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Comparison of Clinical Effects of Percutaneous Nephrolithotomy and Ureteroscopic Holmium Laser Lithotripsy for Renal Calculi

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Abstract: *In this study, 114 cases of upper urinary calculi were retrospectively analyzed to compare the efficacy of microchannel percutaneous nephrolithotripsy (MPCNL) and flexible ureteroscopic lithotripsy (URHL) for the treatment of renal calculi, and to analyze the efficacy and complications of the two surgical methods, so as to provide a more suitable scheme for the selection of surgical methods for upper urinary calculi. Microchannel percutaneous nephrolithotripsy and flexible ureteroscopic lithotripsy were divided into two groups with 57 cases in each group. There was no significant difference in stone clearance rate between MPCNL group and URHL group. Supine MPCNL group USES the oblique cut stone, relative to the prone position and other positions, patients are more likely to tolerate, 14 f ~ 16 f the microchannel renal tissue injury and reduce bleeding risk reduction, intraoperative for complexity or MPCNL for Angle is too small to deal with a difficult calculi can adopt double mirror combination therapy, made clear the effect of the stone, but because of indwelling renal fistula, postoperative hospital stay longer. The URHL group was more inclined to minimally invasive treatment. It was difficult to lithotripsy for hard stones, and the operation time was relatively long, so the risk of infection was increased. However, patients recovered quickly, the length of hospital stay was short, and the duration of ureteral stent implantation was long. Preoperative surgery should be based on the patient's desire and the actual situation such as stone load to choose a more appropriate way of operation.*

Keywords: *Renal Calculus, Percutaneous Nephrolithotomy, Urethral Tube Holmium Laser Lithotripsy, Clinical Comparison*

1. Introduction

Urological calculus is a common urinary system disease, with a global incidence of about 4%~15%. The incidence of urinary calculi is basically the same on both sides. The formation of urinary calculi is mainly caused by the abnormal aggregation of crystal substances such as oxalic acid, uric acid, cystine and citrate in the kidney, ureter and bladder. Currently, flexible ureteroscopic lithotripsy and percutaneous nephrolithotripsy have developed rapidly in recent years, making a breakthrough in the diagnosis and treatment of renal stones [1]. Soft ureter mirror the development of lithotripsy (FURL) on the treatment of urinary stones have new options, FURL the features make it flexible to head through ureters into the exploration of different renal calyx, the ends of their small injury, fewer complications, such as flexible characteristics make soft ureter mirror on kidney stones from the different light processing of all, its development is more and more quickly, the current in the treatment of urinary calculi was more and more attention.

Percutaneous nephrolithotripsy (PCNL) is an important part of urologic surgery by percutaneous puncture to the target renal pelvis under the guidance of ultrasound or X-ray and lithotripsy under endoscope. Hard ureteral lithotripsy is mainly used for the treatment of middle and lower ureteral calculi. For upper ureteral calculi, hard ureteral lithotripsy can be returned to the renal pelvis and calyceus due to the shift of calculi in the process of lithotripsy. However, hard ureteral lithotripsy cannot reach the renal pelvis and calyceus due to the special structure of the endoscope, so it cannot be further lithotripsy. Aguiar proposed 14F~16F dilated percutaneous renal channel for PCNL to further reduce the trauma of percutaneous nephrolithotomy, and the lithotripsis rate is comparable to that of traditional surgery, which plays an important role in the treatment of urinary calculi [2].

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This topic in the past two years to see a doctor in the hospital uropoiesis surgical department were retrospectively analyzed 114 patients with kidney stones, each line of microchannel percutaneous nephroscope lithotripsy (MPCNL) and soft ureter mirror lithotripsy (FURL), analysis of two groups of patients with operation time, complications and postoperative hospital stay, postoperative stone rate index, evaluation of MPCNL and FURL the clinical curative effect of two kinds of operation method, through the comparative study, in the treatment of urinary stones on the way to provide theoretical basis for the selection, before the operation planning and design, has the high clinical significance and value.

2. An Overview of Percutaneous Nephrolithotomy and Ureteroscopic Holmium Laser Lithotripsy

2.1 Percutaneous Nephrolithotomy

Percutaneous nephrolithotripsy (PCNL) is an important part of urologic surgery by percutaneous puncture to the target renal pelvis under the guidance of ultrasound or X-ray and lithotripsy under endoscope. The stoma of MPCNL is small, and the stones need to be broken into small pieces during the operation, and then the stones are flushed out from the percutaneous renal channel after high-pressure pulse water injection by perfusion pump. This improved minimally invasive percutaneous nephrolithotomy has been widely used in China [3]. Surgical position, the traditional PCNL position is prone position surgery, patients need to after anesthesia by supine pose for the prone position, this position kidney position relatively fixed, the more clearly on the anatomy, there are many defects, but also need to put the position after anesthesia and secondary sterilization draping, patients with prone position is more likely to cause discomfort, a series of changes is lowered, the body's blood dynamics change; The oblique supine lithotomy position can alleviate this problem and significantly increase the surgical tolerance of patients. Moreover, for complex upper urinary calculi, the oblique supine lithotomy position can reserve the treatment space for dual mirror combination, thus improving the treatment effect of complex urinary calculi [4].

In cases of this research USES the way of anesthesia for spinal canal anesthesia, surgical position for supine oblique cut stone, anesthesia experienced side shoulder and hip pad high 30 °, the waist dangling, basic straight parallel to the side of the lower limb in the weight from foot to foot, make the waist to the lower limb basic is a straight line, and close to the side of bed, fully show operation area, the contralateral lower limb comfortable place supporting foot rack. The main advantages of this kind of surgical position are: relatively high comfort, conducive to anesthesia monitoring, emergency rescue is more convenient, etc., for complex calculi can be performed simultaneously with dual mirror combined treatment.

The key to the success of PCNL is the direct puncture to the target calyces. Generally, intraoperative positioning and puncture are carried out with the help of B ultrasound, which is a relatively common intraoperative positioning method at present. It can clearly see the distance between the puncture point and the renal pelvis, and also guide the operator to grasp the puncture depth in the process of puncture. In addition, B-ultrasound can determine the degree of hydronephrosis and the location relationship of blood vessels and organs around the puncture channel, thus reducing the incidence of puncture complications [5]. During the process of puncture, the surgeon needs to closely monitor whether there is damage to the intestine or pleura. Although it is not common to cause damage to surrounding organs during the process of puncture, once it occurs, the consequences are serious. If the perirenal anatomical relationship cannot be distinguished, the organs with perirenal abnormality, such as hepatomegaly, splenomegaly, ectopic kidney and megacolon, are more likely to cause complications [6]. With the progress of science and technology and the development of a variety of minimally invasive instruments, the surgical indications of PCNL have become more and more extensive.

2.2 Ureteroscopy

Due to the special structure of the ureteroscope, it is difficult to reach the renal pelvis and calyces, so further lithotripsy cannot be achieved. Repeated endoscopic withdrawal during ureteral lithotripsy also increases the risk of ureteral wall injury.

At present, with the development of advanced equipment, different types of ureteroscope are available, bringing more options for minimally invasive treatment of ureteral calculi. For upper urinary calculi, especially large incarcerated calculi, ureteroscopy is relatively limited, especially after calculi

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are crushed, part of the calculi float to the kidney, and it is difficult for ureteroscopy to reach the renal pelvis and calyx for stone removal. The birth of flexible ureteroscope has solved this problem. Its soft, flexible end and less traumatic features can more easily reach the renal pelvis and calyces through the ureteral cavity [7-8]. For intraoperative calculus upward to the renal pelvis and calyces can be easy to capture rubble, stone hard ureter mirror compared advantage more obvious, and the need to set mirror when using soft ureter mirror scabbard, intraoperative can be repeatedly back mirror, relative to the hard lens reduces the ureter mucosa damage, its safety, minimally invasive, little pain, flexible etc, make its in the treatment of urinary stones on occupies an important position. Therefore, for patients with obesity or stone incarceration, ESWL is often unsatisfactory, while when hard ureteroscope treatment fails, FURL becomes an effective surgical option. In addition, compared with the inevitable complications of PCNL, such as bleeding and organ injury, FURL has also become a more minimally invasive surgical method. The application of flexible ureteroscope in the treatment of upper urinary calculi is not limited to the renal pelvis and calyx calculi within 2cm. At present, the definition and visual range of the new flexible ureteroscope developed by many pharmaceutical companies are significantly improved, which also greatly improves the safety of clinical diagnosis and treatment.

Soft ureteroscope also has certain limitations. Most of the flexible ureteroscope can double twist 270°, which can almost solve most of the renal pelvis and calyces calculi. However, for the inferior calyces, the swing range of the lens is limited due to the placement of optical fiber, especially when the Angle of the renal pelvis infundibular (IPA) is less than 30°, it is relatively difficult to treat calculi [9]. Therefore, it is particularly important to evaluate upper urinary calculi preoperatively, especially lower renal calyx calculi. At this time, the application of PCNL is more convenient and safe. For calculi in the upper or middle calyces of the kidney, Furl has a good lithotripsy effect.

Furl is operated directly through the natural cavity of human body, which basically causes no substantial damage to the kidney, ureter and surrounding blood vessels, generally recovers quickly, and the hospital stay is short [10]. In this study, Furl is considered to be a good surgical option for upper urinary calculi with relatively simple and low stone hardness.

3. Experimental Content and Methods

3.1 Experimental Subjects

Clinical data of kidney stone patients admitted to the Urine Center of our hospital in recent two years were selected, and a total of 114 patients were selected as the research objects according to the inclusion and exclusion criteria. 114 patients were divided into two groups according to the operation method: percutaneous nephrolithotripsy group (n=57) and catheter lithotripsy group (n=57).

3.2 Screening Criteria

(1) Inclusion Criteria

All patients were diagnosed as renal calculi before surgery by a sonographer in the urology department of our hospital, urinary tract plain film (KUB) and urinary tract CT in the radiology department. Unable to position due to severe spinal, hip and knee lesions; Out, coagulation function abnormal.

(2) Exclusion Criteria

Bilateral calculus; There were obvious ureteral strictures and anatomic deformities such as horseshoe kidney stones and repeated kidney stones.

Preoperative blood routine of all patients was within the normal range, and inflammatory indexes such as blood routine and urine routine of patients with urinary tract infection were basically normal after reexamination after anti-infection treatment. Patients with coronary heart disease had no seizure discomfort in recent six months. All operations of all patients were performed by the same group of physicians in the Department of Urology of our hospital.

3.3 Statistical Methods

SPSS 23.0 software was used to analyze the data, and t test was performed. The difference was statistically significant with $P<0.05$. The t-test formula used in this paper is as follows:

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$$t = \frac{\overline{X-\mu}}{\frac{\sigma_X}{\sqrt{n-1}}} \quad (1)$$

$$t = \frac{\overline{X-\mu}}{\frac{\sigma_X}{\sqrt{n}}} \quad (2)$$

4. Comparison of Surgical Outcomes

4.1 Comparison of Basic Data between Two Groups

Table 1. Preoperative general data of MPCNL group and URHL group were compared

Group	number of cases	Year	Gender(man)	Gender(woman)	Sick time
URHL	57	48.64±13.84	42	15	4.28±5.62
MPCNL	57	45.03±12.76	44	13	5.17±5.45
P value		0.091	0.138		0.344

As shown in Table 1, among the 114 subjects selected, 86 were male patients and 28 were female patients. In the URHL group, there were 57 patients, including 42 male patients and 15 female patients, with an average age of (48.64±13.84) and an average duration of (4.28±5.62). In the MPCNL group, there were 44 male patients and 13 female patients, the age of splice disease was (45.03±12.76), and the mean time of disease was (5.17±5.45), and the difference was not statistically significant (P>0.05).

4.2 Comparison of Operative and Therapeutic ESffects

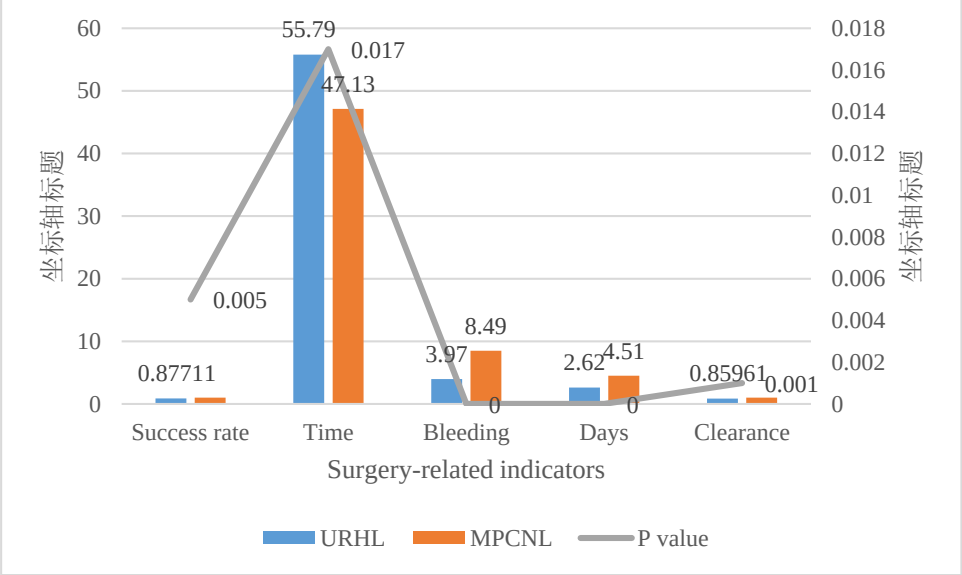

Figure 1. Comparison of surgical indexes between the two groups

The success rate of lithotripsy in URHL group was 87.71%, the mean lithotripsy time was 55.79 minutes, the mean intraoperative blood loss was 3.97 mL, the mean hospital stay was 2.62 days, and the stone clearance rate was 85.96% one month after operation. In the MPCNL group, the success rate of lithotripsy was 100%, the mean time of lithotripsy was 47.13 minutes, the mean intraoperative blood loss was 8.49 mL, the mean length of hospital stay was 4.51 days, and the stone clearance rate was 100% one month after operation. The success rate of lithotripsy, stone clearance rate one month after operation, intraoperative bleeding and postoperative hospital stay in the URHL group were significantly lower than those in the MPCNL group, with statistical significance (P<0.05).

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4.3 Comparison of Postoperative Complications

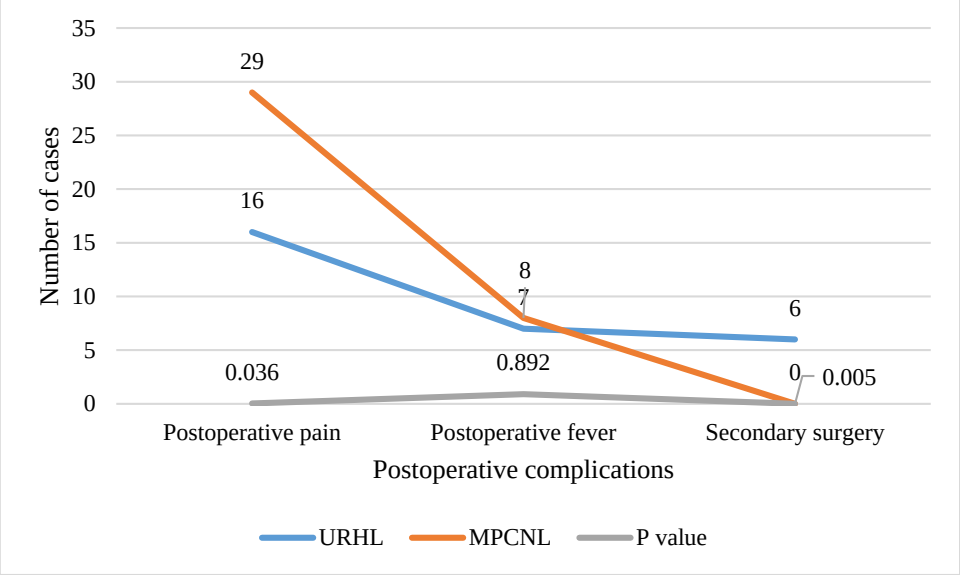

Figure 2. Postoperative complications were compared between the two groups

As shown in Figure 2, in the URHL group, there were 16 patients with postoperative pain, 7 patients with postoperative fever, and 6 patients with the second operation. Twenty-nine patients in MPCN 'l group had postoperative pain and passport. Postoperative fever occurred in 8 cases. Seven patients in the URHL group underwent percutaneous nephrolithotripsy for the second time after surgery, and the differences were statistically significant (P<0.05).

4.4 Experiment is Insufficient

At the same time, there are many deficiencies in this study which need further study and improvement. First of all, this study is a retrospective analysis of some cases selected from previous cases. The number of cases is relatively small, and there may be some sampling error. Secondly, upper ureteral calculi and renal calculi with the diameter of 1~2cm were selected in this study, but the analysis results were not comprehensive, and the calculi larger than 2cm were not included in the study. Therefore, the advantages and disadvantages of the two surgical methods could not be fully explained in the conclusion. In the future, the characteristics of cases with large calculi, multiple calculi and bilateral calculi will be further analyzed and studied, and the two surgical methods will be compared with more detailed and rigorous research data, so as to provide a basis for the choice of surgical methods.

5. Conclusions

In this study, retrospective analysis was performed to compare the efficacy of MPCNL and Furl in the treatment of kidney stones. Microchannel percutaneous nephrolithotripsy (MPCNL) has a high lithoclearing rate, short operation time and small trauma, and has a significant effect on the treatment of kidney stones. However, due to invasive operation, the risks of bleeding and infection are relatively increased. Therefore, it is particularly important to observe the conditions during and after the operation, which requires great attention. MPCNL can be used as the main treatment for complex upper urinary tract calculi. In this study, the MPCNL group adopted the oblique supine lithotomy position, compared with the traditional prone position. The advantage of this position is that it does not need to change the surgical position of the patients twice, and the general condition of the patients can be directly monitored intraoperatively. For complex upper urinary calculi, dual mirror combined treatment can be performed simultaneously, which has significant effect and is worthy of application and promotion.

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