

Respiratory Viral Infection

- **Viral Infection of Respiratory Tract**

- The commonest of human infection.
- Check the table below :

Name of the virus	Disease
1- Influenza virus	URTI and LRTI
2- Parainfluenza virus	
3- Respiratory syncytial virus	LRTI
4- Rhinovirus	URTI
5- Coronavirus	URTI and LRTI
6- Adenovirus	URTI and eye infections

- All respiratory viruses above have **RNA** strands **EXCEPT Adenovirus** has **DNA**.
- In **LRTI** usually the best sample is nasopharyngeal aspirate, bronchial wash, or sputum; while in **URTI** nasopharyngeal swab is sufficient.
- **1-Orthomyxoviruses: Influenza Virus** (*very important*)
 - **Single** Stranded negative sense **RNA** with **8** helical segments.
 - This virus is **highly susceptible** to **mutations** and **rearrangements** **within the infected host**.
 - These are **enveloped** viruses which contain **2 projecting glycoprotein spikes: Hemagglutinin (HA)** and **Neuraminidase (NA)**.
 - **Hemagglutinin (HA)** → main site of **attachment**.
 - Only viruses of **H1, H2, and H3** are known to infect and cause disease in **humans**.
 - **Neuraminidase (NA)** → an **enzyme help in releasing progeny virus** formation from infected cell. Only viruses of **N1 and N2** are known to infect and cause disease in **humans**.
 - **Polymorphic**. (*the influenza virus shape*)

- Types of Influenza Viruses (Check the table below) :

	Type A	Type B	Type C
Infection target	Human and Animals (<i>including birds</i>)	Human only. (<i>we can control it</i>)	Human only.
Outbreak	Outbreaks, epidemic, pandemic and epizootic.	Epidemic & outbreaks	Mild illness.
Antigen	Antigenic drift → minor change. Antigenic shift (<i>reassortment</i>) → major change.	Antigenic drift only.	-

- **Avian flu** hardly infect humans except when **reassortment** happens (*reassortment in pigs for example*).
- **Swine flu** happens after **shift** in swine (pig) ; it is easy to infect humans.
- Influenza virus establish a local **upper respiratory tract** infection and it is a **self-limiting** condition in **immunocompetent** person.
- Spread to the **lower respiratory tract** infection in **immunosuppressed** person.
- Viremia usually occurs (**fever**) .
- Transmission → **inhalation** of respiratory secretion.
- Incubation period → **1 - 4** days
- Seasonal variation → usually in **winter**
- **prognosis** → **self-limiting** disease
- **Symptoms**: Sudden onset of **fever**, malaise, headache, Non-productive cough, chills, sneezing, sore throat, and generalized pain.
- **Complication** of Influenza:
 - → **Primary** Influenza **Pneumonia**. (in immunocompromised)
 - → **2nd bacterial-pneumonia** (*Strep. pneumoniae, H.influenzae*)
 - → Reye's syndrome (*happens in children when infected while taking Aspirin*).
- **Laboratory Diagnosis**: Laboratory investigation done to **identify the type and strain**. Specimen: **Nasopharyngeal aspirate, nasal washing** (*for children*). Rapid and direct detection of influenza virus **A** or **B** from nasopharyngeal aspirate by **immunofluorescence** and **ELISA**. If it was detected that the virus is **A**, we should make **PCR**.

- **Treatment: Amantadine, Oseltamivir (Tamiflu).**
- **Amantadine:** Is only effective against **influenza A** virus.
- **Rimantadine, Oseltamivir (Tamiflu) or Zanamivir (Relenza):** For both influenza **A** and **B**. It is **Neuraminidase inhibitor**; it has to be given within the **first 48 hours**. *Recommended dose is 75 mg twice daily for 5 days.*
- They have **therapeutic** and **prophylactic** effect.
- **Influenza vaccine: 2** types of vaccine, **both** contain the current **influenza A & B**. Vaccine should be given in October or November ,**before** the influenza season begins. *Yearly booster dose recommended.*
- **1-The Flu shot vaccine: Inactivated (Killed vaccine),** Given annually to people **older than 6 months**, including healthy people as well as high risk groups.
- **2-The Nasal spray flu vaccine (Flumist):** This is a *live attenuated* vaccine, approved for use in **healthy** people **only** between **5- 49** years age. *Given annually.*
- **2-Rhinoviruses**
 - Rhinoviruses are responsible for **60%** of **common colds** cases.
 - Common cold is a self-limited illness.
 - Small **Non enveloped** virus, **+ve** polarity **SS-RNA** virus.
 - They are **acid labile** (sensitive). *does not cause infection if taken with food, it causes infection when inhaled.*
 - Can **NOT** be detected by direct **immunofluorescence**.
- **3-Coronaviruses**
 - **Enveloped**, **+ve** polarity **SS-RNA**.
 - Coronavirus are the **second** cause of common cold.
 - Complication: Usually due to **secondary bacterial infection**.
 - Lab diagnosis: **PCR**. It can **NOT** be detected by direct **immunofluorescence**.
 - **Severe Acute Respiratory Syndrome SARS:** A new mutation of **coronavirus**, the animal reservoir may be the **cat**.causes **Atypical pneumonia**, can infect all age groups.
 - Coronavirus is difficult to isolate and it is able to survive in dry air for up to 3 hours.
 - **Middle East Respiratory Syndrome Coronavirus (MERS-CoV):** In September 2012 ,a case of novel coronavirus infection was reported involving a man in **Saudi Arabia** who was admitted to a hospital with **pneumonia** and **acute kidney injury**. Virus closely related to several **bat** coronaviruses. MERS-CoV infected several human cells , including **lower** but **NOT** upper respiratory, kidney ,intestinal, and liver cells.

- **4-Para – Influenza Viruses**

- **Enveloped**, -ve polarity SS-RNA. Envelop surface projection presents as Hemagglutinin, Neuroaminidase.
- **F-glycoproteins** which cause cell to cell membrane to fuse → **syncytia**
- There are **four** para-influenza viruses: 1, 2, 3, 4.
- Transmitted by respiratory droplets; occur mainly in winter.
- **Croup or Acute Laryngotracheobronchitis**: para-influenza Type I,II seen in infants (> 6 months) & young children < 5 years (**more than 6 months → less than 5 years**).
- **Bronchiolitis and pneumonia** Type III
- **Common Cold**
- Direct detection of parainfluenza virus from **nasopharyngeal aspirate** by direct **immunofluorescent**.
- Cell **culture** will appear as **multinucleated giant cell (syncytia)**.
- Hospital admission for infant having **Croup**.

- **5-Respiratory Syncytial Virus (RSV)** (*very important*)

- **Enveloped**, -ve polarity SS-RNA.
- The virus transmitted by **respiratory droplets**; *very contagious*.
- The importance of RSV lies in its tendency to invade the **lower respiratory tract** of **infant <6 months (0-6 months)**
- Causes **bronchiolitis** & **pneumonia** in **infants**. Which are important and **life-threatening** diseases in infants. **Bronchiolitis** may be fatal and can lead to chronic lung disease in later life. *especially under 6 months of life*.
- In old children and adult can cause **common cold**.
- Cell **culture** will appear as **multinucleated giant cell (syncytia)**.
- **ELISA** and **immunofluorescent** for direct detection from nasopharyngeal aspirate.
- Infant will be hypoxic and need hospitalization and isolation → (oxygen inhalation); **Ribavirin** given by inhalation to treat severe **Bronchiolitis and pneumonia**.
- **No vaccine is available**.

- **6-Adenoviruses**

- **Non-enveloped**, ds-DNA.
- Adenoviruses infect epithelial cells lining respiratory tract, conjunctiva, gastrointestinal tract, and genital tract. *can cause anything EXCEPT in brain (does NOT cause **encephalitis**, does NOT cause **meningitis**)*

- The Adenoviruses have the tendency to become **latent** in lymphoid tissue and can be reactivated if immunity become low.
- Adenovirus primary infect children and less commonly infect adult. **Reactivation** occur if the patient become immunocompromised in children or adult.
- The main clinical syndromes:
 - → Conjunctivitis: Can occur as sporadic cases or as an outbreaks. Contaminated instruments at **eye – clinics**. *can cause infection in **conjunctivitis**.*
 - → Keratoconjunctivitis: (Infection of **Cornea** and **Conjunctiva**)
 - → Systemic infection in immunocompromised patient: In these group of patient infection become severe as **pneumonia** or **hepatitis** it can be primary exogenous infection or reactivation.
 - **VERY IMPORTANT**:(does **NOT** cause **encephalitis** , does **NOT** cause **meningitis**)
 - **Laboratory Diagnosis**: Mainly the diagnosis by direct detection of viral antigen by **Immunofluorescence** and **ELISA**. *Other detection methods: Tissue culture or **PCR**.*
- Live Oral vaccine → used to prevent **acute respiratory tract** infection for Military recruits.

-----End of lecture 4-----