

Lecture ~ 05

# Viral Infection of The Respiratory Tract



Microbiology Team - 430

Done By :

**Ghadeer Al-Wuhyad**

Hanan Al-Rabiah

Hatim Al-Ansari

Mohammed Al-Kurbi

Hussam Al-Razqan

**Ibrahim Al-Faris**

Khawla Al-Othman

Mohanned Al-Essa

*Organized By : Basil Alanazi*

## Viral infection of the respiratory tract

Respiratory tract infections are common in adults and children, and mostly caused by viral infection which are self limiting infections, but they might spread down from the upper respiratory tract and cause more severe infection.

### ❖ **Common cold** (caused by Rhino & Corona viruses)

Inflammation of the nose and throat (nasopharynx), highly contagious disease

- **Symptoms**

Watery nasal discharge – Sneezing - Mild sore throat

- **Prognosis**

Self limiting disease (complete recovery)

- **Treatment**

No specific drugs, treatment is supportive

#### **Rhino virus :**

- Family is Picornaviridae
- Un-enveloped
- The viral genome is ss-RNA, with positive polarity

#### **Corona virus :**

- Family is Coronaviridae
- Enveloped (Helical nucleocapsid)
- The viral genome is ss-RNA, with positive polarity

**Rhino virus is the most likely pathogen to cause common cold**

**They replicate in the nasopharynx and shed (live) in the nasal secretions**

**They are sensitive to acids (inactivated by acids)**

### ❖ **Croup** (caused by Parainfluenza types 1 & 2)

Inflammation of the larynx, trachea and bronchi (acute laryngotracheobronchitis)

Common in children (2-3 yrs)

- **Symptoms**

Swelling in the air ways - Difficult and labored breathing - Fever and cough- stridor - cyanosis

#### **Parainfluenza types 1 & 2 viruses (PIV 1 & 2)**

- Family is Paramyxoviridae
- Enveloped
- The viral genome is ss-RNA with negative polarity

## ❖ **Bronchiolitis & Pneumonia i** (caused by Respiratory Syncytial Virus “RSV “ and PIV type 3)

**Bronchiolitis:** Inflammation of the bronchioles and become edematous and obstructed by mucous

**Pneumonia:** An inflammatory infection that occurs in the lung

They are common in infants, and they start as URTI

- **Symptoms**

Expiratory obstruction- wheezing (just in Bronchiolitis) - labored breathing- cyanosis

- **Diagnosis**

Direct finding of the viral antigens in the nasopharyngeal aspirate by immunofluorescent

- **Prognosis**

Most cases are Self limiting and don't require hospitalization

Increasing respiratory distress and cyanosis require hospitalization

**Respiratory Syncytial Virus “RSV “**(is the major cause for Bronchiolitis & Pneumonia in infants)

- Family is Paramyxoviridae
- Enveloped
- The viral genome is ss-RNA with negative polarity

## ❖ **Adenoviruses infections** (caused by adenovirus)

- Pharyngo -conjunctival fever.
- Acute respiratory diseases.
- Gastroenteritis.
- Urinary tract infection.

- **Prognosis**

Self limiting (treatment is supportive)

There is no vaccine available

### Transmission of adenoviruses:

- 1- **Respiratory tract infection** (by inhalation)
- 2- **Intestinal tract infection** (by the fecal oral route)
- 3- **Eye infection** (through contaminated hands)

## **Adenoviruses**

- Family is Adenoviridae
- Unenveloped ( naked )
- The viral genome is linear ds-DNA.

## ❖ Influenza “Flu” (caused by Influenza viruses)

The virus infects the epithelial cells of the nose, throat, Bronchi and occasionally the lungs

### Transmission

**By inhalation of respiratory droplets**

- **Symptoms**

Incubation period 1-4 days

Fever, malaise, chills, sore throat, hoarseness, headache, cough and generalized aches

- **Prognosis**

Recovery is usual. Symptoms last for about 5 days, but weakness often persists longer

**Complications may occur:** - Primary influenza pneumonia.

- Secondary bacterial pneumonia.

- **Treatment:**

- **Amantadine and remantadine:** active against influenza A viruses, and inhibit their replication.
- **Zanamivir (Relenza):** active against influenza A and B viruses, inhibit Neuraminidase, inhalation form
- **Oseltamivir ( Tamiflu ):** active against influenza A and B viruses, inhibit Neuraminidase, oral form

- **Vaccine:**

**1- The flu shot vaccine:**

Inactivated (killed vaccine), given to people older than 6 months

**2- The nasal spray flu vaccine ( Flu mist ):**

This is a live attenuated vaccine, given to people between 5-49 yrs

### Influenza viruses (A, B, C)

- Family is Orthomyxoviridae
- Pleomorphic, enveloped with helical nucleocapsid.
- Two glycoprotein spikes, the **hemagglutinine ( HA )** and the **neuraminidase ( N A )**
- The viral genome consists of 7 - 8 segments of ss-RNA with negative polarity

**HA is the main neutralizing antigen**

**Antibodies to the HA is responsible for immunity**

Influenza	A	B	C
Infect	Humans and animals	Humans	Humans
Spreading	epidemic and pandemic	epidemic	Mild
Antigenic variations	Major and minor	Minor	stable

#### **Antigenic shift “major variation”**

- A complete change in the HA alone or the HA and NA
- This change is due to genetic recombination between human and animal strains
- The RNA segments that codes for the HA is transferred from the animal strain to the human
- It produce new influenza A subtype (HA is from animal influenza A strain)

#### **Antigenic Drift “minor variation”**

- A minor antigenic change in the HA due to mutation in the HA gene.
- It produces a new virus strain, that may not be recognized by the immune system
- Then re-infection occurs

<i>Antigenic shift</i>	<i>Antigenic drift</i>
Occurs only in influenza <u>A viruses</u>	Occurs in both influenza <u>A and B</u> viruses
A complete change in the hemagglutinin (HA) alone or the Hemagglutinin (HA) and neuraminidase(NA)	It is a minor antigenic change in the Hemagglutinin (HA)

#### • **Pandemic spread in influenza A**

Pandemic is a worldwide epidemic of a disease, during the last 100yrs 4 pandemic occurred:

- 1- **Spanish flu, H1N1**
- 2- **Asian flu , H2N2** : antigenic shift in HA and NA
- 3- **Hong Kong flu, H3N2** : antigenic shift only in HA
- 4- **swine flu, H1N1** : has genes from pigs, avian and human (new strain)



	Definition	Organism	Symptoms & signs
<b>Common cold</b>	Inflammation of the nose and throat (nasopharynx)	Rhinoviruses  Coronaviruses	-Watery nasal discharge -Sneezing. -Mild sore throat. -Fever is not common.
<b>Croup</b>	Inflammation of the larynx, trachea and bronchi (acute laryngotracheobronchitis in <u>infants and young children.</u>	Parainfluenza types 1 & 2	-Difficult and labored breathing - Barking spasmodic cough. - <u>Inspiratory stridor.</u> - Hypoxia and cyanosis. - Fever and cough.
<b>Bronchiolitis</b>	Bronchioles become inflamed, edematous and obstructed by mucous	Respiratory Syncytial Virus ( <u>RSV</u> ) parainfluenza virus <u>type 3</u>	- Expiratory obstruction. - <u>Expiratory wheezing.</u> - difficult & labored breathing. - Hypoxia and cyanosis.
<b>Influenza “Flu”</b>	The virus infects the epithelial cells of the nose, throat, Bronchi and occasionally the lungs	Influenza viruses (A, B, C)	Fever, malaise, chills, sore throat, hoarseness, headache, cough and generalized aches

virus	family	Envelope	Viral genome
<b>Rhinoviruses</b>	Picornaviridae	Un-enveloped	ss-RNA, with positive polarity
<b>Coronaviruses</b>	Coronaviridae	Enveloped (Helical nucleocapsid)	ss-RNA, with positive polarity
<b>Parainfluenza type 1 and 2 (PIV 1&amp;2)</b>	Paramyxoviridae	Enveloped	ss-RNA with negative polarity
<b>Respiratory Syncytial Virus (RSV)</b>	Paramyxoviridae	Enveloped	ss-RNA with negative polarity .
<b>Adenoviruses</b>	Adenoviridae	Unenveloped	linear ds-DNA
<b>Influenza viruses (A, B, C)</b>	Orthomyxoviridae	Enveloped (helical nucleocapsid)	7 - 8 segments of ss-RNA with negative polarity