

Orthomyxoviridae:-

General characters

- a. Spherical or pleomorphic, nucleocapsid helical symmetry.
- b. 80-120 nm in diameter .
- c. single-stranded RNA, segmented (eight molecules),negative sense.
- d. Replication occurs in the nucleus.
- e. Genome is segmented facilitating genetic reassortment.
- f. enveloped contains viral in influenza types A & B haemagglutinin (H), responsible for virus attachment and envelope fusion, and a neuraminidase (N) capable of cleaving viral receptors & promoting both entry of virus into cells & release of virions from infected cells.

Reproductive Cycle of an Orthomyxo virus in a Host Cell

It takes about 6 hours for the replication of the orthomyxo virus, killing the host cell in the process. The virus attaches to the permissive cells via the hemagglutinin subunit, which binds to cell membrane glycolipids or glycoproteins containing N-acetylneuraminic acid, the receptor for virus adsorption. The virus is then engulfed by pinocytosis into endosomes. The acid environment of the endosome causes the virus envelope to fuse with the plasma membrane of the endosome, uncoating the nucleocapsid and releasing it into the cytoplasm. A trans membrane protein derived from the matrix gene (M2) forms an ion channel for protons to enter the virion and **destabilize protein binding**, allowing the nucleocapsid to be transported to the nucleus, where the genome is transcribed by viral enzymes to yield viral mRNA.. the virus cap sequences allow the viral mRNA to be transported to the cytoplasm, where it is translated by host ribosomes. The nucleocapsid is assembled in the nucleus.

Genera of Orthomyxoviridae:-

1. Influenza type A.

This type includes influenza A viruses of human and also widespread in animals, particularly aquatic birds, chickens, ducks, pigs, horses, and seals. Influenza type A is responsible for pandemic and for most cases of epidemic influenza (antigenically highly variable).

Epidemic:- is defined as an outbreak of a **contagious disease** that is rapid and widespread, affecting many individuals at the same time.

A pandemic:- is an epidemic that becomes so widespread that it affects a region, continent, or the world.

2. Influenza type B.

This type includes influenza B viruses which are mainly found in humans. Influenza type B may exhibit antigenic changes and sometimes causes epidemics.

2. Influenza type C.

This type includes influenza C viruses of human and swine. Influenza type C is antigenically stable.

Genetic variation in influenza viruses.

A. Events leading to different subtypes:-

Antigenic shift: Major antigenic changes in one or both surface glycoproteins (HA and/ or NA) in influenza A viruses. This due to :

- 1- Genetic reassortment of surface glycoprotein genes occurs between different strains of a given type (possibly involving animal strains).
- 2- Reemergence of strains. Every 10-40 years when a new subtype of influenza A appears, a pandemic results. This happened in :
1918 H1N1 (Spanish flu)
1957 H2N2 (Asian flu)
1968 H3N2 (Hong Kong flu)
1977 H1N1 (Russian flu).

B. Events leading to variation within subtypes:-

Antigenic drift: Minor antigenic changes due to accumulation of point mutations in the gene, resulting in amino acid changes in the protein. Sequence changes can alter antigenic site.

Avian influenza (AI)

Avian influenza (AI) viruses infect domestic poultry as well as pet, zoo, and wild birds. In domestic poultry, AI viruses are typically of **low pathogenicity (LP), causing subclinical infections, respiratory disease, or drops in egg production.** However, a few AI viruses cause **severe systemic infections with high mortality.** **This highly pathogenic (HP)** form of the disease has historically been called fowl plague.

Etiology

AI viruses are type A orthomyxo viruses characterized by antigenically homologous nucleoprotein and matrix internal proteins, AI viruses are further divided into 16 hemagglutinin (H1-16) and 9 neuraminidase (N1-9) subtypes based on hemagglutinin inhibition and neuraminidase inhibition tests, respectively. Most AI viruses (H1-16 subtypes) are of low pathogenicity, but some of the H5 and H7 AI viruses are highly pathogenic for chickens, turkeys, and related gallinaceous domestic poultry.

Transmission:-

1-Fecal –oral route

2- water

Clinical Findings

Clinical signs, severity of disease, and mortality rates vary depending on AI virus strain and host species.

Low Pathogenicity Avian Influenza Viruses:

1-Sub clinical infection

2-respiratory signs such as sneezing, coughing, ocular and nasal discharge, and swollen infraorbital sinuses in poultry.

3-decreased egg production or fertility.

High Pathogenicity Avian Influenza Viruses:

1- HP AI viruses cause severe, systemic disease with high mortality in chickens, turkeys, and other gallinaceous poultry; mortality can be as high as 100% in a few days. **In peracute cases**, clinical signs or gross lesions may be lacking before death. However, in acute cases, lesions may include cyanosis and edema of the head, **comb**, wattle, **and snood (turkey)**; edema and red discoloration of the shanks and feet due to subcutaneous ecchymotic hemorrhages; petechial hemorrhages on visceral organs and in muscles; and blood-tinged oral and nasal discharges. **In severely affected birds**, greenish diarrhea is common.

Swine flu (swine influenza) Swine influenza is an acute, highly contagious, respiratory disease that results from infection with type A influenza virus.. Pigs are the principal hosts of classic swine influenza virus **Etiology** Swine influenza virus (SIV) is an orthomyxo virus of the influenza A group with hemagglutinating antigen H1 and neuraminidase antigen N1 (ie, H1N1). Recently, new subtypes of SIV have been reported (H3N2, H1N2, and H2N3). Influenza B and C viruses have been isolated from pigs but have not caused the classic disease.

Transmission aerosolization and pig-to-pig contact.

Clinical Findings A classic acute outbreak is characterized by sudden onset and rapid spread through the entire herd, often within 1–3 days. The main signs are depression, fever (to 108°F [42°C]), anorexia, coughing, dyspnea, weakness, **prostration**, and a mucous discharge from the eyes and nose. Mortality is generally 1%–4%. The overt course of the disease is usually 3–7 days in uncomplicated infections Some increase a bortions in late pregnancy.

Laboratory Diagnosis

1- Specimens: Nasal washings, gargles, and throat swabs.

2- Isolation:

a. Embryonated eggs

b. Primary monkey kidney cells:- Cell cultures can be tested for the presence of virus by hemadsorption 3-5 days after inoculation.

3-Identification: Viral isolates can be identified by hemagglutination inhibition test(HI).

4- Serology: Routine serodiagnostic tests in use are based on (HI) and ELISA.

5- Polymerase chain reaction (PCR).

Rapid tests based on detection of influenza RNA in clinical specimens using reverse-transcription polymerase chain reaction (RT-PCR) are preferred for diagnosis of influenza. RT-PCR is rapid (<1 day), sensitive ,and specific.

Prevention (vaccines):

The different types of vaccines in use today for influenza included an annual vaccine available for influenza A and B typically two A strains and one B strain.

A-Inactivated-virus vaccines, are either whole virus, split or subunit (surface Ag preparations purified HA & NA) vaccines. These vaccines are administered intramuscularly.

B. Live-virus vaccines

A live attenuated, cold-adapted, temperature sensitive, trivalent influenza virus vaccine administered by nasal spray .

Treatment:-

Amantadine and rimantadine for systemic use in treatment and prophylaxis of influenza A (blocks viral uncoating).

Resistant viruses emerge during therapy.

Zanamivir (Relenza) and Oseltamivir (Tamiflu) NA inhibitors
These drugs are effective against both influenza A and B viruses.