Correlation Analysis between Bacterial Drug Resistance Rate and Antimicrobial Use

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Abstract: Objective: To investigate the drug resistance rate of Acinetobacter baumannii and Klebsiella pneumoniae and carbapenem antibiotics in hospitalized patients in our hospital. **Methods:** The drug resistance rate of Acinetobacter baumannii and Klebsiella pneumoniae and the use of carbapenems in hospitalized patients in our hospital from January to September 2021 were studied (DDDs) were analyzed retrospectively, and the data were analyzed by Pearson correlation method. **Results:** The drug resistance rate of Acinetobacter baumannii to meropenem and biapenem in our hospital did not show significant correlation with their DDDs. The drug resistance rate of Klebsiella pneumoniae was also not significantly correlated with meropenem and biapenem DDDs. **Conclusions:** Acinetobacter baumannii was not found. The drug resistance rate of Klebsiella pneumoniae is related to the use of carbapenems. Our hospital should continue to control the application of drugs and delay the distribution and expansion of drug-resistant bacteria.

Keywords: Klebsiella pneumoniae; Acinetobacter baumannii; Carbapenems; Drug resistance rate; Correlation

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1. Introduction

Gram-negative bacteria are very common in patients with clinical infection. The 2019 report of the national bacterial drug resistance monitoring network shows that the isolation proportion of Gram-negative bacteria far exceeds that of Gram-positive bacteria in major regions of China, with a proportion as high as 70% [1]. Klebsiella pneumoniae opportunistic pathogens generally do not cause disease, and there is a possibility of infection in hospitalized patients. It is also a G-. The most common infection site is the respiratory tract, which can lead to severe pneumonia. Occasionally, it can invade the urinary system and biliary system to cause infection. In severe cases, it can also cause septicemia and other fatal conditions. Acinetobacter baumannii is an important branch of the common flora causing ventilator-associated pneumonia, and it can also be seen in blood flow infection, urinary system and wound infection [2]. In recent years,the drug resistance rate and distribution of drug-resistant bacteria of Pseudomonas aeruginosa, Klebsiella pneumoniae and Acinetobacter baumannii are not optimistic. And the treatment of these common gram-negative pathogens has become more and more difficult because of the rise of their drug resistance rate. In the defense line of antibiotics against bacteria, carbapenem antibiotics have always been effective and adhered to the great antibacterial wall. Improper use may lead to the increase of drug-resistant bacteria in hospitals, and the treatment of drug-resistant bacteria also increases the difficulty of the treatment of clinical infection [3].

In order to understand the use of carbapenems in patients in the Second Affiliated Hospital of Bengbu Medical College and the resistance of Acinetobacter baumannii and Klebsiella pneumoniae to carbapenems, this study is based on the cases treated with carbapenems in our hospital in the first three quarters of 2021. The rationality of drug use was analyzed and its possible correlation with the use of carbapenem antibiotics was discussed, so as to provide guidance for clinical use, in order to standardize clinical rational drug use.

2. Data and Methods

2.1 Data Sources

The antimicrobial susceptibility test results of Acinetobacter baumannii and Klebsiella pneumoniae were

collected from the laboratory department of our hospital from January to September 2021. Obtain the usage (DDDs) of carbapenem antibiotics (meropenem and biapenem) from the his system of our hospital from January to September 2021.

2.2 Method

2.2.1 Analysis on the Use of Antibiotics

Using the defined daily dose (DDD) method recommended by the World Health Organization, the medication frequency of the drug was calculated based on the defined daily dose of each variety. DDD value is calculated with reference to Chinese Pharmacopoeia (2015 Edition) [4], newly compiled Pharmacology (17th Edition) [5] and drug instructions. The consumption of drugs is divided by the corresponding DDD value to obtain the use of antibiotics (DDDs). The DDDs value reflects the frequency of the drug.

2.2.2 Correlation Analysis

Use spss23 0 software for correlation statistical analysis. The Pearson correlation coefficient r between bacterial drug resistance rate and DDDs was calculated. The statistical test of correlation coefficient r showed that $P<0.05$ showed that the correlation had a significant linear relationship [6,7].

3. Results

3.1 Drug Resistance Rate of Therapeutic Bacteria and Usage of Carbapenem Antibiotics

The drug resistance rates of Acinetobacter baumannii and Klebsiella pneumoniae are shown in Tables 1 and 2. Carbapenem antibiotics DDDs are shown in Table 3.

3.2 Correlation between Drug Resistance Rate and DDDs of Antibiotics

According to the Pearson correlation analysis results shown in Table 4, there is no significant correlation between the resistance rate of Acinetobacter baumannii to meropenem and meropenem DDDs by regression analysis ($P>0.05$), which proves that there is no significant correlation at the confidence level of $a=0.05$. The regression analysis between the drug resistance rate of Acinetobacter baumannii compared with apenem and its DDDs was $p>0.05$. The results showed that there was no significant correlation between the drug resistance rate of Acinetobacter baumannii compared with apenem and DDDs. Similarly, there was no significant correlation between the drug resistance rate of Klebsiella pneumoniae to meropenem and biapenem and the DDDs of meropenem and biapenem.

Table 1. Drug resistance rate of Acinetobacter baumannii

Drug name	Drug resistance rate of Acinetobacter baumannii								
	January	February	March	April	May	June	July	August	September
Meropenem	76.2	86	97.14	97	95.45	96.8	76.9	54.55	92.30
Biapenem	76.2	86	97.14	97	95.45	96.8	76.9	54.55	92.30

Table 2. Drug resistance rate of Klebsiella pneumoniae

Drug name	Drug resistance rate of Klebsiella pneumoniae								
	January	February	March	April	May	June	July	August	September
Meropenem	56.5	62.3	59.63	52.15	55.26	69.6	51.3	31.43	45.03
Biapenem	56.5	62.3	59.63	52.15	55.26	69.6	51.3	31.43	45.03

Table 3. Carbapenem antibiotics DDDs

Drug name	DDDs								
	January	February	March	April	May	June	July	August	September
Meropenem	77.00	144.17	127.67	253.17	305.17	295.00	208.50	232.83	176.67
Biapenem	318.00	237.00	273.50	320.25	295.00	256.75	232.50	259.50	260.25

Table 4. Correlation between the change of drug resistance rate of Acinetobacter baumannii and Klebsiella pneumoniae and carbapenem DDDs

Drug resistance rate	Meropenem	Biapenem
Drug resistance rate of Acinetobacter baumannii	r=0.196 *P*=0.613	r=0.224 *P*=0.563
Drug resistance rate of Klebsiella pneumoniae	r=-0.031 *P*=0.937	r=0.011 *P*=0.978

4. Discussion

In recent years, the problem of bacterial drug resistance is no longer a small-scale accidental situation. With the continuous expansion of the distribution range of drug-resistant bacteria, the increasing number of drug-resistant varieties, and the emergence of multi drug-resistant bacteria, it is directly related to the health of every medical worker's patient. The increase of bacterial drug resistance is not only the problem of detection cost and drug cost, but also the problem of drug selection and drug efficacy. After all, the number of drugs is limited, and the variation of bacteria may be unlimited. In recent years, bacteria are more and more resistant to new drugs had been discovered by researchers, which not only increases the pressure of scientific research, but also makes the clinical drug use more and more difficult. Through the comparative study of the drug resistance level of bacteria and the dosage of antibiotics, it is found that there is a macro quantitative relationship between them to a certain extent [8]. The increased selection pressure caused by blindly using antibiotics does not always increase the treatment effect, but leads to the corresponding increase of drug-resistant strains to a certain extent.

Carbapenem antibiotics, as a veteran of the antibacterial industry, "special use level" is not only the affirmation of its effect, but also represents the respect and recognition of this effective old drug. In the battle against multidrug-resistant bacteria, as long as this line of defense is still in place, it will stabilize the hearts of all clinical anti infection workers. The analysis results show that meropenem is more used than apenem. There was no significant correlation between the drug resistance rate of Klebsiella pneumoniae and meropenem and biapenem DDDs. The drug resistance mechanism of Klebsiella pneumoniae has been basically understood through the research of several generations. It can produce a special plasmid mediated enzyme, which has the function of hydrolyzing carbapenems, and has a powerful function, which can make almost allβ-Inactivation of lactamases and carbapenems [9]. When the bacterial culture indicates that it produces ultra broad spectrumβ-Lactamase can be used in the treatment of Klebsiella pneumoniae. Acinetobacter baumannii is common in hospitalized patients infected in our hospital. At present, the commonly used drugs for Acinetobacter baumannii infection in clinic are carbapenems or compound drugs of lactamase inhibitors. In this investigation on the drug resistance rate of Acinetobacter baumannii to meropenem, it was found that there was no significant correlation between the infection rate and the use of meropenem, which also showed that our hospital had a good grasp of the use of carbapenem antibiotics.

Bacterial drug resistance is caused by many internal and external factors, such as the kinetic characteristics of the drug itself, the action mechanism of sterilization, the antibacterial activity of the drug and so on. At the same time, the management mode of clinical drug use, the intensity and mode of drug use, drug dosage and so on also affect the production of bacterial drug resistance to a certain extent. Therefore, when selecting drugs, we should strictly control the indications, minimize empirical drugs, and protect this effective antibacterial weapon while using it well. The number of samples in this study is very limited, and the types of basic diseases, nutritional status and compliance of patients can affect the treatment effect to varying degrees. Therefore, clinical pharmacists should also give full play to their advantages, fully learn and master the professional knowledge of pharmacy, and understand the drug instructions and relevant diagnosis and treatment guidelines in detail. It is particularly important to correctly grasp the dose, course of treatment and administration method.

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