Infectious Disease

General Principles of Microbial Pathogenesis

Despite the availability and use of effective vaccines and antibiotics, infectious diseases are main an important health problem. Infectious diseases are particularly important causes of death among the elderly people, with acquired immunodeficiency syndrome (AIDS), those with chronic diseases and those receiving immunosuppressive drugs.

1. Prions: prions are composed of abnormal forms of a host protein, termed prion protein (PrP). these agents cause transmissible spongiform encephalopathies including kuru, bovine spongiform encephalopathy (BSE; better known as mad cow disease); probably transmitted to humans by the meat from BSE-infected cattle). PrP is normally found in neurons & diseases occur when the PrP undergoes a conformational change that confers resistance to protease.

Accumulation of abnormal PrP leads to neuronal damage and distinctive spongiform pathologic changes in the brain.

2. Viruses: Viruses are obligate intracellular parasites that depend on the host cell's metabolic machinery for their replication. They consist of a nucleic acid genome surrounded by a protein coat (called a capsid) that is sometimes encased in a lipid membrane.

Viruses are classified by their:

- Nucleic acid genome (DNA or RNA but not both)
- The shape of the capsid (icosahedral or helical)
- The presence or absence of a lipid envelope
- Their mode of replication ,the preferred cell type for replication (called tropism)
- The type of pathology they cause.

Viruses account for a many types e of human infections. Many viruses cause transient illnesses (e.g, colds, influenza).

Other viruses are not eliminated from the body and persist within cells of the host for years, either continuing to multiply (e.g., chronic infection with hepatitis B virus HBV) or surviving in some non-replicating form (termed latent infection) with the potential to be reactivated later For example, herpes Zoster virus.

- Some viruses are involved in transformation of a host cell into a benign or malignant tumor (e.g., human papilloma virus (HPV – induced benign warts and cervical carcinoma).

3. Bacteria: are prokaryotes, meaning that they have a cell membrane but lack membrane-bound nuclei and other membrane-enclosed organelles.

There are two forms of cell wall structures: a thick wall surrounding the cell membrane that retains crystal-violet stain (gram-positive bacteria) and a thin cell wall sandwiched between two phospholipid bilayer membranes (gram-negative Bacteria).

Bacteria are classified by: **Gram staining** (positive or negative), **Shape** (spherical are cocci; rod-shaped are bacilli), **Needing for oxygen** (aerobic or anaerobic).

Normal healthy people can be colonized by as many as Bacteria on the skin (Staphylococcus epidermidis), Bacteria in the mouth (streptococcus mutans), and Bacteria in the gastrointestinal tract (ex. Intestinal flora)

Chlamydia and Rickettsia : are obligate intracellular bacteria which replicate inside membrane bound vacuoles in epithelial and endothelial cells respectively .

Chlamydia trachomatis : is the most frequent infectious cause of female sterility (by scarring and narrowing of the fallopian tubes) & blindness (infected cornea).

Rickettsia injure the endothelial cells in which they grow, and so cause a hemorrhagic vasculitis, often visible as a rash, but they may also injure the central nervous system (CNS) and cause death.

4. Fungi: are eukaryotes that possess thick chitin-containing cell walls and ergosterol-containing cell membranes. Fungi can grow either as rounded yeast cells or as slender filamentous hyphae.

Hyphae may be septate (with cell walls separating individual cells) or aseptate.

Fungi may cause superficial or deep infections.

- Superficial infections involve the skin, hair, and nails.

Fungal species that are confined to superficial layers of the human skin are known as dermatophytes

- Deep fungal infections can spread systemically and invade tissues, destroying vital organs in immunocompromised hosts, but usually heal or remain latent in otherwise normal hosts.

5. Protozoa: Parasitic protozoa are single-celled eukaryotes that are major causes of disease and death in developing countries. Protozoa can replicate intracellularly within a variety of cells (e.g.Plasmodium in red blood cells, Leishmania in macrophages) or extracellularly in the urogenital system, intestine, or blood.

The most prevalent intestinal protozoans are :

Entamoeba histolytica and Giardia lambli are ingested as nonmotile cysts in contaminated

food or water and it resistant to acidity of stomach it and become motile trophozoites that attach to intestinal epithelial cells

6. Helminths:

Parasitic worms are highly differentiated multicellular organisms.

Their life cycles are complex; most alternate between sexual reproduction in the definitive host and asexual multiplication in an intermediate host or vector. Thus, depending on parasite species humans could harbor adult worms (e.g., Ascaris lumbricoides) or asexual larval forms (e.g., Echinococcus spsecies).