Antibiotic-resistant bacteria

Antibiotic-resistant bacteria are strains of bacteria that have developed mechanisms to evade the effects of antibiotics, rendering them ineffective in treating infections caused by these bacteria. Over time, bacteria can acquire genetic changes or acquire resistance genes from other bacteria, allowing them to survive and multiply even in the presence of antibiotics.

There are several mechanisms by which bacteria can become resistant to antibiotics:

Mutation: Bacteria can undergo spontaneous mutations in their DNA, leading to changes in their genetic code that make them less susceptible or completely resistant to the action of antibiotics. These mutations can affect various targets, such as the bacterial cell wall, enzymes, or other cellular processes.

Horizontal gene transfer: Bacteria have the ability to exchange genetic material with other bacteria, even across different species. This transfer can occur through mechanisms like conjugation (direct transfer of genetic material between bacteria), transformation (uptake of DNA from the environment), or transduction (transfer of DNA via bacteriophages). If the transferred DNA carries antibiotic resistance genes, the recipient bacterium can acquire resistance to those antibiotics.

Antibiotic inactivation or modification: Some bacteria produce enzymes that can chemically modify or break down antibiotics, rendering them inactive. For example, beta-lactamase enzymes produced by certain bacteria can degrade beta-lactam antibiotics, such as penicillins and cephalosporins.

Efflux pumps: Bacteria can possess efflux pumps that actively pump out antibiotics from within the bacterial cell, preventing the antibiotics from reaching their intended targets at effective concentrations.

The emergence and spread of antibiotic-resistant bacteria have become a global health concern. Antibiotic resistance can lead to more severe and prolonged infections, increased mortality rates, and higher healthcare costs. It poses challenges in treating common infections, such as urinary tract infections, respiratory tract infections, and wound infections, as well as more serious infections like bloodstream infections.

To combat antibiotic resistance, various strategies are employed:

Antibiotic stewardship: Promoting the appropriate and responsible use of antibiotics by healthcare professionals, ensuring that antibiotics are prescribed only when necessary, and optimizing the selection, dosage, and duration of antibiotic therapy.

Infection prevention and control: Implementing strict infection control practices in healthcare settings to prevent the spread of resistant bacteria, including proper hand hygiene, use of personal protective equipment, and adherence to sterilization and disinfection protocols.

Development of new antibiotics: Research and development efforts are ongoing to discover and develop new antibiotics that can effectively target resistant bacteria and combat emerging resistance mechanisms.

Combination therapy: Using a combination of antibiotics with different mechanisms of action to enhance effectiveness and prevent the development of resistance.

Alternative approaches: Exploring alternative treatment options, such as phage therapy (using bacteriophages to infect and kill bacteria) or the use of bacteriocins (naturally occurring antimicrobial peptides produced by bacteria).

It is important for healthcare providers, researchers, policymakers, and the general public to work together to address the problem of antibiotic resistance through a multifaceted approach, aiming to preserve the efficacy of existing antibiotics while promoting the development of new treatment strategies.

Qiu et al. investigated the contamination of antibiotic-resistant bacteria in the air of different departments in hospitals.

From 2018.07 to 2021.06, 191 samples of air-conditioning filter dust in three hospitals were collected. Antibiotic-resistant bacteria were isolated from the accumulated dust. The drug sensitivity test was conducted for Staphylococcus aureus, Acinetobacter baumannii, and Enterobacteriaceae.

A total of 119 samples were detected with antibiotic-resistant bacteria from 191 samples, and the detection rate was 62.30%. The detection rate of different departments from high to low was surgical ward(68.29%) >intensive care unit(ICU)(59.62%) >medical ward(57.92%). A total of 362 strains of antimicrobial-resistant organisms were isolated, mainly were Acinetobacter(28.73%), Pseudomonas (22.10%), Bacillus(22.10%), Staphylococcus(9.12%), etc. Among them, 72 strains of target organisms were detected, and the detection rate was 19.89%(72/362), the detection rate of different target bacteria from high to low was Acinetobacter baumannii(12.71%)> Enterobacteriaceae(4.72%)> Staphylococcus aureus(2.76%)(P<0.05). The drug sensitivity test showed that 41 strains of antimicrobial-resistant organisms were detected, and the detection rate was 56.94%(41/72), including carbapenem-resistant Acinetobacter baumannii(CR-ABA), methicillin-resistant Staphylococcus aureus(MRSA), carbapenem-resistant Enterobacteriaceae(CRE), etc.24 strains of multidrug-resistant organisms(MDROs) were detected and the detection rate was 58.54%(24/41). The detection rate of different departments from high to low was ICU(80.00%)>medical ward(60.00%)>surgical ward(46.15%).

There was contamination by Acinetobacter baumannii, Staphylococcus aureus, and Enterobacteriaceae in the air of hospitals, some of them were MDROs, mainly detected in neurological ward, respiratory medical ward, thyroid and breast surgery ward, neurosurgery ward, cardiothoracic surgery ward, gallideulous surgical ICU and general ICU [1].

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Qiu W, Xia Y, Gong L, Yuan F, Chen Q, Li J, Liang J, Tang F. [Antibiotic-resistant bacteria contamination in the air of different departments in hospital]. Wei Sheng Yan Jiu. 2022 Jul;51(4):617-623. Chinese. doi: 10.19813/j.cnki.weishengyanjiu.2022.04.020. PMID: 36047268.