Virology

Lec (9)

Dr. Areej A. Hussein

Teaching Objectives:

1. Know general characteristic of Togaviridae and Coronavirus.
2. Distinguish Characteristic of strains.
3. Recognize the mechanism of entry and replication.
5. Know treatment and prevention.

Togaviridae family

Rubella virus a member of Togaviridae family, alphavirus genus consist of about 30 viruses, most viruses transmit through mosquitoes or other blood -feeding arthropods except rubella is classified in a separate genus in the Togaviridae family, has no arthropod vector and is not an arbovirus , but is acquired via the respiratory route. Rubella (means ‘little red’) Enveloped (toga=cloak), also known as German measles, is a mild disease in children and adults, but can cause devastating problems if it infects the fetus, especially if the infection is in the first few weeks of pregnancy.

Important properties

- Those possess a single stranded, positive-sense RNA, and therefore has no virion polymerase. Measuring about 70 nm in diameter.
- Nucleocapsid has icosahedral symmetry.
- The envelope surrounded by particle contains two glycoprotein (Surface spikes contain hemagglutinin).
- All alpha viruses are antigenically related. Only one major antigenic type
- Viruses are inactivating by acid, pH, heat, lipid solvents, detergents, bleach, phenol, 70% alcohol and formaldehyde.
- Replicates in the cytoplasm.
**Mode of Transmission:**
- The virus is transmitted via droplets.
- Infected mother to fetus transplacentally.

**Pathogenesis and Immunity:**
- Initial replication of the virus occurs in the nasopharynx and cervical lymph nodes. From there it spreads via blood to the internal organs and skin.
- The origin of the rash is unclear; it may be due to Ag-Ab-mediated vasculitis. Infection leads to lifelong immunity. Second cases of rubella do not occur; similar rashes are caused by other viruses, such as coxsackievirus and echovirus. Ab cross the placenta and protects the newborn.
- The disease occurs worldwide. For several years, cytomegalovirus rather than rubella virus has been the leading viral cause of congenital abnormalities.

**Clinical Findings:**

**A- Rubella:** It is a milder, shorter disease than measles. After an incubation period of 14-21 days, a brief prodromal period with fever and malaise is followed by a maculopapular rash, which starts on the face and progresses downward to involve extremities. Posterior auricular lymphadenopathy is characteristic. The rash typically lasts 3 days.

**B- Congenital rubella syndrome:** the significance of rubella virus is not as a cause of mild childhood disease but as a teratogen. When a non immune pregnant woman is infected during the 1st trimester, especially the 1st month, significant congenital malformations can occur as a result of maternal viremia and fetal infection. The increased rate of abnormalities during the early weeks of pregnancy is attributed to the very sensitive organ development that occurs at that time. The malformations are widespread and involve primarily the heart (e.g., patent ductus arteriosus), the eyes (e.g., cataracts), and the brain (e.g., deafness and mental retardation).
Congenitally infected infants have significant IgM titers and persistent IgG titers long after maternal Ab has disappeared.

**Lab Diagnosis:**
- Virus can be grown in cell culture, but it produces little CPE, it is usually identified by its ability to interfere with echovirus CPE. If rubella virus is present in patient's specimen and has grown in the cell culture, no CPE will appear when the culture is superinfected with an echovirus.
- Rising Ab titer 4-fold or greater between acute-phase and convalescent-phase sera in the hemagglutination inhibition test or ELISA.
- Observing the presence of IgM Ab in single acute-phase serum sample may help in diagnosis.
- Pregnant woman exposed to rubella virus, the presence of IgM Ab indicates recent infection, whereas a 1:8 or greater titer of IgG Ab indicates immunity and protection of the fetus.
- If recent infection has occurred, an amniocentesis can reveal whether there is rubella virus in amniotic fluid, which indicates definite fetal infection.

**Treatment and prevention:**
- No antiviral therapy.
- Immunization with live attenuated vaccine with measles and mumps (MMR) subcutaneously at age of 15 months, and to unimmunized young adult woman if they are not pregnant and will use contraception for the next 3 months. Vaccine is a live one it should not be given to immunocompromized patients or to pregnant woman.
- Vaccine has caused significant reduction in the incidence of rubella and congenital rubella syndrome. It induces respiratory IgA interrupting the spread of the virus by nasal carriage.
- Immune serum globulins IG can be given to pregnant woman in 1st trimester, but it may fail to prevent fetal infection.

**Corona viruses:** Is a genus of animal virus belonging to the family coronaviridae. The name "coronavirus" is derived from the Latin *corona*, meaning crown or halo, and refers to the characteristic appearance of virions under electron microscopy (E.M.) with a fringe of large, bulbous surface projections creating an image reminiscent of the solar corona. This morphology is created by the viral spike (S) peplomers, which are proteins that populate the surface of the virus and determine host tropism. The human coronaviruses cause common colds in adults primarily in the winter and early seasons and have been implicated in gastroenteritis in infants. A novel coronavirus was identified as the cause of a worldwide outbreak of A Severe Acute respiratory Syndrome (SARS). In 2003.

**Important properties of Corona viruses:**
- Are enveloped particles. 120-160nm in diameter.
- Genome is single stranded- positive sense RNA (26-32kb).
- Helical nucleocapsid Icosahedral, 28-30 nm, contains 60 subunits.
- The viral structural protein include a phosphorelated nucleocapsid (N), membrane glycoprotein (M) serve as a matrix protein embedded in the envelope lipid bilayer and interacting with the nucleocapsid, Spike protein(S). Some viruses like human coronavirus OC43 have hemagglutinin (HE).
- Have two serotypes of human, strain 229E and OC43.
**Mode of transmission:**

1-The main way that SARS seems to spread is by close person to person contact the virus that causes SARS is thought to be transmitted most readily by respiratory droplets.

2-The virus also can spread when a person touches a surface or object contaminated with infectious droplets and then touches his or her mouth, nose or eye.

3- In addition it is possible that the SARS virus might spread more broadly through the air (airborne spread) or by other ways that are not now known.

**Replication cycle.**

The virus attaches to receptors on target cells by glycoprotein spikes on the viral envelope (either by the S or HE), Then particle is internalized, probably by absorptive endocytosis. The S protein glycoprotein may cause fusion of the viral envelope with the cell membrane, RNA act as mRNA, and then newly replicated genome RNA associated with viral protein in cytoplasm. The particles acquire an envelope by budding through the plasma membrane and release
**Symptoms of SARS:**

The incubation period for SARS is 4-5 days. In general, SARS begins with a high fever (temperature more than 38°C), headache, an overall feeling of discomfort and body aches, some people also have mild respiratory symptoms at the outset about 10-20% of patients have diarrhea, after 2 to 7 days, SARS patients may develop a dry cough and pneumonia.

**Laboratory diagnosis**

1- Isolation of virus in cell culture has been difficult. The SARS virus was recovered from oropharyngeal specimens using vero monkey kidney cell.

2- Detection of viral antigen in respiratory secretions by using the ELISA test

3- Antibody detection to SARS virus in a single serum specimen, a four-fold or greater increase in SARS-CoV antibody titer between acute and convalescent phase

4- Detection of SARS virus RNA by RT-PCR.

**Prevention**

There's no available vaccine.