Infectious diseases

Mechanisms of Viral Injury:

Viruses can directly damage host cells by entering them and replicating at the host's expense. The predilection of viruses to infect certain cells and not others is called **tropism**, and is determined by several factors including:

(1) The major determinant of tissue tropism is the presence of viral receptor on host cells, e. g HIV glycoprotein gp120 bind to CD4 on T cells

(2) Presence of cell type specific transcription factors that recognize viral enhancer and promoter sequences e.g. JC virus in oligodendroglial cells in CNS.

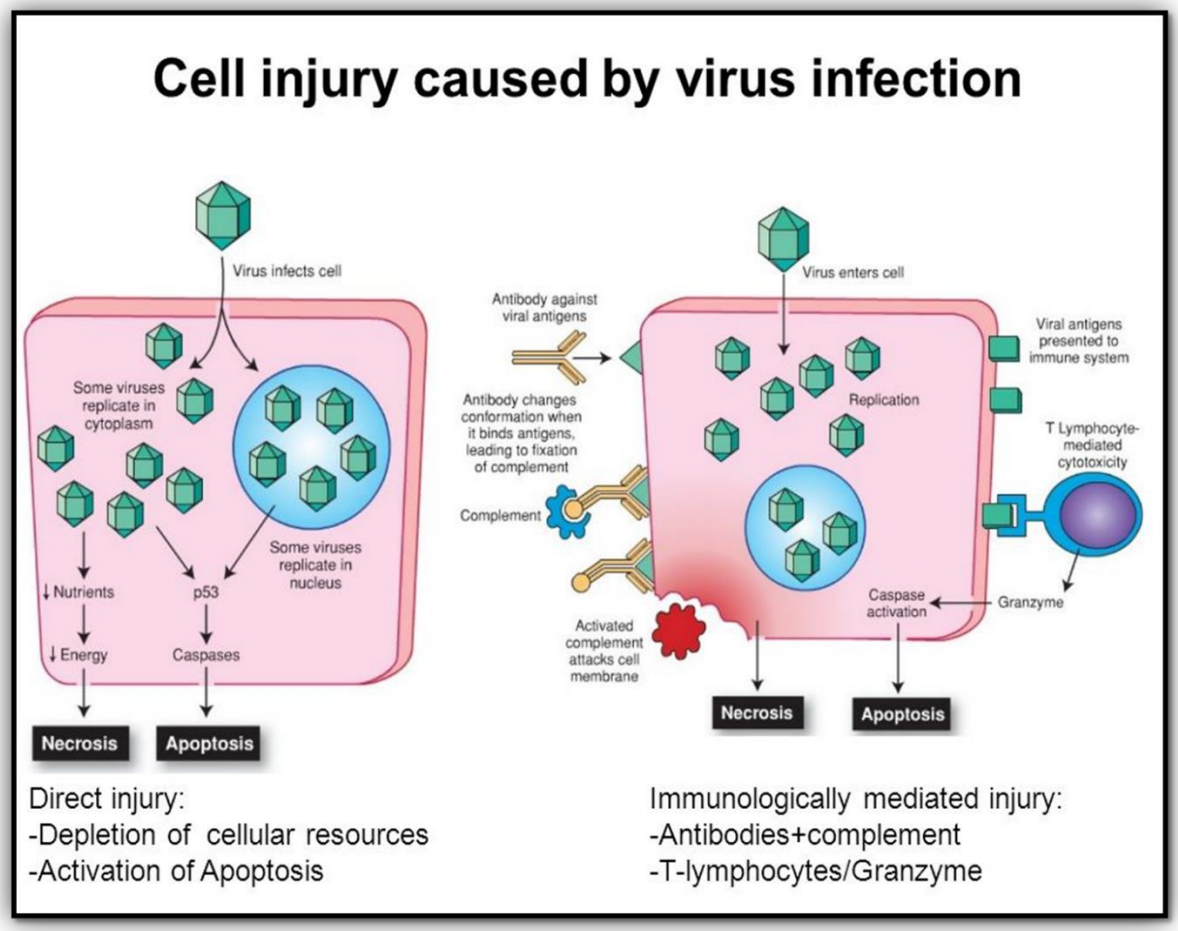
(3)Physical barrier like local temperature, pH, and host defenses, e, g, Rhinoviruses infect cells within the upper respiratory tract because they replicate at lower temperatures found in these sites.

Once viruses are inside host cells, they can damage or kill the cells by a number of mechanism:

1. Direct cytopathic effects: Some viruses kill cells by preventing synthesis of host macromolecules (e. g. host cell DNA, RNA, or proteins), by producing degradative enzymes and toxic proteins, or by inducing apoptosis.

2. Antiviral immune response: Viral proteins on the surface of the host cells may be recognized by the immune system, and the host lymphocytes may attack virus-infected cells. Cytotoxic T lymphocytes (CTLs) are important for defense against viral infections, but CTLs also can be responsible for tissue injury.

3. Transformation of infected cells into benign or malignant tumor cells: Different oncogenic viruses can stimulate cell growth and survival by a variety of mechanisms, including expression of virus-encoded oncogenes, anti-apoptotic strategies.



Mechanisms of Bacterial Injury:

Bacterial damage to host tissues depends on the ability of the bacteria to adhere to host cells, invade cells and tissues or deliver toxins.

1- Bacterial adherence to host Cells: Bacterial surface molecules that bind to host cells or extracellular matrix are called Adhesion e, g:Streptococcus pyogenes is a gram-positive bacterium that adheres to host tissues by virtue of protein F and teichoic acid which projecting from the bacterial cell wall and bind to fibronectin on the surface of host cells and in the extracellular matrix.

2. Virulence of intracellular bacteria: Intracellular bacteria infect either epithelial cells (Shigella), macrophages (M. Tuberculosis,M. leprae),or both (S. typhi).The growth of bacteria in cells may allow the bacteria to escape from certain effector mechanisms of the immune response (e.g. antibodies).

3. Bacterial Toxins: Any bacterial substance that contributes to illness can be considered a toxin. Toxins are classified as endotoxins, which are components of the bacterial cell, and exotoxins, which are proteins that are secreted by the bacterium.

Patterns of inflammatory response to infection:

There are four histological patterns of tissue reaction

1. Suppurative (Purulent) Inflammation:This pattern is the reaction to acute tissue damaged characterized by increased vascular permeability and leukocytic infiltration, predominantly of neutrophils. The neutrophils are attracted to the site of infection by release of chemoattractants from the "pyogenic" (pus-forming) bacteria that evoke this response.

Morphology: Collection of neutrophils may give rise to liquefactive necrosis forming abscesses.

The necrotic tissue + inflammatory cells constitute Pus & the bacteria that lead to pus formation called " pyogenic" bacteria.

2. Mononuclear and Granulomatous inflammation: Diffuse, predominantly mononuclear, interstitial infiltrates are a common feature of all chronic inflammatory processes, but when they develop acutely they often are a response to viruses, intracellular bacteria, or intracellular parasites.

Morphology: The mononuclear cell predominates within the inflammatory lesion depends on the host immune response to the organism. For example, plasma cells are abundant in the primary and secondary lesions of syphilis whereas lymphocytes predominate in HBV infection.

Granulomatous inflammation: is a distinctive form of mononuclear inflammation usually evoked by infectious agents that resist eradication and are capable of stimulating strong T cell-mediated immunity (ex., M.Tuberculosis , schistosomiasis).

Granulomatous inflammation is characterized by accumulation of activated macrophages called "epithelioid" cells, which may fuse to form giant cells in some cases there is a central area of caseous necrosis.

3. Cytopathic- cytoproliferative reaction: These reactions are usually produced by viruses. The lesions are characterized by cell necrosis or cellular proliferation usually

with sparse inflammatory cells. Some viruses replicate within cells and make viral aggregates are visible as inclusion bodies (e, g, Herpes virus and adeno virus) or induce cells to fuse and form multinucleated cells (e.g., Measles virus or herpes viruse)

4. Tissue Necrosis: Some organism e, g .Clostridium perfringens and others that secrete powerful toxins can cause rapid and severe necrosis (gangrenous necrosis) that tissue damage is the dominant feature. Because few inflammatory cells are present, necrotic lesions resemble infarction.

5. Chronic inflammation and scaring: Many infection elicit chronic inflammation, which can either resolve with complete healing or lead to extensive scarring.

Morphology

M. Tuberculosis causes constrictive fibrous pericarditis , chronic HBV infection may cause cirrhosis of liver in which dense fibrous septa surround nodules of regenerating hepatocytes.