Picornaviruses

Picornaviruses are small (20–30 nm) **non enveloped** viruses composed of an **icosahedral nucleocapsid** and a **single-stranded** RNA genome. The genome RNA has positive polarity; i.e., on entering the cell, it functions as the viral mRNA. Picorna viruses replicate in the cytoplasm of cells. They are not inactivated by lipid solvents, such as ether, because they do not have an envelope.

picornaviridae family contains viruses that infect many species of animal as well as humans . poliovirus was the first virus that was propagated in the cell culture and purified using plaque assay.

Important picornaviruses

1- Poliovirus
2- Hepatitis A virus
3- Coxsakievirus
4- Foot and Mouth Disease Virus (FMD)
5- Rhinovirus

The picornavirus family includes two groups of medical importance: the **enteroviruses** and the **rhinoviruses.** Among the major enteroviruses are poliovirus, coxsackieviruses, echoviruses, and hepatitis A virus.

Enteroviruses infect primarily the enteric tract, whereas rhinoviruses are found in the nose and throat. Enteroviruses replicate optimally **at 37°C**, whereas rhinoviruses grow better at **33°C,** in accordance with the lower temperature of the nose. Enteroviruses are **stable** under acid conditions (pH 3–5), which enables them to survive exposure to gastric acid, whereas rhinoviruses are **acid-labile**. This explains why rhinovirus infections are restricted to the nose and throat.

Rhinoviruses

These viruses are the main cause of the common cold. There are **more than 100 serologic types.** Most of the rhinoviruses can survive and **replicate better at 33°C** than at 37°C, which explains why they affect primarily the nose and conjunctiva rather than the lower respiratory tract. Because they are **acid-labile,** they are killed by gastric acid when swallowed. This explains why they do not infect the gastrointestinal tract, unlike the enteroviruses. The host range is limited to humans and chimpanzees.

Replicative Cycle:

Replication is similar to that of poliovirus. The cell surface receptor for rhinoviruses is ICAM-1, an adhesion protein located on the surface of many types of cells.

Transmission

There are **two modes** of transmission for these viruses. In the past, it was accepted that they were transmitted directly from person to person via aerosols of respiratory droplets. However, now it appears that an indirect mode, in which respiratory droplets are deposited on the hands or on a surface such as a table and then transported by fingers to the nose or eyes, is also important.

Epidemiology

Rhinoviruses occur worldwide, causing disease particularly in the fall and winter. The reason for this seasonal variation is unclear. Low temperatures per se do not predispose to the common cold, but the crowding that occurs at schools, for example, may enhance transmission during fall and winter. The frequency of colds is high in childhood and tapers off during adulthood, presumably because of the acquisition of immunity.

A few serotypes of rhinoviruses are prevalent during one season, only to be replaced by other serotypes during the following season. It appears that the population builds up immunity to the prevalent serotypes but remains susceptible to the others.

Pathogenesis & Immunity

The portal of entry is the upper respiratory tract, and the infection is limited to that region. Rhinoviruses rarely cause lower respiratory tract disease, probably because they grow poorly at 37°C. Immunity is serotype-specific and is a function of nasal secretory IgA.

Clinical Findings

After an incubation period of 2–4 days, sneezing, nasal discharge, sore throat, cough, and headache are common. A chilly sensation may occur, but there are few other systemic symptoms. The illness lasts about 1 week. Note that other viruses such as coronaviruses, adenoviruses, influenza C virus, and coxsackieviruses also cause the common cold syndrome.

Laboratory Diagnosis

Diagnosis can be made by isolation of the virus from nasal secretions in cell culture, but this is rarely attempted. Serologic tests are not done.

Treatment & Prevention

No specific antiviral therapy is available. Vaccines appear impractical because of the large number of serotypes. Paper tissues impregnated with a combination of citric acid (which inactivates rhinoviruses) .High doses of vitamin C have little ability to prevent rhinovirus-induced colds. Lozenges containing zinc gluconate are available for the treatment of the common cold, but their efficacy remains unproved.

Coronaviruses

Coronaviruses are an important cause of the common cold, second only to rhinoviruses in frequency. In 2002, a new disease, an **atypical pneumonia** called SARS (severe acute respiratory syndrome) emerged.

Important Properties

Coronaviruses have a non segmented, SS RNA +ve sense genome. They are enveloped viruses with a helical nucleocapsid. Coronaviruses have a characteristic morphology on electron microscopy, they are surrounded by an outer envelope studded with spikes, resembling a crown (corona). They infect a wide range of animal hosts, including humans.

Listing of human coronaviruses

1- Human coronavirus 229E
2-Human coronavirus OC43
3- SARS-CoV

Prior to the SARS epidemic, two major serotypes were known to infect humans, known as the 229E and OC43 coronaviruses. The coronavirus that caused the SARS (SARS-CoV) outbreak is different from the existing human strains.

Replicative Cycle

The receptor for the SARS coronavirus on the surface of cells is angiotensin-convertingenzyme-2. The virus adsorbs to cells via its surface spikes (hemagglutinin), after which it enters the cytoplasm, where it is uncoated. The positive-strand genome is translated into two large polypeptides, which are self-cleaved by the virus-encoded protease. Two of these peptides aggregate to form the RNA polymerase (transcriptase) that replicates the genome. In addition, mRNAs are synthesized, then translated into the structural proteins. The virus is assembled and obtains its envelope from the endoplasmic reticulum, not from the plasma membrane. Replication occurs in the cytoplasm.

Transmission

Coronaviruses are transmitted by the respiratory aerosol. Infection occurs worldwide and occurs early in life, as evidenced by finding antibody in more than half of children. Outbreaks occur primarily in the winter on a 2- to 3-year cycle.

Epidemiology

SARS originated in China in November 2002 and spread rapidly to other countries with a fatality rate of approximately 9%. Human-to-human transmission occurs, and some patients with SARS are thought to be "super-spreaders," but this remains to be confirmed. Early in the outbreak, many hospital personnel were affected, but respiratory infection control procedures have greatly reduced the spread within hospitals. There are many animal coronaviruses, and they are suspected of being the source of the SARS-CoV.

Pathogenesis & Immunity

Coronavirus infection is typically limited to the mucosal cells of the respiratory tract. Approximately 50% of infections are asymptomatic, and it is unclear what role they play in the spread of infection. Immunity following infection appears to be brief and reinfection can occur.

Clinical Findings

The common cold caused by coronavirus is characterized by coryza (rhinorrhea, runny nose), sore throat, and low-grade fever. This illness typically lasts several days and has no long-term sequelae. Coronaviruses also cause diarrhea and Vomiting . The most common complication of infection are Kidney failure and Severe Acute Respiratory Syndrome. SARS is a severe atypical

pneumonia characterized by a fever of at least 38°C, nonproductive cough, dyspnea, and hypoxia. Chills, malaise, and headache commonly occur, but sore throat and rhinorrhea are uncommon. The binding of the virus to this receptors on the surface of respiratory tract epithelium may contribute to the dysregulation of fluid balance that causes the edema in the alveolar space. Pneumonia caused by SARS coronavirus is characterized by diffuse edema resulting in hypoxia. Chest x-ray reveals interstitial infiltrates that do not cavitate. Leukopenia and thrombocytopenia are seen. The incubation period for SARS ranges from **2 to 10** days, with a mean of 5 days.

Laboratory Diagnosis

The diagnosis of the "common cold" is primarily a clinical one. If SARS is suspected, antibody-based and PCR-based tests can be used.

Treatment & Prevention

There is no antiviral therapy or vaccine available. A combination of ribavirin and steroids has been tried in the treatment of life-threatening cases of SARS, but their efficacy is uncertain.

Respiratory Syncytial Virus

RSV is one of the Paramyxoviruses that leading cause of bronchiolitis and pneumonia in infants under on year of age . The viruses produce a characteristic syncytia formation in the respiratory epithelium cells ; hence the name is given as respiratory syncytial virus.

The virus starts its infection in the upper or lower respiratory tract infecting ciliated epithelium . Spread of the virus proceeds by cell fusion. Sever form of disease may cause bronchiolitis, pneumonia or **croup*** in infants .

***Croup** is sometimes called as barking cough and is characterized by swelling around the vocal cords, It usually associated with the inflammation of larynx, trachea, and bronchioles .

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Good Luck