VIROLOGY LECTURE

By: Dr. Mohammed Arif
Associate Professor &
Consultant Virologist
Head of the Virology Unit
College of Medicine & KKUH
Viral etiology:
- Family: Paramyxoviridae
- Pleomorphic, 150 – 300 nm
- Enveloped, two glycoprotein spikes (H and F)
- The H-glycoproteins
  - Mediate adsorption of the virus to the host cell surface.
  - The main neutralising Ag.
- The F-glycoproteins
  - Mediate penetration of the virus to host cell by fusion process.
  - Mediate fusion of infected cells together to form syncytium (multinucleated giant cell)
- ss-RNA, negative polarity.
- Virion contains the enzyme transcriptase
- One serotype
Measles Virus (Continued)

- I.P.: 10 -14 days
- Age: Child hood disease
- Transmission: Respiratory droplets
- Clinical Features:

1. **Prodromal:** fever, cough, runny nose, conjunctivitis, lasting 1-3 days.

2. **Koplik’s spot:** small, red papules with white central dot appear on the inside of the cheek, their number 5 or 6, remain for a day or two. They are diagnostic for measles.

3. **Rash:** maculopapular rash first appear on the face then spread downward over the trunk and extremities.
   - The rash is red, become confluent, lasts 4 or 5 days then disappears, leaving brownish, discoloration of the skin and fine desquamation.
   - Recovery is complete.
Measles Virus (Continued)

- **Common complications:**
  - Croup, bronchitis, otitis media

- **Rare complications:**
  1. Post-infectious encephalitis
  2. Subacute sclerosing panencephalitis.
  3. Giant cell pneumonia.

- **Prevention:**
  - Live attenuated vaccine (MMR)
  - **Contains:** live attenuated measles, mumps and rubella virus strains.
  - **Administered** in one dose intramuscularly or subcutaneously.
  - Protection: excellent immunity.
  - **Contraindication:** should not be given to pregnant women and immunocompromised.
Measles Virus (Continued)

- **Prophylaxis:**
  - Passive immunization with normal immunoglobulin can be used to confer immediate immunity in infants or immunocompromised.

- **Treatment:**
  - No specific anti-viral drug therapy.

- **Lab. Diagnosis:**
  - Detection of IgM – Ab to measles virus.
Subacute Sclerosing Panencephalitis (SSPE)

- Late and rare complication of measles.
- Develops several years after measles attack.
- Slowly progressive disease of the CNS ending in death.
- The disease characterized by personality changes, memory defect, intellectual impairment, impairment of vision, speech and cognition, lack of coordination, blindness, convulsion, coma, death.
- No effective treatment
- Diagnosis based on the clinical features, characteristic EEG (changes in waves and spikes forms) and high level of measles – Ab in CSF.
Measles Virus

- Post – infectious encephalitis:
  - Rare complication
  - Develops few days after the main illness.
  - Symptoms: fever, headache, vomiting, mental confusion, drowsiness, lack of coordination, convulsions.
  - Mortality rate ranges from 10-20%.
  - Survivors are left with neurological sequelae.

- Giant cell pneumonia:
  - Rare complication
  - Seen in the immunocompromised children.
  - Due to direct virus invasion of the lungs.
Measles Virus (Continued)

Pathogenesis:

Virus – entry

Infection of epithelial cells of the URT

Viremia

Virus-replication in the lymphoid tissue

Viremia

Virus infect endothelial cells of blood vessels in the skin

Cytotoxic T-cells attack virus-infected vascular endothelial cells in the skin

Development of maculopapular rash
Rubella (German Measles)

- Viral etiology: Rubella virus

- **Virology:**
  
  Family: Togaviridae
  
  Genus: Rubivirus
  
  - Pleomorphic 50 – 75 nm.
  
  - Enveloped, helical nucleocapsid.
  
  - ss-RNA, positive polarity.
  
  - Agglutinate avian erythrocytes.

- I.P. 14 -21 days

- Transmission: by inhalation of respiratory droplets.
Rubella (German Measles) (Continued)

- **Pathogenesis:**
  - After entry, the virus replicates in the upper respiratory tract.
  - The virus spread by the blood stream to lymphoid tissue, skin and organs.
  - Cellular immune response in addition to circulating virus- Ab complexes are thought to play a role in development of the rash and arthritis.

- **Age**: Childhood disease.
Rubella (German Measles) (Continued)

- **Clinical features:**
  1. Prodromal: fever, cough, conjunctivitis.
  2. Rash: maculopapular rash.
    - The rash is discrete, erythematous, first appears on the face then spreads to trunk and limbs.
    - The rash fades after 48 hr.
    - In nearly 50% of all infections, there is no rash at all.
    - Rubella is characterized by enlargement of the post-auricular and suboccipital lymph nodes
    - Recovery is complete.

- **Complications:**
  1. Mild arthritis in adult females.
  2. Post-infectious encephalitis
  3. Thrombocytopenic purpura.
Rubella (German Measles) (Continued)

- Prevention:
  - Live attenuated vaccine (MMR)

- Prophylaxis:
  - Passive immunization with normal immunoglobulin may have some attenuating effect in rubella.

- Treatment:
  - No specific anti-viral drug therapy

- Lab Diagnosis:
  - Detection of IgM –Ab to rubella virus
Congenital Rubella

- Infection occurs in utero, before rupture of the fetal membrane.
- The fetus is infected transplacentally.
- Rubella virus has no cytocidal effect on the fetal cells.
- The virus establishes persistent infection in the fetal cells. It interferes with the cells division resulting in malformation in the heart, eyes and hearing organs.
- Congenital rubella occurs only when non-immune pregnant woman acquires the virus in the first 12 weeks (first-trimester) of pregnancy.
The main congenital defects are:

1. Eye-abnormalities (cataract, glaucoma, retinopathy)
2. Congenital heart diseases.
3. Deafness
4. Mental retardation

- Affected infants have also:
  - Hepatosplenomegaly
  - Thrombocytopenic purpura
  - Low birth weight
  - Jaundice
  - Anaemia

- Infected infants shed the virus into throat and urine for several months and can infect susceptible individual.
**Congenital Rubella (Continued)**

- **Lab. Diagnosis:**
  - By detection of IgM-Ab in the infant serum.

- **Treatment:**
  - There is no specific anti-viral drug therapy available.

- **Prevention:**
  - By immunization of all children at age of 15 months with MMR-vaccine.
  - Live attenuated vaccine should not be given to immunocompromized or pregnant women.
Erythema Infectiosum
(Slapped cheek or fifth disease)

- Virology:
  - Due to human parvovirus B19
  - Family: parvoviridae
  - Small, unenveloped, icosahedral, ss-DNA, negative strand.
  - One serotype
- I.P.: 4-10 days
- Transmission: By inhalation of respiratory droplets.
- Age: childhood disease
Pathogenesis:

- Parvo B-19 infects primarily two types of cells.
  - Red blood cells precursors (erythroblasts in the bone marrow which accounts for the aplastic anemia).
  - And the endothelial cells in the blood vessels which accounts, in part, for the rash.
  - Immunocomplexes composed of virus and IgM or IgG also contribute to the pathogenesis of the rash and arthritis that seen in adults infected with B-19.
Erythema Infectiosum
(Slapped cheek or fifth disease) (Continued)

- Clinical features:
  - Fever with maculopapular rash.
  - The rash is erythematous, confluent, fine, most intense on the cheek.
  - The rash may appear on the trunk and limbs.
  - Lesions fades from the centre leaving the periphery red, developing characteristic reticular or lace-like pattern.
  - There is mild generalized lymphadenopathy.
  - Arthralgia with swelling and pain in the joints are seen in women.
  - Recovery is complete.
Erythema Infectiosum
(Slapped cheek or fifth disease) (Continued)

- Complications:
  1. Aplastic anaemia: characterized by absence of regeneration of RBC seen in immunocompromised.

- Prevention:
  - There is no vaccine available yet.

- Treatment:
  - No specific anti-viral drug therapy.

- Lab. Diagnosis:
  - Detection of IgM - Ab
Erythema Infectiosum
(Slapped cheek or fifth disease) (Continued)

- Fetal infection:
  - Congenital infection due to parvovirus B-19 occurs only when non-immune pregnant women acquires the virus in the first half of pregnancy.
  - Intrauterine infection can lead to severe anaemia, massive oedema, congestive heart failure and fetal death (hydrops fetalis).
**Exanthem subitum**  
(Roseola infantum, Sixth Disease)

- **Virology:**
  - Caused by human herpes virus type 6.
  - Family: herpesviridae
  - Enveloped, icosahedral nucleo-capsid.
  - ds – DNA

- **I.P.:** 10 - 14 days

- **Transmission:** by inhalation of respiratory droplets.

- **Age:** Childhood disease
Exanthem Subitum
(Roseola infantum, Sixth Disease)

- Clinical features:
  - Fever for 3-5 days, as the fever subsides a discrete maculopapular rash appears first on the trunk then spread to face and limbs.
  - There is mild generalized lymphadenopathy.
  - Infection in adult may present with a glandular fever like illness.
  - Recovery is complete.

- Complications:
  - Rare, thrombocytopenia, encephalitis.

- Prevention:
  - There is no vaccine available yet.

- Treatment:
  - No specific therapy.