Antimicrobials (1)

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Chemotherapy

- Drugs used in treating infectious diseases and cancer.
- Infectious diseases are a major cause of death worldwide (Kozier, et al).
- The control of the spread of microbes & the protection of people from communicable diseases & infections are carried out on the international, national, community, and individual levels.

History

- 2500 years ago: anti-infective substances were found: Chinese used moldy soya beans for carbuncles & boils.
- Greeks (Hippocrates) used wine to treat wounds.
- 1900's: Syphilis treated with arsenic
- 1936: Sulfonamides discovered.
- 1940s: Penicillin & Streptomycin discovered.
- 1950s: Golden age of antimicrobials.

Infection related concepts

Infection: is an invasion of body tissue by microorganisms (MO's) & their growth there. Such a MO is called: infectious agent.

If the MO produces no clinical evidence of disease, the infection is called subclinical or asymptomatic.

If a MO leads to a detectable alteration in normal tissue function, it is called an infectious disease.

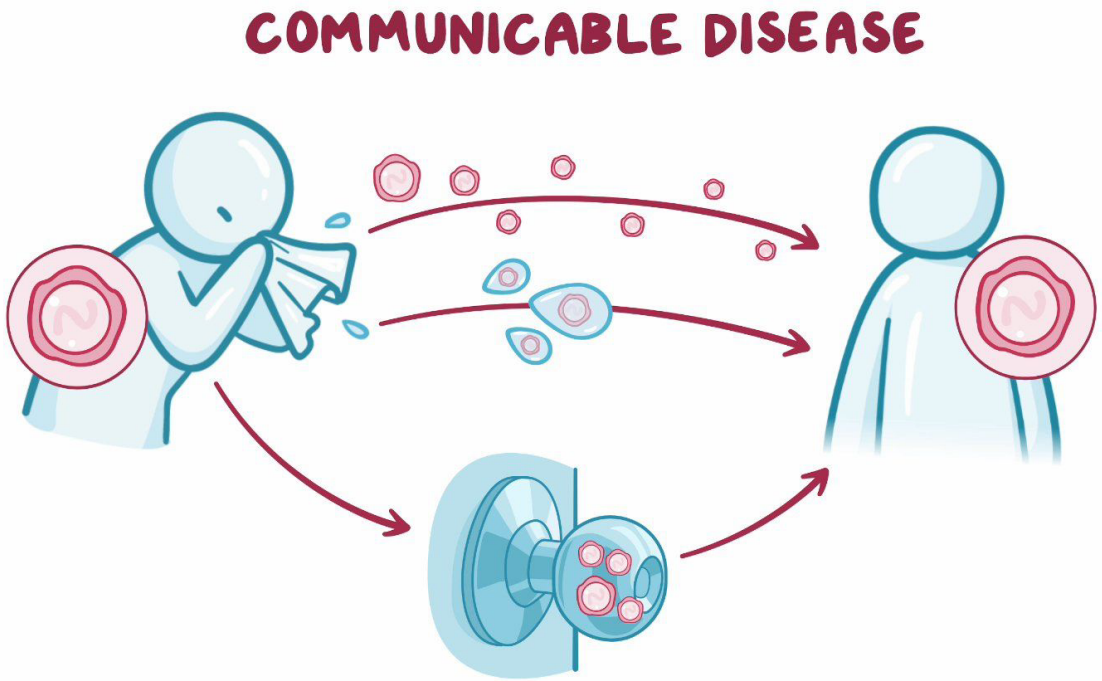
Infection related concepts

Pathogenicity: is the ability to produce disease; thus a pathogen is a MO that causes disease.

True pathogen causes disease or infection in a healthy individual.

Opportunistic pathogen causes disease only in a susceptible individuals

Communicable disease: is the ability of the infectious agent to be transmitted to an individual by direct or indirect contact or as an airborne infection, e.g.; common cold virus is more readily transmitted than the bacillus that causes leprosy (Hansen's disease).



Types of MOs Causing infections

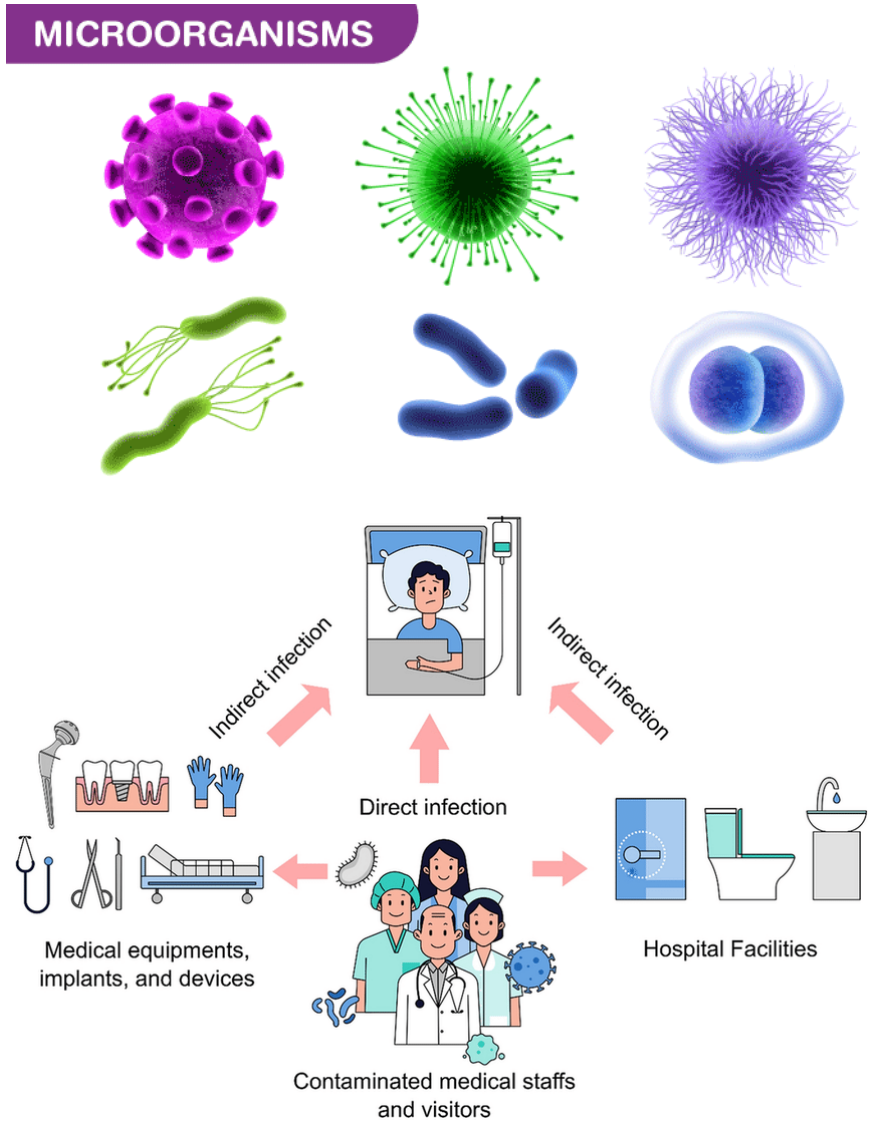
1. Bacteria: the most common, hundred species can attack humans, transferred by air, water, food, soil, body tissues & fluids, and inanimate objects.

2. Viruses: consist primarily of nucleic acid, therefore must enter living cells in order to reproduce (e.g.; rhinovirus, hepatitis, HIV)

3. Fungi: include yeasts & molds. Candida albicans is a normal flora in human mouth, GIT and vagina.

4. Parasites: live on other living organisms examples: protozoa that causes malaria, helminthes (worms), arthropods (mites, fleas, ticks).

Community-acquired: e.g. nosocomial=also referred to as healthcare-associated infections (HAI).



General manifestations of infection

Infection caused by bacteria take many forms, ranging from mild local infection to life-threatening systemic infection.

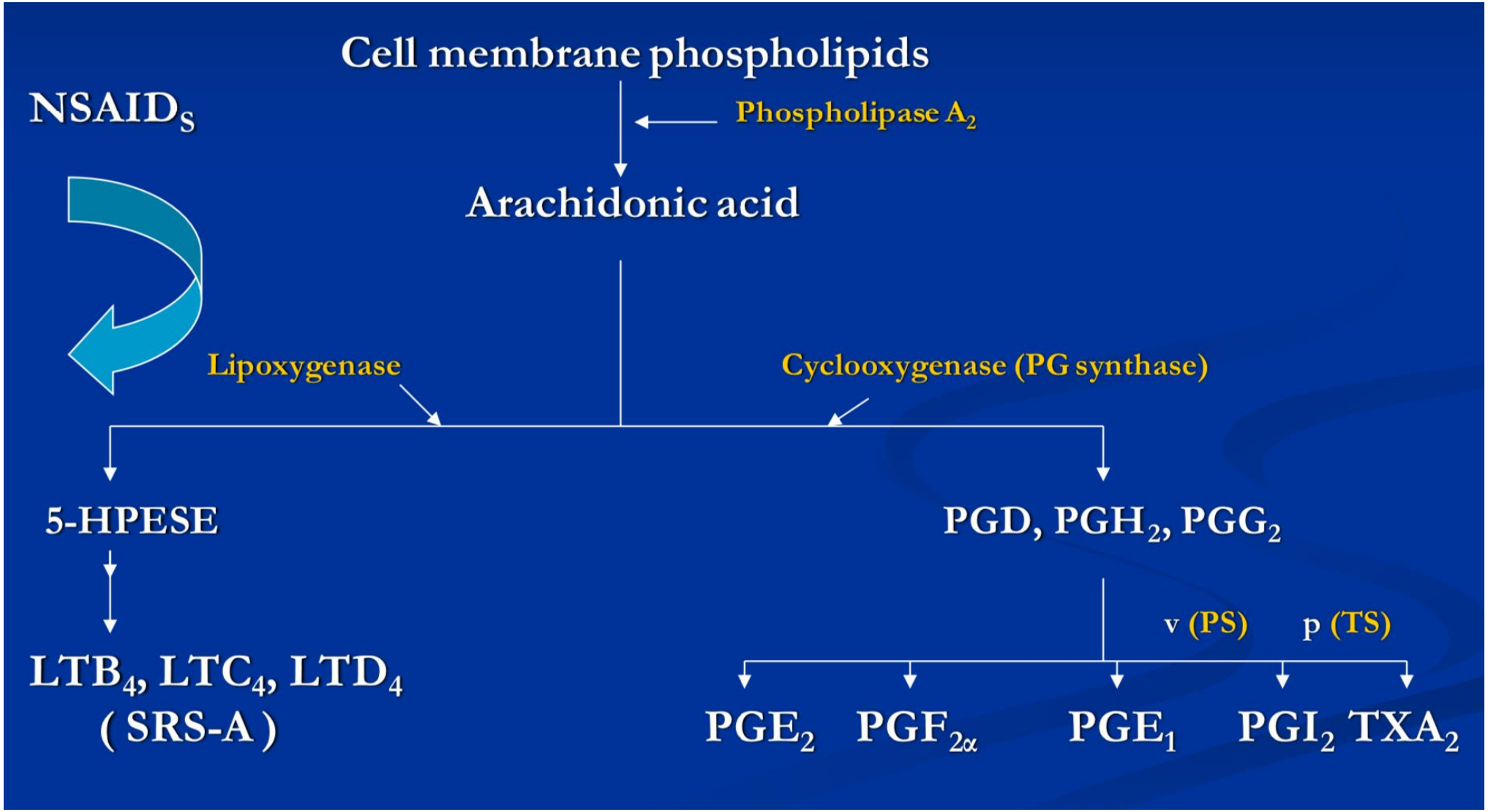
Fever, chills, rigors, Pain or aches, Nausea, Vomiting, Weakness..

Symptoms of Infections

- Fever (body temperature of 38 degrees and above)
- Redness around the site
- Swelling around the site
- Pain
- Loss of function of the area

Infection vs inflammation.

- An infection occurs when germs enter the body, increase in number, and cause a reaction of the body.
- Inflammation occurs when mediators and inflammatory cells travel to the place of an injury or foreign body like bacteria. It is an essential part of your body's healing process.
- Anti-inflammatory drugs have no antibacterial activity e.g. steroids and NSAIDs .
- Whereas, certain antibiotics have both antibacterial and anti- inflammatory effects e.g. azithromycin [interferes with the function of PLA2], tetracyclines and co-trimoxazole [suppress production of luekotrienes].


Cell membrane phospholipids
NSAIDS
Phospholipase A2
Arachidonic acid
Lipoxygenase
Cyclooxygenase (PG synthase)
5-HPESE
PGD, PGH2, PGG2
v (PS)
p (TS)
LTB4, LTC4, LTD4
(SRS-A)
PGE2
PGF2α
PGE1
PGI2
TXA2

Antimicrobials

Antimicrobials are classified into:

Antibiotics: Agents or antimicrobials that interfere with the growth or multiplication or kill microorganisms like bacteria, fungi and they are of natural source e.g. Penicillin's.

Chemotherapeutic agents: Agents or antimicrobials that interfere with the growth or multiplication or kill microorganisms and they are of synthetic source e.g. Sulfonamides.

Antiseptics: Agents that kill or inhibit growth of microorganisms when applied to tissues.

Disinfectants: Agents killing or inhibiting growth of microorganisms when applied to nonliving objects.

Cidal vs. Static

Cidal (Irreversible inhibition of growth within therapeutic dose):

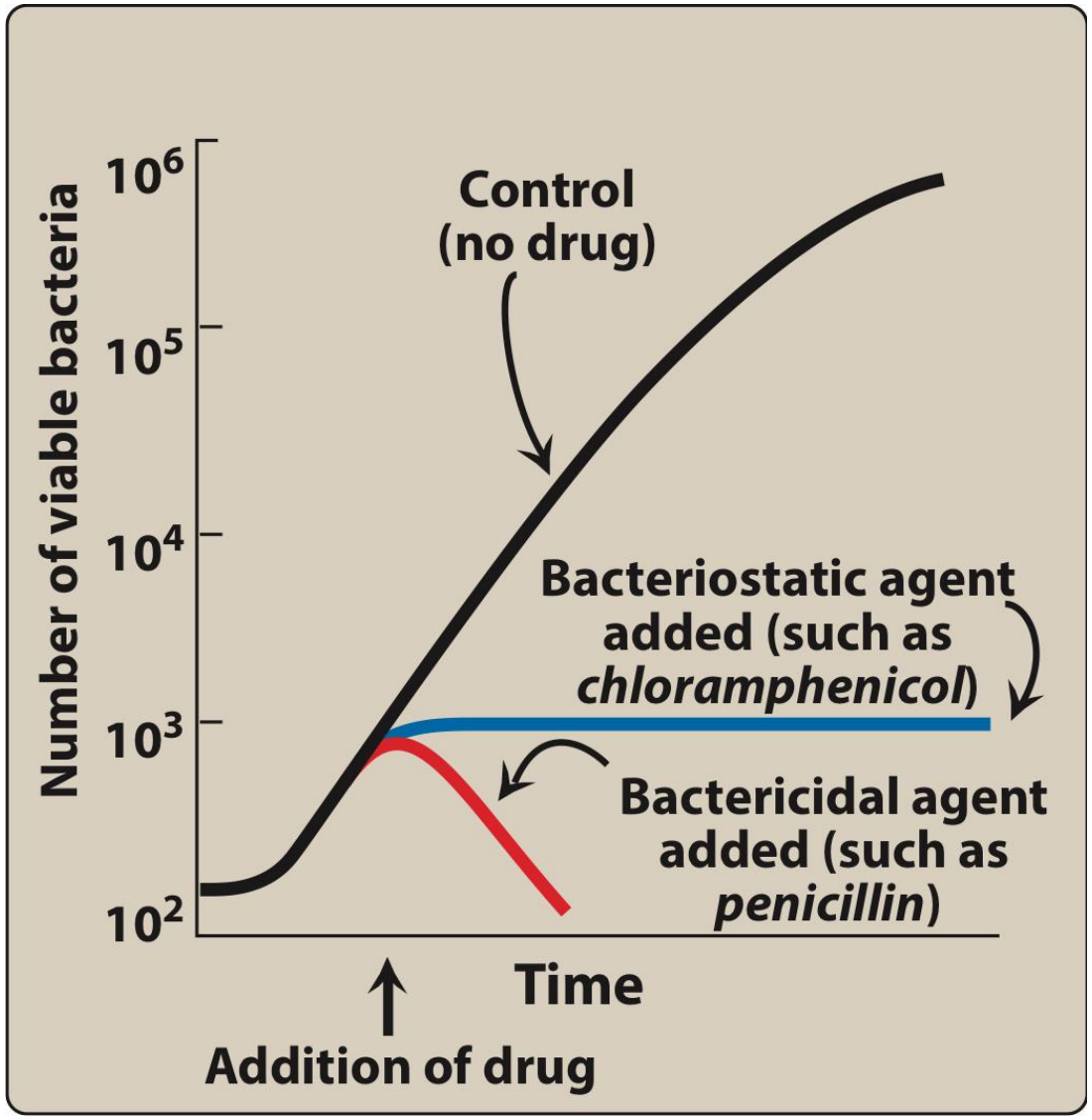
An agent that kills microorganisms
Bactericidal, fungicidal, viricidal…etc

e.g. Penicillin's, Cephalosporin's, Aminoglycosides.

Static (Reversible inhibition of growth within therapeutic dose):

An agent that inhibits growth of microorganism
Bacteriostatic, fungistatic, viristatic…etc

e.g. Sulfonamides, Tetracyclines, Macrolide antibiotics…etc



MIC

A static agent in large doses becomes cidal and cidal agents in low doses become static.

One drug (chloramphenicol) could be bacteriostatic for one organism (gram negative rods), & cidal for another (S. pneumoniae).

[Cidal and static has nothing to do with spectrum of activity nor mechanism of action].

MIC: (Minimal Inhibitory Concentration) :Lowest concentration of antibiotic that prevents visible microbial growth