ORIGINAL RESEARCH

Influence of Rational use of Antibacterial Drugs on Drug Resistance of Pathogenic Bacteria in Nosocomial Infection

Wenmei Bao, BS; Shouping Sheng, BS; Jianlin Xu, BS

ABSTRACT

The purpose of this study is to explore the impact of multi-departmental linkage and rational drug use supervision on the drug resistance of pathogenic bacteria in primary hospitals. Use the method of pharmacies and infection control departments to jointly develop hospital antimicrobial usage guidelines and reward and punishment systems to promote the rational use of antimicrobial drugs. In addition, clinicians and clinical pharmacists of the pharmacy department participated in the formulation of anti-infection programs, infection control departments and pharmacy supervision, and compared the rational use of antibacterial drugs, the time of antibacterial drug use, and the detection of drug-resistant bacteria between the two groups before and after the implementation of the mechanism. Our results showed that the rational use rates of medication indications, drug selection, drug dosage, and medication course in the observation group were 97.74%, 96.99%, 98.50%, and 96.24%, respectively, which were higher than 79.71% in the control group, 76.81%, 72.46% and 75.36%, the difference was statistically significant ($P < .05$); there was no statistically significant difference in the rational utilization rate of drug administration routes between the two groups ($P > .05$). The antibacterial drug use time of the observation group was (7.39±1.84) d shorter than that of the control group (13.53±2.61) d, and the difference was statistically significant ($P < .05$). The detection rate of drug-resistant bacteria in the observation group was 24.44%, which was lower than 42.86% in the control group, and the difference was statistically significant ($P < .05$). This shows that the grassroots multi-department linkage supervision mechanism is in line with the management model of standardizing the rational use of antimicrobial drugs at the grassroots level, and the intervention in the application of antibacterial drugs is conducive to improving the knowledge reserve of drug use among the grassroots people. The economic cost of reducing drug-resistant bacteria is huge. In addition to death and disability, long-term illness can result in longer hospital stays, the need for more expensive medications, and a significant financial burden on those affected. Therefore, improving the rationality of clinicians' medication use will help shorten treatment time and reduce drug-resistant bacteria. It is worthy of clinical promotion and application. (*Altern Ther Health Med.* 2024;30(1):210-214).

Wenmei Bao, BS; First Branch Hospital Infection Management Office, People's Hospital of Zongyang County, Tongling City, Anhui Province, China. **Shouping Sheng, BS; Jianlin Xu, BS;** Infection Management Office, People's Hospital of Zongyang County, Tongling City, Anhui Province, China.

Corresponding author: Wenmei Bao, BS
E-mail: yfydyymrxyz@163.com

INTRODUCTION

Healthcare-associated infection (HAI) is generally defined as an adverse event resulting from healthcare provision. In the context of the normal functioning of the healthcare sector, reducing the risk of pathogenic microorganisms spreading in the hospital environment is a considerable challenge. The financial cost to hospitals caused by HAI is a serious problem for the healthcare system. In recent years, with the rapid development of my country's medical industry, various high-efficiency and broad-spectrum antibacterial drugs have been continuously developed at home and abroad, providing more choices for clinical diagnosis and treatment; antibacterial drugs are currently used clinically in the treatment of an important drug for various bacterial infections.[1] When carrying out various medical activities, in most cases, it is necessary to choose such drugs to treat patients to ensure their therapeutic effect.[2] However, due to the increasing incidence of bacterial infections in recent years, the irrational application of antibacterial drugs has become increasingly serious, leading to a gradual increase in the incidence of modern nosocomial infections, and the drug resistance of pathogenic bacteria has also increased.[3] Relevant studies have pointed out that,[4]

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irrational use of antibacterial drugs can promote drug resistance of pathogens to a certain extent and increase the difficulty of treatment and the incidence of nosocomial infection.[5] Usually, the spread of highly resistant strains in individual hospitals is related to the local epidemiological situation. When screening the use of antimicrobial drugs in most hospitals, it was found that the degree of regulation of antimicrobial drugs was inversely proportional to bacterial resistance.[6] When using antibacterial drugs for the first time, if the indications are not well grasped, there is no detailed medication basis. There are problems with the dosage and course of treatment of antibacterial drugs; the effect of antibacterial drugs will be poor, and there will be the case of unreasonable medication.[7] The emergence of various multidrug-resistant bacteria, especially "super bacteria," has brought a series of problems to clinical diagnosis and treatment work and patients and the use of antibacterial drugs in the clinical departments of primary hospitals is not standardized, and the incidence of nosocomial infections continues to rise.[8]

To ensure the rational application of antimicrobials, it is necessary to subdivide the hospital in detail and do a good job in the joint supervision of multiple departments. Not only must it conform to the hospital's management model, but it also needs to formulate a practical and feasible reward and punishment system according to the management plan of the relevant management department. While carrying out the rational application of antibacterial drugs, it also strengthens the connection of multi-departmental cooperation and promotes communication between various departments. This method is called multi-department linkage supervision. When carrying out rational drug use management, medical staff should provide detailed medication guidance for patients in accordance with the relevant content of drug instructions in their daily work.

On the one hand, it can avoid the phenomenon of irregular medication in the medication process; on the other hand, it can also make the doctor's treatment plan more systematic and standardized.[9] Physicians should pay close attention to the patient's medication status when taking medication to avoid adverse drug reactions. When necessary, the drug can be stopped or replaced to ensure the patient's therapeutic effect and medication safety. The joint management mechanism between administrative supervision departments and pharmacies can effectively regulate the use of antibacterial drugs in hospitals and reduce the resistance of pathogenic bacteria caused by abusing antibacterial drugs.[10] Therefore, in daily clinical medical activities, to ensure that the diagnosis and treatment of various infectious diseases in the hospital can be carried out smoothly and the personal safety and interests of patients are effectively guaranteed, in actual diagnosis and treatment activities, it is necessary to use various class of antibacterial drugs.[11]

On January 1, 2021, the hospital began to jointly manage the hospital pharmacy and infection department, and analyzed the impact of multi-department linkage and rational drug use supervision on the drug resistance of nosocomial infection pathogens. In order to reduce the resistance of pathogenic bacteria caused by antimicrobial drugs and standardize the use of antimicrobial drugs in hospitals, it is necessary to rationally select plans, manage hospital medication, and rationalize the broad understanding of hospital antibiotic policy guidelines for more rational use of antimicrobial drugs. The report is as follows.

MATERIALS AND METHODS
Participants
A total of 69 infected patients diagnosed and treated in our hospital from January 1, 2021 to December 31, 2021 were collected as the control group, including 41 males and 28 females. The age ranged from 16 months to 88 years, with an average (62.44 ± 19.85). In addition, 133 patients who were diagnosed and treated for infection in our hospital from January 1, 2022 to December 31, 2022 were selected as the observation group, including 93 males and 40 females. Aged 1 to 91 years old, with an average of (64.1 ± 19.6) years old. There was no statistical difference in the general data of the two groups of patients ($P > .05$), so the data of the two groups were comparable.

Development of Antibacterial Drug Guidelines
According to the relevant laws and regulations of our country and the rules and regulations, formulate the use of antibacterial drugs suitable for our hospital, and combine the development of the disease and the relevant laws and regulations of our country to revise the application of antibacterial drugs at any time. Strictly follow the principles of antibiotic use to formulate rewards and punishments suitable for our hospital.

Responsibility System and Management
Clarify the responsibility system for clinical application management of antimicrobial drugs[12] and establish a complete management team for drug use regulation to supervise the normal use of drugs. In accordance with the relevant regulations, daily management of the reasonable situation of medication is carried out, and the person in charge of each department is well selected to ensure that the person in charge can be quickly found when the antibacterial drugs are used clinically, and the responsibility is implemented and clarified. Do a good job in the responsibility management of rational application of antimicrobial drugs. In the daily work of the hospital, the clinical application management of antimicrobial drugs and medical quality management should be taken as the key management content of daily hospital operations. Those clinical practitioners who have passed the antibacterial drug training and examination will be granted the right to use antibacterial drug prescriptions. The rational application of antimicrobial drugs will be added to the goal of the comprehensive examination of department directors as a relevant evaluation and assessment standard to arouse the great attention of medical staff to the rational use of antibacterial drugs and improve their enthusiasm and effectiveness.

Education and Training

(a) The Department of Infection Control regularly preaches the relevant knowledge of nosocomial infection control to the hospital staff, popularizes the knowledge of rational application of antibacterial drugs to clinicians, and conducts regular course training. Beginning with clinicians, manage the rational use of antimicrobials.[13] When the patients are admitted to the hospital, the person in charge of the infection control department supervises the patients' initial application of antibiotics, and the collection and statistics of nosocomial infection cases is done well. Suppose any illegal use of antibiotics at work by medical personnel is found at work. In that case, they should immediately inform the pharmacy and do a good job controlling and distributing the drugs. (b) The pharmacy is responsible for supervising the use intensity of antibacterial drugs, doing a good job in collecting and processing relevant data, regularly reporting to the infection control department according to relevant arrangements, and doing a good job of handing over detailed information. If it is found that departments or physicians have violated related regulations, they need to make relevant records of violations. If the violations are too serious, they must withdraw the right to prescribe antibiotics. In the daily application of antibacterial drugs in the hospital, do a good job in hierarchical management. When applying antimicrobials at different management levels, physicians must administer medications according to the medication levels, ensure strict implementation of the hierarchical management system, and prohibit doctors from administering drugs across levels. (c) The Laboratory Department is responsible for identifying pathogenic bacteria in hospital-acquired cases and the detection of drug resistance of pathogenic bacteria. It reports the test results in a timely manner. It enables physicians and pharmacists to keep abreast of patients' specific symptoms and pathogenic infection status, regulate patients' diseases through rational medication, and ensure the therapeutic effect of patients.[14]

Statistical method

The data in this research were analyzed by SPSS 26.0 software, including counting data and measurement data. The former is represented by "[n (%)]" and "χ^2" is used for testing, and the latter is represented by "Mean ± Standard Deviation", and take "t" to carry out the test, if $P < .05$, it can be confirmed that there is a significance in the data difference.

RESULT

Pathogenic Bacterial Distribution and Drug Resistance

There were 69 cases of nosocomial infection before the implementation of the linkage management mechanism, and 56 strains of pathogenic bacteria were detected, including 23 strains of drug-resistant bacteria, accounting for 41.07%; the intensity of use of antibacterial drugs was 35.68, and the utilization rate was 49.87%. After implementing the linkage management mechanism, 133 cases of nosocomial infection were detected, and 90 strains of pathogenic bacteria were

Table 1. The composition ratio of pathogenic bacteria detected in samples sent for nosocomial infection in two groups (%)

| Pathogenic bacteria	2021		2022	
	Number of strains	Constituent ratio	Number of strains	Constituent ratio
Gram-negative bacteria	34	60.71	37	41.11
Gram-positive bacteria	16	28.57	39	43.33
Fungus	6	10.72	14	15.56
Total	56	100.0	90	100.0

Table 2. Comparison of rational use of antibiotics between the two groups [n (%)]

Group	Number of cases	Medication indications	Drug selection	Drug dosage	Medication course	Route of administration
Control group	69	55(79.71)	53(76.81)	50(72.46)	52(75.36)	66(95.65)
Observation group	133	130(97.74)	129(96.99)	131(98.50)	128(96.24)	130(97.74)
t		19.17	20.74	14.31	4.58	0.69
P value		.000	.000	.000	.032	.406

Table 3. Comparison of antibacterial drug use time and cost between two groups of patients (mean ± standard deviation)

Group	Number of cases	Antimicrobial use time (d)
Control group	69	13.53±2.61
Observation group	133	7.39±1.84
t		19.40
P value		.000

Figure 1. Violin plot comparing the duration of antimicrobial use between the two groups
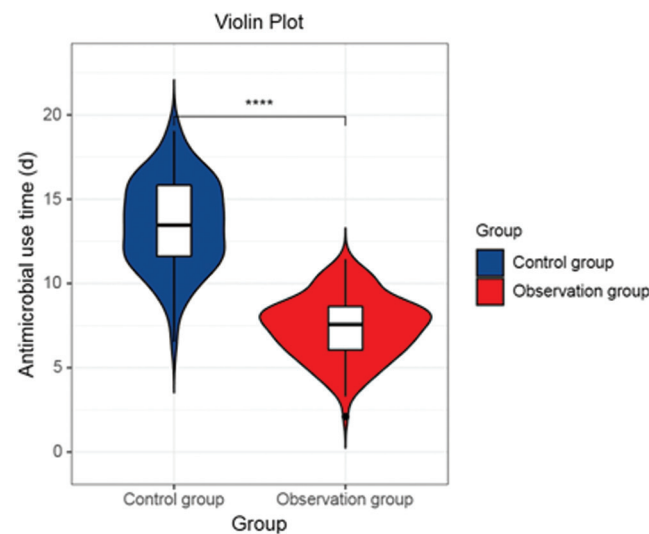
detected, including 21 strains of drug-resistant bacteria, accounting for 23.33%; the intensity of antibiotic use was 33.54, and the utilization rate was 50.17%. There were statistically significant differences in the drug-resistant strains of pathogenic bacteria and the intensity of antimicrobial use before and after the implementation of the linkage management mechanism ($P < .05$). The composition of pathogenic bacteria in hospital infection is shown in Table 1.

Comparison of Rational Antibiotic Use

Our statistical results showed (Table 2) that the rational use rates of medication indications, drug selection, drug dosage, and course of administration in the observation group were 97.74%, 96.99%, 98.50%, and 96.24%, respectively,

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Table 4. Comparison of the detection of drug-resistant bacteria between the two groups of patients (%)

Group	Number of pathogenic strains	Fungus	Non-fermenting bacteria	Other	Total
Control group	56	5	8	11	24(42.86)
Observation group	90	6	4	12	22(24.44)
χ^2					5.42
P value					.020

higher than 79.71%, 76.81%, 72.46% and 75.36% in the control group, the difference was statistically significant ($P < .05$); there was no statistically significant difference in the rational utilization rate of drug administration routes between the two groups ($P > .05$).

Comparison of Antibacterial Drug Use Duration

The antibacterial drug use time of the observation group was (7.39±1.84) d shorter than that of the control group (13.53±2.61) d, and the difference was statistically significant ($P < .05$) (Table 3, Figure 1).

Comparison of Drug-Resistant Bacteria Detection

In order to test whether the implementation of the linkage management mechanism has a certain effect on drug-resistant bacteria, we collected the data before and after the linkage management mechanism. The results showed (Table 4) that the detection rate of drug-resistant bacteria in the observation group was 24.44%, which was lower than 42.86% in the control group, and the difference was statistically significant ($P < .05$).

DISCUSSION

The Importance of Rational Antibiotic Use

In recent years, with the wide application of antibacterial drugs in clinical practice, the resistance of pathogens has continued to increase, making it more difficult to cure hospital-associated infectious diseases. According to many clinical studies, the irrational application of antibacterial drugs can lead to increased drug resistance to infectious pathogens.[15] Factors such as the dose, course, and frequency of the first application of antibiotics can all affect the therapeutic effect of antibiotics. Therefore, strengthening the rational application of antibacterial drugs in hospitals is vital to effectively reduce pathogenic bacteria's drug resistance and promote the curative effect of infectious diseases. Rational use of antibiotics is clinically called safe and effective use of antibiotics, which means ensuring effectiveness under the premise of ensuring safety.[16-18]

Challenges in Antibiotic Management

In continuous social and economic development, the medical industry is also developing rapidly to better meet people's needs. As an important part of clinical treatment activities, drugsirectly affect the clinical treatment effect.[19] Therefore, new drug varieties are constantly being introduced (especially antibacterial drugs). Suppose the hospital cannot scientifically manage the use of antibacterial drugs in the treatment activities. In that case, it will bring great economic pressure to the patients and different degrees of damage to the patients' bodies, eventually affecting the clinical treatment effect. Therefore, when choosing antibacterial drugs for treatment in daily clinical work, attention should be paid to the selection of antibacterial drugs that are sensitive to drug susceptibility tests.[20] At the same time, it also needs to be based on the patient's weight, age, size and degree of infection, body immunity, and related conditions of the body. And refer to the distribution concentration, adverse reactions, and half-life of antibacterial drugs in the body to determine the dosage, interval time, and frequency of medication.[21,22] In recent years, with the widespread use of antibacterial drugs in clinical practice, although the corresponding clinical diagnosis and treatment effect has been achieved to a certain extent, the drug resistance of pathogenic bacteria has been increasing.[23] And brought great difficulty to the treatment of nosocomial infectious disease. The current situation in my country is that antibiotics are widely used in clinical diagnosis and treatment activities, with many varieties and rapid updates, and the relationship between various drugs is complicated. Most of the newly used antibiotics will lose their original effect due to the emergence of drug resistance of bacteria within a few years. If antibacterial drugs are not used correctly in the actual treatment process, drug-resistant strains will grow rapidly. The incidence of adverse reactions and drug resistance of clinical antibacterial drugs has become a common problem in the medical field. The World Health Organization has loudly called for "if antibacterial drugs are not used rationally today, there will be no drugs available tomorrow". Therefore, in actual medical activities, hospitals need to pay attention to the use of antibacterial drugs, and relevant government departments should pay enough attention to this issue. And improve the management system for antibacterial drugs and strengthen the supervision of antibacterial drugs to provide patients with better and more accurate medical services.

Benefits of Multi-Departmental Linkage Supervision

multi-department linkage rational drug use supervision is applied to the application of antibacterial drugs in hospitals, which can not only ensure the rationality of drug use, make the use of antibacterial drugs more convenient, but also control the incidence of nosocomial infections, and reduce the drug resistance of nosocomial infection pathogens. This is a positive management program, which is worth popularizing and applying. Since the division of departments in primary hospitals is not clear enough, to effectively implementntimicrobial drugs, it is necessary to strengthen supervision and management with various departments.[24] In the process of supervision and management, corresponding reward and punishment measures can also be taken to reward departments and individuals who do well and to punish those who do not, which can improve the enthusiasm of supervisors for the supervision of scientific use of antibacterial drugs. At the same time, it can significantly reduce the phenomenon of misuse of antibacterial drugs in hospitals. The abuse of

antibacterial drugs can be effectively controlled through reasonable management of antibacterial drugsand the drug resistance of pathogenic bacteria can be effectively reduced, which has positive significance in clinical treatment activities.[25]

The results of this study show that the joint supervision of the application of antibacterial drugs can effectively reduce the incidence of drug resistance to pathogens, improve the distribution of drug resistance to pathogens, and improve the efficacy of treatment. Intervention in antimicrobial drug application is conducive to improving the drug-related knowledge reserve of clinicians, improving the rationality of drug use, helping to shorten treatment time, reducing treatment costs, and reducing the occurrence of drug-resistant bacteria. It is worthy of clinical promotion and application.

Evidence-Based Statements

Rational use of antibiotics requires specific analysis of specific diseases to develop an individualized treatment plan. Rational selection and rational application are two crucial issues for the rational use of antibiotics. In actual clinical treatment activities, antibiotics suitable for patients' conditions should be carefully selected, and the types of antibiotics used should be reduced as much as possible. Hospitals should continue to standardize and supervise the use of antibiotics. Strengthen management in terms of dosage, frequency, and course of treatmento ensure the scientific use of antibacterial drugs so that the drug resistance of nosocomial infection pathogens can be effectively controlled.[26] Relevant studies believe that the unreasonable application of antibacterial drugs will lead to enhanced drug resistance of pathogenic bacteria and may even lead to the emergence of multidrug-resistant pathogens in severe cases, which will greatly impact treatment work. Relevant studies have shown that when screening the use of antibiotics in most hospitals, it was found that the standardization of antibiotics was inversely proportional to bacterial resistance. When using antibacterial drugs for the first time, if the indications are not well grasped, there is no detailed medication basis, and there are problems with the dosage and course of treatment of antibacterial drugs, it will lead to poor use of antibacterial drugs.[27] To ensure the rational application of antimicrobials, it is necessary to analyze the hospital in detail and do a good job in the joint supervision of multiple departments. Not only must it conform to the hospital's management model, but it also needs to formulate an effective and feasible reward and punishment system according to the management plan of the relevant management department. While carrying out the rational application of antibacterial drugs, it also strengthens the connection of multi-departmental cooperation and promotes communication between various department.[28] This method is called multi-department linkage supervision. When carrying out rational drug use management, medical staff should provide detailed medication guidance for patients in accordance with the relevant content of drug instructions in their daily work. On the one hand, it can avoid the phenomenon of irregular medication and unauthorized discontinuation in the process of medication; on the other hand, it can also make the doctor's treatment plan more systematic and standardized.[29] Physicians should pay close attention to the patient's medication status when giving medication to the patient to avoid adverse drug reactions. When necessary, the drug can be stopped or replaced to ensure the patient's therapeutic effect and medication safety.

Limitations and Future Research

Due to limited conditions, this study did not further detect the drug-resistance genes of drug-resistant bacteria or explore the mechanism of bacterial drug resistance. We hope to improve the experimental conditions in the follow-up research, strive to detect the resistance genes of various drug-resistant bacteria, and provide a scientific basis for preventing and controllingrug-resistant bacteria in this region.[30]

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