Lecture 6

Viral infection of respiratory tract

"influenza and adenoviruses"

- Additional Notes
- Important
- Explanation
- Examples

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OBJECTIVES:

- Introduction to respiratory viral infections
- Characteristics of respiratory viruses
- Mode of transmission
- Clinical features
- Lab diagnosis
- Management & treatment.

Introduction:

- Are the commonest of human infections and cause a large amount of morbidity and loss of time at work (sick leave).
- Are common in both children and adults.
- Mostly caused by viruses.
- Mostly are mild and confined to the upper respiratory tract (URT).
- Mostly are self-limiting disease.
- URT-infection may spread to other organs causing more severe infection and death.

Influenza Virus

- Family: Orthomyxoviridae.
- Structural features: Enveloped virus with 2 projecting glycoprotein spikes:
  - ✓ Haemagglutinin (HA):
    - Attachment to the cell surface receptors.
    - Antibodies to the HA is responsible for immunity.
    - 16 haemagglutinin antigenic type, H1 – H16.
    - Found in human influenza viruses: H1, H2, H3.
  - ✓ Neuraminidase (NA)
    - Responsible for release of the progeny viral particles from the infected cell.
    - 9 neuraminidase antigenic type, N1 – N9.
    - Human associated N antigenic type are N1, N2.
- Genome: 8 Segmented "Paces of genes", -ve polarity ssRNA.
- This virus is highly susceptible to mutations and rearrangements within the infected host.

- Types of influenza virus:
  1. Influenza A:
     - ✓ Infects human and Animal.
     - ✓ Causes epidemic" Outbreak" & pandemic "Outbreak but wider geographical area"
     - ✓ Causes epizootic in animal.
     - ✓ Antigenic drift(1) ➔ minor change.
     - ✓ Antigenic shift(2) ➔ major change.
  2. Influenza B:
     - ✓ Infects human only
     - ✓ Causes outbreak
     - ✓ Antigenic drift only
  3. Influenza C:
     - ✓ Infects human only
     - ✓ Causes mild illness

(1) a mechanism for variation in viruses that involves the accumulation of mutations within the genes that code for antibody-binding sites.

(2) two different viruses from two different strains (one is human) passing to intermediate host (pig) and there they infect the same cell; genes from different strains mix to form a new virus strain.
i.e: H2N2 (human) + H3N8 (avian) ➔ intermediate host (Pig) ➔ H3N2 "human"

- Pathogenesis: The virus infects the epithelial cells of the nose, throat, bronchi and occasionally the lungs.
- Transmission: Inhalation of infectious aerosol droplets.
- incubation period: 1-4 days.
- Symptoms: Fever, malaise, headache, cough, chills, sore throat, and generalized pain.
- Prognosis: Usually self-limiting disease.
- Complications:
  - ✓Primary influenza pneumonia.
  - ✓2nd bacterial pneumonia.
  - ✓Reye's syndrome. (i.e. Viral infections + aspirin).
- Lab diagnosis: nasopharyngeal swab ➔ direct immunoflourecent (I.F.) or PCR
- Treatment:

  1.Amantadine ➔ influenza A virus only 2.Rimantadine ➔ influenza A & B viruses.
- Prevention:
  - ✓The flu shot vaccine (killed vaccine): Given to people older than 6-months.
  - ✓The nasal spray flue vaccine (Flu mist): for use in healthy people between 5-49 years.
  - ✓Both vaccines contain two strains of the current circulating influenza A virus and the current circulating strain of influenza B virus.

Avian Flu

- Avian influenza type A virus (H5N1).
- Family: Typical orthomyxovirus.
- Avian influenza viruses do not usually infect human.
- High risk group includes those who working in poultry farms and those who are in close contact with poultry.
- Symptoms:
  - ✓ Ranges from typical flu to severe acute respiratory disease
  - ✓ Diarrhea, abdominal pain and bleeding from the nose have been reported
- Diagnosis: Throat swab ➔ PCR "Polymerase chain reaction"
- Treatment:
  - ✓ Oseltamivir and Zanamivir
  - ✓ Should be initiated within 48 hours.

Parainfluenza virus

- Family: Paramyxoviridae.
- Structural features: Enveloped virus with -ve polarity ssRNA genome, with 5 serotypes.
- Transmission: Inhalation of infectious aerosol droplets mainly in winter.
- Clinical syndrome:
  1. Croup or acute laryngotracheobronchitis (Type I, II):
     - ✓Mainly in infants and young children.
     - ✓Fever, harsh cough, difficult inspiration can lead to airway obstruction.
  2. Bronchiolitis and Pneumonia (Type III):
     - ✓Young children.
- Diagnosis: Direct detection from nasopharyngeal airway by direct I.F.[1]
- Treatment: Supportive treatment, No specific treatment or vaccine available.

[1]Immunofluorescence

Respiratory Syncytial Virus (RSV)

- Family: Paramyxoviridae.
- Structural features: Enveloped virus with -ve polarity ssRNA genome.
- Transmission: Inhalation of infectious aerosols mainly in winter.
- Clinical syndromes:
  - ✓ Bronchiolitis: Life-threatening disease in infant especially under 6, and can lead to chronic lung disease in later life.
  - ✓ Pneumonia: can also be fatal in infant.
- Diagnosis: Direct detection of the Ag from nasopharyngeal airway by direct I.F.[1]
- Treatment: Ribavirin administered by inhalation for infants with severe cases.
- Vaccine: No vaccine available, but passive immunization immunoglobulin can be given for infected premature infants.

[1] Immunofluorescence

Rhinovirus & Coronavirus

- Rhinovirus:
  - Family: Picornaviridae.
  - Structural features: Non-enveloped virus with +ve polarity ssRNA genome, more than 100 serotypes available.
  - Transmission: Inhalation of infectious aerosol droplets.
  - Clinical symptoms: The 1st cause of common cold.
  - Symptoms: Sneezing, clear watery nasal discharge with mild sore throat, and cough.
  - Treatment and prevention: Usually self-limiting disease, no specific treatment, and no vaccine available.

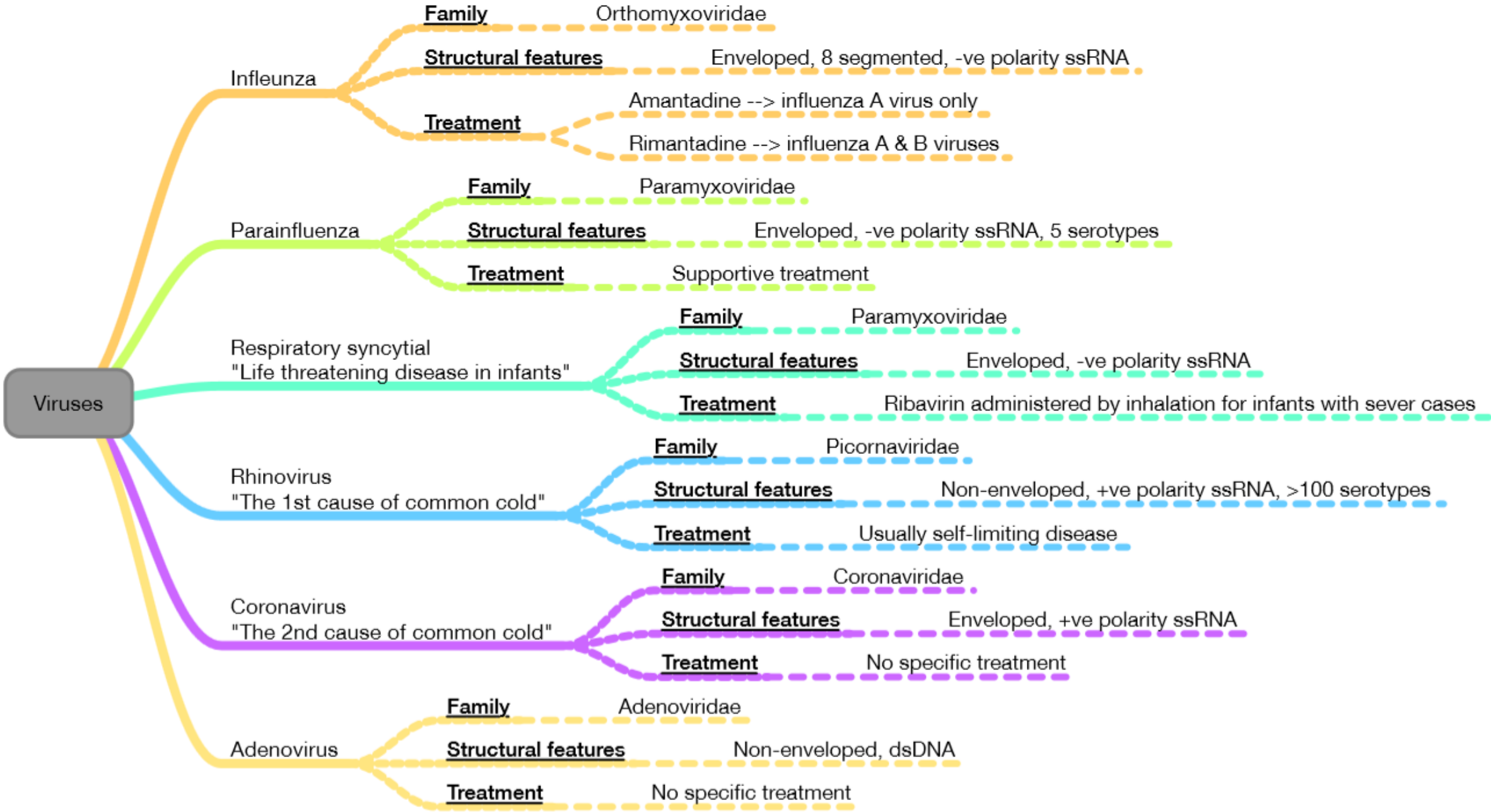
- Coronavirus:
  - Family: Coronaviridae.
  - Structural features: Enveloped virus with +ve polarity ssRNA genome.
  - Transmission: Inhalation of infectious aerosol droplets.
  - Clinical symptoms: The 2nd cause of common cold.
  - Treatment and prevention: No specific treatment or vaccine available.

- Severe Acute Respiratory Syndrome (SARS)
  In winter of 2002, a new respiratory disease known as (SARS) emerged in China. A new mutation of coronavirus, a zoonotic disease, the animal reservoir may be cat, and cause atypical pneumonia with difficulty in breathing.

Adenovirus

- Family: Adenoviridae.
- Structural features: Non-enveloped virus with ds-DNA genome.
- Pathogenesis: Adenovirus infects epithelial cell lining respiratory tract, conjunctiva, urinary tract, gastrointestinal tract and genital tract.
- Clinical syndrome:
  - ✓Phrayngitis and tonsilitis
  - ✓Pharyngioconjunctivitis
  - ✓Conjunctivitis
  - ✓Pneumonia: in preschool children
  - ✓Gastroenteritis
  - ✓Acute hemorrhagic cystitis
  - ✓Cervicitis and urethritis
- Lab diagnosis: Direct detection of the Ag from nasopharyngeal airway by direct I.F. [1]
- Treatment and prevention: No specific treatment or vaccine.

[1]Immunofluorescence


Viruses
Infleunza
Family
Orthomyxoviridae
Structural features
Enveloped, 8 segmented, -ve polarity ssRNA
Treatment
Amantadine --> influenza A virus only
Rimantadine --> influenza A & B viruses
Parainfluenza
Family
Paramyxoviridae
Structural features
Enveloped, -ve polarity ssRNA, 5 serotypes
Treatment
Supportive treatment
Respiratory syncytial
"Life threatening disease in infants"
Family
Paramyxoviridae
Structural features
Enveloped, -ve polarity ssRNA
Treatment
Ribavirin administered by inhalation for infants with sever cases
Rhinovirus
"The 1st cause of common cold"
Family
Picornaviridae
Structural features
Non-enveloped, +ve polarity ssRNA, >100 serotypes
Treatment
Usually self-limiting disease
Coronavirus
"The 2nd cause of common cold"
Family
Coronaviridae
Structural features
Enveloped, +ve polarity ssRNA
Treatment
No specific treatment
Adenovirus
Family
Adenoviridae
Structural features
Non-enveloped, dsDNA
Treatment
No specific treatment

Quiz

1.Which one of the following is considered as first cause of common cold?

a. Rhinovirus b. Coronavirus c. Adenovirus

2.Which one of the following is structurally non-enveloped?

a. Parainfluenza b. Coronavirus c. Rhinovirus

3.Which one of the following is the only virus with dsDNA?

a. Adenovirus b. Influenza c. Respiratory Syncitial

4.Avian flu do not usually infect humans.

a. T b. F

ANSWERS: 1.A 2.C 3.A 4.A