University of Tikrit

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Basic Nursing Sciences

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Parasitology

Effect of Viruses

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Effect of viruses on host macromolecular synthesis

Many viruses inhibit host RNA, DNA or protein synthesis (or any combination of these). The mechanisms by which the virus does this vary widely.

Cytopathic effect (CPE)

The presence of the virus often gives rise to morphological changes in the host cell. Any detectable changes in the host cell due to infection are known as a Cytopathic effect. Cytopathic effects (CPE) may consist of cell rounding, disorientation, swelling or shrinking, death, detachment from the surface, etc.

Many viruses induce apoptosis (programmed cell death) in infected cells. This can be an important part of the host cell defense against a virus - cell death before the completion of the viral replication cycle may limit the number of progeny and the spread of infection. The cytopathic effects produced by different viruses depend on the virus and the cells on which it is grown. This can be used in the clinical virology laboratory to aid in identification of a virus isolate.

Assays for plaque-forming units

The CPE effect can be used to quantitate infectious virus particles by the plaque- forming unit assay. Cells are grown on a flat surface until they form a monolayer of cells covering a plastic bottle or dish. They are then infected with the virus. A plaque is produced when a virus particle infects a cell, replicates, and then kills that cell. Surrounding cells are infected by the newly replicated virus and they too are killed. This process may repeat

several times. The cells are then stained with a dye which stains only living cells. The dead cells in the plaque do not stain and appear as unstained areas on a colored background. Each plaque is the result of infection of one cell by one virus followed by replication and spreading of that virus. However, viruses that do not kill cells may not produce plaques.

Methods assays for viruses

a- Electron-microscopy enables every virion to be counted but are not informative about infectivity.

b- Hemagglutinations are a less sensitive measure of how much virus is present, but again are not informative about infectivity.

c- Other methods, e.g. plaque assay, measure the number of infectious virus particles.

Viral detection:

The rise or fall of antibodies (Abs.) or antigens (Ags.) in serum from patients can predict where in cycle of infection such as HIV, HBV as with any other infecting organism the presence of circulating Abs. or Ags. in the host can be useful in detecting infection methods include:

1. Abs detection by complement fixation.
2. Hemagglutination.
3. Radioimmunoassay assay.
4. Enzyme enhanced assays.
5. Neutralization.

6. Western blot.
7. ELISA test.

Viral Genetics:

Viruses grow rapidly, there are usually a large number of progeny virions per cell. There is, therefore, more chance of mutations occurring over a short time period.The nature of the viral genome (RNA or DNA; segmented or non-segmented) plays an important role in the genetics of the virus.Viruses may change genetically due to mutation or recombination

Mutants

* **Spontaneous mutations**

These arise naturally during viral replication: e.g. due to errors by the genome-replicating polymerase or a result of the incorporation of tautomer forms of the bases. DNA viruses tend to more genetically stable than RNA viruses. There are error correction mechanisms in the host cell for DNA repair, but probably not for RNA.

* **Mutations that are induced by :**

1- **Chemical:**
   a. Agents acting directly on bases, e.g. nitrous acid
   b. Agents acting indirectly, e.g. base analogs which mispair more frequently than normal bases thus generating mutations.

2- **Physical**: Agents such as UV light or X-rays

Types of mutation

Point mutants (one base replaced by another) or insertion/deletion mutants. The kinds of phenotypic changes seen in virus mutants:

Conditional lethal mutants. Temperature sensitive (ts) mutants. **Host range.**

Plaque size. **Drug resistance.**

Enzyme-deficient mutants. Hot mutants.

Attenuated mutants.

Persistent Viral Infections

Influenza Virus (Orthomyxovirus)

True influenza is an acute infectious disease caused by a member of the orthomyxovirus family. influenza virus A, B or, to a much lesser extent, influenza virus C. However, the term 'flu' is often used for any febrile respiratory illness with systemic symptoms that may be caused be a myriad of bacterial or viral agents as well as influenza viruses.

Influenza outbreaks usually occur in the winter in temperate climates. 'flu season usually starts in October or November and is at its height from December to March .

Pathogenesis and Diseases:

Major outbreaks of influenza are associated with influenza virus type A or B. Infection with type B influenza is usually milder than type A. Type C virus is associated with minor symptoms. Influenza is an acute respiratory tract infection by sudden onset of fever, malaise, chills, muscular cramp and cough after incubation period of 1to 3 days. The complication is otitis media,

sinusitis, bronchitis and pneumonia. Influenza virus infects the epithelial cells of the respiratory tract.

Transmission and Spread

The virus is transmitted by direct contact with respiratory secretion, spread person to person via small particle aerosols (less than 10μm diameter) that can get into the respiratory tract. It can also be spread via fomites since it can survive for a short time on surfaces and can be spread by this route if the virus is introduced into the nasal mucosa before it loses infectivity. The incubation period is short, about 18 to 72 hours. Virus concentration in nasal and tracheal secretions remains high for 24 to 48 hours after symptoms start and may last longer in children. Titers are usually high and so there are enough infectious virion in a small droplet to start a new infection.

Symptoms and complications

1- Uncomplicated influnza

Fever (38 - 40 degrees C) Myalgias, headache Dry cough, nasal discharge Ocular symptoms –photophobia, tears, ache.

2- Pulmonary complications, sequelae

-Croup (acute laryngotracheobronchitis) in young children symptoms include cough (like a barking seal), difficulty breathing, stridor (crowing sound during inspiration)

-Primary influenza virus pneumonia

3 - Secondary bacterial infection: This often involves ***Streptococcus Pneumonia, Staphylococcus aureus, Hemophilus influenzae***