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Paper – VII – Medical biology
Gr - A
Lecture - 3

PATHOGENESIS OF VIRAL INFECTION

Pathogenesis of viral infection is based upon the kind of interaction between the virus & the host factors. These host factors include:

(a) Entry of virus into a susceptible cell.
(b) Viral replication and spread.
(c) Viral effect on cell function.
(d) Host resistance to viral infection & Viral shedding.

Entry of virus

Body surfaces like skin, respiratory, gastrointestinal and urinogenital tracts or conjuctiva act as possible gate for the entry of virus into host. However, majority of viruses enter the animal body through mucosal cells of its respiratory tracts like Corona, chicken Pox or gastrointestinal tracts like Poliovirus. Sometimes viruses are introduced directly into blood stream either by infected needles (Hepatitis B, HIV) or through bite of insect vector (Arbovirus) Rubella & cytomegalo-virus responsible for severe neonatal disease. Some tumor viruses (avian leucosis virus) are vertically transmitted.

Viral Replication & Spread

Fenner 1948 studied the mode of spread of virus using mouse pox as experimental model. viruses producing disease at the site of their entry such as influenza and Corona virus (respiratory tract), and Rota virus (gastrointestinal tract) spread over the epithelial surface

locally & are confined to the site without any systemic spread. Which virus like Small Pox, chicken Pox, enteroviruses etc. produce lesions in the organs other than the portal of entry. After primary replication at the site of entry, the viruses pass through the lymphatics to the local lymph nodes & further multiply. After multiplication in the lymph nodes, viruses enter the blood stream & cause primary viraemia. These viruses are transported by blood to central foci (liver, Spleen). After extensive multiplication in the central foci, viruses reenter the blood stream causing secondary viraemia, which triggers the onset of clinical symptoms. During Sec. viraemia, viruses are spread widely in the target organ where they multiply producing distinctive lesions. The time taken by the virus from its entry into the host upto its spread into the target organs represents its incubation period.

Viral Effect on cell Function

The outcome of interaction between virus & host cell results into cytolytic or cytocytic growth, non cytocidal productive growth, abortive infection & cell transformation.

(a) Cytolytic or cytocytic growth :- Viruses replicate & reproduce in the susceptible host cells & release the progeny viruses. These new viruses infects new cells destroying the target tissue by producing disease. They produce cytopathic effect in the host cell in the form of necrosis & cell inclusions. This is called cytolytic cycle.

(b) Non-cytocidal productive growth — In the absence of normal inhibitory effect on the host cell metabolism some viruses are unable to kill their host cell during their reproductive cycles. This type of productive co-existence of both the virus & host cell

Persistante infection. This infection may remain latent.

(c) Abortive Infection :- Some viruses are able to infect cells but fail to replicate inside them, this is called abortive or non-reproducing infection. In such infections there is either loss of some essential function of the cell due to mutation or production of interfering substance.

(d) Cell Transformation :- Nucleic acid of the virus is incorporated into the host cell DNA of the infected cell leading to cell transformation.

Host Resistance to Viral Infection

Host resistance to viral infection may be specific or non-specific.

Specific Host Response to viral infections :- The immune response against virus sets in within a few days after pr. infection or immediately in an immunized host. Both humoral & cell mediated immune response develop.

Circulating Antibody :- In a previously immunized individual, IgA limits the intensity of viral attack on the mucosal surfaces, while serum IgG acts in the lower respiratory tract. IgM and IgG are unable to dislodge viruses from the site of primary entry in a previously immunized host. But these antibodies prevent the spread of viruses like Polio virus to the target organ. They also help quick recovery from viral disease.

Cell mediated immunity : operates at a later stage of infection & prevents the infection of target organ and promotes recovery from the disease. The infected cells possess specific antigens on their surface. Lymphokines are released by activated T-cells.

Activated macrophages of an immunized person destroy some viruses better than macrophages of uninfected Persons. cytotoxic T- cells also destroy infected targetcell

Non-Specific Defence Against virus → These factors play a more important role in the adult than in young animals. It involves humoral, cellular & enviornmental factors which may be present before infection or induced by the virus

Humoral Factors

(a) Humoral Inhibitors :— Non-specific inhibitors such as lipid & non-lipid inhibitors inhibit viral attachment to the host cell nuclease may remain in the cytoplasm and destruct the viral nucleic acid.

(b) Interferon :— Interaction between the virus & the phagocyte leads to the production of interferon & endogenous Pyrogen. Pyrogen mediates fever & sometimes adversly affects the replication of virus. Three human interferons are identified β produced by leucocytes, γ produced by T-lymphocytes. fibroblasts and α interferons produced by T- lymphocytes. IFN α & β are potent antiviral agents while γ is an immunomodulator.

Cellular Factors

(1) Polymorphonuclear leucocytes :- PMN appear in many inflammatory exudates of viral infection. They play some role in host defence either by inhibiting viral growth or by destroying them.

(2) Mononuclear Phagocytes (MN) viruses are ingested by both blood & tissue macrophage Although some viruses resist ingestion, they are ingested by the

Macrophages along with other viruses but resist killing and replicate intracellularly within them.

Environmental Factors — Lymphocytes inactivate some viruses non-specifically, while some virus infected cells are killed by natural killer cells without the help of antibody in a non-specific way.

Viral Shedding

It refers to the expulsion & release of virus progeny following successful reproduction during a host cell infection. Once replication has been completed and the host cell is exhausted of all resources in making viral progeny. The virus may begin to leave the cells by various methods. This may be achieved by either of the 3 methods as budding, as apoptosis and as exocytosis.

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