



Microbiology

team 436



lecture: Viral Infections of the Respiratory System

■ important

■ Extra notes

■ Doctors notes

"لا حول ولا قوة إلا بالله العلي العظيم" وتقال هذه الجملة إذا دهم الإنسان أمر عظيم لا يستطيعه ، أو يصعب عليه القيام به .

Objectives:

- Introduction to respiratory viral infections
- Characteristics of respiratory viruses (Orthomyxoviridae, Paramyxoviridae)
- Mode of transmission
- Clinical features
- Lab diagnosis
- Treatment & prevention

Viral infection of respiratory tract

They are the commonest of human infection and cause 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
- Mostly are self-limiting disease (**no need for treatment**)
- Upper respiratory tract infection may spread to other organ causing more severe infection and death

Clinical manifestation :

- Common cold “rhinitis”
- Pharyngitis
- Tonsillitis
- Sinusitis
- Otitis media
- Croup “ acute laryngotracheobronchitis “
- Acute bronchitis
- Acute bronchiolitis
- Viral pneumonia

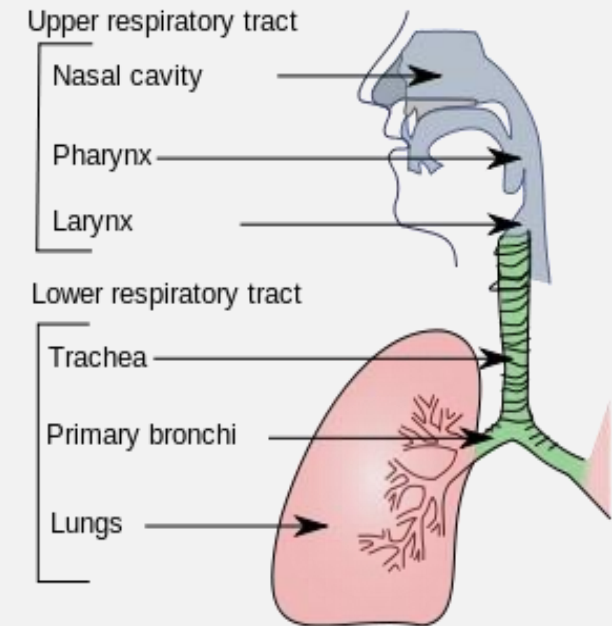


Table 22.1 Respiratory illnesses and their common viral causes*

Respiratory illness	Main causal viruses
Rhinitis (common cold)	Rhinoviruses (100 serotypes) Coronaviruses (3 serotypes)
Pharyngitis	Influenza A and B viruses Parainfluenza virus (types 1–3) Adenoviruses B, C, E Coxsackie A virus
Laryngotracheobronchitis (Croup)	Influenza virus Parainfluenza virus (types 1 & 2)
Bronchitis	Respiratory syncytial virus Parainfluenza virus (usually type 3) Influenza virus
Bronchiolitis	Respiratory syncytial virus Human metapneumovirus Parainfluenza virus (usually type 3)
Pneumonia	Influenza virus Respiratory syncytial virus Human metapneumovirus Parainfluenza virus (usually type 3) Adenoviruses B, C, E

*Other viruses can cause respiratory illness as part of a systemic infection, e.g. measles, pneumonia and pharyngitis in primary Epstein–Barr virus infection.

Common respiratory viruses:

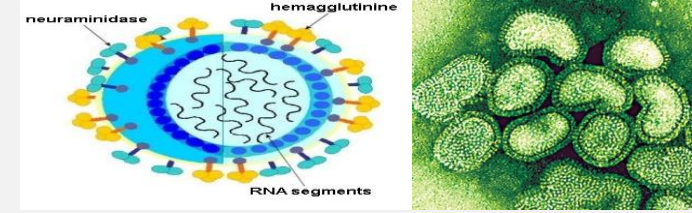
Name of the virus	Family	Disease
1-Influenza virus	<i>Orthomyxoviridae</i>	URT & LRT infection
2-Parainfluenza virus	<i>Paramyxoviridae</i>	URT & LRT infection
3-Respiratory syncytial virus	<i>Paramyxoviridae</i>	LRT infection
4-Rhinovirus	<i>Picornaviridae</i>	URT infection
5-Coronavirous	<i>Coronaviridae</i>	URT & LRT infection
6-Adenovirus	<i>Adenoviridae</i>	URT and eye infections
7-Human metapneumovirus	<i>Paramyxoviridae</i>	LRT infection

سندرس كل واحد
بالتفصيل في هذه
المحاضرة والتي تليها

- URT- infection includes : rhinitis “ common cold”, tonsillitis , pharyngitis
- LRT- infection includes : croup, bronchitis, bronchiolitis, pneumonia

Influenza virus :

Family: **Orthomyxoviridae**.



Features:	Envelope contain 2 projecting glycoprotein spikes:		Divided into subtypes
<p>-Genome:</p> <ul style="list-style-type: none"> • 8 Segmented (it is the only segmented virus in this 2 lectures) • (-ve)polarity ssRNA. (-ve polarity = the virus RNA will transcription to mRNA then translation to protein) <p>-Highly susceptible to mutation and rearrangements within the infected host</p>	<p style="text-align: center;">Heamagglutinin “H”</p> <ul style="list-style-type: none"> • <u>Function</u>: attachment to the cell surface receptor • Antibody for HA is responsible for immunity • 16 haemogglutinin antigenic type H1-H16 • Human associated antigenic type are H1, H2, H3 	<p style="text-align: center;">Neuroamindase “N”</p> <ul style="list-style-type: none"> • <u>Functin</u> :An enzyme respnsible for release of the progeny viral particles from the infected cell • 9 neuroaminidase antigenic type N1-N9 • Human associated N antigenic type are N1, N2 	<p>-based on the haemagglutinine and neuraminidase proteins.</p> <p>-The currently circulating strains are: H1N1 & H3N2.</p>

Types of Influenza Viruses

Influenza A

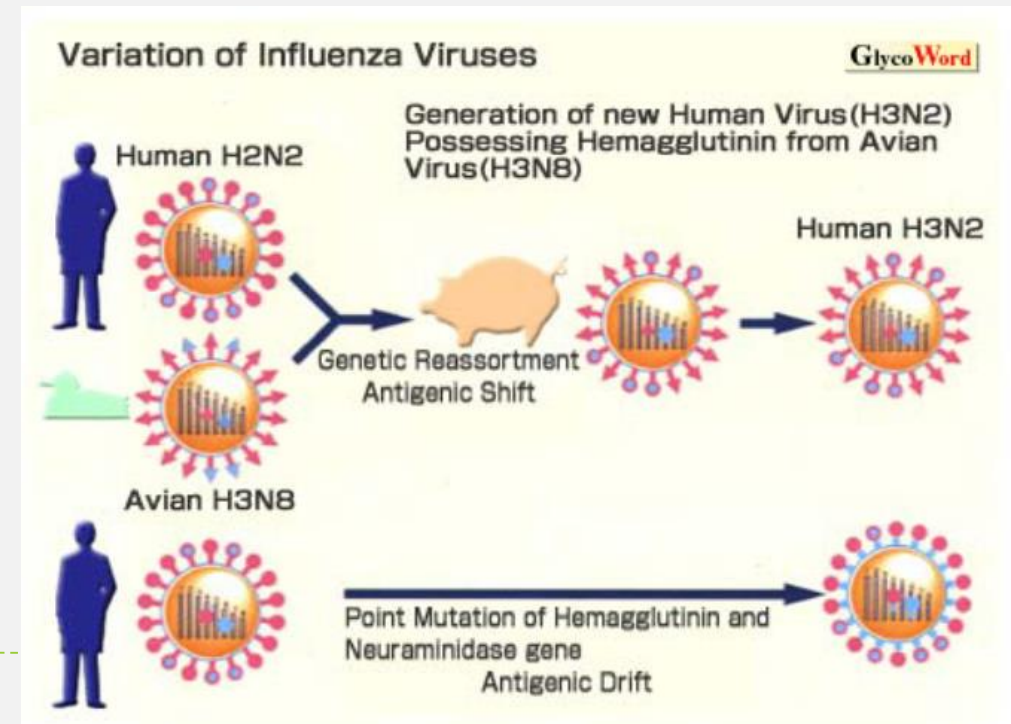
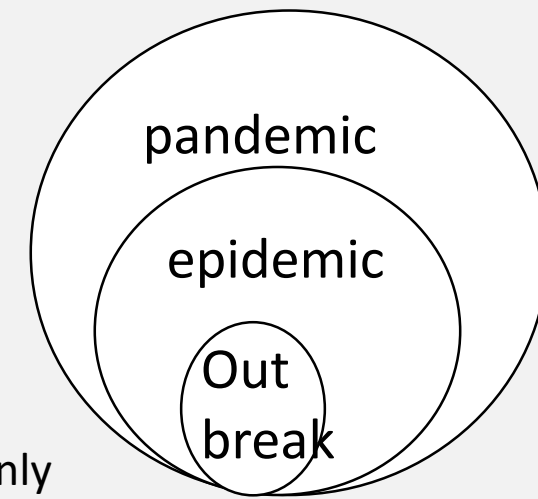
- Infect **human and animals**.
- cause epidemic and pandemic
- cause epizootic in animals
- Antigenic drift -> minor change **in the genetic material**
- antigenic shift - > major change **in the genetic material**

Influenza B

- Infect **human**
- Cause outbreaks
- Antigenic drift only

Influenza C

- Infect **human** only
- Cause mild illness



Influenza virus :

- 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
 - prognosis: usually self limiting disease
 - Symptoms: fever - Cough - Malaise - Headache - chills - sore throat - generalized pain
-

Influenza virus :

- Complication of Influenza:

- ✓ Primary Influenza Pneumonia.
- ✓ 2nd bacterial-pneumonia
- ✓ Reye's syndrome [fatty degeneration of CNS and Liver (Aspirin)]

- Treatment:

1: **Amantadine** is effective against influenza **A virus only**.

2: Rimantadine, **Oseltamivir** (Tamiflu) or **Zanamivir** (Relenza) are effective against **both influenza A & B** viruses and can be used as treatment and prophylaxis.

- Lab diagnosis:

- ✓ **routine testing** by Direct detection of Influenza A or B virus from sputum, nasopharyngeal swab, aspirate (NPA) or respiratory secretion **by direct immunofluorescent assay (IFA)**. **(detect the antigen)**
- ✓ Other detection methods not common: Cell culture, PCR.

Influenza virus :

- Prevention:

Influenza vaccine: Two types of vaccines available:

1- The flu shot vaccine: Inactivated (killed vaccine).

- Given to people older than 6-months, including healthy people and those with chronic medical conditions. **injection**

2- The nasal spray flue vaccine (Flu mist): Live attenuated vaccine.

- Approved for use in healthy people between 5-49 years of age. **Nasal spray**
- Both vaccines contain two strains of the current circulating influenza A virus and the current circulating strain of influenza B virus. **(2 A + 1 B)**
- Vaccine should be given in October or November, before the influenza season begins.

Avian flu

- Viral etiology: Avian influenza type A virus (H5N1).
- Family: Typical orthomyxovirus.
- Epidemiology: Wild birds are the natural reservoir for the virus. They shed the virus in saliva, nasal secretion and feces.
- All domestic poultry are susceptible to infection.
- They become infected, when they eat food contaminated with secretion or excretion from infected bird.
- 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 in human:

- Ranges from typical flu to severe acute respiratory disease.
- Diarrhea, abdominal pain and bleeding from the nose have been reported.

• Treatment:

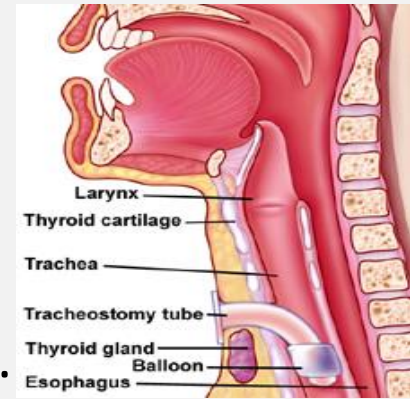
- Should be initiated within 48 hours.
- Oseltamivir** and **Zanamivir** are used.

• Lab diagnosis:

- PCR, detection of the viral RNA in throat swap.

2- Parainfluenza Virus

- **Family:** Paramyxoviridae.
- **Structural features:** Enveloped virus with - polarity ssRNA genome, with 5 serotypes.
- **Transmission:** Inhalation of infectious aerosol droplets mainly in winter.
- **Clinical syndrome:**
 - a. Croup or acute laryngotracheobronchitis. PIV Type-I, II affect mainly in infants and young children. Fever, harsh cough, difficult inspiration can lead to airway obstruction which may require hospitalization and tracheostomy.
 - b. Bronchiolitis and Pneumonia: PIV **Type-III** in young children.
- **Lab diagnosis:** routine testing by Direct detection of the virus from sputum, nasopharyngeal swab, aspirate (NPA) or respiratory secretion by direct immunofluorescent assay (IFA).
- **Other detection methods:** tissue culture, PCR.
- **Treatment and prevention:** Supportive treatment, No specific treatment or vaccine available.



3- Respiratory Syncytial Virus (RSV) + Human metapneumovirus

- **Family:** Paramyxoviridae.
- **Structural features:** Enveloped virus with - polarity ssRNA genome.
- **Transmission:** Inhalation of infectious aerosols mainly in winter.
- **Clinical syndromes:**
 - a. Bronchiolitis: Life-threatening disease in infant especially under 6 month of life with respiratory distress and cyanosis can be fatal and can lead to chronic lung disease in later life.
 - b. Pneumonia: can also be fatal in infant.
- **Lab diagnosis:** routine testing by Direct detection of the virus from sputum, nasopharyngeal swab, aspirate (NPA) or respiratory secretion by direct immunofluorescent assay (IFA).
- **Other detection methods:** Isolated of virus by cell culture from N.P.A with multinucleated giant cell or syncytia as cytopathic effect (C.P.E); PCR.
- **Treatment and prevention:** Ribavirin administered by inhalation for infants with severe condition.
- **Vaccine:** No vaccine available, but passive immunization immunoglobulin can be given for infected premature infants.

For Human metapneumovirus there is no diagnosis EXCEPT PSR

4- Measles Virus

Transmission - Epidemiology – pathogenesis - Clinical features – Complication - Lab diagnosis - Treatment and prevention

Measles Virus

Family:
Paramyxoviridae.

Structural features:
Enveloped virus with ss-RNA genome.

infects human only.



Transmission

- Inhalation of infectious aerosol droplets.

Epidemiology

- Measles virus infects human only. Most cases in preschool children, very infectious cases mainly in winter and spring.

pathogenesis

- Virus infects first epithelial cells of respiratory tract then virus spread to the blood causing viremia .The virus reaches the lymphoid tissue where it replicates further and widely disseminated to the skin with maculopopular rash.

4- Measles Virus

Transmission - Epidemiology – pathogenesis - Clinical features – Complication - Lab diagnosis - Treatment and prevention

- Clinical features:

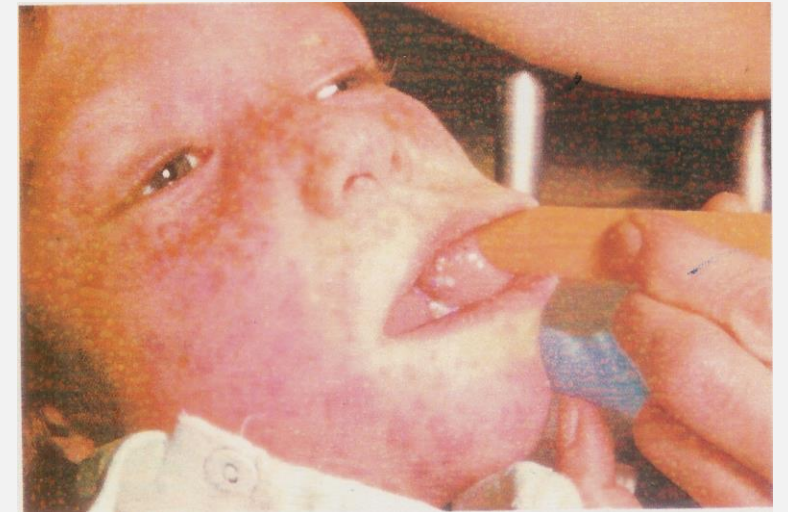
- I.P.: 7- 14 days.

- Prodromal symptom: Fever, cough, conjunctivitis and running nose

- Koplik's spot: Small red papules with white central dots appear mostly in buccal mucosa

- Rash: Maculopapular rash first on face trunk then extremities. The rash is red, become confluent, last 4 or 5 days, then disappears leaving brownish discoloration of the skin and final desquamation

- Recovery complete in normal children with life long immunity.



4- Measles Virus

Transmission - Epidemiology – pathogenesis - Clinical features – Complication - Lab diagnosis - Treatment and prevention

- Complication:

1- Encephalitis :Acute or Subacute sclerosing panencephalitis (SSPE)

2- Giant cell pneumonia: rare in immunocompromised children due to direct invasion of measles virus to the lung tissue.

- Lab diagnosis:

Serology by detection of IgM Ab (**it's a mark for acute infection**) using ELISA , and in case of SSPE detection of measles antibodies in CSF or detection of viral NA using PCR.

- Treatment and prevention:

No specific treatment, Prevention by giving the live attenuated vaccine (MMR) for Measles, Mumps and Rubella (given to all children 15 month and booster dose at school entry. Give excellent long last protection.

5- Mumps Virus

Transmission –Epidemiology – pathogenesis - Clinical Features – Complications - Lab diagnosis - Treatment and prevention

Mumps Virus

is an acute benign viral Parotitis*.

Family:
Paramyxoviridae.

Structural features:
Enveloped virus with ss-RNA genome. The viral envelope is covered with two glycoprotein spikes, hemagglutinine and neuraminidase

disease of children (5-15 years), but also can be seen in young adult with more complicated feature.

Transmission

- Inhalation of infectious aerosol droplets during sneezing and coughing, direct contact with saliva.

Epidemiology

- Mumps virus infects human only.
- Highly infectious, peak in winter.
- Long incubation period 18-21 days

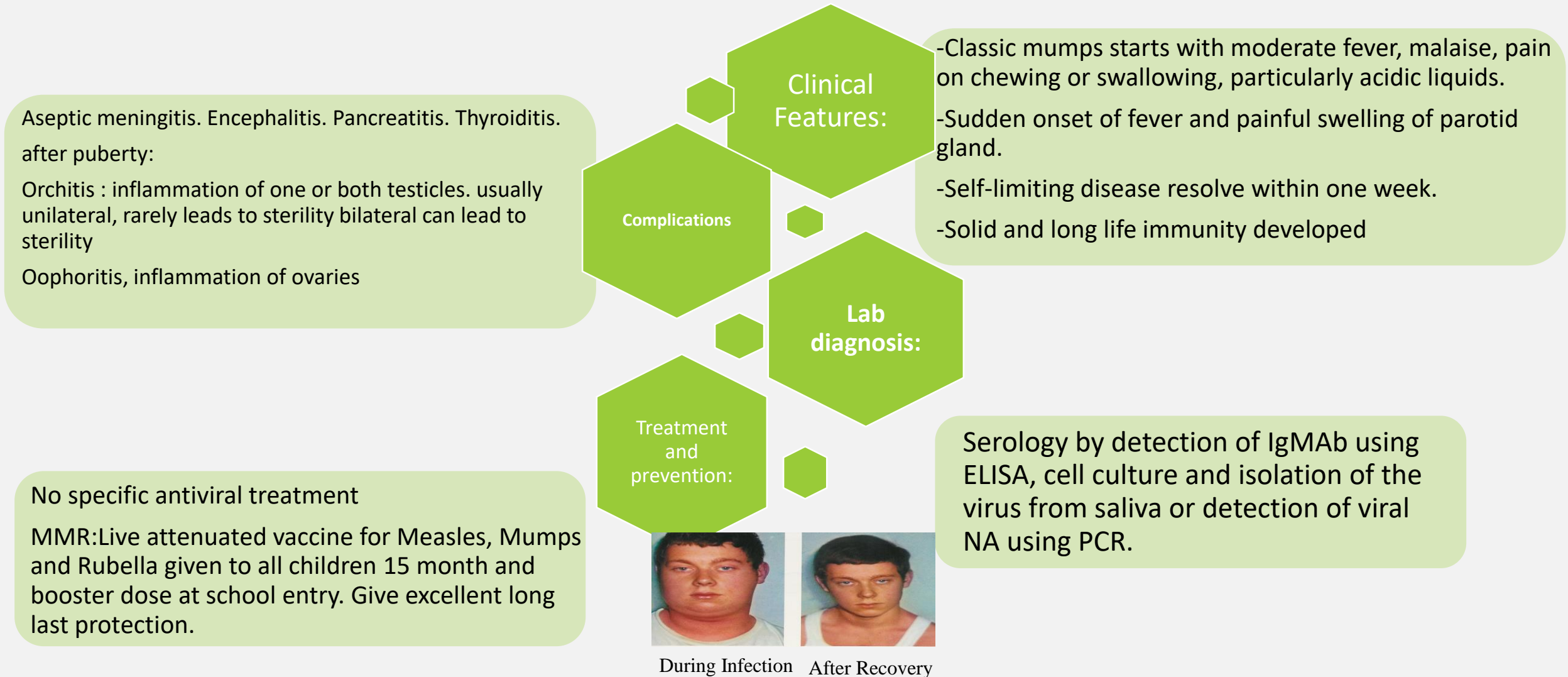
pathogenesis

- Infection started in the epithelial cells of upper respiratory tract, then virus spread by viremia to parotid gland mainly and to other organs as: testes, ovaries, pancreas and CNS.

*Parotitis (painful inflammation and swelling of salivary gland mainly parotid glands)

5- Mumps Virus

Transmission –Epidemiology – pathogenesis - Clinical Features – Complications - Lab diagnosis - Treatment and prevention



GOOD LUCK!

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