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Analysis of the Efficacy of Flexible Ureteroscopy and Rigid Ureteroscopy with Holmium Laser Lithotripsy in the Treatment of Upper Ureteral Stones in the Elderly

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Abstract: *Objective:* To compare the clinical efficacy of rigid ureteroscopy and flexible ureteroscopy with holmium laser lithotripsy in elderly patients with upper ureteral stones. *Methods:* 12 elderly cases of upper ureteral stones were selected and divided into two groups according to the type of surgery. The control group and the observation group adopted rigid ureteroscopic holmium laser lithotripsy and flexible ureteroscopic holmium laser lithotripsy, respectively. General observation indicators, laboratory indicators, and short-term efficacy-related indicators of surgery were compared between the two groups. *Results:* The operation time, ambulation time, and hospitalization time of the observation group were shorter than those of the control group, and the intraoperative blood loss was less than that of the control group ($P < 0.05$). There was no significant difference in the total primary/secondary stone clearance rate, postoperative complications, and disease recurrence rate after six months of follow-up in the two groups ($P > 0.05$). *Conclusion:* Compared with rigid ureteroscopic holmium laser lithotripsy, flexible ureteroscopic holmium laser lithotripsy for elderly patients with upper ureteral stones is more conducive to shortening the treatment and postoperative recovery time, and simultaneously, it causes no severe complications and is worthy of promotion.

Keywords: Rigid ureteroscopy; Flexible ureteroscopy; Holmium laser lithotripsy; Elderly; Upper ureteral stones

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1. Introduction

Ureteral stones are a common type of clinical emergency. It mainly refers to the temporary blockage caused by ureteral stenosis during the discharge of kidney stones. If this situation is not resolved, the stone will remain on the site longer and cause damage. Damage to the ureter can lead to clinical symptoms such as hematuria and renal colic. In severe cases, it may also lead to aggravation of hydronephrosis and renal failure, endangering the patient's life [1]. Upper ureteral stones are difficult to pass naturally due to the high obstruction position of the stone. In addition, most of the patients are elderly patients with low surgical tolerance due to factors such as their advanced

age and low immunity. Therefore, extra caution is needed in selecting surgical options [2]. It has been confirmed by many clinical cases that endoscopy combined with holmium laser lithotripsy can effectively and safely treat ureteral obstruction in elderly patients with upper ureteral stones. There are two options for endoscopy, including rigid ureteroscopy and flexible ureteroscopy. Their clinical application value requires confirmation of more clinical trials. Based on this, this study selected 12 elderly cases of upper ureteral stone as samples to evaluate the clinical efficacy of rigid ureteroscopic or flexible ureteroscopic with holmium laser lithotripsy.

2. Materials and methods

2.1. Materials

12 elderly cases of upper ureteral stones admitted from January 2020 to December 2022 were selected. They were grouped based on the surgical plan, with 6 cases in a group. There were 3 males and 3 females in the control group; age ranged from 60 to 86 years old, with an average of 67.32 ± 9.52 years; disease duration ranged from 0.5 to 5.0 years, and the mean was 2.78 ± 1.04 years. There were 4 males and 2 females in the observation group; the age ranged from 60 to 85 years old, with an average age of 65.12 ± 9.41 years; the disease duration ranged from 0.5 to 4.5 years, with an average year of 2.31 ± 0.99. The data between the groups were standardized and compared, and there was no significant difference ($P > 0.05$).

Inclusion criteria included patients who meet the relevant diagnostic criteria in the "Chinese Guidelines for the Diagnosis and Treatment of Urological Diseases" [3]; patients whose disease has been confirmed by imaging, laboratory, and other examinations; patients who meet the relevant indications of the surgical procedures used in this article; patients who are ≥ 60 years old, have clear consciousness, and can communicate normally; patients who have no history of mental, cognitive, psychological, and other diseases; patients with no missing information in their medical records; patients who have informed consent and voluntarily sign relevant documents. Exclusion criteria were patients with contraindications to surgical treatment; patients who have severe dysfunction of important organs such as the heart and brain, or malignant tumors; patients who have severe urinary system or systemic infection; patients who have blood system or immune system diseases; patients who dropped out of the study midway.

2.2. Methods

Rigid ureteroscopic holmium laser lithotripsy was performed in the control group. Patients were instructed to adopt a lithotomy position and epidural anesthesia was performed. After confirming that the anesthesia effect reached a satisfactory standard, a rigid ureteroscope was inserted until it reached the ureteral opening on the affected side. A rigid scope was used to insert a zebra guidewire and observe the surrounding stones. Once clear, the water pressure was reduced and the guidewire was slowly withdrawn. Then, a holmium laser fiber was inserted until the stone was reached, and the laser therapy instrument was turned on to perform lithotripsy. Larger stones can be removed with lithotomy forceps, while smaller stones can be flushed out directly with normal saline. After confirming that all stones had been removed, the double J tube was left to complete the operation. Relevant antibiotics should be used rationally according to routine postoperative procedures.

Flexible ureteroscopic holmium laser lithotripsy was adopted in the observation group, with the same body position and anesthesia form as the control group. After confirming that the anesthesia was in full effect, the flexible ureteroscope was slowly inserted along the expansion sheath until it reached the renal pelvis flexibly. The angle of the soft mirror was adjusted to fully explore the situation of the stone obstruction. After confirmation, the holmium laser fiber was inserted, and the same lithotripsy operation was completed as in the control group. The postoperative treatment plan was also the same as in the control group.

2.3. Observation indicators

(1) General observation indicators of surgery: The observed operation time, intraoperative blood loss, ambulation time, and hospital stay were compared in a standardized manner between the two groups.

(2) Short-term efficacy-related indicators: Statistical analysis was performed on the primary/secondary stone clearance rate and the incidence of postoperative complications (including ureteral injury, infection, urethral bleeding, etc.), and the observation results were compared between the two groups; at the same time, the patients were followed up for 6 months to perform statistical analysis and compare the recurrence rate of the disease.

2.4. Statistical analysis

Using SPSS25.0 for Windows software as the statistical basis, all the obtained data were divided by nature. Measurement data were displayed as mean ± standard deviation (SD), and a parallel *t*-test was performed; count data were displayed as %; at the same time, the chi-square test was performed. If the final *P* value was smaller than 0.05, it indicated a statistically significant difference.

3. Results

3.1. Comparison of general observation indicators of surgery between the two groups

Based on **Table 1**, after observing the general indicators of surgery in the two groups, the observed values in the observation group were all lower than those of the control group, and the difference between the groups was statistically significant, $P < 0.05$.

Table 1. Comparison of general observation indicators (mean ± SD)

Group	Number of cases	Operation time (minutes)	Intraoperative blood loss (mL)	Time to get out of bed (hours)	Length of hospital stay (days)
Control group	n = 6	52.86 ± 15.65	8.87 ± 2.68	20.11 ± 8.98	5.89 ± 1.24
Observation group	n = 6	35.29 ± 10.18	6.04 ± 1.54	9.25 ± 3.05	3.19 ± 0.78
t	-	2.305	2.243	2.805	4.515
P	-	0.044	0.049	0.019	0.001

3.2. Comparison of short-term efficacy-related indicators between the two groups

As shown in **Table 2**, there was no statistically significant difference in the primary and secondary stone clearance rates, total postoperative complications, and disease recurrence rate between the two groups, $P > 0.05$.

Table 2. Comparison of short-term efficacy-related indicators [n (%)]

Indicators		Control group (n = 6)	Observation group (n = 6)	χ^2	*P*
Primary stone clearance rate		5 (83.33)	6 (100.00)	1.091	0.296
Secondary stone clearance rate		1 (16.67)	0 (0.00)		
Postoperative complications	Ureteral injury	1 (16.67)	0 (0.00)	-	-
	Infection	1 (16.67)	1 (16. 67)	-	-
	Blood oozing from the urethral orifice	1 (16.17)	0 (0.00)	-	-
	Total value	3 (50.00)	1(16.67)	1.500	0.221
Disease recurrence rate		1 (16.17)	1 (16.17)	1.778	0.182

4. Discussion

The clinical treatment of ureteral stones must take into consideration of both the location and size of the stone. The higher the location of the stone and the larger its diameter, the less likely it is to be passed naturally, and it is challenging to rely solely on drug treatment. To achieve the ideal therapeutic effect, timely surgical treatment is necessary, but the issue lies in choosing the surgical approach [4]. Holmium laser lithotripsy is currently clinically recognized as the energy source with the best lithotripsy effect. Compared with extracorporeal shock wave lithotripsy, it not only has a higher success rate in single lithotripsy but also a shallower penetration depth. Additionally, there is no electric current in holmium laser lithotripsy, thus guaranteeing the safety of the treatment. However, it requires a longer operation time for larger stones (diameter ≥ 2 cm), which may not be ideal for elderly patients who are relatively weak and have poor tolerance for surgery. Generally, the clinical efficacy of holmium laser lithotripsy alone is insufficient to reach satisfactory standards. Therefore, some scholars suggest combining endoscopic technology with holmium laser lithotripsy to leverage the high-definition lens of ureteroscopy. It further clarifies the condition of the stone and guides doctors to perform more precise and efficient holmium laser lithotripsy operations [5-8].

A total of 12 research subjects were selected for this study and divided into two groups. The control group underwent rigid ureteroscopic holmium laser lithotripsy, and the observation group adopted flexible ureteroscopic holmium laser lithotripsy. Although there is no significant difference in the primary/secondary stone clearance rate, total postoperative complications, and recurrence rate six months after surgery between the two groups, the observation group had shorter operation time and postoperative recovery time, and less intraoperative blood loss compared with the control group, suggesting that flexible ureteroscopic holmium laser lithotripsy performed in the observation group has more application advantages. This is because the flexible ureteroscope has a smaller diameter and a twistable scope, enabling a smoother and more efficient insertion and providing the surgeon with a wider visualization. In addition, the flexibility of the turning angle also improves the accuracy of the operation to a certain extent, which is more conducive to avoiding irritation and damage to the surrounding normal tissue and effectively reducing oxidative stress. Its combination with holmium laser lithotripsy can further improve the one-time stone clearance rate and help patients obtain more satisfactory treatment outcomes [9-11].

5. Conclusion

In summary, for elderly patients with upper ureteral stones, flexible ureteroscopic holmium laser lithotripsy is recommended as the first choice of treatment. It can shorten treatment and recovery time, reduce intraoperative blood loss, and guarantee treatment safety. However, it should be noted that flexible ureteroscopy is not suitable for patients with upper urinary tract infections, infectious stones, etc. If used inappropriately, it may cause serious consequences such as bacteremia and sepsis, hence this treatment option should be fully considered based on the actual situation of the patient [12].

Disclosure statement

The author declares no conflict of interest.

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