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Epidemic Characteristics and Control of Acinetobacter Baumannii

Yuxia Bao

The Affiliated Hospital of Inner Mongolia Medical University, Huhehot, Mongolia, 010050, China

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Abstract: Acinetobacter baumannii belongs to Moraceae and Acinetobacter. In the past three decades, Acinetobacter baumannii has gradually developed into a very important hospital infection pathogen, and the number of hospital infection cases and outbreaks caused by this bacterium has gradually increased. Acinetobacter baumannii has a remarkable ability to quickly establish drug resistance mechanisms. Some strains are even resistant to all current antibiotics. The emergence of multi drug resistant strains has caused great difficulties in clinical treatment. In this paper, the epidemiological characteristics of Acinetobacter baumannii infection and its prevention and treatment strategies were reviewed.

1. Introduction

Acinetobacter baumannii is one of the common non-fermented Gram-negative bacilli, which is ubiquitous in nature and easy to survive in human skin and humid environment[1]. Because of its strong adhesive ability, it can be transmitted in hospital through the hands of medical staff and ward staff and incomplete disinfection of medical instruments. In addition, in recent years, due to the irrational use of antibacterial drugs and the increase of various invasive tests, the nosocomial infection of this bacterium has increased year by year[2]. The rising trend of nosocomial infection of Acinetobacter baumannii, the decrease of its sensitivity to various antimicrobial agents, and the emergence of multidrug-resistant Acinetobacter baumannii make it a global clinical treatment problem and research hotspot[3].

In recent years, the clinical detection rate of Acinetobacter baumannii is high, and it has become one of the main pathogenic bacteria of nosocomial infection in China. Acinetobacter baumannii is the only clinically isolated gram-negative bacteria, second only to Escherichia coli and Klebsiella pneumoniae[4]. Acinetobacter baumannii can cause hospital-acquired pneumonia, bloodstream infection, abdominal infection, central nervous system infection, urinary system infection, skin and soft tissue infection, etc., and even lead to the death of patients. Acinetobacter baumannii has long-term survival ability in vitro, which is easy to cause clone spread. It also plays an important role in hospital infection monitoring, and it has caused outbreaks in burn department and intensive care unit[5]. In recent years, with the wide application of antibiotics, the drug resistance of Acinetobacter baumannii has become more and more serious. The emergence of multi-drug resistant Acinetobacter baumannii and pan-drug resistant Acinetobacter baumannii has brought

some difficulties to clinical anti-infection treatment, which has aroused people's great attention and alarm[6]. The risk factors of Acinetobacter baumannii infection include: long-term hospitalization, admission to intensive care unit, mechanical ventilation, invasive operation, exposure to antibiotics and serious basic diseases[7]. Acinetobacter baumannii infection is common in critically ill patients, often accompanied by other bacterial and/or fungal infections. The mortality of Acinetobacter baumannii infection patients is high, but there is a lack of large-scale clinical research on its attributable mortality.

2. Epidemic Characteristics and Drug Resistance

2.1 Epidemic Characteristics

In recent years, there have been reports of the prevalence of Multidrug Resistant Acinetobacter Baumannii (MDRAB) around the world, such as in Asia, Europe, North America, South America and the Western Pacific. Some may lead to the prevalence of MDRAB in the whole city and country, or even spread widely among different countries, which has become a public health problem that needs to be actively addressed. With the increasing proportion of Acinetobacter baumannii clinical isolates in China, China has also entered the ranks of countries with serious prevalence of this bacterium[8]. At present, reports of outbreaks of infection caused by Acinetobacter baumannii in hospitals have emerged in different regions of China. The phenomenon of clonal dissemination suggests that some cloned MDRAB are easy to survive in nature, hospital environment, human skin and other suitable environments due to their significant drug resistance and strong viability, resulting in widespread transmission[9].

Acinetobacter baumannii is an important pathogen of hospital infection, especially in the intensive care unit, and also an important pathogen of community acquired pneumonia. The patients infected with Acinetobacter baumannii are mainly concentrated in Intensive Care Unit (ICU), respiratory medicine department, burn infection department and neurosurgery department. The most serious infection is in ICU. The reason may be related to many factors such as the serious condition of patients in these departments, long hospitalization, frequent and long invasive operations, poor body resistance due to the use of various broad-spectrum antibacterial drugs and immunosuppressants, etc. These factors provide Acinetobacter baumannii with a suitable survival The condition of proliferation and dissemination is easy to cause infection.

The outbreak of Acinetobacter baumannii nosocomial infection is mainly caused by homologous pollution, especially the contaminated ventilator or catheter related equipment, which spreads the bacteria planted in infected patients or contaminated articles through the hands of medical staff. It is reported that almost everything in the hospital may be a potential source of infection, including soap, soap dispenser, bed edge, bed sheet, pillow, computer keyboard, door handle and drip stand, etc. Even Acinetobacter baumannii was isolated from suspended particles in the air.

2.2 Drug Resistance Analysis

The drug resistance mechanism of Acinetobacter baumannii is complex, as shown in Figure 1.

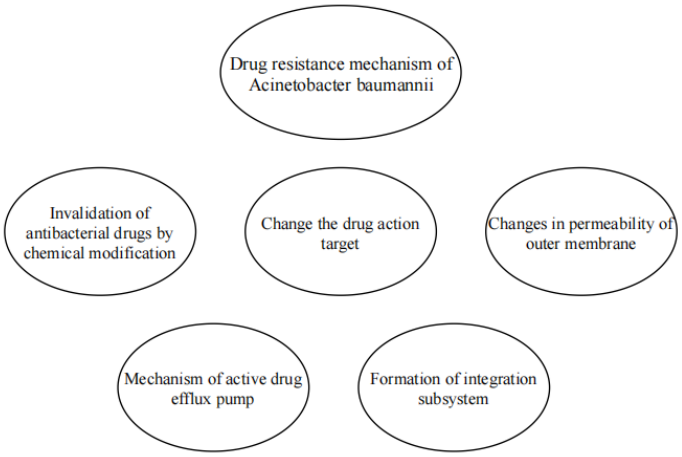

Figure 1: Factors of Drug Resistance Mechanism

At present, it is uncertain whether the drug resistance gene of Acinetobacter baumannii is original or acquired by the bacteria. With the in-depth exploration of the drug resistance gene of Acinetobacter baumannii, the complexity of the drug resistance gene of Acinetobacter baumannii has also been further recognized. Acinetobacter is a gram-negative coccobacterium that does not ferment sugar, and can be divided into at least 16 gene species. Acinetobacter baumannii (AB) is its main strain. AB is mostly a conditional pathogen. Because of its widespread distribution in water, soil, hospital environment and human skin surface, its strong environmental viability and extensive drug resistance, AB has become an increasingly important hospital infection pathogen. In general, AB strains resistant to at least three of the seven commonly used antibiotics against Pseudomonas are called MDRAB. The seven antibiotics are shown in Table 1. The AB strain that is fully resistant to the above seven types of antibiotics is called Acinetobacter baumannii with universal resistance (PDRAB). According to the statistics of a university hospital, the infection of Acinetobacter spp. (CRAB) resistant to carbapenems showed an upward trend in 8 years, and PDRAB emerged rapidly in the past 3 years. The survey shows that the increase of MDRAB is related to the annual use of ciprofloxacin and carbapenems in hospitals. With the wide application of antibiotics, especially in those producing broad-spectrum β- It is inevitable that the incidence of CR-AB and PDRAB will increase rapidly in hospitals where the incidence of Enterobacter lactamases or AmpC producing enzymes increases. The use of carbapenems is an independent risk factor for MDRAB.

Table 1: Seven Antibiotics

Types of antibiotics
Penicillins against Pseudomonas spp
Cephalosporins
Aminoglycosides
Quinolones
Carbapenems
Tetracyclines
Sulfonamides

3. Treatment and Prevention Control

3.1 Treatment

Due to the complex and diverse drug resistance mechanism of Acinetobacter baumannii, the reports of multi-drug resistance and pan-drug resistance of Acinetobacter baumannii are increasing gradually, which makes the selection of clinical antimicrobial agents face serious challenges. The treatment of Acinetobacter baumannii infection should be based on the patient's clinical situation and drug sensitivity results, and single drug therapy or combined drug therapy should be adopted. For the treatment of multi-drug resistant Acinetobacter baumannii infection cases, clinicians often use combined drug therapy to improve the curative effect of antibiotics, reduce adverse reactions and prevent the production of drug-resistant bacteria by reducing drug dosage[10].

Antibiotic-sensitive Acinetobacter baumannii infection can usually be caused by cephalosporins, β-lactam/β-lactamase inhibitors, or carbapenems alone or in combination with aminoglycosides. The treatment time is similar to other infections caused by Gram-negative bacilli, which is generally judged empirically by clinicians and depends on the infection site.

At present, it is difficult to treat multidrug-resistant Acinetobacter baumannii, especially carbapenem-resistant Acinetobacter baumannii. One of the drugs that can be selected is polymyxin and the other is tigecycline. Polymyxin showed low drug resistance in multi-drug resistant and carbapenem resistant Acinetobacter baumannii isolates, and the effective rate was over 80% in some clinical studies. The combination of polymyxin and other drugs in the treatment of nosocomial infections caused by multidrug-resistant Acinetobacter baumannii has also achieved remarkable results, but the adverse reactions of polymyxin drugs are obvious, mainly nephrotoxicity and neurotoxicity. Ticycline has good activity against most gram-negative bacilli such as Acinetobacter.

3.2 Prevention and Control

To prevent and control the hospital infection of Acinetobacter baumannii, we should first establish a sound monitoring system in the hospital to monitor the hospital infection cases, Acinetobacter baumannii and its drug resistance, and the use of antibiotics, so as to actively control the spread of infection in the early stage. The step-down prevention and control strategy can be used, that is, to classify patients according to their epidemiological data and related risk degree, and to implement different levels of dynamically adjustable hierarchical prevention and control measures for patients, which can prevent the further spread of drug-resistant bacteria infection

The control of transmission routes mainly includes hand hygiene of medical personnel, environmental pollution, surgical incision and invasive operation of patients. Before and after invasive operation, before and after nursing the patient, before and after contact with the patient's mucous membrane, damaged skin or wound, after contact with the patient's blood, body fluid, secretion, excreta and wound dressing, hand washing should be strictly carried out to reduce the occurrence of cross infection. During arteriovenous catheterization, thoracentesis, abdominal cavity puncture, use of respirator and catheterization, aseptic technical operation procedures must be strictly followed, and the status of catheter indwelling and the time of catheter use must be checked frequently. If any abnormality is found, it should be handled in a timely manner to prevent infection caused by invasive operation. When necessary, bacterial culture and drug sensitivity test should be conducted at the end of catheter after catheter removal. The use of antibiotics is also a risk factor for the outbreak of multidrug-resistant Acinetobacter baumannii hospital infection. Attention should be paid to and strengthening the management of multidrug-resistant Acinetobacter baumannii hospital infection. Microbiological examination and drug sensitivity test for patients with signs of infection

can help to find Acinetobacter baumannii infection in time, rational application of antibiotics can delay the generation of drug resistance, and comprehensive prevention and control of the transmission of Acinetobacter baumannii.

4. Conclusions

Acinetobacter baumannii bloodstream infection mostly occurs in severe patients, especially those who stay in hospital for a long time, often accompanied by infection in many parts of the body and various invasive procedures, with high mortality. The use of immunosuppressant, nonstandard use of antibiotics, lung infection, invasive operation, especially invasive mechanical ventilation are the risk factors of death caused by Acinetobacter baumannii bloodstream infection. Acinetobacter baumannii, which causes bloodstream infection, is mostly a multi-drug genus. Timely and repeated blood culture is of great significance for improving the diagnosis rate, selecting sensitive antimicrobial agents and avoiding the abuse of antimicrobial agents. In clinic, we should pay attention to the prevention and control of nosocomial infection, try our best to improve the patient's body condition, enhance the patient's immunity, reduce all kinds of invasive operations, standardize the use of antibacterial drugs, identify high-risk patients as soon as possible, reduce the risk factors of blood flow infection, and give certain intervention measures at an early stage to reduce the blood flow infection rate and the mortality rate.

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