Antimicrobial Resistance (AMR)

Definition:
Antimicrobial resistance (AMR) is the ability of microorganisms (bacteria, viruses, fungi, and parasites) to resist the effects of medications that once could successfully treat them, leading to reduced efficacy of standard treatments, persistence of infections, and increased spread to others.

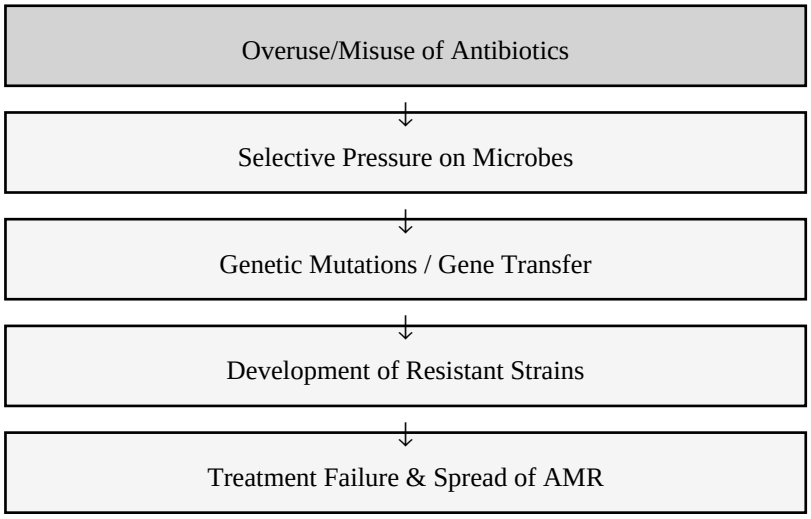
Etiopathogenesis:
- Overuse and misuse of antibiotics in humans, animals, and agriculture.
- Incomplete or inappropriate antibiotic therapy.
- Poor infection control practices in healthcare settings.
- Genetic mutations in microbes or acquisition of resistance genes (plasmids, transposons).
- Mechanisms of resistance:
  • Enzyme production (β-lactamases).
  • Altered drug target sites.
  • Reduced permeability or efflux pumps.
  • Biofilm formation protecting bacteria from antibiotics.

Clinical Manifestations:
- Recurrent, persistent, or severe infections not responding to standard treatment.
- Increased duration of illness and hospitalization.
- Higher risk of complications and mortality.
- Common resistant infections: MRSA, VRE, MDR-TB, ESBL-producing E. coli, Carbapenem-resistant Enterobacteriaceae (CRE).

Management:
<u>Non-Pharmacological:</u>
- Infection prevention and control (hand hygiene, sterilization).
- Vaccination to reduce disease burden.
- Antimicrobial stewardship programs.
- Public health education on rational drug use.
- Surveillance and monitoring of resistance patterns.

<u>Pharmacological:</u>
- Use of narrow-spectrum antibiotics guided by culture and sensitivity.
- Combination antibiotic therapy in resistant cases.
- Development of novel antibiotics and alternative therapies (phage therapy, immunotherapy).
- Optimized dosing and treatment duration to reduce resistance selection pressure.

Flowchart: Pathophysiology of Antimicrobial Resistance


Overuse/Misuse of Antibiotics
Selective Pressure on Microbes
Genetic Mutations / Gene Transfer
Development of Resistant Strains
Treatment Failure & Spread of AMR