

# Antibiotic Resistance and its Mechanisms of Development

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**Abstract-** Resistance to antibiotic is biological phenomenon that can be accelerated by variety of factor including human practices.

According to researchers, the resistance to antibiotic is increasing at faster rate than it can be control .since antibiotic resistance can pass from bacterium to bacterium and resistance bacterial infection can pass from person to person.

New resistance mechanisms are emerging and spreading globally threatening our ability to treat common infectious diseases results in prolonged illness disability and death without effective antimicrobial for prevention and treatment of infection, medical procedure become very high risk. Developing prescription guidelines, public awareness, quality compliance and monitoring of antibiotics manufactured or dispensed, public sanitization, improved hospital infection control are some of the measures to be taken to prevent growing problem of antibiotic resistance.

Antibiotic resistance can cause significant danger and suffering for children and adults who have common infections, once easily treatable with antibiotics. Microbes can develop resistance to specific medicines. A common misconception is that a person's body becomes resistant to specific drugs. However, it is microbes, not people that become resistant to the drugs. If a microbe is resistant to many drugs, treating the infections it causes can become difficult or even impossible. Someone with an infection that is resistant to a certain medicine can pass that resistant infection to another person. In this way, a hard-to-treat illness can be spread from person to person. In some cases, the illness can lead to serious disability or even death.

**Index terms-** Antibiotics, Mechanisms, Resistance

**Key Facts:** Antibiotics are the lifesaving drugs.

**They only treat bacterial infections**

**Use antibiotics only if required & use as per direction.**

## INTRODUCTION

Antibiotics:

Antibiotics are the chemical substances produced by various micro-organisms capable of destroying and inhibiting the growth of microorganisms.

Ex: penicillin, streptomycin, erythromycin

Antibiotic resistance:

Ability of bacteria and other micro-organisms to withstand antibiotic to which they were once sensitive, Antibiotic resistance occurs when bacteria change in some way that reduces or eliminates the effectiveness of drugs, chemicals, or other agents designed to cure or prevent infections. The bacteria survive and continue to multiply causing more harm. Antibiotic resistance has been called one of the world's most pressing public health problems. Almost every type of bacteria has become stronger and less responsive to antibiotic treatment when it is really needed. These antibiotic-resistant bacteria can quickly spread to family members, schoolmates, and co-workers - threatening the community with a new strain of infectious disease that is more difficult to cure and more expensive to treat.

Causes of antibiotic resistance:

Antibiotic use promotes development of antibiotic-resistant bacteria. Every time a person takes antibiotics, sensitive bacteria are killed, but resistant

germs may be left to grow and multiply. Repeated and improper uses of antibiotics are primary causes of the increase in drug-resistant bacteria.

While antibiotics should be used to treat bacterial infections, they are not effective against viral infections like the common cold, most sore throats, and the flu. Widespread use of antibiotics promotes the spread of antibiotic resistance. Smart use of antibiotics is the key to controlling the spread of resistance.

Some common causes are given below:

- Over prescription of antibiotics
- Patient not finishing the entire course of antibiotics
- Poor hygiene and sanitation
- Poor infection control in health care setting

#### Cycle of antibiotic resistance

Antibiotic resistance occurs when bacteria change in some way that reduces or eliminates the effectiveness of drugs, chemicals, or other agents designed to cure or prevent infections. The bacteria survive and continue to multiply causing more harm. Bacteria can do this through several mechanisms. Some bacteria develop the ability to neutralize the antibiotic before it can do harm, others can rapidly pump the antibiotic out, and still others can change the antibiotic attack site so it cannot affect the function of the bacteria.



Antibiotics kill or inhibit the growth of susceptible bacteria. Sometimes one of the bacteria survives because it has the ability to neutralize or escape the effect of the antibiotic; that one bacterium can then multiply and replace all the bacteria that were killed off. Exposure to antibiotics therefore provides selective pressure, which makes the surviving bacteria more likely to be resistant. In addition, bacteria that were at one time susceptible to an antibiotic can acquire resistance through mutation of their genetic material or by acquiring pieces of DNA that code for the resistance properties from other

bacteria. The DNA that codes for resistance can be grouped in a single easily transferable package. This means that bacteria can become resistant to many antimicrobial agents because of the transfer of one piece of DNA.

Mechanisms of antibiotic resistance to beta lactam antibiotic:

Antibiotic resistance occurs by following ways, For beta lactam antibiotics:

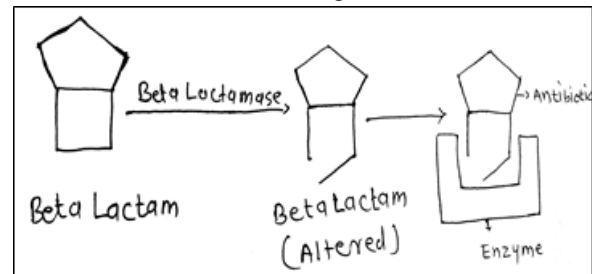
Beta lactam is class of antibiotics which includes penicillin, ampicillin, and amoxicillin.

Beta lactam antibiotics act by inhibiting the cell wall synthesis.

Resistance to antibiotics is carried out in various ways, some of them are

1. via enzymatic degradation:

Beta lactam ring degraded by enzyme beta lactamase and the structure of antibiotic get altered.



2. by alteration in enzyme:

Transpeptidase enzyme is also called penicillin binding protein .due to modification in enzyme the enzyme unable to bind with antibiotic like penicillin. As a result the process of peptidoglycan synthesis goes unaltered



3. Rapid efflux:

Antibiotics comes inside the bacterial cell ,after entering into cell, the cell will starts to expel antibiotics outside the bacterial cell through pumps and minimize the effect of antibiotics.

High levels of antibiotic resistance found worldwide: WHO’s first release of surveillance data on antibiotic resistance reveals high levels of resistance to a

number of serious bacterial infections in both high- and low-income countries.



WHO's new Global Antimicrobial Surveillance System (GLASS) reveals widespread occurrence of antibiotic resistance among 500 000 people with suspected bacterial infections across 22 countries.

The most commonly reported resistant bacteria were *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, and *Streptococcus pneumoniae*, followed by *Salmonella* spp. The system does not include data on resistance of *Mycobacterium tuberculosis*, which causes tuberculosis (TB), as WHO has been tracking it since 1994 and providing annual updates in the Global tuberculosis report. Among patients with suspected bloodstream infection, the proportion that had bacteria resistant to at least one of the most commonly used antibiotics ranged tremendously between different countries – from zero to 82%. Resistance to penicillin the medicine used for decades worldwide to treat pneumonia ranged from zero to 51% among reporting countries. And between 8% to 65% of *E. coli* associated with urinary tract infections presented resistance to ciprofloxacin, an antibiotic commonly used to treat this condition.

#### Overview of antibiotic resistance in India:

India is among the nations with the highest burden of bacterial infections.

An estimated 410,000 children aged five or less die from pneumonia in India annually; with pneumonia accounting for almost 25 % of all child deaths. The crude mortality from infectious diseases in India today is 417 per 100,000 persons.

The Food Safety and Standards Authority of India (FSSAI) banned the use of antibiotics and several pharmacologically active substances in fisheries. There is no regulation in the poultry industry where many of the commercially available pre-mixed feeds come with added antibiotics

Consequence of antibiotic resistance:

1. Long lasting illness
2. Extended hospital stay
3. Prolonged treatment
4. Increase cost of treatment

Global action plan

The "Global action plan on antimicrobial resistance" has 5 strategic objectives:

1. To improve awareness and understanding of antimicrobial resistance.
2. To strengthen surveillance and research.
3. To reduce the incidence of infection.
4. To optimize the use of antimicrobial medicines.
5. To ensure sustainable investment in countering antimicrobial resistance.

Prevention:

1. Don't take antibiotics for viral infection
2. Don't to take some else's antibiotics
3. Complete your prescribed course of treatments
4. Make sure your vaccination up to date
5. Don't share to your antibiotics with anyone.
6. Keep your hands clean, Cover your mouth and nose when or sneezing.
7. Avoid touching your eyes, nose, and mouth with unwashed hands.
8. Avoid close contact with people who have colds or other upper respiratory infections.
9. Take antibiotics ONLY if you need them.: Whooping cough, Urinary tract infection (UTI)
10. Antibiotics DO NOT work on viruses, such as those that cause: Colds and runny noses, even if the mucus is thick, yellow, or green most sore throats (except strep throat)

#### CONCLUSION

- Antibiotics are at end of road.
- Antibiotics are precious.

- We need to preserve this resource by working together.
- Combating antimicrobial resistance requires action today or there will be no cure tomorrow.

Antibiotics are extensively used both on human and animal health practices in developed and developing countries of the world mainly for treatment and control of various diseases. However the use, misuse and overuse of these medicines contributed favorable conditions for the emergence, and development of antibiotic resistant bacteria. Similarly, the other factor which contributes for includes: Sub-therapeutic doses, non-laboratory oriented antibiotic therapy, use of ineffective drugs and poor storage of drugs. These all can result infections with much more difficult to treat. Even though there are guidelines in both human and veterinary medicine for responsible use of antibiotics, vaccination, competitive exclusions and others for rational use and the control of antibiotic resistance, there are still some indications on the misuse of antibiotics by health care providers, unskilled practitioners and drug consumers. These all coupled with rapid spread of resistant bacteria consequently, may lead to increased mortality; antibiotics are at end of road .antibiotics are precious .we need to preserve this resource by working together. Combating antimicrobial resistance requires action today or there will be no cure tomorrow.

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