Pathogenesis of the viruses

Pathogenesis
- Mean
  - The complex interaction between viruses and the host
  - resulting
  - Diseases

Pathogenicty & virulence
- You should differentiate between two terms.
  - Virulence
    - Mean
      - Severity of disease caused by different strains of the same M.O …… and this may be related to NO. of M.O needed to cause infection (e.g. (10) virions of strain A of herpes simplex virus (HSV) may cause vesicular lesion whereas (10^4) virions of strain B of HSV required to do the same lesion)
    - That in mean
      - Strain A more virulence than strain B of HSV
        - What is that A more virulent than B
          - Only small mutative changes or one point mutation needed to convert it virulence strain to a virulence or a virulence strain to virulence
The consequence of viral infection

Cytopathic effect (CPE)
- It occurs in the infected host cell as well as in the cell culture
- It gives an idea about the type of the virus
- Indicates the sort of immune response expected
- The forms of cytopathic effect
  - Cell lyses
    - Replication cycles of some viruses (e.g., adenovirus) large amount of capsid protein
    - Inhibition of both cell and viral synthesis activities
    - Following by cell lysis and release of new viruses
  - Cell fusion
    - Some viruses have fusion protein which
      - Mediate the entry of the virus through the plasma membrane of the cell
      - Lead to formation of multinuclear giant cells (e.g., RSV, Measles, HSV)
  - Inclusion bodies
    - Inhibition of both cell and viral synthesis activities
    - Followed by cell lysis and release of new viruses

Formation of new cell surface antigens

Page 3
Cytopathic effect (CPE)

Inclusion bodise

Which are Eosinophilic or Basophilic bodies appear with cells as a result of infections with some but not all viruses. Their nature varies according to virus type.

Aggregation of mature virions

Areas of altered staining at sites of viral synthesis

Degenerative changes

Some viruses induce Tumor Antigen (T. Ag) on the surface of the cells converted these cells to malignant or tumor cell.

Which is formed due to enveloped viruses budding from cell surface (e.g. Herpes, paramyxovirus, and Retro viruses).

These Ags specific for the virus rather than the host cell so The infected cell being as foreign cells so become susceptible to attach by T. cytotoxic cell (Tc-cell).
In order to the virus produce disease in the infected cells, the virus must be

- Invade the host cell
- Replicate at the site of invading
- Overcome the local defence mechanism (e.g., IFN, lymphocyte, Macrophage)
  - Undergo further replication in its target area
  - Spread from site of infection to another area or organs
- Exit to infect other susceptible host

*Routes of invasion*

- Skin
  - A formidable barrier to microbes and trauma is necessary before infection can take place
  - Notice
    - Viruses absorb directly epith. Cells a replicat in these cells
    - Viruses enter through M.M mostly cause generalized infection rather than localized lesion
      - e.g., Enterov. invade Entero v. invade Enteric channel like polio
      - But cause Disease in CNS rather than enteritis
- Mucous Membrane
  - Viruses absorb directly epith. Cells a replicat in these cells
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Localized lesion at the site of implication

Pox viruses, Papilloma viruses, Herps virus, Rabies

Varicella virus enter through M.M of respiratory tract
- But
  - Its Target sit in skin

Replicate at the site of invading

Produce generalized infection in the CNS

Spread from site of infection to another area or organs

Overcome the local defence mechanism (e.g., IFN, lymphocyte, Macrophage)

Enteric channel like polio
- But
  - Disease in CNS rather than enteritis

Exit to infect other susceptible host

Undergo further replication in its target area
Mucose memb.

Resp. tract
Smaller droplet more widely

Gastrointestinal tract or celled feco-oral rought
Which mean
Viruses shed into the Feces-humans get infection by contaminated food with Feces

Sexually transmitted diseases ( STD)
AIDS hepatitis

Surgical Treatment e.g.
Creutzfeldt-Jakob disease

Viruses shed into the Feces—humans get infection by contaminated food with Feces

Blood transfusion and Blood product e.g. of these viruses
Hepatitis B virus (HBV) HCV HIV

Through organs transplantation
Like
Kidney Bone marrow

The localized infection characterized by
3-1day
Replication restricted to the surface

Generalized infection

Blood stream cause primary viremia

→Enter Blood stream cause primary viremia

↓Reticulo endothelial organ ( liver spleen B.M)

Blood secondary viremia

Target organ

Virus enter through pith. cell

Migrate to regional L.N
The Target Organs

Skin
- A rash is features in number of v. infections of some viruses e.g.
  - Measles

Lung
- Most resp. infection involved as a part of generalized infection e.g.
  - Measles

Liver
- Target of hepatitis viruses (A,B,C,D,E) also may be damaged as a part of generalized infection e.g.
  - Yellow Fever

CNS
- Rabies

Blood stream
- Viremia e.g.
  - Polio v.

Kidney
- Rarely infected by viruses with exception CMV
  - Lead to
    - Formation inclusions in proximal Renal which virus is shed in to the urine

Nerve

Kidney
- HSV
- Rabies
- VZV

Notice; some skin rushes are manifestation of immune response (immune pathological damage) rather than due to tissue damage

© Hemorrhages rash is due to disseminated intra vascular coagulation
Knowledge of I.p is important because aid to the diagnosis is essential in tracing the spread of outbreaks.

Incubation period

1. **Short I.P**
   - Less than a week
   - E.g., Enterovirus, Influenza, Arbovirus

2. **Medium I.P**
   - Range b/w 7 – 21 days
   - Seen in generalized infection
   - E.g., Poliomyelitis, Measles, Rubella, Mumps

3. **Long I.P**
   - Measured in weeks or months
   - E.g., 4-2 weeks H A virus, 20 – 60 + weeks H B V

4. **Very long I.P**
   - Measured in years
   - Mainly due to unconventional viruses like prions, papova viruses, measles which is generally during reactivation
   - Cause delayed disease in CNS

- Subclinical sclerosing parencephalitis (SSPE), CJD, Kuru

L.P classified to 4 group
Pathogenesis patterns of diseases

Acute non persistent infection
- Most acute infection resolves spontaneously.
- The death in rare unless CNS or severe infection
  - e.g. Poliomyelitis

Persistent infection with acute onset
- This chronicity is due to latency (which mean persistence of the viral DNA in the host cell … So it only happen with DNA viruses + retro viruses
- Because
  - Their DNA integrated which the host cell DNA or present in Personal form

Insidious infection with fatal outcomes
- Latent infection maybe
  - Infecting virus may be demonstrated but the patient is asymptomatic but produce in quantity during reactivation
- Never cause signs of disease
- Reactivate one or more occasions causing Episode of illness
- Established very soon after primary infection
  - e.g. HSV
- Delayed for 2 – 3 year e.g. Chronic carrier of HBV
- Lead to malignant disease
The differences between chronic and latent infection

Chronic infection
- In chronic infection viruses continuously produced with or without integration of the viral DNA with the host cell DNA
- Also it can induce in cell culture to produce viruses without destroying these cells

Insidious infection with fatal outcomes
- Two types of infection resemble each other superficially
  - Slow virus infection
  - Arena virus in mice

In Both of them the immune system fail to recognize the virus infected cells as foreign also some Abs produce virus – Ab complex
  lead to
- Death due to their deposition

Latent infection
- It may cause by DNA or retro viruses
- Integration of the viral DNA with the host cell DNA

Shedding of the virus from – the host
- Either from Target organs
  - the virus can shed for – all body system except CNS
  - virus can shed from – clinically normal people HSV ( saline ) CMV ( urine ) breast milk
- viruses infect the gut shed from – faces

9Page