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Comparison between nephroscopy and ureteroscopy for the treatment of concurrent infection of ureteral calculi.

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Abstract

Objective: To compare the effects of calculus removal through nephroscopy and holmium laser calculus removal through ureteroscopy on patients with concurrent urinary infection at one side of their upper ureteral calculi.

Method: A total of 160 patients admitted to our hospital because of concurrent urinary infection at one side of their upper ureteral calculi were selected from March 2014 to February 2016 and randomly divided into two groups: the control group comprised 80 cases treated with holmium laser calculus removal through ureteroscopy and the observation group included 80 cases subjected to calculus removal through nephroscopy. The clinical effects on renal functions and their indexes were compared.

Results: The calculus clearance rate of the observation group was 96.3%, which was higher than that (85.0%) of the control group. The Cr, BUN, and Cys-C levels of the patients in the observation group were significantly higher than those in the control group (P<0.05). Before treatment was administered, the differences in IPSS, MFR, and QOL scores between the two groups were not significant (P>0.05). After the patients were treated, the IPSS and QOL scores in the observation group were significantly lower than those in the control group (P<0.05) and the MFR score in the observation group was significantly higher than that in the control group (P<0.05). The occurrence rate of postoperative complications in the observation group was 5.0%, which was significantly lower than that (16.2%) in the control group (P<0.05).

Conclusion: Calculus removal through nephroscopy for patients with concurrent urinary infection at one side of their upper ureteral calculi was superior to holmium laser calculus removal through ureteroscopy. The former could also radically eliminate calculi and reduce postoperative complications. Therefore, calculus removal through nephroscopy should be further promoted.

Keywords: Upper ureteral calculi, Urinary infection, Calculus removal through nephroscopy.

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Introduction

Upper ureteral calculi with concurrent urinary infection are commonly detected in the urinary system [1]. Urinary tract obstruction increases intrapelvic pressure in patients and consequently promotes the entry of bacteria into blood during backflow to induce septicopyemia, which is possibly concurrent during and after operation [2]. As such, an appropriate therapeutic schedule should be prepared to improve the calculus clearance rate and reduce serious complications [3]. In this study, 160 patients were selected, and a grouping comparison form was used to examine the therapeutic effects of calculus removal under nephroscopy and holmium laser calculus removal under ureteroscopy and to provide a reference for clinical applications.

Data and Method

General data

A total of 160 patients admitted in our hospital for concurrent urinary infection at one side of the upper ureteral calculi were selected from March 2014 to February 2016 and used as research objects. These patients were randomly divided into two groups: 80 cases in the control group included 54 males (67.5%) and 26 females (32.5%) with ages ranging from 35-70 years (average age of 57.6 ± 2.8 years) and 80 patients in the observation group possessed calculi at one side of the upper ureter. The data of the patients in the two groups in terms of gender, age, and calculus position did not evidently differ (P>0.05).

Inclusion and exclusion criteria

Inclusion criterion: Definite diagnoses were performed on patients through abdominal X-ray examination in accordance with the Chinese Guidelines on Diagnosis and Treatment of Urological Surgical Diseases.

Exclusion criterion: Patients with psychiatric history and patients with coagulation disorders were excluded.

Therapeutic method

Observation group: The patients in the observation group were subjected to microchannel perctaneous nephrolithotomy. The patients were initially instructed to lie in lithotomy positions, and the combined anesthesia through tracheal intubation was carried out. A 5F ureteral catheter was then placed below the calculi on the affected side of the ureter. The patients were subsequently asked to lie in a prone position after hydronephrosis was completed. The position of the puncturing kidney calices was confirmed through B-ultrasound, and a puncture was made on 11 ribs and expanded to 18F after the target kidney calices were penetrated. Afterward, a microscope was placed on the upper segments of the pelvis and the ureter to observe the calculi, which were in turn crushed by using an ultrasound-assisted pneumatic ballistic system and expelled from the body one by one. A two-stage operation was facilitated on the basis of the operation status of a patient. After the operation was accomplished, the double j catheter and the nephrostomy tube were retained, and a conventional anti-infective treatment was administered.

Control group: The patients in the control group were subjected to holmium laser calculus removal through ureteroscopy. Lithotomy positions were confirmed, and epidural anesthesia was administered. The ureteroscope was placed below the calculi to observe their positions and quantity. A holmium laser fiber was also placed, laser frequency was adjusted to 20 Hz, energy was set to 1.0 J, and the calculi were crushed and removed with lithotomy forceps. The double J catheter was retained after operation, and conventional anti-infective therapy was provided.

Observation indexes

Three days after operation, blood samples were collected from the patients, and serum creatinine (Cr), blood urea nitrogen (BUN), and serum cystatin C (Cys-C) were detected by using a fully automatic biochemical analyzer. IPSS, MFR, and QOL scores were determined before and after operation. One month after operation, an plain abdominal X-ray film was reexamined to observe the calculus clearance effect, and no residue of the calculi or residual calculi with diameters within 4 mm were considered as clearance criteria. Complications represented by septicopyemia and fever after operation were observed and accurately recorded.

Statistical analysis

Data were statistically analyzed with SPSS18.0. Measured data were expressed as $\overline{x} \pm S$ through a t test. Calculated data were expressed as percentages through a chi-square test. $P<0.05$ indicated significant differences between the groups.

Results

Comparison of clinical effects

The results indicated that the calculus clearance rate of the patients in the observation group was significantly higher than that in the control group ($P<0.05$; Table 1).

Table 1. *Comparison of calculus clearance rates of patients in the two groups (n, %).*

Group	Number of cases	First calculus removal	Second calculus removal	Not cleared	Clearance rate
Observation group	80	62	15	3	77 (96.3)
Control group	80	55	13	12	68 (85.0)
χ^2					5.958
P					0.015

Comparison of renal function indexes

After the treatment was administered, the Cr, BUN, and Cys-C indexes of the patients in the observation group were significantly lower than those in the control group ($P<0.05$; Table 2).

Table 2. *Comparison of Renal Function Indexes of Patients in the Two Groups after Treatment ($x \pm S$).*

Group	Number of cases	Cr (μmol/L)	BUN (mmol/L)	Cys-C (μg/L)
Observation group	80	67.2 ± 5.4	4.8 ± 1.6	765.8 ± 74.6
Control group	80	69.5 ± 7.1	5.5 ± 1.9	790.4 ± 62.0
t		2.306	2.520	2.2681
P		0.022	0.013	0.025

Comparison of IPSS, MFR, and QOL scores before and after operation

Before treatment was administered, the IPSS, MFR, and QOL scores of the patients in the two groups did not significantly differ ($P>0.05$). After treatment was given, the IPSS and QOL of the patients in the observation group were significantly lower than those in the control group ($P<0.05$), and the MFR

score of the patients in the observation group was significantly higher than that in the control group (P<0.05; Table 3).

Table 3. Comparison of IPSS, MFR, and QOL Scores of Patients in the Two Groups before and after Operation (x ± S, scores).

Group	IPSS score		MFR		QOL score	
	Before operation	After operation	Before operation	After operation	Before operation	After operation
Observation group (80)	29.77 ± 4.28	9.42 ± 3.73	5.81 ± 2.76	14.07 ± 3.27	4.62 ± 1.93	1.92 ± 0.82
Control group (80)	29.14 ± 4.05	13.71 ± 3.36	5.88 ± 2.94	11.96 ± 3.13	4.71 ± 1.88	2.67 ± 1.01
t	0.668	7.124	0.108	2.911	0.208	3.600
P	0.506	0.000	0.914	0.005	0.835	0.001

Comparison of postoperative complications

Of the total number of patients, 1 suffered from septicopyemia and 3 experienced fever in the observation group after they underwent the operation, and their total occurrence rate was 5.0%. In the control group, 5 cases manifested septicopyemia and 8 exhibited fever after their operation was completed, and their total occurrence rate was 16.2%. These postoperative complications significantly differed between the groups (χ^2=5.331, P=0.021).

Discussion

The complications of ureteral calculi and kidney calculi were similar. For example, the characteristics of ureteral colic caused by calculi in the middle and upper ureteral segments were lumbago on one side and microscopic hematuria [4]. Pain was associated with angina and could radiate toward the hypogastric region on the same side, testis, or labia. Hematuresis was slight, and most patients only manifested microscopic hematuria. After the patients experienced pain, hematuresis was aggravated, and approximately half of these patients suffered from gross hematuria [5]. Under angina, it could be concurrent with other symptoms, such as nausea and vomiting, cold sweat, pale complexion, abdominal distension, and polypnea. The calculi at the ureterovesical junction could cause frequent micturition, urgent urination, odynuria and ipsilateral hydronephrosis, and infection [6]. Bilateral ureteral calculi could cause anuria. In the case of hydronephrosis and infection, the kidneys might experience pressing pain during physical examination. Sporadically, the pressing pain occurred along the running position of the ureter, and the lower ureteral calculi might be touched through the rectum or vagina [7]. Research on the upper ureteral calculi has indicated that patients manifest urinary tract obstruction because urine retention possibly increases intrapelvic pressure and then facilitates bacterial proliferation in a large quantity [8]. Bacteria likely enter the circulatory system through backflow and consequently cause cellular ischemia, anoxia, and metabolic dysfunction [9]. Normal renal functions are also affected, and septicopyemia may be induced easily during and after operation. As such, the Vrisks of death among patients are possibly increased. Therefore, clinical treatments should timely scavenge urinary calculi to alleviate these symptoms and maintain an unobstructed urinary tract when anti-infection agents are administered [10].

In this research, 160 cases were grouped and compared, and percutaneous nephrolithotripsy and holmium laser calculus removal through ureteroscopy were used, although these procedures were under minimally invasive surgery category. The results indicated that the calculus clearance rate of percutaneous nephrolithotripsy was 96.3%, which was higher than that of holmium laser calculus removal through ureteroscopy (85.0%). The Cr, BUN, and Cys-C indexes of the patients after operation were evidently improved. Before treatment, the IPSS, MFR, and QOL scores of the patients in the two groups have no significant differences (P>0.05). After treatment, the IPSS and QOL of the patients in the observation group were significantly lower than those in the control group (P<0.05), and the MFR score was significantly higher than that in the control group (P<0.05). The advantages of percutaneous nephrolithotripsy were based on the following: waist incision was within 1 cm, and this parameter ensured esthetic property and did not affect normal labor force after operation; blood vessels were abundant in the kidneys, percutaneous nephrolithotripsy slightly influenced the kidney and its surrounding tissues, and this procedure could reduce bleeding quantity and effectively protect the kidney. Patients undergoing percutaneous nephrolithotripsy exhibited a low probability of suffering from septicopyemia and fever after operation because percutaneous renal puncture drainage contributed to anti-infective therapy, could reduce toxin diffusion when the calculi were crushed period, and could avoid the aggravation of urinary infection. High-pressure lavage likely increases pressure in the pelvis and kidney calices and consequently provide favorable conditions for bacterial diffusion. Percutaneous nephrolithotripsy was a simple operation that yielded low bleeding quantity, and high-pressure lavage could be avoided or reduced. As a result, the occurrence risks of complications were decreased and kidneys were protected. The standard channel surgery and two-stage minimally invasive surgery through nephroscopy elicited favorable effects with calculus clearance rates of 85.71% and 91.43%, respectively. These results indicated that physicians should continuously improve surgical operation techniques. For patients with these indications, two-stage minimally invasive surgery could be adopted.

Conclusion

The effects of percutaneous nephrolithotripsy on patients with concurrent urinary infection at one side of the upper ureteral calculi were more significant than those of holmium laser calculus removal through ureteroscopy. Thus, the former should be promoted for the treatment of this condition.

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