: The proportion of patients with stage III CKD was 47.1%, stage II 35.3%, and stage I 2.9%.

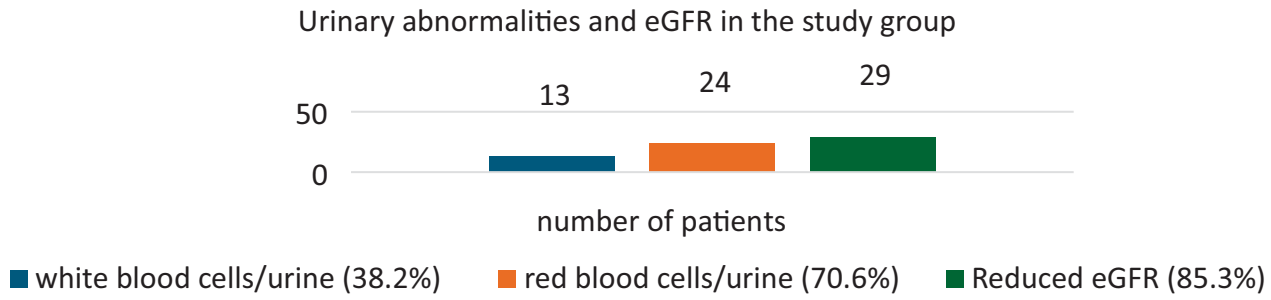

Figure 2. Urinary abnormalities and eGFR in the study group

All patients had a JJ stent placed for at least 2 weeks and had urine cultures free of infection before undergoing retrograde ureteroscopy with a flexible scope and laser lithotripsy. The average placement duration was 28.53 ± 17.46 days, with a minimum of 14 days (2 weeks) and a maximum of 89 days (3 months).

3.2. Treatment results

Procedural success was defined as the presence of residual fragments ≤ 3 mm; based on this criterion, the success rate was 97.1%. The duration of JJ stent removal after retrograde ureteroscopy with a flexible ureteroscope and laser lithotripsy was, on average, 5.97 ± 1.29 days, with a minimum of 4 days and a maximum of 9 days. The average hospital stay was 6.56 ± 1.62 days.

The average duration of surgery was 74.71 ± 26.88 minutes, with the shortest being 50 minutes. The

most common duration was ≤ 60 minutes; there was one case (2.9%) lasting up to 180 minutes with 4 stones: 1 stone 35 mm and 3 stones 10 mm.

Post-operative follow-up revealed stone-free rates of 47.1% at 1 month, 79.5% at 3 months, and 97.1% at 6 months. The patients had improved most of their test results: mean creatinine 86.11 ± 15.64 µmol/L (compared to 96.08 ± 20.43 before surgery); eGFR still decreased in 70.6% of cases (compared to 85.3% before surgery). Only 08 cases (23.5%) had grade I hydronephrosis (compared to 79.4% before surgery who had grade I or higher).

Table 3. Hospital stay, procedure, and f-URS results

Research characteristics	Mean ± standard deviation	Minimum value	Maximum value
Hospital stay duration (days)	6.56 ± 1.62	3	10
Time to remove JJ stent after surgery (days)	5.97 ± 1.29	4	9
Surgery duration (minutes)	74.71± 26.88	50	180
Time to place JJ stent (days)	28.53 ± 17.46	14	89

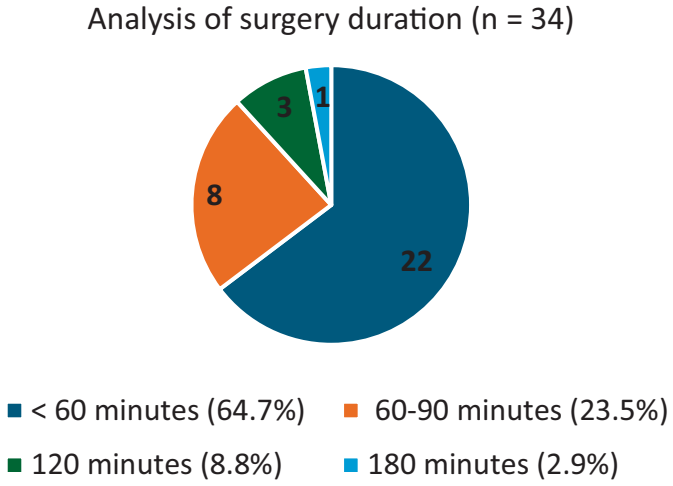

Figure 3. Analysis of surgery duration

When performing a complete urinalysis, we found that 38.2% had white blood cells in urine, and 70.6% had red blood cells in urine. When evaluating the degree of renal impairment according to eGFR, 85.3% showed reduced eGFR. After surgery, most patients had improvement in kidney function and hydronephrosis. The average creatinine was 86.11 ± 15.64 µmol/L (compared to pre-surgery 96.08 ± 20.43). Estimated glomerular filtration rate (eGFR) remained reduced in 70.6% of cases, compared to 85.3% before surgery. Additionally, 8 cases of grade I hydronephrosis accounted for 23.5%. The difference was statistically significant with $p < 0.05$ (Fisher's test) in terms of recovery of kidney function and degree of hydronephrosis.

3.3. Factors related to results of kidney stone treatment using flexible ureteroscopy lithotripsy

When analyzing the common characteristics of the population in relation to treatment outcomes, we observed that the history of surgical methods previously used for stone treatment was significantly associated with f-URS outcomes ($p = 0.006$), while other characteristics did not show statistically significant differences. Linear regression analysis showed a positive correlation between the history of surgical methods for urinary stone treatment and the outcomes of this procedure, with no autocorrelation ($p = 0.017$, Durbin Watson = 2.419, positive Pearson).

The Histogram showed a relatively normal distribution with a Mean close to 0 and a standard deviation of 0.985, close to 1. The P-Plot also had similar values, indicating a normal distribution with residuals not violated. However, the adjusted R^2 was only 14%, showing the low level of influence of surgical methods for treating urinary stones in the medical history with this technical result.

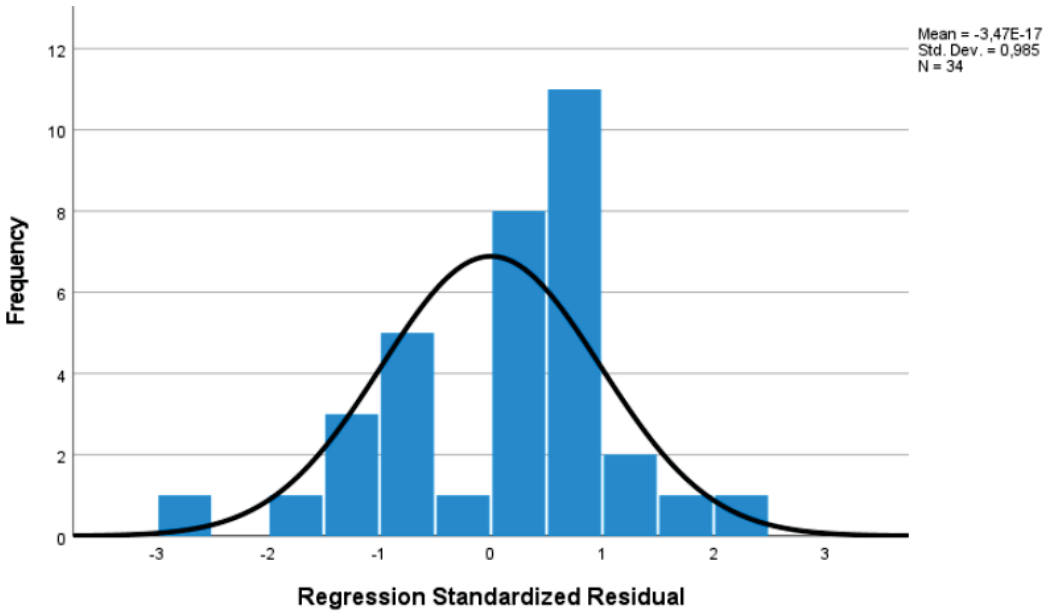

Figure 4. Histogram showing the positive correlation between the history of stone surgery and f-URS results

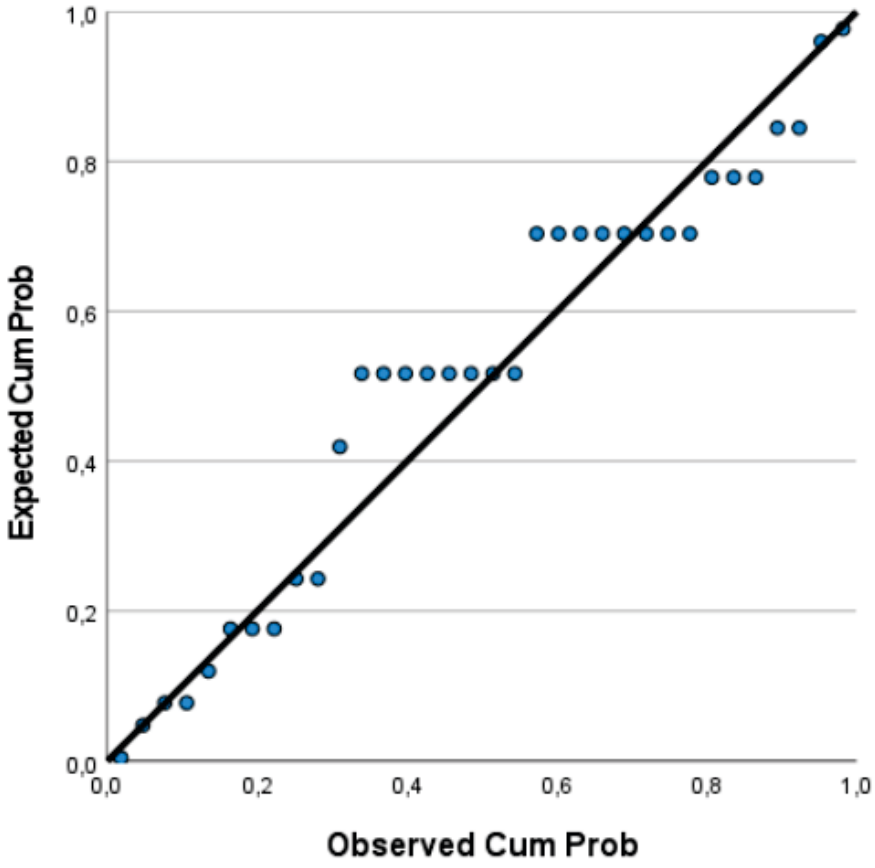

Figure 5. P-Plot chart analyzing the positive correlation between the history of surgical treatment for stones and f-URS results

In our study, there was no correlation between the number of stones, stone size, and the degree of hydronephrosis with f-URS outcomes. However, anatomical abnormalities, specifically in our study, the Calyceal neck stenosis, affected kidney stone treatment outcomes with f-URS, which was statistically significant (p = 0.032 in Fisher's test). The Pearson correlation assessment = -0.214,

indicating a negative correlation between anatomical abnormalities and f-URS outcomes; however, it was not statistically significant (p = 0.224), which was entirely consistent since in our study, there were only 2 cases of calyceal neck stenosis, which could not represent the study population.

After surgery, most patients showed improvement in kidney function and hydronephrosis. The average creatinine was 86.11 ± 15.64 µmol/L (compared to 96.08 ± 20.43 before surgery). The estimated glomerular filtration rate (eGFR) was still reduced in 70.6% of cases compared to 85.3% before surgery. There were 08 cases of grade I hydronephrosis, accounting for 23.5%. The difference was statistically significant with $p < 0.05$ (Fisher's test) in the recovery of kidney function and the degree of hydronephrosis.

4. DISCUSSIONS

Our study included 21 males (61.8%) and 13 females (38.2%), with an average age of 53.8 ± 13.2, ranging from 21 to 78 years old. Our results were similar to the study by Phan Truong Bao (2016), which performed URS on 60 cases with an average age of 53.2 ± 10.7 years (youngest 27, oldest 75), although the proportion of females (56.7%) in Phan Truong Bao's study was higher than males [6]. Our results also aligned with the study by Herrera-Gonzalez et al. (2011), with an average age of 51.31 ± 15.36 and a male/female ratio of 73/52, as well as some other studies [7, 8]. Our sample size was small; however, this also confirms that f-URS is applied to adults of both genders.

Patients were admitted to the hospital due to lower back pain in 55.88% of cases or for scheduled follow-up in 44.1%. This was also similar to the study by Pham Ngoc Hung (2018), with 53.9% presenting with lower back pain and 46.1% for follow-ups, as well as some other studies[2, 9].

Among 34 patients, 15 (44.12%) had a history of surgical treatment for urinary stones: 11 patients underwent surgery once (32.34%), 2 patients underwent surgery twice (5.89%), and 2 patients underwent surgery three times. In the 21 surgical procedures, the majority were right ureteral lithotripsy (38.1%), left ureteral lithotripsy (19.05%), 9.52% bladder stone lithotripsy, 9.52% retroperitoneal endoscopic removal of right kidney stones, and 23.81% percutaneous nephrolithotomy. According to the study by Phan Truong Bao (2016), 51 cases (85%) had a history of at least one intervention for kidney or ureteral stones on the same side, while 9 cases (15%) had never undergone any intervention [6]. In Herrera-Gonzalez's study (2011), among 125 f-URS cases, 25 cases underwent extracorporeal shock wave lithotripsy (20%), 4 cases underwent ureteroscopic lithotripsy (3.2%), and 10 cases underwent percutaneous stone removal (8%) [7]. The choice of f-URS for patients who had previously undergone one or multiple kidney or ureteral interventions has been confirmed as an advantage in many studies [3, 5, 7, 10].

Up to 79.4% of patients had hydronephrosis on ultrasound of grade I or higher, specifically: Grade II hydronephrosis accounted for the highest proportion at 38.2%, grade I accounted for 29.4%, and grade III accounted for 11.8%. The study by Phan Truong Bao (2016) reported that in the mild hydronephrosis group, there were 32 cases (53.3%), 26 patients (43.3%) had grade II hydronephrosis, and 2 (3.3%) had grade III hydronephrosis [6].

Among the 34 patients in our study group, there was an average of 1.88 ± 1.25 stones, with 55.9% having 1 stone, 20.6% having 2 stones, 8.8% having 3 stones, and 8.8% having 4 stones. One patient had 5 stones, sized 10 - 12 mm, and one patient had 8 stones, but the size was only 2 - 6 mm. The study by Bui Dang Ngoc and colleagues (2024) at 108 Military Central Hospital reported the average number of stones was 1.7 ± 0.8, with 40 patients (56.4%) having 1 stone, 16 patients (22.5%) having 2 stones, and 15 patients (21.1%) having 3 stones [5]. Herrera-Gonzalez's study (2011) reported that there was an average of 3.59 ± 3.57 stones, with a minimum of 2 stones and a maximum of 33 stones [7].

The average stone size in our study sample was 15.76 ± 6.56 mm; the smallest was 6 mm, and the largest was 35 mm. The most common size group was 10 - 20 mm (70.6%), followed by < 10 mm at 14.7%, and 21 - 30 mm at 11.8%. There was 1 patient with 4 stones, including 1 stone sized 35 mm, and the remaining 3 stones sized ≤ 10 mm. Consistent with the study by Bui Dang Ngoc (2024), the average stone size was 16.9 ± 4.6 mm [5]. The

study by Hoang Long and colleagues at Hanoi Medical University Hospital (2022) reported the average stone size of 12.6 ± 2.3 mm [8]. In Pham Ngoc Hung's study (2018), 22 out of 27 cases with total stone size > 20 mm involved 2 or more stones [9]. Phan Truong Bao (2016) only selected stones ≤ 20 mm (6 - 20 mm), with an average stone size of 10.7 ± 3.5 mm [6].

All of our patients did not exhibited fever or infection after surgery. The patients had their JJ stents removed after 5 - 7 days and were discharged 0 - 2 days after stent removal. The placement of a JJ stent is considered a routine step in our f-URS procedure. The study by Miernik et al. (2007) also placed JJ stents 7 to 14 days before surgery as a routine step in performing f-URS [10].

In our study, we had one unsuccessful case, accounting for 2.9%; the remaining 97.1% were successful. Our results were consistent with most authors, both domestically and internationally, who achieved a high overall stone-free success rate with the stone fragment size of ≤ 4 mm immediately post-surgery [3, 8, 9].

Re-examinations every month to evaluate complete stone clearance under ultrasound or KUB, our results recorded 47.1% stone-free after 1 month, 79.5% after 3 months, and 97.1% after 6 months. Author Phan Truong Bao (2016), with 60 patients, reported a stone-free rate of 61.7% after 1 month and 75% after 3 months, higher than ours, possibly due to the sample size and stone size in Phan Truong Bao's study being limited to ≤ 20 mm [6]. Bui Dang Ngoc's study (2024) reported stone-free rates immediately after surgery, after 1 month, and after 3 months as 81.7%, 83.1%, and 84.5%, respectively [5].

5. CONCLUSIONS

Our study confirms that retrograde nephrolithotripsy via flexible ureterorenoscopy with Holmium laser is safe and effective given appropriate indications, and should be widely adopted in hospitals nationwide.

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Đánh giá kết quả ứng dụng kỹ thuật nội soi niệu quản ngược dòng với ống soi mềm tán sỏi thận bằng laser tại Bệnh viện Lê Văn Việt từ 2022 đến 2025

Nguyễn Khoa Lý, Nguyễn Thị Bích Uyên, Phạm Sơn Lâm

TÓM TẮT

Đặt vấn đề: Nghiên cứu đánh giá kết quả và một số yếu tố liên quan đến điều trị bệnh nhân sỏi thận tán sỏi ngược dòng bằng nội soi niệu quản ống mềm với năng lượng laser Holmium (NSM) tại Bệnh viện Lê Văn Việt từ tháng 8 năm 2022 đến tháng 7 năm 2025. Phương pháp nghiên cứu: Nghiên cứu hồi cứu, cắt ngang, mô tả. Kết quả và bàn luận: Nghiên cứu có 34 người bệnh (NB): 21 nam (61.8%) và 13 nữ (38.2%). Độ tuổi trung bình (TB) 53.8 ± 13.2. Lý do vào viện chủ yếu là đau hông lưng, chiếm tỉ lệ 55.8%. 4.7 % NB có tăng huyết áp, 23.6 % có đái tháo đường và 11.8% có cả hai bệnh. 15 NB (44.12%) từng phẫu thuật (PT) sỏi tiết niệu với tổng 21 lần. tỉ lệ nội soi niệu quản và lấy sỏi thận qua da lần lượt là 57.15% và 23.81%. Kích thước sỏi TB là 15.76 ± 6.56 mm (6 - 35mm). Tất cả NB được đặt sonde JJ ít nhất 2 tuần và cấy nước tiểu không có nhiễm trùng trước NSM. Thời gian phẫu thuật trung bình là: 74.71 ± 26.88 phút, tỉ lệ thành công là 97.1%, thời gian nằm viện trung bình là: 6.56 ± 1.62 ngày (3 - 10 ngày). Kết luận: Điều trị sỏi thận bằng NSM là phương pháp an toàn và hiệu quả, có tỉ lệ sạch sỏi cao. Trong nghiên cứu chúng tôi, với quy trình có đặt sonde trước phẩu thuật ít nhất 2 tuần, kết quả 47.1 % hết sỏi sau 1 tháng, 79.5 % sau 3 tháng và 97.1% sau 6 tháng.

Từ khóa: *nội soi niệu quản, sỏi thận, nội soi tán sỏi thận ngược dòng*

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