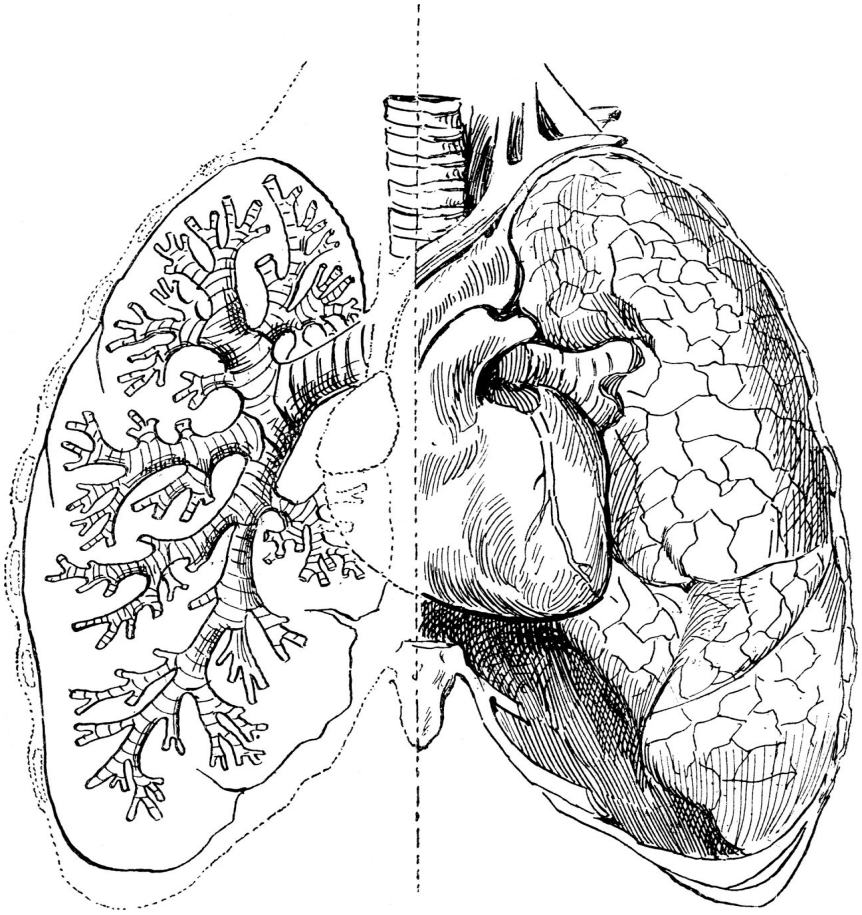
Microbiology

435's Teamwork
Respiratory Block



- Please contact the team leaders for any suggestion, question or correction.
- Pay attention to the statements highlighted in **bold** and\or red.
- **Footnotes color code:** General | Females | Males.

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Respiratory Viral Infection

- Lectures four and seven -

Learning Objectives:

- Introduction to respiratory viral infections.
- Characteristics, transmission, clinical features, diagnosis, management, and treatment.

Concepts **(Very Important to understand)**:

RNA sense[1] in viruses[2]
Positive-sense (+ve strand): (5' to 3') viral RNA signifies that a particular viral RNA sequence may be **directly translated** into the desired viral proteins.
Negative-sense (-ve strand): This RNA (3' to 5') **cannot be translated into protein directly**. Instead, it must first be transcribed into a positive-sense RNA that acts as an mRNA. Some viruses (Influenza, for example) have negative-sense genomes and so must carry an RNA polymerase inside the virion.
Antigenic drift[3] (minor change).
A mechanism for variation in viruses that involves the accumulation of mutations within the genes that code for antibody-binding sites. This results in a **new strain[4]** of virus particles which cannot be inhibited as effectively by the original antibodies.
Antigenic shift[5] (major change).
The process by which two or more different strains of a virus, or strains of two or more different viruses, combine to form a **new subtype[6]** having a mixture of the surface antigens of the two or more original strains.[7]

[1] Polarity.
[2] We recommend you to Read more.
[3] We recommend you to Read more.
[4] سلالة.
[5] We recommend you to Read more.
[6] بمعنى أن الفيروس يتحد مع فيروس من نفس نوعه، أو من نوع مختلف، لينتج عن هذا الاتحاد فيروس جديد بخصائص الفيروسات المتحدة جميعًا.
[7] الهدف من هاتين الآليتين هو انتاج اجزاء جديدة لايمكن للجهاز المناعي مهاجمتها لأن الاجسام المضادة تكون مبرمجة على الاجزاء السابقة لهذه التغييرات، لذلك يفلت الفيروس من الجهاز المناعي أو التطعيمات المجهزة له.

Introduction:

- Virus infection of the respiratory tract are the commonest of human infection and cause a large amount of morbidity and loss of time at work (sick leave).
- Common in both **children** and **adults**.
- Most of them are mild and confined[8] to the upper respiratory tract (URT).
- Most of them are **self-limiting diseases**[9].
- URTI may spread to other organs causing more severe infection and death.

Common respiratory viruses:

Name of the virus	Family (Not important)	Disease
1- Influenza virus	*Orthomyxoviridae*	URTI[10] and LRTI[11]
2- Parainfluenza virus	*Paramyxoviridae*	
3- Respiratory syncytial virus		LRTI
4- Rhinovirus	*Picornaviridae*	URTI
5- Coronavirus	*Coronaviridae*	URTI and LRTI
6- Adenovirus	*Adenoviridae*	URTI and eye infections
7- Human metapneumovirus	*Paramyxoviridae*	LRTI

1,2,3,4,5,6 mode of transmission is by inhalation.

Clinical manifestations:

Upper respiratory tract infections (URTI) includes:

- Rhinitis (common cold), tonsillitis[12], pharyngitis[13], sinusitis, otitis[14] and influenza (flu).

- **Lower respiratory tract infections (LRTI)** includes:

- Croup[15], acute bronchitis[16], acute bronchiolitis[17], viral pneumonia[18] and influenza (flu).

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[8] تقتصر على.

[9] A disease process that resolves spontaneously with or without specific treatment. لأن الفيروسات ليس لها علاج غالبًا.

[10] Upper respiratory tract infections.

[11] Lower respiratory tract infections.

[12] التهاب اللوزتين.

[13] التهاب الحلق (البلعوم).

[14] التهاب الأذن.

[15] مرض الخُناق في الحنجرة.

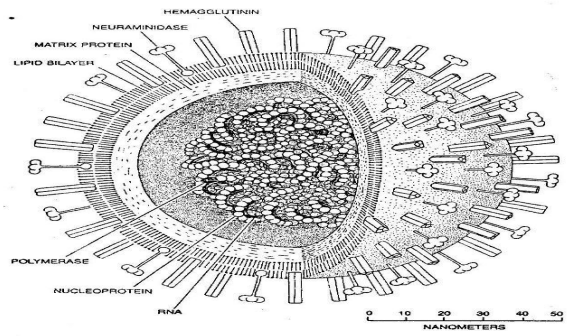
[16] التهاب الشعب الهوائية.

[17] التهاب الشعيبات الهوائية.

Orthomyxoviridae Family

- Influenza virus, Avian flu and Swine flu -

1. Influenza Virus (very important)[19]



Structural features:

- 8 helical Segment genom (-ve polarity **ssRNA**[20]).
- Enveloped virus with 2 projecting glycoprotein spikes:
- Haemagglutinin (H) main site of **attachment.**
- Neuraminidase (N)

Influenza viral proteins:

Haemagglutinin[21] (H)	Neuraminidase[22] (N)
Attaches to the cell surface receptors.	Responsible for release of the progeny viral particles from the infected cell.
The virus can agglutinate certain erythrocyte.	
Antibodies to the Haemagglutinin is responsible for immunity.	9 neuraminidase antigenic types (N1–N9).
16 haemagglutinin antigenic types, (H1– H16).	Human associated N antigenic type are N1, N2. Other N from non-human source[23].
Human associated H antigenic type are H1, H2, H3. Other H from non-human source[24].	

Epidemiology:

- Seasonal, spreads mostly in winter.
- Highly susceptible to mutations and rearrangeable within the infected host.
- **Past antigenic shifts:**
- 1918 → H1N1 "Spanish Influenza" → 20-40 million deaths.
- 1957 → H2N2 "Asian Flu" → 1-2 million deaths.
- 1968 → H3N2 "Hong Kong Flu" → 700,000 deaths.
- 1977 → H1N1 Re-emergence[25] → not pandemic[26].

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[18] التهاب الصدر.

[19] This virus is highly susceptible to mutations and rearrangements within the infected host.

[20] Single-Stranded RNA

[21] Glycoprotein found on the surface of influenza viruses. (More)

[22] Enzymes that hydrolyze glycosidic bonds, leading to the degradation neuraminic acids.

[23] still can infect humans

[24] still can infect humans

[25] Come again.

[26] Global disease outbreak.

Types of influenza virus:

- Divided into **subtypes** based on the haemagglutinin and neuraminidase proteins.
- The currently circulating strains are **H1N1 and H3N2.**

	Type A	Type B	Type C
Infection target[27]	**Human** and **Animal**.	Human only.	Human only.
Outbreak	Epidemic[28], pandemic[29] and epizootic[30].	Epidemic & outbreaks[31]	Mild illness.
Antigen	Antigenic drift → minor change. Antigenic shift → major change.	**Antigenic drift only.**	-

Pathogenesis:

- The virus infects the epithelial cells of the **nose, throat, bronchi** and occasionally **the lungs.**
- Influenza virus establish a local upper respiratory tract infection.
- According to the **host's immunity**, it can either be localized or spread to the LRT.
- Viremia and fever usually occur.

Transmission:

Inhalation of infectious **aerosol droplets**[32].

Incubation period:

1-4 days.

Symptoms:

Fever, malaise, headache, cough, chills, sore throat, and generalized pain.

Prognosis:

Usually a **self-limiting disease**.

Complications:

- **Primary influenza pneumonia**[33]**.**
- **Secondary bacterial pneumonia** (*Streptococcus pneumoniae*, *Haemophilus influenzae*).
- Reye's syndrome[34], Myositis[35], post influenza encephalitis[36], bronchial Asthma, sinusitis.

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[27] Any virus that affects humans only is controllable (good to control).
[28] Spreads rapidly to many people.
[29] Global disease outbreak. HIV is a great example of it.
[30] Temporarily prevalent and widespread in an animal population.
[31] Outbreak is infection is a specific place (college - house - restaurant and so on.)
[32] Accumulation of solid particles or liquid droplets in air or another gas.
[33] In immunocompromised patient, infection spread from upper to lower respiratory tract.
[34] Fatty degeneration of CNS and liver.

Lab diagnosis:

- **Routine testing** by direct detection of Influenza A or B virus from:
- Sputum.
- Nasopharyngeal swab aspirate (NPA).
- Respiratory secretion by direct immunofluorescent assay **(IFA)**.
- **Other detection methods:**
- Tissue culture.
- PCR[37].

Treatment:

1) Amantadine

- Effective against influenza **A virus** only**.**

2) Rimantadine, Oseltamivir (Tamiflu) or Zanamivir (Relenza)

- Effective against both **influenza A & B viruses.**
- It can be used as a treatment or prophylaxis[38].

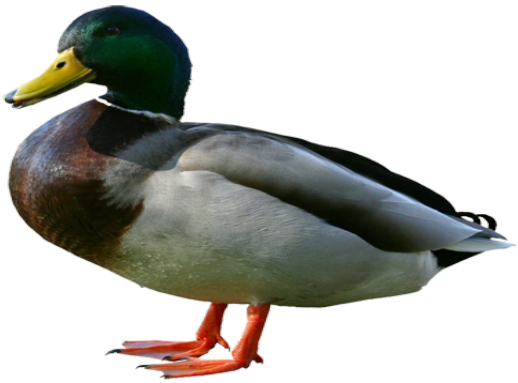
Prevention:

- **Two** types of vaccines available.
- **Both** vaccines contain **two strains** of the current circulating influenza A virus and the current circulating strain of influenza B virus.
- Vaccine should be given in **October** or **November**, before the influenza season begins (winter).

1- Flu shot vaccine	2- The nasal spray flu vaccine (Flumist)
- Inactivated (killed vaccine)[39]. - Given to people older than 6-months, including healthy people and those with chronic medical condition. - Given annually by intramuscular injection,vaccine include virus A and B	- Live attenuated vaccine[40]. - Approved for use in healthy people ONLY between 5-49 years of age. - Cannot be given to person at high risk,asthma,pregnant or immunocompromised - must be given annually.

[35] Inflammation and degeneration of muscle tissue.
[36] Inflammation of the brain.
[37] **P**olymerase **c**hain **r**eaction: a rapid technique for in vitro amplification of specific DNA or RNA sequences, allowing small quantities of short sequences to be analyzed without cloning. We will do this when the IFA shows (apple green fluorescence) which means type A so we want to determine which strain of influenza.
[38] Not only to treat the infected individuals, but to prevent the uninfected from getting infected as well.
[39] Grown in culture then killed by Heat or formaldehyde.
[40] Contains living organisms.

2. Avian flu[41] (H5N1or H3N8)



Etiology:

Avian influenza type **A virus.**

Epidemiology:

- Avian influenza viruses **do not usually** infect human.
- **Wild birds**[42] are the natural reservoir[43] for the virus.
- They shed the virus in saliva, nasal secretion and feces.
- All domestic poultry[44] are also susceptible to the infection.
- They become infected when they eat the food which is contaminated with secretion or excretion from another infected bird.
- High risk group includes those who are working in poultry farms[45] 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 swab.

3. Swine Flu[46] (H1N1)

Read more about it Here.

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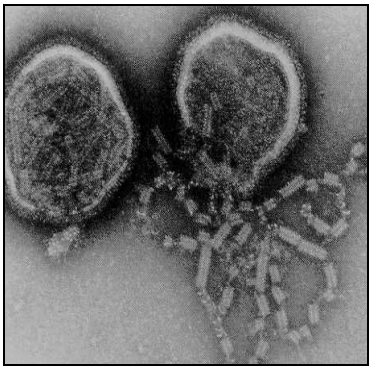
41 انفلونزا الطيور.
42 الطيور البرية.
43 المصدر.
44 الدواجن المستأنسة.
45 مزارع الدواجن.
46 انفلونزا الخنازير.

Paramyxoviridae Family

- Parainfluenza and RSV -

1. Parainfluenza Virus



Structural features:

- There are **four parainfluenza** viruses: 1, 2, 3, 4.
- Enveloped virus with (-ve polarity ssRNA) genome, with 5 serotypes[47].
- Envelop surface projections presents as Hemagglutinin HA and Neuraminidase NA.

Transmission:

Inhalation of infectious **aerosol droplets** mainly in winter.

Clinical syndrome:

Syndrome	Croup [48] or acute laryngotracheobronchitis	Bronchiolitis and Pneumonia	Immunocompromised patient
Infecting type	Types 1, 2, and 4	Types 3 and 4	Type 3 (very dangerous)
Host	**Infants**[49] and **young children**	**Young children**	Bone marrow transplant patient.

Symptoms:

Fever, harsh cough, and difficult inspiration. Airway obstruction require hospitalization and tracheostomy[50].

Lab diagnosis:

- **Direct**:
  - Detection of parainfluenza virus from **nasopharyngeal aspirate** by direct immunofluorescent.
- **Culture:**
  - Isolation of the virus from nasopharyngeal aspirate OR mouthwash in cell culture will appear as **multinucleated giant cell** (syncytia).
- **PCR.**

Treatment and prevention:

Hospital admission for infant having Croup for careful monitoring of upper airway (endotracheal intubation[51] and tracheotomy). **No** specific antiviral treatment. **No** vaccine available.

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[47] Serologically distinguishable strain of a microorganism.

[48] مرض يصيب الحنجرة مسببا الشعور بالخنق

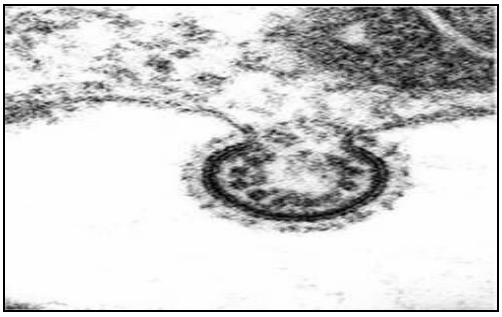
Associated with harsh cough ,hoarse voice and difficult inspiration should be treated by tracheotomy

[49] 6 months to 5 years. And in older people it will cause common cold.

[50] A surgical cut in the trachea made to relieve an obstruction to breathing.

[51] Passage of a tube through the nose or mouth into the trachea for maintenance of the airway during anesthesia.

2. Respiratory Syncytial Virus (RSV)



Structural features:

Enveloped virus with (-ve polarity ssRNA).

Transmission:

- Inhalation of infectious **aerosol droplets** mainly in winter.
- RSV virus is very contagious with (I.P[52] 3-6 days).
- The importance of RSV lies in its tendency to invade the LRT of infant (<6 months).

Clinical syndromes:

1) Bronchiolitis:

Life-threatening disease in infants especially under 6 month of life. With respiratory distress and cyanosis, it can lead to a chronic lung disease later in life, or be fatal.

2) Pneumonia:

Can also be **fatal** in infants.

Lab diagnosis:

- **Direct detection of the virus**:

From sputum, nasopharyngeal swab, aspirate (NPA[53]) or respiratory secretion by direct immunofluorescent assay (IFA) and ELISA.

- **Other detection methods:**

Isolated of virus by cell culture from (NPA) with **multinucleated giant cell or syncytia as cytopathic effect[54] (C.P.E)** or PCR.

Treatment and prevention:

- **Ribavirin[55]** administered by **inhalation** for infants with severe condition.
- Infants will be **hypoxic** and need hospitalization for **oxygen inhalation** and should be isolated than other infants.

Vaccine:

No vaccine available, but passive immunization immunoglobulin[56] can be given for infected premature infants.

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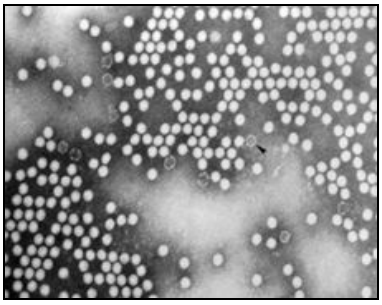
[52] Incubation period.
[53] Nasopharyngeal Aspirate.
[54] Structural changes in host cells that are caused by viral invasion. not used routinely.
[55] Broad-spectrum antiviral used in treatment of severe viral pneumonia.
[56] Contains antibodies that gives short-term protection -unlike vaccines- or reduce the severity of certain diseases.

Picornaviridae Family

- Rhinovirus -



Structural features:

Non-enveloped virus with (**+ve polarity** ssRNA) genome, more than 100 serotypes available.

Transmission:

Inhalation of infectious **aerosol droplets**.

Clinical symptoms:

Rhinoviruses are the **1st cause** of **common cold**, responsible of 60% of all cases. The main symptoms of common cold are **sneezing, clear watery nasal discharge**[57] with mild sore throat[58], and **cough**.

Treatment and prevention:

Usually **self-limiting disease**, **No** specific treatment, and **No** vaccine available.

Coronaviridae Family

- Coronavirus -

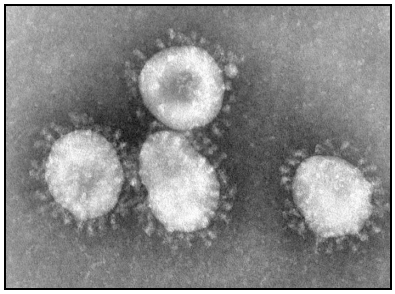
Structural features:

Enveloped virus with (**+ve polarity** ssRNA).

The name Coronavirus means crown[59] when viewed with an electron microscope.

Transmission:

Inhalation of infectious **aerosol droplets.**



Clinical symptoms:

- The **2nd cause** of **common cold.**[60] (After Rhinovirus)
- Coronavirus can also cause severe respiratory diseases.[61]

Lab diagnosis:[62]

PCR or **Tissue culture**.

Treatment and prevention:

No specific treatment or vaccine available.

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[57] علامة مهمة من علامات العدوى الفيروسية عموما + للتفريق بين العدوى البكتيرية والفيروسية.

[58] الم في الحلق.

[59] تاج.

[60] Self-limiting disease.

[61] Will be discussed later.

[62] One of the smallest viruses that's why we don't use IFA.

Adenoviridae Family

- Adenovirus -

Structural features:

Non-enveloped virus with **dsDNA**[63] genome.
47 serogroup, divided into 6 groups from A-F.

Pathogenesis:

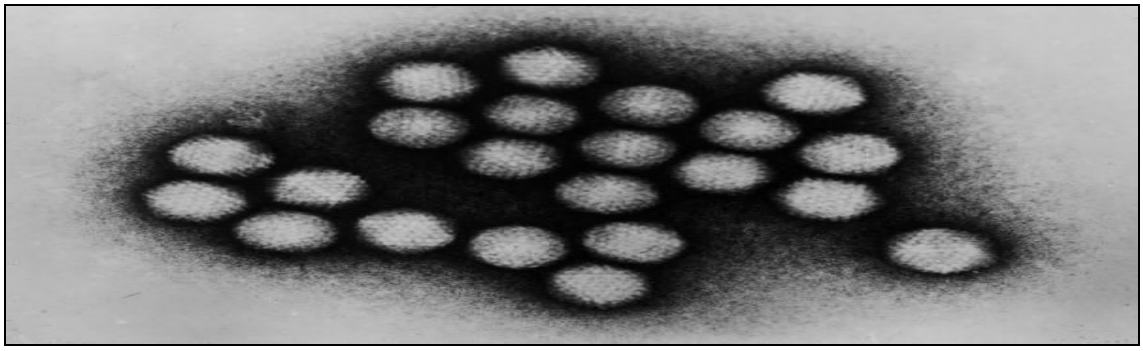
- Adenovirus infects **epithelial cell** lining the respiratory tract, **conjunctiva**[64], **urinary tract**, GIT or genital tract.[65]
- Viremia[66] may occur after this **local replication** of the viruses, so the virus can **spread** to other visceral organs, like the urinary bladder for example.
- The Adenoviruses have the tendency to become **latent** in **lymphoid tissue**, and can be reactivated whenever the immunity becomes compromised.
- Adenovirus primary infect children and less commonly infect adult.
- Reactivation occur if the patient become immunocompromised in children or adult.

Lab diagnosis:

Direct detection of the Ag from NPA[67] or conjunctival swab and Stool by direct IFA[68] and ELISA.
Other detection methods: Tissue culture or PCR.

Treatment and prevention:

- **No** specific treatment
- Live oral vaccine: used to prevent acute respiratory tract infection for Military recruits [adenovirus serotype 4 –7].



[63] Double-Stranded DNA.
[64] The mucous membrane that covers the front of the eye and lines the inside of the eyelids.
[65] But it can't affect the brain and cause Meningitis or Encephalitis.
[66] The presence of viruses in the blood.
[67] Nasopharyngeal Aspirate.
[68] Immunofluorescent assay.

Clinical syndromes (Read it just in case):[69]

Disease	Extra information
Acute febrile pharyngitis	Occurs in preschool children. Fever, nasal congestion and cough.
Follicular conjunctivitis[70]	Occurs as sporadic cases or outbreaks.
Pharyngoconjunctivitis	Occurs in children. Presents with fever.
Tonsillitis	-
Keratoconjunctivitis[71]	Due to irritation of the eye by a foreign bodies, dust or debris, or contaminated instruments at the eye clinic.
Acute respiratory tract disease	Fever, cough, pharyngitis and cervical adenitis. Serotype 4 and 7 in Military recruits.
Pneumonia	It can be followed by residual[72] lung damage. Serotype 3 and 7 in preschool children.
Gastroenteritis[73]	Serotypes 40 and 41 in children and infants.
Mesenteric adenitis and intussusceptions	In children.
Acute hemorrhagic cystitis[74]	Dysuria[75] and hematuria[76].
Cervicitis[77] **and Urethritis**[78]	Sexually transmitted.
Systemic infection in immunocompromised patient	Infection become as severe as pneumonia or hepatitis. It can be primary exogenous infection or reactivation.

End of the first lecture

[69] Just remember that it affects all organs except brain {meningitis - encephalitis = brain inflammation}
[70] Inflammation of the conjunctiva of the eye.
[71] Infection of cornea and conjunctiva.
[72] Remaining after the greater part or quantity has gone.
[73] Inflammation of the stomach and intestines causing vomiting and diarrhea.
[74] Lower urinary tract infection.
[75] Painful or difficult urination.
[76] The presence of blood in urine.
[77] Inflammation of the cervix.
[78] Inflammation of the urethra.

Other viruses transmitted by respiratory system

Learning Objectives:

- Introduction to severe respiratory viral infections and examples of childhood fever.
- Characteristics of MERS-CoV, Measles, Mumps, Parvovirus B19 viruses.
- Mode of transmission.
- Clinical features.
- Lab diagnosis.
- Management and treatment.

Severe forms of Coronavirus

- SARS CoV[79] and MERS CoV -

Structural features:

Mentioned previously.

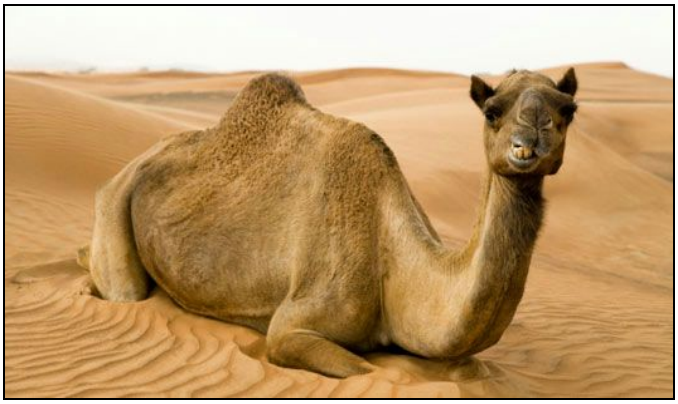
Transmission:

Mentioned previously.

Clinical symptoms:

Coronavirus also causes zoonotic[80] disease. (After **influenza A).**

The virus is capable of infecting both humans and animals including **birds**, **camels** and others.



[79] Coronavirus.

[80] الحيوانية المنشأ.

1. SARS-CoV

Severe Acute Respiratory Syndrome (SARS):

- In winter of 2002, a new respiratory disease known as (SARS) emerged in China after a new mutation of **coronavirus**.
- The disease **spread** worldwide due to travelling.
- The animal reservoir may be **cats** or **bats.**
- SARS starts with **high fever** followed by cough with difficulty in breathing (atypical pneumonia).
- Associated with high mortality[81] due to respiratory failure.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2. MERS-CoV[82]

Middle East Respiratory Syndrome (MERS):[83]

- In September 2012, a case of novel[84] **coronavirus** infection was reported involving a man in Saudi Arabia who was admitted to a hospital with **pneumonia** and **acute kidney failure.**
- The virus is closely related to several **bat coronaviruses.**
- MERS-CoV infected several human cells, including lower **but not upper respiratory tract**, kidney, intestinal and liver cells.


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[81] معدل الوفيات.

[82] متلازمة الشرق الأوسط التنفسية لفيروس كورونا.

[83] SARS is more infectious than MERS.

[84] New or unusual.

Epidemiology:

- So far, all the cases have been linked to countries in and near the **Arabian Peninsula**[85]**.**
- Highly infectious, peak in winter.

Incubation period:

(2-14 days).

Transmission:

This virus **spread** from ill people to others through **close contact**, such as caring for or living with an **infected** person. However, there is no evidence of sustained **spreading** in community settings.[86] Evidence also suggested that the virus can be **acquired** from direct close contact with animals.[87]

Clinical Features:

- Most people with confirmed MERS-CoV infection developed severe **acute** respiratory illness.
- They had **fever**, **cough**, and **shortness of breath.**
- Some people also had **gastrointestinal** symptoms including **diarrhea** and **nausea/vomiting**.
- Some infected people had mild symptoms (such as cold-like symptoms) or **no symptoms** at all and they **recovered completely.**

Complications:

- About 30% of people with MERS-Co **died**[88].
- Severe complications include **pneumonia** and **kidney failure**.
- Most of the people who died had an underlying medical condition. People with pre-existing medical conditions (comorbidities[89]) such as **diabetes, cancer,** and **chronic lung**, **heart**, and **kidney disease** may be more likely to become infected with MERS-Co, or have a severe case. Individuals with **weakened immune systems** are also at **higher risk** for getting MERS or having a severe case.

Lab diagnosis:

- Detection of the viral nucleic acid by **PCR**[90]**(common).**
- Serology by **detection** of **IgM (may false positive)**.
- Isolation of the virus from **Nasopharyngeal aspiration** (NPA) by cell culture.

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[85] شبه الجزيرة العربية.

[86] That means it doesn't cause pandemic or epidemic.

[87] Mainly bat & camel.

[88] 42% from infected people in KSA died.

[89] The simultaneous presence of two chronic diseases or conditions in a patient.

[90] **P**olymerase **c**hain **r**eaction a rapid technique for in vitro amplification of specific DNA or RNA sequences, allowing small quantities of short sequences to be analyzed without cloning.

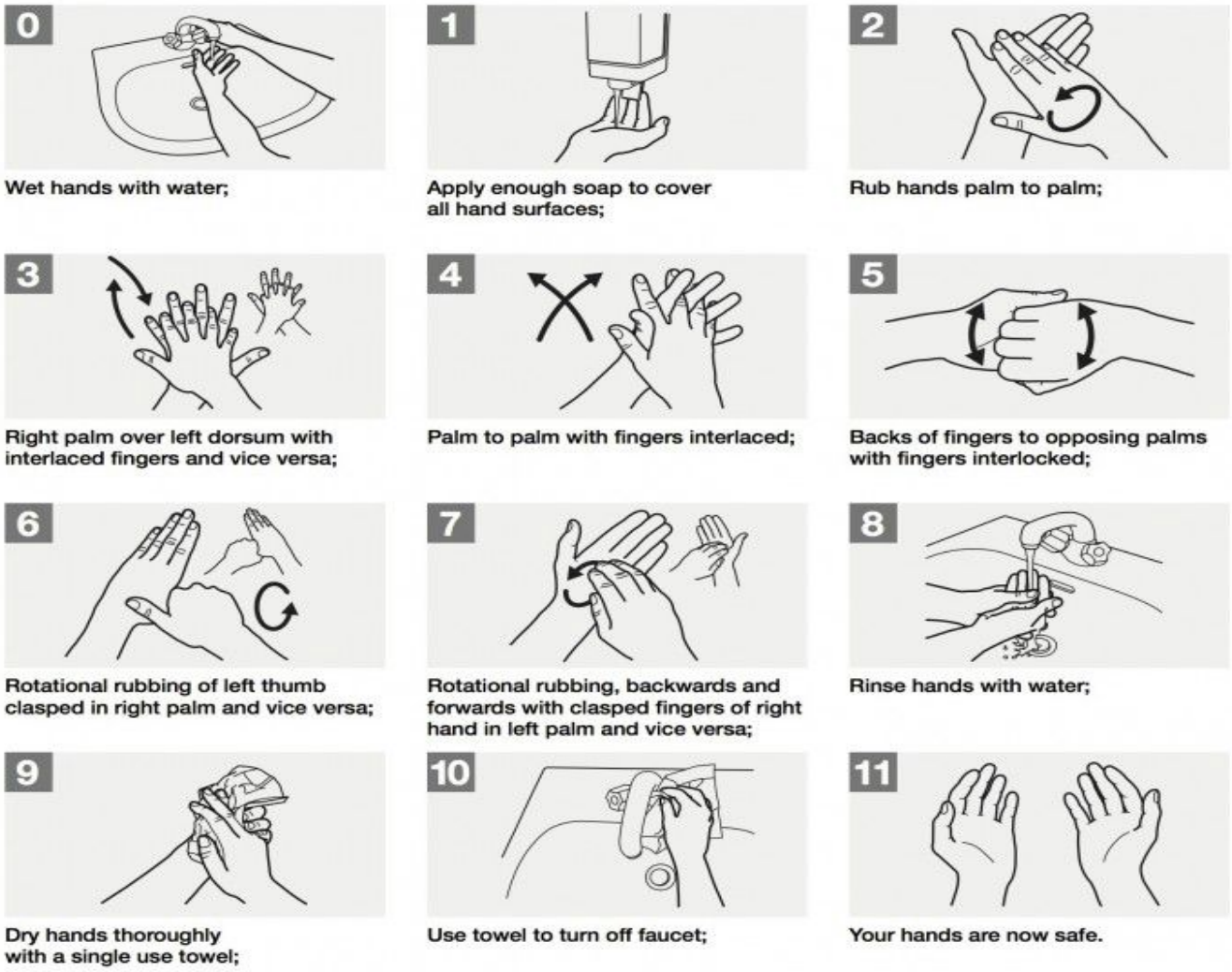
Treatment:

- **No specific** antiviral treatment.
- For **severe cases,** current treatment includes care to **support vital organ functions.**

Prevention:

People should protect themselves from respiratory illnesses by taking everyday **preventive actions:**

- **Wash your hands** often with soap and water for 20 seconds.
- Use an **alcohol-based hand sanitizer**.
- **Cover** your nose and mouth with a tissue when you cough/sneeze, and throw it in the trash.
- **Avoid touching** your eyes, nose and mouth with unwashed hands.
- **Avoid personal** contact, such as kissing, or sharing cups or eating utensils, with sick people.
- **Clean** and disinfect frequently touched surfaces such as toys and doorknobs.



Measles Virus الحصبة

Family:
Paramyxoviridae.

Structural features:
Enveloped virus with (**-ve polarity ssRNA**) genome.

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 **epithetical cells** of respiratory tract, then, the virus **spreads** to the **blood** causing **viremia.** After that, it gets **disseminated to the** skin causing **maculopapular**[91] **rash.**

Complications:
1- **Encephalitis**[92]: **Acute** or **Subacute sclerosing pan encephalitis** (SSPE).[93]
2- **Giant cell pneumonia**[94]: Deadly, rare condition that affects **immunocompromised children** (Suffering from leukemia or AIDS) due to the **direct** invasion of measles virus to the lung tissue.

Clinical features:
- **Incubation period:** (7- 14 days).
- **Prodromal symptom:** High fever, cough, **conjunctivitis** and running nose.
- **Koplik's spot:** Small white papule[95] appear in **buccal**[96] **mucosa**. (More).
- **Rash**:
  - Maculopapular[97] rash on the **face trunk** then the **extremities**.
  - The rash becomes **red** and **confluent**[98] at the **last 4** or **5 days.**
  - Disappears leaving brownish discoloration of the skin and final **desquamation**[99].
- Recovery complete self-limited in normal children **with life long immunity** and complications can also occur.

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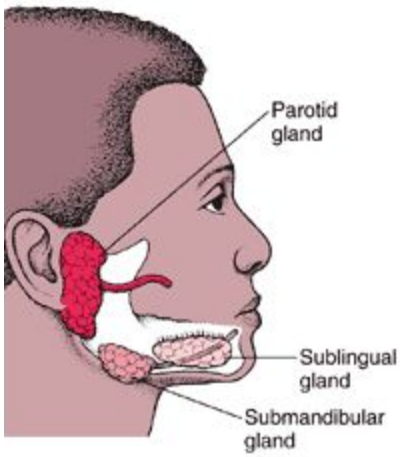
[91] Pertaining to a cutaneous eruption consisting of both macules and papules.
[92] Inflammation of the brain.
[93] It is a rare case in which the kid get measles and he recovers completely but after 2-5 years some of his brain cells which still affected by measles will start to spread until they affect the whole brain and the kid will die.
[94] The lung tissue shows multinucleated giant cells lining the alveoli.
[95] A small, raised, solid pimple or swelling. "it is the first signs appears in measles"
[96] Relating to the mouth.
[97] Flat, red area on the skin that is covered with small confluent bumps.
[98] Flowing together or merging.
[99] التقشر.

Mumps Virus[100]



Mumps: is an **acute** benign viral parotids.
Parotids: painful inflammation and swelling of salivary gland.

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

Family:
Paramyxoviridae.

Structural features:
Enveloped virus with (**-ve polarity** ssRNA)
The viral envelope is covered with two glycoprotein spikes, hemagglutinin and neuraminidase.[101]

Transmission:
Inhalation of infectious **aerosol droplets** during **sneezing**, **coughing** or direct contact with saliva.

Epidemiology:
- Mumps virus infect only human.
- Highly infectious, peak in **winter.**
- Long **incubation period** (18-21 days.)

Pathogenesis:
Infection started in the **epithelial cells** of the upper respiratory tract, then, the virus **spreads** by **viraemia** to **parotid gland -mainly-** and to **other organs** as: **testis, ovary, pancreas** and **CNS.** [102]

Clinical Features:
- Classic mumps
- Sudden onset of **fever** and **painful swelling** of **parotid gland[103].**
- **Self-limiting disease** resolve **within one week.**
- **Solid and long life immunity occurs.**
- Aseptic meningitis: **rare** presentation.

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[100] النكاف، هو مرض فيروسي يسبب انتفاخا واوجاعا في الغدد اللعابية Salivary glands وخاصة في الغدد النكفية Parotid glands الموجودة بين الاذن والفك. (المزيد هنا)

[101] The same proteins which found in influenza but they have different characteristics and they work in a different way.

[102] As complication.

[103] Either of a pair of large salivary glands situated just in front of each ear.

Complications:

Seen mainly if infection occur in young adult as:

- Bilateral[104] can lead to sterility.
- Thyroiditis[105], Aseptic meningitis[106], Encephalitis[107], Pancreatitis[108].
- **after puberty:**

- **Orchitis**: inflammation of one or both testicles. usually unilateral, rarely leads to sterility.
- **Oophoritis**: inflammation of ovaries.

Lab diagnosis:

- Serology by **detection of IgM**.
- Viral culture and isolation from saliva or CSF[109].

Treatment and prevention:

- **No specific** antiviral treatment.
- self-limited disease
- **MMR[110]**:

- **Live attenuated vaccine** For **M**easles, **M**umps and **R**ubella.
- Given to all children 15 month and **booster dose at school entry.**
- Give excellent long last protection.

[104] On both sides.
[105] Inflammation of the thyroid.
[106] Serous inflammation of the linings of the brain.
[107] Inflammation of the brain, caused by infection or an allergic reaction.
[108] Inflammation of the pancreas.
[109] Cerebrospinal fluid.
[110] More.

Parvovirus B19

Family:
Parvoviridae.

Structural features:
Small non-enveloped **ssDNA** with **icosahedral** capsid. One antigenic type.

Incubation period:
(4-10 days).

Transmission:
Inhalation of respiratory **droplets**. **Blood transfusion**, **mother to baby**.

Epidemiology:
- **Worldwide** and mostly in winter and spring, Children (5-10 years).
- The virus causes **slapped cheek**[111], **erythema infectiosum**[112], fifth disease.

Pathogenesis:
- The virus **infects** the **endothelial cells** of the **blood vessels** in the **skin**, and the red blood cells precursors (**erythroblast**) in the bone marrow, which account for aplastic anemia.
- **Immune Complexes** may attribute to the development of the **rash**.

Clinical features:
- The disease starts with **fever**, **sneezing** and **coughing**.
- Followed by the development of the **maculopapular**[113] **rash.**
- The rash is **red**, **confluent**, **fine**, most intense on the cheek.
- The rash may appear on the trunk and limbs.
- Lesions fades from the center leaving the periphery red, developing characteristic reticular or lace-like pattern.
- There is mild generalized **lymphadenopathy**[114]**.**
- Arthralgia[115] with swelling and pain in the joints are seen in women.
- **Recovery is complete.**

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[111] صفع الخد.

[112] (more)

[113] Pertaining to a cutaneous eruption consisting of both macules and papules.

[114] A disease affecting the lymph nodes.

[115] Pain in a joint.

Complications:

- **Aplastic crisis**[116] **sudden** and **temporary** disappearance of **erythroblasts** from the bone marrow, seen in patients with **hemolytic anemia.** The bone marrow **does not produce RBCs.**
- **Chronic anemia** occurs in the **immunocompromised** when the immune system is **unable** to produce antibodies to neutralize the virus.
- **Hydrops fetalis**[117] occurs during **pregnancy** when the mother become infected with parvovirus B19.

Lab diagnosis:

Detection of **IgM** by **ELISA** or PCR.

Prevention:

There is **No vaccine available.**

Treatment:

There is **No specific** antiviral drug therapy.

[116] Temporary cessation of red cell production.

[117] Condition in the fetus characterized by an accumulation of fluid, or edema, in at least two fetal compartments.

« قُلْ هَلْ يَسْتَوِي الَّذِينَ يَعْلَمُونَ وَالَّذِينَ لاَ يَعْلَمُونَ »
سورة الزمر الآية ٩

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