

Comparative Study of Minimally Invasive Treatment of Ureteral Calculi in People's Armed Police Officers and Soldiers

Jianfeng Huang, Tao Wang, Haosheng Chang, Qianhui Wang, Yong Nie*

Beijing People's Armed Police Corps Hospital, Beijing, China.

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***Corresponding author:** Yong Nie, Beijing People's Armed Police Corps Hospital, Beijing, China.

Abstract

Objective: To observe and analyze the effect of minimally invasive treatment of ureteral calculi in People's Armed Police officers and soldiers. **Methods:** 76 People's Armed Police officers and soldiers with ureteral calculi admitted to our hospital from December 2021 to October 2023 were randomly divided into the holmium laser group treated with transurethral ureteral soft ureteroscopic holmium laser lithotripsy and the conventional pneumatic ballistic lithotripsy group treated with ureteroscopic pneumatic ballistic lithotripsy, with 38 cases each. The conditions of stone removal and discharge in the two groups were observed, and postoperative rehabilitation and pain were monitored, and the risk of complications in the two groups was analyzed. **Results:** The one-time lithotomy success rate (97.37%, 37/38) and postoperative stone removal rate (97.37%, 37/38) in the holmium laser group were significantly higher than those in barometric ballistics group (81.58%, 31/38). 78.95%, 30/38) ($P < 0.05$). The operative time (49.48 ± 10.68 min), the duration of postoperative visible hematuria (14.52 ± 1.68 h) and the indwelling time of double J tube (3.98 ± 0.78 d) in holmium laser group were significantly lower than those in pneumatic ballistic group (58.52 ± 8.63 min, 18.23 ± 1.92 h, 8.13 ± 1.03 d) ($P < 0.05$). The incidence of postoperative complications and VAS score in the holmium laser group were significantly lower than those in the barometric ballistics group ($P < 0.05$). **Conclusion:** The clinical efficacy of this study in the treatment of ureteral calculi in People's Armed Police officers and soldiers is reliable, the advantages of minimally invasive surgery are further improved, the postoperative pain is less, the risk of complications is lower, and the postoperative rehabilitation speed is accelerated, which is helpful for People's Armed Police officers and soldiers to recover as soon as possible and resume normal training and work.

Keywords

Minimally invasive, People's Armed Police officers and soldiers, Special groups, Ureteral calculi, Complications, Double J-tube

Ureteral calculi is a common type of calculi in urinary system diseases with a high incidence. Its main disease is caused by the kidney stone discharge process staying in the ureter, causing ureteral obstruction. The clinical symptoms of patients are mainly abdominal pain, requiring early intervention and treatment. Surgery is the most effective way to treat ureteral calculi, and traditional open surgery is more traumatic, so the clinical field has actively explored minimally invasive treatment technology, and through ureteroscopic lithotripsy technology, the effects of lithotripsy,

stone extraction, and stone discharge can be achieved, effectively reducing the trauma of ureteral calculi treatment. At present, the two groups of treatment methods have more clinical applications, compared with the traditional operation, both of them are significantly reduced in trauma, but their clinical advantages and therapeutic effects in the application of ureterolithiasis in the special group of People's Armed Police officers and soldiers are still unclear [1]. Therefore, this study selected 78 cases of ureteral calculi treated by People's Armed Police officers and soldiers in our hospital from December 2021 to October 2023, compared and analyzed the efficacy and safety of different minimally invasive surgery methods in the treatment of ureteral calculi among People's Armed Police officers and soldiers, and summarized its application value, as reported below.

1. Data and methods

1.1 General Information

76 People's Armed Police officers and soldiers with ureteral calculi admitted to our hospital were randomly divided into a pneumatic ballistic routine group and a holmium laser experimental group, 38 cases each. Holmium laser treatment group: 2 females and 36 males, aged 19-40 years; The diameter of the stone was 1.0-2.0cm, with an average of (1.42±0.39) cm. Stone location: middle and lower segment in 34 cases; 4 other cases. Pneumatic ballistics routine group: 2 females and 36 males, aged 21-45 years; The diameter of the stones was 1.0-1.9 cm, with an average of (1.40±0.36) cm. Stone location: middle and lower segment in 35 cases; 3 other cases. There was no significant difference in general data between the two groups ($p > 0.05$) [1].

1.2 Inclusion and exclusion criteria

Inclusion criteria: preoperative imaging examination (CT/plain urography) and intraoperative exploration confirmed ureteral calculi (unilateral); Before admission, routine examination and preoperative preparation were improved by the three-level health diagnosis and treatment system of the Armed police Force. Arrange surgery upon admission; Age ≥ 18 years old; End diameter 1~2cm; Patients with no contraindications to surgery; Informed consent forms are signed by patients and their families. Exclusion criteria: ureteral malformation; Patients with other urinary system diseases before operation; Patients with acute and chronic infectious diseases; Patients with other stones; Abnormal coagulation function; Poor blood pressure control, etc.

1.3 Methods

Holmium laser transurethral ureteral soft lens holmium laser lithotripsy treatment: F6.5 Olympus rigid ureteroscope with ultra-fine fiber can reduce ureteral injury, while pneumatic trajectory can not use fine mirror, and the operation of ureteral damage is greater; After combined lumbar and epidural anesthesia, the bladder lithotomy position was taken, the ureteroscope entered the bladder along the urinary tube, the ureteral catheter was placed at the ureteral opening, and suitable energy lithotripsy was selected according to the calculi condition. The exploration of upper urinary tract stones requires confirmation of the ureteral opening on the affected side, the placement of ureteroscopy through the ureter under the guidance of a guide wire, and the exploration of local ureteropyeloureteral stones up the pyeloureter. After the exploration of various stones, the guide wire is indwelled and the mirror is removed. The soft lens sheath was placed under the guidance of the guide wire, and then the ureteral soft lens was sent to the renal pelvis, and holmium laser fiber was placed. The laser energy and frequency were adjusted according to the stone size, and the stone (diameter < 3 mm) was cut and crushed by Chin laser. The coordinated application of lithotomy forceps and net basket was used to remove large gravel, and after checking the ureteral mucosal injury, the F4-5 double J tube was indorsed.

Pneumatic ballistic lithotripsy under ureteroscope under pneumatic ballistic routine group: the location of calculi was determined according to imaging examination, the appropriate anesthesia method and body position, and the ureteroscopic placement method were the same as those in the holmium laser group (fine mirror could not be used for pneumatic ballistic). A guide wire was inserted into the ureteral opening on the affected side to probe the calculi condition, ensure a clear surgical field, and implement a lithotripsy program. Pressure perfusion was continued to irrigate the operative area and the local area of the opera.

1.4 Observation Indicators

1.4.1 Surgical results

Success criteria for one-time stone removal: CT review 3d after surgery, if the stone is completely passed or the residual stone is small (diameter ≤ 3 mm). Postoperative stone removal criteria: CT review 2 weeks after surgery, if the stone is completely discharged, no residual. The success rate of one-time stone removal and postoperative stone removal rate of the two groups were compared [2].

1.4.2 Intraoperative and postoperative index monitoring

The operation time of the two groups was recorded, and the duration of postoperative visible hematuria and indwelling time of double J tubes in the two groups were monitored, and the differences in various indicators between the two groups were compared [3].

1.4.3 Postoperative pain evaluation

The postoperative pain of the two groups was evaluated using the VAS visual analogue pain scale (VAS, 0~10 points), and the pain of the patients at 4h, 8h, 24h, and 36h after surgery was recorded, and the mean difference between the two groups was compared [4].

1.4.4 Monitoring of postoperative complications

Complications such as fever, bleeding, ureteral perforation/stenosis, and urinary tract infection were monitored and compared between the two groups.

1.5 Statistical Methods

SPSS20.0 statistical software was used to analyze all the data. The measurement data were represented by mean \pm standard deviation ($\pm s$) and a T-test was used. The statistical data were represented by (% , n) and χ^2 test was used. $P < 0.05$ was considered to be statistically significant.

2. Results

2.1 Comparison of stone removal and drainage effects between the two groups

The success rate of one-time stone removal and postoperative stone removal rate in the experimental group were significantly higher than those in the conventional group ($P < 0.05$) (see Table 1).

Table 1. Comparison of treatment effect between the two groups (n, %)

group	n	Success rate of one-time lithotomy	Postoperative stone removal rate
Holmium laser set	38	97.37(37/38)	97.37(37/38)
baroballistics	38	81.58(31/38)	78.95(30/38)
χ^2	—	4.823	5.023
P	—	0.019	0.016

2.2 Comparison of intraoperative and postoperative observation indexes

Table 2. Comparison of intraoperative and postoperative observation indexes ($\bar{x} \pm s$)

Observation index	Holmium laser set	baroballistics	t	P
Operation time(min)	49.48 \pm 10.68	58.52 \pm 8.63	6.325	0.015
Postoperative duration of hematuria was visible to the naked eye	14.52 \pm 1.68	18.23 \pm 1.92	5.129	0.013
Double J-tube indwelling time(d)	3.98 \pm 0.78	8.13 \pm 1.03	4.413	0.020

2.3 Postoperative pain evaluation of the two groups

The VAS score of the experimental group was significantly lower than that of the conventional group ($P < 0.05$) (see Table 3).

Table 3. Comparison of postoperative VAS scores between the two groups ($\bar{x}\pm s$)

group	6 hours after surgery	12 hours after surgery	24hours after surgery	48hours after surgery
Holmium laser set	3.82±1.12	4.25±1.02	3.75±0.85	3.02±0.92
baroballistics	3.91±1.68	5.69±1.57	5.70±1.63	4.85±1.12
T	5.185	6.742	4.859	4.225
P	0.011	0.013	0.020	0.021

2.4 Comparison of complications

The incidence of postoperative complications in the holmium laser group (2.63%, 1/38) was significantly lower than that in the barometric ballistics group (23.68%, 9/38) ($P<0.05$) (see Table 4).

Table 4. Statistics of postoperative complications (n, %)

Group	Holmium laser set	Baroballistics	χ^2	P
Ureteral stenosis	0	5.13(2)	0.162	0.763
Urinary exosmosis	0	2.56(1)	0.136	0.816
Ureteral mucosal avulsion	0	5.13(2)	0.162	0.795
Hemorrhage	2.63(1)	2.56(1)	0.112	0.816
Fever	0	2.56(1)	0.136	0.816
Urinary tract infection	0	5.13(2)	0.162	0.763
Complication rate (%)	2.63(1/38)	23.68(9/38)	5.069	0.019

3. Discussion

Ureteral calculi is a common clinical type of calculi, and young people also have a high incidence, so it is necessary to actively improve its prevention and control level. Among People's Armed Police officers and soldiers, ureteral stones also have a relatively high incidence. This special group of patients is characterized by young patients, acute illness but short course of disease, early detection of stones, small stones in most cases, perfect physical examination system and medical system, timely detection, rapid surgical treatment, and good prognosis for patients [5]. In recent years, minimally invasive urology technology has developed rapidly, and endoscopes such as ureteroscopy have been gradually improved and widely used in urological diagnosis and treatment. Combined with holmium laser technology and pneumatic ballistic lithotripsy, ureteral calculi can be effectively detected and lithotripsy can be completed. It should be combined with the clinical application experience of minimally invasive urological endoscopic technology and lithotriptic technology in the treatment of ureteral calculi, and according to the clinical characteristics of ureteral calculi among People's Armed Police officers and soldiers, scientific and rational use of the three-level health diagnosis and treatment system of armed police force should be carried out to carry out technological innovation and treatment process improvement, so as to promote the People's Armed Police officers and soldiers with calculi to recover better and faster from surgery. And put into normal work or even high-intensity military training as soon as possible [6].

Although there are many clinical applications of pneumatic lithotripsy via ureteroscopy, the ureteral lining is damaged to a certain extent during the process of ballistic lithotripsy, and some stone fragments are easy to return to the kidney, which increases the difficulty of stone cleaning, and the therapeutic effect needs to be improved. Holmium laser technology is a pulsed laser. After acting on ureteral stones, the energy-water that can be formed instantaneously vaporizes to form air bubbles and then shatters stones, which can break stones into tiny fragments to form a powder state. The fragments have less damage to ureteral mucosa and are not easily returned to the kidney, which effectively enhances the difficulty of stone extraction and makes the stone discharge process smoother [7]. According to relevant literature reports, transurethral ureteral soft lens holmium laser lithotripsy can obtain a better stone removal effect, with a one-off stone removal rate of up to 90% and a higher stone removal rate. Compared with pneumatic ballistic lithotripsy, the effect is significantly improved [8], because transurethral ureteral soft lens holmium laser lithotripsy can be used with a thinner ureteroscope, resulting in smaller volume after lithotripsy and

less damage to ureteral mucosa. The upper part of the stone is more difficult to be pushed back (pushed back) renal pelvis, etc., applied to such special groups as People's Armed Police officers and soldiers is more reasonable and scientific. Transurethral ureteral flexible holmium laser lithotripsy is safer, and the incidence of postoperative complications in the holmium laser group is significantly lower than that in the pneumatic ballistics routine group, further confirming the low injury rate of minimally invasive treatment technology based on holmium laser lithotripsy. In addition, the experimental group can flexibly deal with stone extraction methods, forming the characteristic experience of military hospital surgery: for hard stones, easy-to-crush stones, and cases with large ureteral cavity and ureteral opening, in order to reduce the damage to the ureter, the method of stone splitting and segmentation with stone extraction forceps can be personalized, and a variety of stone crushing methods can also be combined. Holmium laser lithotripsy can effectively reduce the operation time, can reduce the laser damage to ureteral tissue, the application of double J tube with line after surgery, the indwelling time can be shortened to 3~7d, postoperative trauma is small, physical recovery is fast, postoperative patients can quickly recover gastrointestinal function, help to improve the rehabilitation effect of People's Armed Police officers and soldiers. It is necessary to pay attention to the selection, thickness and time of removing the double "J" tubes after surgery. The double "J" tubes with a line at the end can be used for direct removal without the assistance of cystoscopy. At the same time, the tubes can be removed 3-5 days after surgery for patients with satisfactory lithotripsy effect and no obvious bleeding, infection and other complications.

In addition, relying on the three-level medical system of the army, the hospital treatment time of patients can be greatly shortened. Before admission, the health team and the health office can complete the preoperative routine examination of blood, urine and stool, liver and kidney function, and electrocardiogram, so as to ensure the minimally invasive operation of ureteroscopic lithotripsy within 2-4 hours after admission and 24-48 hours after the operation. In the absence of obvious signs of bleeding and infection, they can be referred back to the health team for observation, give full play to the role and advantages of the primary medical system, and fully improve the limited medical resources of the central hospital. In addition, it is necessary to pay attention to the implementation of active follow-up and drug treatment after discharge, and closely cooperate with grass-roots medical staff, which can again shorten the recovery time of the disease, and greatly reduce the recovery time of high-intensity military training for recovered officers and soldiers.

4. Conclusion

In summary, the holmium laser treatment of ureteral calculi in People's Armed Police officers and soldiers has reliable clinical efficacy, the advantages of minimally invasive surgery are further improved, the postoperative pain is less, the risk of complications is lower, and the postoperative rehabilitation speed is accelerated, which is conducive to the People's Armed Police officers and soldiers to recover as soon as possible and resume normal training and work.

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