Result of retrograde semirigid ureteroscopy with holmium laser in the renal pelvis stone's management

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Summary

Objective: To evaluate the treatment of renal pelvis stone by retrograde ureteroscopy using holmium laser at 103 Military Hospital. *Subject and method:* A prospective longitudinal clinical description was performed from April 2018 to April 2020 on 57 patients (33 male and 24 female patients). *Result:* The success rate was 100%, the rate of fragments migrated into the renal calices was 10.5%, conversion rate to open surgery was 0%, stone free rate was 93%, intra-operative complication rate was 0%, post-operative complication rate was 1.8%. *Conclusion*: Endoscopic retrograde using holmium laser is a safe and effective treatment method for renal pelvis stone.

Keywords: Retrograde ureteroscopy, renal pelvis stone, holmium laser.

1. Background

Renal pelvis stone is a common disease in urinary tract diseases. Renal pelvis stone sometimes does not need immediate intervention. If they cause upper urinary tract blockage, they will quickly affect kidney function and cause complications such as pyelonephritis, hydronephrosis, sepsis, and even loss of kidney function.

From 1980 onwards, in addition to two classic treatment methods, namely medical treatment and open surgery to remove stones, less invasive methods have gradually become popular, including retrograde ureteroscopy. The energy used in retrograde ureteroscopy (URS) is usually a gas pulse (pneumatic) or an electrical pulse (electrokinetic), but since the Holmium Laser has proven its superiority, retrograde ureteroscopy using laser has gradually become popular and replaced for other types of energy. In Vietnam, Holmium laser has been applied in stone treatment since the early years of the 21st century, in the research of the authors Nguyen Minh Quang (2003) [1], Doan Tri Dung (2008) [2].

Currently, renal pelvis stone can be treated by various methods such as Percutaneous nephrolithotripsy (PCNL), Retroperitoneal laparoscopic, retrograde ureteroscopy, etc., depending on equipment conditions, as well as the level and habits of the surgeons. For retrograde ureteroscopy, it is ideal to use a flexible endoscope along with laser energy. However, in fact, because the cost of equipment, as well as the cost of surgery is still quite high compared to the common ground, flexible retrograde ureteroscopy has not really been widely applied.

Clinically, we found that renal pelvis stone can be completely accessed and effectively dissolved with a semi-rigid endoscope in some cases. Therefore, this study was conducted to evaluate the results of treatment of renal pelvis stone by retrograde ureteroscopy with holmium laser lithotripsy at 103 Military Hospital.

2. Subject and method

2.1. Subject

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A serial case of consecutive patients with renal pelvis stone ≤ 20mm in largest diameter, treated by retrograde ureteroscopy using holmium laser and semi-rigid endoscope, were seleted. The patients were clinically examined, performed routine tests to assess kidney function (urea, creatinine), ultrasound (measurement of renal parenchymal thickness, hydronephrosis grade, location and size of stones), Kidneys-Ureters-Bladder scan (KUB) and Intravenous Urography (UIV), or CT scanner of the urinary system.

Exclusion criteria were patients with insufficient research records, or the patient did not agree to participate in the study, was not eligible for follow-up after surgery.

The study was performed at The Department of Urology, 103 Military Hospital, from April 2018 to April 2020.

2.2. Method

Research design: Prospective, longitudinal clinical description.

Research indicators: Success rate, stone-free rate, rate of intra- and post-operative complications, causes of failure.

Success rate: Is the ratio between the number of successful lithotripsy cases to the total number of operations.

Rate of stone-free: Determined by X-ray examination after surgery (or before JJ-stent removal) shows no stones, or 1 piece of stone < 4mm.

Intraoperative complications were recorded: Perforation, ruptured renal pelvis, renal pelvic mucosa peeling, or serious renal bleeding that needs to change the treatment method.

Complications after surgery: Fever, urinary tract infection...

Causes of failure: There was an accident that had to be converted to open surgery to solve, could not reach the stone, had to stop the surgery to switch to another method...

Instruments: 7.5Fr semi-rigid ureteroscope, endoscopic stone pince, gabion, guide wire, Holmium laser lithotripsy.

Surgical steps

After being under general anesthesia, the patient lies on his back in lithotomy position, thighs at 120°, knees flexed at 90°, and supported on racks. The 7.5Fr semi-rigid endoscope was placed into the bladder, identifying 2 ureter holes; thread the guidewire through the ureter hole, put the endoscope along the guide to access the stone; as soon as the stone is accessible, use a gabion to catch the stone and fix it in place; The stone was pulverized by holmium laser, and larger pieces were removed with a stone trap. After lithotripsy, put a 7Fr JJ stent and drain the urethra with a 2W Foley catheter.

Statistical analysis

Analyzing and processing data using SPSS 25.0 software. Use the appropriate statistical algorithms; qualitative variables are presented as a percentage; quantitative variables are presented as mean values.

Research ethics

The study complies with ethical regulations in biomedical research patients were consulted, explained in detail and signed a consent form before surgery. All personal information of research participants was kept confidential and used for research purposes only.

3. Result

From April 2018 to April 2020, we collected data from 57 patients. The average age of the patients was 46.23 ± 11.16 years old (26 - 69 y-o), the most common age group was from 30 to 50 years old (accounting for 59.6%). Regarding gender, in our study, there were 33 male patients accounting for 58% and 24 female patients accounting for 42%. The average size of stones was 12.53 ± 3.485mm (5 - 19mm). In which, the group of stones with the size of 11 - 15mm met the highest rate of 25/57 patients, accounting for 44%, stones < 10mm encountered in 21 patients and accounted for 37%. Through the study of 57 patients, there were 29 patients with grade 2 of hydronephrosis (50.9%), 21 patients with grade 1 (36.8%), 2 patients with grade 3 (3.5%), no

patients with grade 4. There were 5 patients who did not have hydronephrosis on ultrasound (8.8%).

The rate of successful placement of a ureteroscope to access stones in our study was 57/57 cases (100%). During the approach to the stone, we observed 29 patients (51%) with edema of renal pelvis mucosa and 28 patients (49%) without edema of renal pelvis mucosa. In addition, 3 patients (5.3%) in the process of bringing the diffuser up to approach the stone found that the ureter was folded, however, all 57/57 cases (100%) had access to the stone.

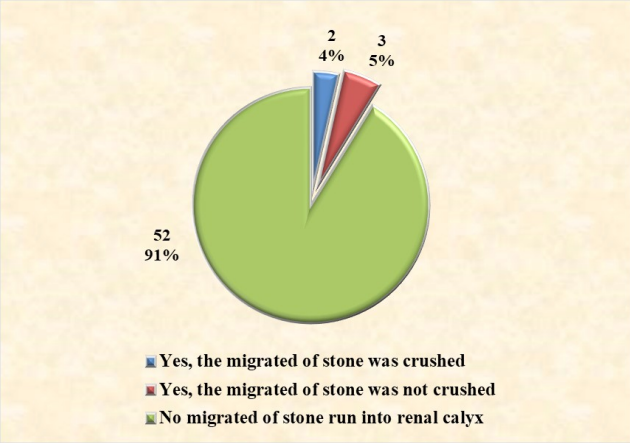

Figure 1. The migration of stone fragments (n = 57)

The process of lithotripsy, 52/57 patients (91.2%) were completely fragmented, 5 patients of stone fragments migrating to the renal calyx, of which, 2 cases found the stone (the fragments are all in the upper renal calyx) and successfully fragmented, 3 cases inaccessible and unable to break fragments (2 cases of stone fragments in the middle calyx, 1 case of stone fragment in the lower calyx).

Table 1. Accidents during surgery

Accidents	Number of patients (n = 57)	Ratio (%)
Hemorrhage	3	5.3
Damage to the pelvic mucosa (scratches, burns)	8	14
Stone fragments migrating into the calyx	5	8.8

Among 57 patients, there were 13 cases (22.8%) had accidents during surgery (3 patients had both damage to the renal pelvis mucosa and stone fragments running into the renal calyx), of which: Damage to the renal pelvis mucosa met in 8 cases (14%), 3 cases with mild bleeding intra-operative (5.3%), 5 cases (8.8%) of stone fragments running to the calyx during the lithotripsy. No patient had to change treatment method.

There was no intraoperative complication. After surgery, there was 1 patient (1.8%) presented with pale red urine 2 days of surgery, however, the patient's hemodynamics was stable, the hematuria was gone on the 4th day postoperatively.

Table 2. Technical results of lithotripsy

Result	Number of patients (n = 57)	Ratio (%)
Good	44	77.2
Moderate	13	22.8
Poor	0	0
Total	***57***	***100***

Our study had a 100% success rate, with no cases of failure. There were 44 patients with good results (77.2%), 13 patients with moderate results (19.3%) and no patient with poor results (0%).

Table 3. KUB X-ray (1 month after surgery)

Result	Number of patients (n = 57)	Rate (%)
No stone remain	53	93
Residual stone fragment ≤ 4mm	4	7
Residual stone fragments > 4mm	0	0
Total	***57***	***100***

53 patients with clear stones accounted for 93%, 4 patients had stones ≤ 4mm, none of them had stones > 4mm.

Overall results after 1 month: 57/57 patients (100%) achieved good results.

4. Discussion

The size of stones in our study is less than 20mm, in which mainly stones belong to the group of 10 - 15mm. In a few cases of small stones (5 - 7mm), we still decided to perform surgical method because the patient was in a lot of pain, and medical treatment was not effective.

During the lithotripsy process, due to the high position of the stone in our study, combined with the dilated renal pelvis, there were 2 cases of stone, under the pressure of water stream, moving into the upper renal calyx, 2 cases of fragment the stone enter the central calyx and 1 case of the stone fall on the lower calyx of the kidney. After crushing the other stones and removed the stone, with 2 cases of the stone in the upper calyx, we carried the endoscope up to the renal pelvis, using Dormia to fix the stone in the calyx, then put them in the kidney pelvis and crush them and take out the fragment; In the remaining 3 cases, we could not access the stone, ended the operation and placed the JJ stent. These cases we assign to the patient KUB X-ray scan after surgery. Considering that the stone fragment size in all 3 cases is ≤ 4mm, we decided not to have the second surgical intervention, so that the patient should have combined medical treatment.

During our lithotripsy, 3/57 patients (5.3%) had mild bleeding complications, affecting the vision of the surgery field. This incident occurred in 2 patients with edema, inflammation of the renal pelvis mucosa, during the lithotripsy process, the shock force of the laser energy and the rubbing stone caused the bleeding. In the other case, the cause of bleeding is due to Dormia being damaged during the canopy process, when taking the gab out, Dormia's cut branch damaged the pelvic and ureter mucosa. Mild bleeding is a accident that does not leave consequences for the patient, and does not affect the surgical procedure much. During lithotripsy, 8/57 patients (14%) have scratched lesions or burns to the renal pelvis mucosa due to laser energy or stone fragments rubbing against the renal pelvis during stone removal.

The results of our study do not have any cases of perforation or removal the pelvic mucosa, no case had to change the treatment method.

We did not encounter any cases of sepsis, urinary tract infection. Most patients immediately had red urine after catheterization, but after a few hours, the urine became clear. There is 1 case of hematuria after 2 days of surgery but the patient is stable, the urine is no longer red on the 4th day after surgery. Research by Vu Le Chuyen (2006) [3] had a hematuria rate of 42.9%, of which 100% of cases of hematuria after 3 days of treatment. Meanwhile, according to Aridogan (2005) [4], the rate of hematuria after lithotripsy was 7.3%.

We successfully performed retrograde ureteroscopy for 57/57 patients (100%). There were no failure cases and no cases to change treatment methods. In which, there were 44 patients with good results (77.2%), 13 patients with medium results (22.8%), no patient with poor results (0%). In which, 13 patients had complications in surgery (3 patients had both renal pelvis mucosal injury and stone fragments run into the renal calyx). Our technical results are equivalent to some other authors: Dang Van Duy (2018) [5] laser retrograde ureteroscopy lithotripsy for 61 case had a success rate was 100%, Doan Tri Dung (2008) [2] lithotripsy success for the 13/13 case, no case could not fragment the stone or must be change treatment method. Mursi et al (2013) [6] had success rate (86.6%), Ekrem Akdeniz et al (2014) [7] succeeded 87.9%.

Of 57/57 patients in our study were placed with JJ stent and 1 month after lithotripsy, the patients were scheduled to return to withdraw JJ stent. We conduct clinical examination and KUB X-ray for follow-up cases. Results on clinical examination showed that 100% of patients do not have any case with renal colic, some patients still smoldering hypogastrium pain, the cause may be due to JJ stent inserted. On KUB X-ray, there were 53/57 stone clean cases, 4 cases with stone pieces ≤ 4mm, there were no cases of stone above 4mm. Thus, the rate of common stone removal after 1 month of lithotripsy was 93%. This result is also similar to Li et al (2018) [2] with 95.7% for stone less than 10mm and 89% for

stone of 10 - 20mm size, Breda et al (2008) [9] had endoscopic lithotripsy for kidney stone with average size of 22mm results stone free rate is 93.3%, Dang Van Duy (2018) [5] performed retrograde ureteroscopy for 61 patients, Doan Tri Dung (2008) [2] laser retrograde intrarenal lithotripsy for 13 patients with a stone free rate of 77%.

In our study, even though lithotripsy was performed by semi-rigid endoscope, the stone location was high (renal pelvis), but the success rate of lithotripsy was up to 100%, the stone clearance rate was 93%. The reason may be that the patients are well prepared before surgery, the quality of equipment is high, and the surgeons are also proficient in retrograde endoscopic surgery.

5. Conclusion

Our study shows that retrograde ureteroscopy with semi-rigid endoscope was a technique that can be performed well in cases of stone size ≤ 20mm and the renal pelvis was not too dilated and the stones are less mobile. Our success rate was 100% with stone free rate was 93% after surgery; there were no cases of intra-operative complications and 1 case of post-operative complications (1.8%), but this case was mild complication and none of the patients had to perform surgical methods to solve and all were stable after a few days of post-operative medical treatment.

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