Comparative Study of Different Cephalosporins Antibiotics in Preventing Infection after Percutaneous Nephrolithotomy

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The purpose of this study was to compare the clinical efficacy of cefotaxime and ceftazidime in preventing infection after percutaneous nephrolithotomy, and to compare the advantages and disadvantages of different cephalosporins antibiotics in the treatment, in order to determine the best preparation. A retrospective controlled trial design was used in this study. A total of 105 patients who underwent percutaneous nephrolithotomy in our hospital from April 2020 to February 2023 were collected, including 47 cases in cefotaxime group and 58 cases in ceftazidime group. The baseline and postoperative infection incidence, blood routine leukocyte level and C-reactive protein level were recorded respectively. Through the follow-up of patients and the collection of related test data, the clinical efficacy and adverse reactions of cefotaxime group and ceftazidime group in preventing infection after percutaneous nephrolithotomy were compared. In this study, postoperative urinary tract infection occurred in 1 case (2.1 %) in cefotaxime group and 3 cases (5.2 %) in ceftazidime group. The total incidence of infection was 2 cases (4.3 %) in cefotaxime group and 8 cases (13.8 %) in ceftazidime group. There was no significant difference between the two groups (purge 0.732). In terms of inflammatory indexes, there was no significant difference in leukocyte level and C-reactive protein level between cefotaxime group and ceftazidime group before treatment. After treatment, the leukocyte level and C-reactive protein level in both groups were significantly lower than those before treatment, and the leukocyte and C-reactive protein levels in cefotaxime group were significantly lower than those in ceftazidime group ($p<0.05$). This study shows that cefotaxime has certain advantages in preventing infection after percutaneous nephrolithotomy and is helpful to reduce the level of postoperative inflammation.

Key words: Cefotaxime, ceftazidime, percutaneous nephrolithotomy, postoperative infection, cephalosporins

Percutaneous nephroscopy is a minimally invasive surgical technique, which can be used in the treatment of renal calculi, ureteral calculi and other urinary calculi[1]. This kind of operation has a decisive effect, but there are also certain risks, such as postoperative infection. Although postoperative infection is more common in clinical work, its possible consequences and complications cannot be ignored, often leading to thousands of medical accidents[2]. Therefore, in the process of percutaneous nephroscopy, the prevention of postoperative infection becomes very important, and effective measures need to be taken to reduce the incidence. To achieve the prevention of postoperative infection, the use of antibiotics is a common means[3]. Antibiotics can inhibit and kill bacteria, and effectively prevent postoperative infection. However, the preventive effect of different antibiotics on infection will be different. At present, for the choice of antibiotics to prevent infection after Percutaneous Nephrolithotomy (PCNL), the common drugs used in clinic are cephalosporins, penicillin, fluoroquinolones and macrolides[4]. Among them, cephalosporins antibiotics are widely used in the prevention of postoperative infection because of their wide antibacterial spectrum, good curative effect and low side effects. Cephalosporins are one of the common antibiotics used to prevent bacterial infection[5]. Because of their excellent antibacterial effect and good tolerance in clinical treatment, cephalosporins have become the first choice for the prevention of postoperative infection. Cephalosporins antibiotics include cefotaxime, ceftazidime and so on. Although cephalosporin antibiotics have more mature experience in clinical

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application, there are few studies on the prevention of infection after PCNL and the advantages and disadvantages of cefotaxime and ceftazidime. Therefore, we hope to use retrospective controlled trials to compare the preventive effects of different cephalosporins antibiotics after PCNL in order to determine the best preparation selection. In this study, we will include 105 patients after PCNL from April 2020 to February 2023, of which 47 were treated with cefotaxime and 58 with ceftazidime. To find the best treatment scheme to prevent infection by comparing the clinical efficacy of different preparations. This study will more comprehensively evaluate the efficacy of cefotaxime and ceftazidime in the prevention of infection after PCNL and provide reference for the formulation of scientific and accurate treatment plan. We believe that this study will play a positive role in improving the level of clinical treatment, reducing the incidence of postoperative infection and reducing patient mortality. The subjects were 105 patients who underwent PCNL in our hospital from April 2020 to February 2023, including 47 patients with cefotaxime and 58 patients with ceftazidime. Inclusion criteria include the PCNL; no obvious symptoms of infection, such as fever, leukocytosis, etc., and complete clinical data, surgical records and laboratory results. In exclusion criteria, the patients with low immunity diseases such as leukemia, lymphoma and Acquired Immunodeficiency Syndrome (AIDS); patients with severe organic kidney diseases such as renal failure, glomerulonephritis and severe renal disease; patients with a history of allergy or intolerance to cephalosporins; patients who have been treated with antibiotics within 3 mo before operation and patients who do not have complete clinical data, surgical records and laboratory results. Cefotaxime group including the intravenous injection of cefotaxime (Zhuhai Federal Co., Ltd., specification for 1.0 g/tube), dose according to the patient's body weight, usually 1-2 g, cefotaxime was added to 0.9 % sodium chloride injection 100 ml. Administration time including the drug was given 30 min before the operation, and continued to be administered about 48 h after the operation, once a day. Patients in ceftazidime group were given ceftazidime 2.0 g by intravenous drip (Hainan Herui Pharmaceutical Co., Ltd., specification is 1.0 g/tube), ceftazidime was added to 0.9 % sodium chloride injection 100 ml, the administration time was 30 min before operation, and continued administration 48 h after operation, once a day. The patients were reexamined 1 d and 3 d after operation, including blood routine, urine routine, body temperature, white blood cell count and so on. The clinical data, surgical data and postoperative examination results of all subjects will be collected and entered into the research database. All cases were followed up, including 1 w, 2 w and 1 mo after operation. Clinical parameters will include the occurrence of postoperative infection and the results of urine test. The main clinical indexes such as white blood cell count and C-Reactive Protein (CRP) were re-examined. The researchers will calculate the incidence and severity of postoperative infection-associated cystitis among groups, as well as the safety and complications of drug use. In this study, Statistical Package for the Social Sciences (SPSS) 23.0 software is used to process and analyze the data. Two groups of comparative methods were used for statistical analysis. The measurement data were expressed in the form of mean±standard deviation, and two independent sample t-tests were used for statistical analysis. The counting data were expressed by frequency percentage (%), and the statistical test was compared and analyzed by Chi-square (χ^2) test. $p<0.05$ was statistically significant. A total of 105 patients who underwent PCNL were included in this study, including 65 males and 40 females. There was no significant difference in age, sex and Body Mass Index (BMI) between the two groups in terms of age, sex and BMI ($p>0.05$) as shown in Table 1. Comparing the infection situation of the two groups during the follow-up period after operation, the results showed that there was no significant difference in the overall infection rate between the cefotaxime group and the ceftazidime group (purge 0.732). However, the patients with respiratory tract infection, incision infection and urinary tract infection in the cefotaxime group were less than those in the ceftazidime group as shown in Table 2. There was no significant difference in leukocyte level and CRP level between cefotaxime group and ceftazidime group before treatment. After treatment, the leukocyte level and CRP level in both groups were significantly lower than those before treatment, and the leukocyte and CRP levels in cefotaxime group were significantly lower than those in ceftazidime group ($p<0.05$) as shown in

Table 3. PCNL is a common surgical method for the treatment of renal calculi in urology. The operation mainly includes percutaneous nephroscope intubation, pyeloscope entry and stone extraction. The operation is widely used in the treatment of urinary diseases such as kidney stones and ureteral stones. During PCNL, we should pay attention to some possible complications, such as postoperative infection and accidental injury of urinary tract, and actively take preventive measures[6]. The common methods to prevent postoperative infection include thorough preoperative preparation, aseptic operation and physical drug infection prevention[7]. It should be noted that clinical research such as empirical epidemiological studies on these problems is necessary to further improve the clinical efficiency and safety of PCNL. PCNL may lead to contamination of bacteria in the kidneys from the urinary tract and kidneys gathered near stones[8]. When treating kidney stones, the stone itself may also be a nest and can become a habitat for pathogens. During the operation, the patient's urine may also enter the kidney and cause contamination, which can lead to infection. Low immunity is also another important factor leading to postoperative infection[9,10]. After operation, lack of rest, malnutrition and excessive fatigue will weaken the body's own immunity, and the repair ability of the injured tissue will also decrease. Therefore, it is very important to focus on the maintenance of physical resistance after operation. The level of surgical skills and hand hygiene will also affect the incidence of infection. For example, if the patient's medication is underused, or the wound is not properly perfused, or the wound is improperly bandaged, it can form a channel of transmission, thus increasing the risk of infection. Generally speaking, the emergence of postoperative infection needs the joint action of many factors, which is not worth paying attention to. Only through comprehensive consideration of these factors can the incidence of postoperative infection be reduced. Cefotaxime and ceftazidime are two widely used antibiotics in the prevention of infection after PCNL[11]. In our study, we found that cefotaxime is more effective in preventing infection after PCNL than ceftazidime. This result may be caused by a variety of factors, including the characteristics of pathogens, pharmacological characteristics, pharmacokinetics, dose and frequency of administration. The characteristics of pathogens is one of the key factors in the selection of suitable drugs. Gram-negative bacteria are the most common pathogens in urinary system infections, such as *Escherichia coli, Klebsiella, Pseudomonas aeruginosa* and so on. In our study, cefotaxime and ceftazidime are the third generation cephalosporins and have good antibacterial activity against these Gram-negative bacteria. However, in considering the drug resistance of pathogens, we need to choose specific antibiotics. In terms of the pharmacological properties of the drug, we know that the action time of cefotaxime is relatively short, so it needs to be administered more frequently. Ceftazidime needs less times of administration[12]. In clinical practice, the dose and frequency of cefotaxime and ceftazidime may also be affected by individual differences between doctors and patients. In addition, the pharmacokinetics of drugs is also an important factor affecting the efficacy of drugs. For example, the antibacterial activity of cefotaxime may gradually decrease with the metabolism and elimination of the drug in the body, and more frequent administration is needed to maintain the therapeutic effect. Therefore, when using cefotaxime, special attention should be paid to the time and dose of administration. In our study, we found that the use of cefotaxime may be more effective in preventing infection after PCNL. This result may be due to the stronger antibacterial activity and shorter action time of cefotaxime against common pathogens after PCNL. However, we need to note that this result may not apply to other types of surgery or the treatment of different diseases. Overall, our study provides some preliminary evidence that cefotaxime is more effective in preventing infection after PCNL. However, we believe that more studies are needed to verify these results and to further study the etiology and drug treatment of related urinary diseases. In the future research, more consideration should be given to the individual factors of patients and the individualization of treatment regimens, so as to better promote clinical practice and reduce the risk of infection. In this study, there are some obvious limitations that need to be paid attention to, the most important of which is the small number of samples. In addition, the selectivity bias caused by retrospective, non-randomized study design and the lack of detailed drug dose and patient

information also limit the wide applicability of the study. Of course, these limitations do not affect the importance of the research results, but future studies need to adopt more scientific, randomized controlled research methods. At the same time, more in-depth research should be carried out on the details such as the dose of cephalosporins antibiotics to prevent infection and patient selection, in order to evaluate the potential of its medical application in a more comprehensive way.

TABLE 1: COMPARISON OF GENERAL CONDITIONS BETWEEN THE TWO GROUPS OF PATIENTS

Features	Cefotaxime group (n=47)	Ceftazidime group (n=58)	p value
Age	50.8±12.3	51.5 ± 12.1	0.73
Gender			0.64
Male	30 (63.8 %)	35 (60.3 %)	
Female	17 (36.2 %)	23 (39.7 %)	
BMI	24.5±2.1	24.9±2.2	0.13

TABLE 2: COMPARISON OF POSTOPERATIVE INFECTION INCIDENCE BETWEEN THE TWO GROUPS (n %)

Group	n	After treatment	Respiratory tract infection	Incidence of infection
Cefotaxime	47	1 (2.1)	0 (0.0)	2 (4.3 %)
Ceftazidime	58	3 (5.2)	2 (3.4)	8 (13.8 %)
χ^2				0.625
p				0.732

TABLE 3: COMPARISON OF WBC AND CRP LEVELS BETWEEN CEFOTAXIME GROUP AND CEFTAZIDIME GROUP BEFORE AND AFTER TREATMENT

Group	n	WBC (10^9/l)		CRP (ρ/mg×l^{-1})	
		Before treatment	After treatment	Before treatment	After treatment
Cefotaxime	47	10.42±1.86	7.13±1.43*#	23.56±2.35	12.25±1.53*#
Ceftazidime	58	10.65±2.23	8.96±1.35*	23.73±3.24	18.23±2.65*
t		0.67	4.13	0.71	4.62
p		>0.05	<0.05	>0.05	<0.05

Note: *p<0.05, compared with the results of the group before treatment and #p<0.05, compared with the results of the control group after treatment

Conflict of interests:

The authors declared no conflict of interests.

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