

To Explore the Effect of Flexible Ureteroscope Holmium Laser Lithotripsy and Percutaneous Nephrolithotomy in the Treatment of Patients with Kidney Stones

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Abstract: *Objective:* To observe the effect of flexible ureteroscopic holmium laser lithotripsy and percutaneous nephrolithotomy in the treatment of patients with kidney stones. *Methods:* 62 patients with kidney stones in our hospital (from August 2023 to October 2024) were randomly divided into an observation group (31 cases) treated with flexible ureteroscope holmium laser lithotripsy and a control group (31 cases) treated with percutaneous nephrolithotomy. Observe surgery-related indicators, stone clearance rate, stress indicators, complication rate and quality of life. *Results:* Compared with the control group, the observation group had better surgery-related indicators, higher stone clearance rate, lower levels of stress indicators, lower incidence of complications, and higher quality of life score, $p < 0.05$. *Conclusion:* Flexible ureteroscopy holmium laser lithotripsy can achieve better surgical results in patients with kidney stones, improve stone clearance rate, reduce stress response, reduce the incidence of complications, and improve quality of life. It is superior to percutaneous nephrolithotomy and is worth learning from.

Keywords: Ureteroscopic flexible holmium laser lithotripsy; Percutaneous nephrolithotomy; Kidney stones; Effect

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1. Introduction

Kidney stones are a disease with a high incidence in urology. Analysis shows that there are also certain gender differences in the affected groups. Generally, there are more men than women, and the main victims are young and middle-aged men^[1]. After the disease occurs, patients will also have obvious symptoms, such as pain, hematuria, etc., but if the disease is in the early stages, the patient will not show other obvious discomfort characteristics. Kidney stones must be treated promptly and effectively, otherwise the progression of the disease will lead to further development of stones, eventually causing serious complications, such as infection, obstruction, etc., and even renal failure, which will have a greater impact on the patient's life safety^[2]. There are a variety of commonly used treatment methods to choose from in the treatment of this disease, such as flexible ureteroscope holmium laser lithotripsy and percutaneous nephrolithotomy.

The above two methods are minimally invasive and have been widely used in clinical practice. However, in-depth research is needed on the selection of specific surgical methods^[3]. This study selected 62 patients with kidney stones in our hospital to observe the clinical treatment effects of the above two surgical techniques.

2. Materials and methods

2.1. General information

62 patients with kidney stones in our hospital from August 2023 to October 2024 were selected and randomly divided into 2 groups. There were 31 patients in the control group, 19 males and 12 females, aged 33 to 68 (50.84 ± 2.38) years old, and 31 patients in the observation group, 20 males and 11 females, aged 32 to 67 (50.67 ± 2.62) years old. Comparison of general data, $p > 0.05$.

2.2. Method

2.2.1. Control group

Before the operation, the patient needs to undergo general anesthesia and maintain the bladder lithotomy position. The operator uses a ureteroscope to insert a ureteral catheter into the renal pelvis of the patient's affected side. After completing the above content, he assists the patient to adjust his position and maintain the prone position. He uses ultrasound to observe the stone situation in detail and accurately locates the puncture point to establish a percutaneous renal channel. After that, an incision needs to be made at the intersection of the posterior axillary line and the edge of the twelve ribs, with a length of 1cm, and then a zebra guidewire is inserted, and the channel is expanded through a fascial dilator along the direction of the guidewire. Then the percutaneous nephroscopic sheath is inserted, and the scope core is inserted. After the stone location is clear, the zebra guidewire is withdrawn, and the lithotripsy operation is carried out using an ultrasonic lithotripter. During this process, the stones need to be effectively flushed out with lavage fluid to ensure that there is no bleeding or residual stones in the patient. Then the double J catheter is placed, the mirror core is withdrawn, and the nephrostomy tube is left in place and sutured and fixed.

2.2.2. Observation group

Patients underwent routine cystoscopy before surgery, and the ureteral F5 double J tube was placed in the renal pelvis of the affected side. General anesthesia was performed, tracheal intubation was performed, and surgical treatment was performed in the stone position. A rigid ureteroscope is inserted through the urethra. During this period, pay attention to withdrawing the already placed F5 double-J tube. After clarifying the position of the ureteral opening, insert the ureteral catheter and zebra guidewire accurately. Afterwards, a flexible ureteroscope sheath is inserted into the ureter and reaches the renal pelvis. A flexible ureteroscope is inserted along the ureteric sheath to carefully explore the location of the stone, and then the zebra guidewire is withdrawn. After completing the above operations, insert the 200mm holmium laser fiber and carry out the lithotripsy operation. After the lithotripsy is completed, the optical fiber is taken out, and then the zebra guidewire is inserted again, and the flexible ureteroscope and the flexible sheath are withdrawn. Finally, direct vision is observed through the rigid ureteroscope, and the ureteral stent is inserted along the guidewire.

2.3. Observation indicators

Surgery-related indicators: operation time, intraoperative blood loss, hemoglobin reduction index, hospitalization time; stone clearance rate; stress indicators; complication rate; quality of life: Brief Health Scale (SF-36).

2.4. Statistical methods

SPSS26.0 software statistical data, measurement data expressed: ($\bar{x} \pm s$), t test, count data expressed: n,%, χ^2 test, $p < 0.05$, the difference is statistically significant.

3. Results

3.1. Comparison of surgery-related indicators

The observation group was better than the control group, $p < 0.05$, **Table 1**.

Table 1. Comparison of surgery-related indicators

Group	Operation time (min)	Intraoperative blood loss (mL)	Hemoglobin lowering index (g/L)	Length of stay (d)
Control group (n = 31)	108.27 ± 4.28	76.32 ± 9.72	12.28 ± 1.27	5.49 ± 0.63
Observation group (n = 31)	82.37 ± 2.37	26.38 ± 5.48	0.57 ± 0.10	3.49 ± 0.12
<i>t</i>	29.475	24.919	51.179	17.363
<i>p</i>	0.000	0.000	0.000	0.000

3.2. Comparison of stone clearance rates

The observation group was higher than the control group, $p < 0.05$, **Table 2**.

Table 2. Comparison of stone clearance rates

Group	Stone removal(n)	Stone clearance rate (%)
Control group (n = 31)	29	93.55
Observation group (n = 31)	23	74.19
χ^2	-	4.292
<i>p</i>	-	0.038

3.3. Comparison of stress indicators

Three days after surgery, the observation group was lower than the control group, $p < 0.05$, **Table 3**.

Table 3. Comparison of stress indicators

Group	NE (pg/mL)		Cor (mmol/L)	
	Before surgery	3 days after surgery	Before surgery	3 days after surgery
Control group (n = 31)	202.38 ± 18.26	251.28 ± 20.37	94.58 ± 8.72	162.38 ± 12.34
Observation group (n = 31)	203.48 ± 17.64	302.58 ± 30.45	94.42 ± 7.65	121.48 ± 10.42
<i>t</i>	0.241	7.796	0.077	14.100
<i>p</i>	0.810	0.000	0.939	0.000

3.4. Comparison of complication rates

The observation group was lower than the control group, $p < 0.05$, **Table 4**.

Table 4. Comparison of complication rates (n%)

Group	Hematuria	Ureteral injury	Infection	Total
Control group (n = 31)	1 (3.23)	2 (6.45)	1 (3.23)	4 (12.90)
Observation group (n = 31)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.0)
χ^2	-	-	-	4.276
<i>p</i>	-	-	-	0.039

3.5. Quality of life comparison

The observation group was higher than the control group, $p < 0.05$, **Table 5**.

Table 5. Comparison of quality of life (point)

Group	General health	Emotional function	Somatic pain	Energy	Physiological function	Physiological function	Mental health	Social function
Control group (n = 31)	72.87 ± 2.56	73.84 ± 2.85	71.93 ± 3.74	73.94 ± 2.56	74.82 ± 2.94	72.93 ± 2.84	74.82 ± 2.83	73.72 ± 2.84
Observation group (n = 31)	76.95 ± 3.86	78.65 ± 2.69	77.84 ± 3.96	78.96 ± 2.84	77.95 ± 2.58	78.55 ± 2.96	79.97 ± 2.95	77.59 ± 2.86
<i>t</i>	4.905	6.834	6.041	7.310	4.455	7.628	7.014	5.346
<i>p</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

4. Discussion

Kidney stones are a urinary system disease with a very high clinical incidence, and the symptoms shown by patients in the early stages of the disease are not obvious, so the disease is difficult to detect in the early stage. As the disease continues to develop, the patient's body will also show various symptoms of discomfort, among which pain is the most common, and its degree will also vary from person to person. Some patients may only have a slight dull pain, while some patients will show severe colic. If the patient's condition continues to deteriorate and is not effectively controlled, it will cause serious complications and endanger life safety^[4]. In the treatment of kidney stones, traditional open lithotomy was a commonly used treatment method in the past. However, during practical application, it was found that the trauma caused by surgical treatment is large, which will significantly affect the patient's kidneys and surrounding tissues, and prolong the postoperative recovery time^[5]. Therefore, traditional open lithotomy is rarely used in clinical practice at this stage. In recent years, kidney stone treatment technology has made great progress, further reducing the impact of surgical treatment on patients, and different surgical methods also reflect corresponding characteristics and advantages^[6]. Currently, the clinical treatment of kidney stones is more inclined to flexible ureteroscopic holmium laser lithotripsy and percutaneous nephrolithotomy. The above two methods are more advanced and less invasive. However, there are certain differences in the effects of different surgical techniques. In-depth research is needed on this content to provide basis and reference for the selection of specific surgical techniques.

In the treatment of patients with kidney stones, percutaneous nephrolithotomy is widely used. It mainly establishes a percutaneous renal channel in the patient's waist for lithotripsy. This treatment method can directly reach the patient's kidneys and effectively treat larger kidney stones, with high lithotripsy efficiency. However, during the treatment process, this surgery needs to establish a channel on the body surface. In this case, it will cause certain trauma to the patient's body and may leave scars after the operation. In addition, the kidney needs to be punctured during the surgical treatment, which

also involves a certain risk of bleeding. In severe cases, it will have a greater impact on the patient's renal function. Patients who undergo percutaneous nephrolithotomy have a relatively slow recovery rate and require long-term bed rest, which will further prolong the hospital stay. In this case, the risk of some complications will increase ^[7]. Flexible ureteroscopy holmium laser lithotripsy has also attracted widespread attention. This treatment method mainly uses the flexible bending characteristics of the ureteroscopy to successfully reach the renal pelvis and each renal calyces, thereby accurately positioning the stones, and has good practicability in the more hidden and complex kidney stones. Holmium laser fiber can accurately touch the stones, generate strong energy in a short time, and crush the stones into fine particles, which is more conducive to the discharge of stones ^[8]. Flexible ureteroscopy holmium laser lithotripsy is performed through the natural orifice and does not require additional incisions on the patient's body surface, which further reduces the trauma to the patient's body, reduces the risk of postoperative complications, speeds up postoperative recovery, and encourages patients to return to normal life and work more quickly. Moreover, this surgical procedure causes almost no damage to the patient's kidneys and surrounding tissues, and has a significant protective effect on renal function. Therefore, this surgical procedure is more suitable for patients with higher renal function protection requirements. Based on the analysis of the results of this study, it is believed that compared with percutaneous nephrolithotomy, flexible ureteroscopy holmium laser lithotripsy has better results and has outstanding clinical application advantages ^[9]. Analyzed from the perspective of trauma, this surgery can minimize the trauma to the patient's overall body, better preserve the patient's physical integrity, and reduce the risk of postoperative complications. Patients do not need to worry too much about prolonged hospitalization due to complications, further reducing their psychological burden. Percutaneous nephrolithotomy requires an incision on the patient's body surface. This operation will cause greater trauma to the patient, affect the appearance of the body, and increase the risk of bleeding during the operation. When the amount of bleeding is large, it will increase the difficulty of surgical treatment and even further damage the patient's body ^[10]. In terms of postoperative recovery, flexible ureteroscopic holmium laser lithotripsy also shows more obvious advantages. Patients recover faster after surgery, and various body functions can return to normal levels in a short time, further reducing hospitalization time and returning to normal life and work. During percutaneous nephrolithotomy, due to the impact of trauma, the patient's postoperative recovery is relatively slow and requires a long period of rest and recovery. In this case, the hospitalization time will be further prolonged.

Therefore, in the treatment of patients with kidney stones, compared with percutaneous nephrolithotomy, flexible ureteroscopy holmium laser lithotripsy has a significant overall efficacy, which is mainly reflected in the significant surgical effect, improving the stone clearance rate, reducing stress reactions, reducing complications, promoting improvement in quality of life, and has promotion value.

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Disclosure statement

The author declares no conflict of interest.

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