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المضادات الحيوية (BCH 476)

Antibiotics

Lecture 23: Bacteriostatic and bacteriocidal antibiotics

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Bacteriocidal/bacteriostatic versus Antibiotics/

- Bacteriostatic agents prevent the growth of bacteria.
- Refrigeration can be bacteriostatic for those bacteria that cannot reproduce at such low temperatures.
- Sometimes a bacteriostatic state is advantageous as it allows for the long-term storage of bacteria.
- Ultra-low temperature freezing and lyophilization (the controlled removal of water from a sample) are means of preserving bacteria.
- Another bacteriostatic technique is the storage of bacteria in a solution that lacks nutrients, but which can keep the bacteria alive. Various buffers kept at refrigeration temperatures can keep bacteria alive for weeks.

Bactericidal antiseptics

- As antiseptics (i.e., germicide agents that can be used on human or animal body, skin, wounds and the like), few of them can be used, under proper conditions (mainly concentration, pH, temperature and toxicity toward man/animal).
- Among them:
  - diluted chlorine preparations (Daquin's solution, 0.5% sodium or potassium hypochlorite solution, pH-adjusted to pH 7 - 8, or 0.5 - 1% solution of sodium benzenesulfochloramide (chloramine B).
  - iodine preparations, such as iodopovidone in various forms (ointment, solutions, wound plasters),
  - Lugol's solution, peroxides as urea perhydrate solutions and pH-buffered 0.1 - 0.25% peracetic acid solutions,
  - alcohols with or without antiseptic additives, used mainly for skin antisepsis,
  - weak organic acids, such as sorbic acid, benzoic acid, lactic acid and salicylic acid
  - some phenolic compounds, such as hexachlorophene, triclosan and Dibromol,
  - cation-active compounds, such as 0.05 - 0.5% benzalkonium, 0.5 - 4% chlorhexidine, 0.1 - 2% octenidine solutions.
  - Others are generally not applicable as safe antiseptics, either because of their corrosive or toxic nature.

Bacteriostatic antibiotics

- Antibiotics that limit the growth of bacteria by interfering with bacterial protein production, DNA replication, or other aspects of bacterial cellular metabolism.
- They only slow down the growth or reproduction of the infecting microorganism.
- Bacteriostatic antibiotics inhibit growth and reproduction of bacteria without killing them; killing is done by bactericidal agents.
- Bacteriostatic agents must work with the immune system to remove the microorganisms from the body. However, there is not always a precise distinction between them and bactericides;
- High concentrations of some bacteriostatic agents are also bactericidal, whereas low concentrations of some bacteriocidal agents are bacteriostatic.
- This group includes the
  - Tetracyclines
  - Trimethoprim
  - Macrolides
  - sulphonamides
  - chloramphenicol
  - lincosamides

Bactericidal antibiotics

- Bactericidal antibiotics kill bacteria
- Among of them antibiotics that inhibit cell wall synthesis: the Beta-lactam antibiotics, (penicillin derivatives (penams), cephalosporins (cephems), monobactams, and carbapenems) and vancomycin. There may be others.

- Aminoglycosidic antibiotics are usually considered bactericidal, although they may be bacteriostatic with some organisms

- **Penicillin** and its derivatives are bacteriocidal because they act on the peptidoglycan layer of Gram-positive and Gram-negative bacteria.
- By preventing the assembly of the peptidoglycan, penicillin antibiotics destroy the ability of the peptidoglycan to bear the stress of osmotic pressure that acts on a bacterium.
- The bacterium ultimately explodes. Other antibiotics are lethal because they prevent the manufacture of DNA or protein.
- Unlike bacteriocidal methods such as the use of heat, bacteria are able to acquire resistance to antibiotics. Indeed, such resistance by clinically important bacteria is a major problem in hospitals.