Chapter-2 (I)

Anti-Microbial Resistance

Anti-microbial resistance

Resistance to antimicrobial agents has become a major source of morbidity and mortality worldwide. Its occurs due to the exposure of unspecific chemical or substance on to the microbes and leads to the physiological adaptation against the particular chemical or substance. It also occurs due to the repeatedly uses of the specific substances.

Antimicrobial agents can be divided into groups based on the mechanism of antimicrobial activity.

1. Agents that inhibit cell wall synthesis.
2. Depolarize the cell membrane.
3. Inhibit protein synthesis.
4. Inhibit nucleic acid synthesis.
5. Inhibit metabolic pathways in bacteria.

Antimicrobial are two types.

- Bacteriostatic. Chloramphenicol, macrolides, clindamycin, sulfa, trimethoprim, tetracyclines.
- Bactericidal. Aminoglycosides, beta-lactams, vancomycin, rifampin, metronidazole.

Factors contributing to antibiotic resistance.

1. Environmental factors— Due to the changes in the environmental condition, it modifies or effects the microbial growth and leads to the adaptation in the microbes against the particular environment condition.
    - Population and overcrowding.
    - Poor sanitation.
    - Ineffective infection control program.
    - Widespread use of antibiotics in animal husbandry and agriculture and as medicated cleansing products.

2. Drug related factors.
    - Fake and quality of drugs.
    - Soaring used is antibiotics.
    - OTC availability of antimicrobials.
    - Irrational fixed dose combination of antimicrobials.
3. Patient related factors.
    - Poverty.
    - Poor adhere of dosage regimens.
    - Lack of sanitation concept.
    - Lack of education.
    - Self-medication.
    - Misconception.
4. Physician/prescriber related factors—
    - Inappropriate use of available drugs.
    - Overuse of anti-microbial.
    - Inadequate dosing.
    - Lack of current knowledge and training.

Two types of antimicrobial resistance.

1. Intrinsic or natural— The most common bacterial mechanisms involved in intrinsic resistance are reduced permeability of the outer membrane and the naturel activity of efflux pumps.
    - It always expressed in the species.
2. Acquired— bacteria acquire any genetic material, transformation, transposition, and conjugation, mutations etc.

Mechanism of antimicrobial resistance—

- Limiting uptake of a drug— Certain bacteria modify their cell membrane porin channels, there by preventing the antimicrobials from entering into the cell. There are two main ways in which porin changes can limit drug uptake, a decrease in the number of porins present, and mutations that change the selectivity of the porin channel.
- Modification of a drug target—One mechanism of resistance to the beta-lactam drugs used almost exclusively by G+ bacteria is via alteration in the structure and number of PBPs (penicillin-binding proteins). Change in number decrease in binding ability.

- Inactivation of a drug— it is done by two mechanisms
  1. Actual degradation of the drug.
  2. Transfer of a chemical group to the drug.
- Active efflux of a drug— Bacteria posses chromosomally encoded genes for efflux pumps. Some are expressed constitutively, and others are induced or overexpressed under certain environmental stimuli or when a suitable substrate is present.