ANTIMICROBIAL RESISTANCE — A GLOBAL THREAT IN MODERN MEDICINE

Mo'minov M.Sh

Bachelor's Student, Faculty of Medicine Kokand University, Andijan Branch
Andijan, 170100

https://orcid.org/0009-0003-9978-6276

Antimicrobial resistance (AMR) is a complex biological process characterized by microorganisms adapting to the effects of antimicrobial drugs and consequently losing their sensitivity to them. Today, AMR is one of the most pressing challenges facing the global healthcare system, as it severely limits the effectiveness of treatment for infectious diseases. According to the World Health Organization (WHO), if appropriate measures are not taken, antibiotic-resistant infections may become one of the leading causes of death in the future.

Although the discovery of antibiotics marked a revolutionary turning point in the history of medicine, their uncontrolled and inappropriate use has led to the rapid development of resistant microorganisms. As a result, many infectious diseases that were previously easy to treat now present with severe clinical courses and high mortality rates.

One of the main etiological factors contributing to the development of antimicrobial resistance is the irrational use of antibiotics. This includes self-medication, taking antibiotics without a physician's prescription, incorrect dose selection, and failure to complete the full course of treatment. In addition, unjustified use of broad-spectrum antibiotics disrupts the natural balance of the microbiota and promotes the selection of resistant strains.

The molecular mechanisms of AMR include enzymatic inactivation of antibiotics, alteration of target receptors, increased activity of efflux pumps, and reduced permeability of the bacterial cell wall. These mechanisms enable bacteria to evade the effects of antimicrobial agents.

Currently, the most dangerous resistant pathogens encountered in clinical practice include methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), extended-spectrum beta-lactamase (ESBL)-producing *Escherichia coli* and *Klebsiella pneumoniae*, as well as carbapenem-resistant *Enterobacteriaceae* (CRE). These microorganisms are commonly identified in cases of sepsis, nosocomial pneumonia, urinary tract infections, and postoperative complications.

The negative consequences of antimicrobial resistance are not limited to clinical challenges alone. Prolonged treatment duration, extended hospital stays, and the need to use expensive reserve antibiotics impose a significant economic burden on healthcare systems. Moreover, AMR restricts the advancement of high-risk medical fields such as transplantation, oncology, and intensive care medicine.

Prevention and Control Measures

The implementation of antibiotic stewardship programs plays a crucial role in combating antimicrobial resistance. These programs promote the rational selection of antibiotics and their use at appropriate doses and for optimal durations. In addition, adherence to infection control protocols, along with enhanced sterilization and disinfection measures, is essential for preventing the spread of nosocomial infections.

Improving medical literacy among the general population and providing continuous education for physicians and healthcare workers are also effective strategies in preventing AMR. Furthermore, the development of alternative therapeutic approaches—such as next-generation antibiotics, bacteriophages, and immunotherapy—remains one of the priority areas of modern scientific research.

Conclusion: In conclusion, antimicrobial resistance is a global challenge facing modern medicine and requires a comprehensive and systematic approach to address it. Rational use of antibiotics, strengthening infection control measures, and advancing scientific research are essential for reducing the negative impact of AMR. Effective implementation of these strategies will play a decisive role in protecting the health of future generations.

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