

PASSION ACADEMIC TEAM **YU - MEDICINE**

Sheet# 3 - Microbiology

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Lec. Title : Respiratory viruses

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If you come by any mistake , please
kindly report it to
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RESPIRATORY SYSTEM

Variation and Epidemiology >> influenza group A

small (single point mutation) and there is no effect on the antigenicity of the virus

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Antigenic **drift**: median or small epidemic.

Antigenic **shift**: large scale epidemic.

changing in the DNA sequence (large) >> changing the antigenicity of the virus

معلومة مهمة : الإنفلونزا الموسمية يلي تنتقل عن طريق الطيور والخنازير (bigs and avian) ويتوصل للإنسان بتكون بتحتوي على أنواع جديدة من ال antigens غير عن المتعارف عليهم (H1,H2,H3,N1,N2) والسبب انه ال virus دخل على ال intermediate host مثلا الطيور وبعدها انتقل للإنسان .. وهيك رح ياخذ معه جزء من ال antigens يلي بالطيور وينقلها للإنسان .. فمثلا ممكن الإنسان ينصاب ب H1N9 << ومثل ما حكينا هاذ لازمة new vaccines

avian viruses have 16 types of HA antigen , and 9 types of NA antigen .

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Antigenic Shift Of Influenza virus

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- Reassortment of genes is a common feature of Influenza A, but not B or C
- When two different "A" viruses infect the same cell, their RNA segments can become *mixed* during replication
- New viruses produced in this way may survive due to a selective advantage within the population

Antigenic Drift of Influenza Virus

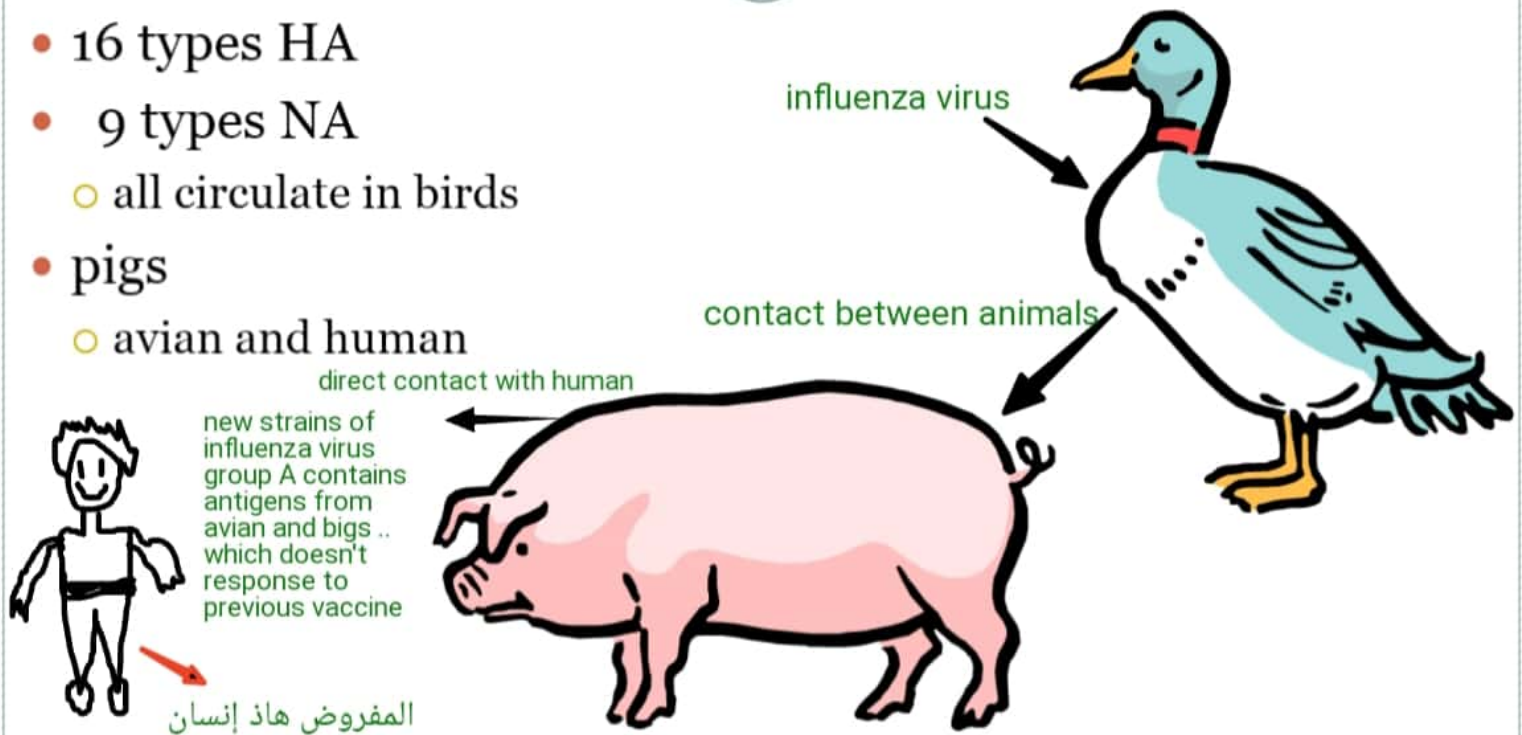
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- Constant mutations in the RNA of influenza which lead to polypeptide mutations
- Changes are less dramatic than those induced by Shift
- If these mutations affect HA or NA they may cause localized epidemics

where do “new” HA and NA come from?

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- 16 types HA
- 9 types NA
 - all circulate in birds
- pigs
 - avian and human

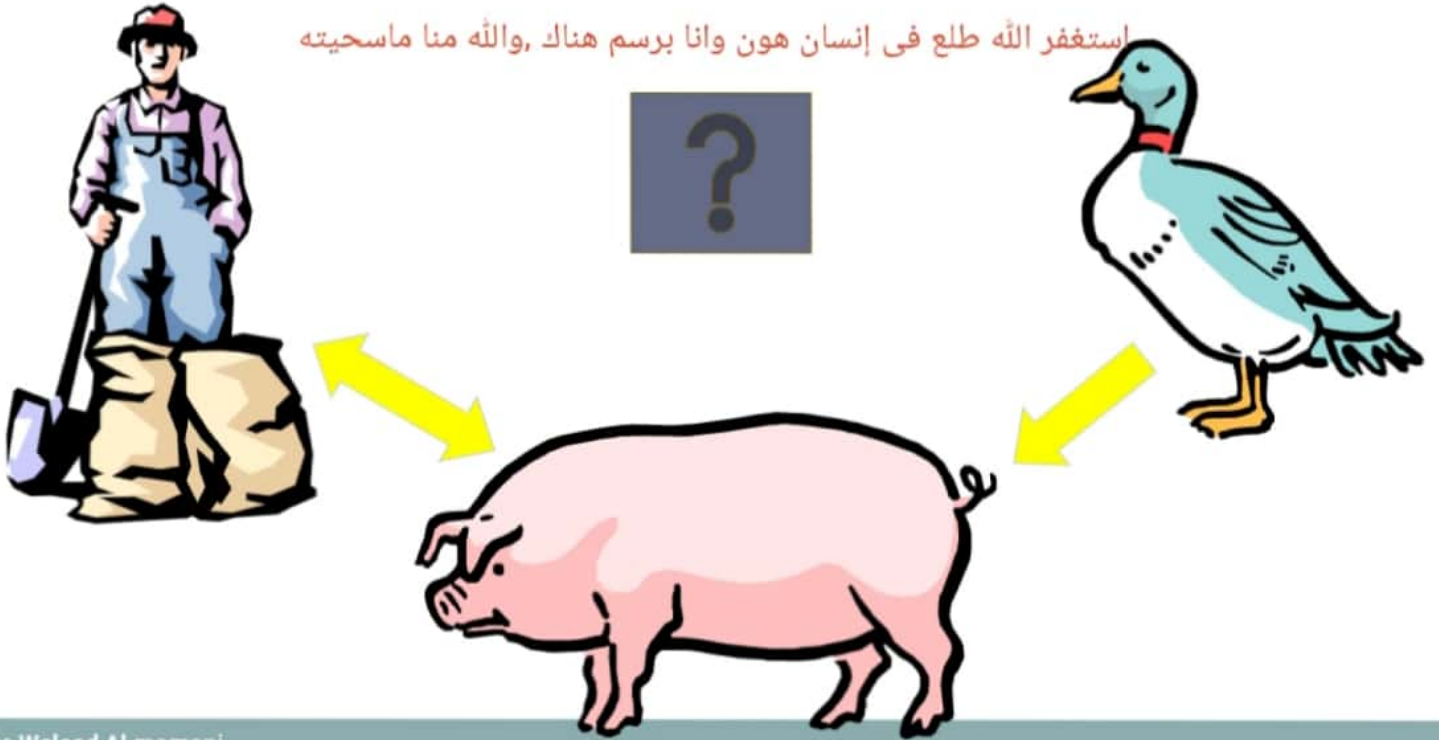


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where do “new” HA and NA come from?

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استغفر الله طلع في إنسان هون وانا برسم هناك, والله منا ماسحيته



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why do we not have influenza B pandemics?

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- So far no shifts have been recorded
- No animal reservoir known



Resistance

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- The particles are relative labile ,not resistant to drying, etc.

influenza B virus >> very simple and weak .. however , it has remarkable pathogenicity

بمعنى انه ضعيف جدا وما يتحمل حرارة وجفاف ومع ذلك بعمل pathogenicity

Pathogenesis

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clinical features :

- Influenza is characterised by **fever**, **myalgia**, **headache** and **pharyngitis**. In addition there may be **cough** and in **severe cases**, **prostration**.

the most important feature of influenza virus A :

- There is usually **not coryza** (runny nose) which characterises **common cold infections**.

dry nose يكون influenza virus A ال

فيروسات الرشح العادية

- Infection may be very mild, even asymptomatic, moderate or very severe >> depends on the immune system of each individual

Transmission

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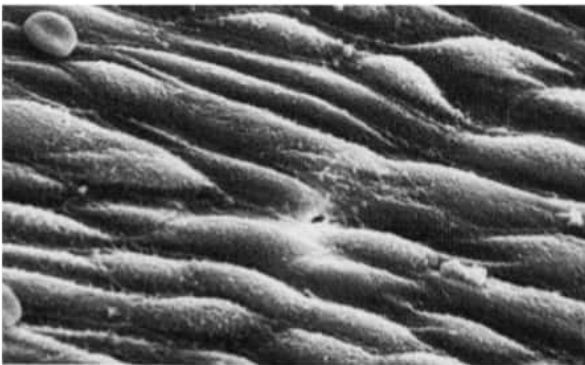
- Source of infection: patients and carriers.
- **AEROSOL**
 - 100,000 TO 1,000,000 VIRIONS PER DROPLET
- 18-72 HR INCUBATION

- # when the virus enters the respiratory tract directly affect the motion of cilia(there is no reflux) which cause accumulation of mucus .
- # In some cases virus enters the lungs and cause pneumonia .
- # viruses can cause secondary infections

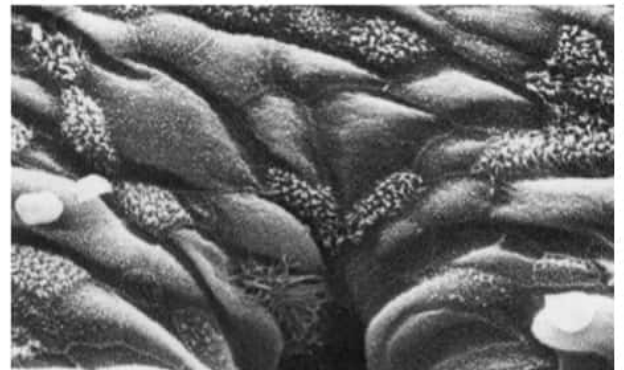


NORMAL TRACHEAL MUCOSA

the most affected part of respiratory tract is trachea



3 DAYS POST-INFECTION



7 DAYS POST-INFECTION

SYMPTOMS: for respiratory tract infection in general

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- FEVER
- HEADACHE
- MYALGIA
- COUGH
- RHINITIS
- OCULAR SYMPTOMS



PULMONARY COMPLICATIONS

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- CROUP (YOUNG CHILDREN)
 - PRIMARY INFLUENZA VIRUS PNEUMONIA → influenza virus enters directly to the lungs
 - SECONDARY BACTERIAL INFECTION
 - *Streptococcus pneumoniae*
 - *Staphylococcus aureus*
 - *Hemophilus influenzae*→ influenza virus prepares the respiratory tract for entering the bacteria ,which cause secondary infection .
- # these three bacteria represent the most common secondary bacterial causative agent cause pneumonia

Lab Diagnosis

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it is very difficult to diagnose and culture viruses because they are intracellular organism , but still we can culture it using live cells
we can use egg yolks as a culture media

- **Viral detection:**

Respiratory secretions

(direct aspirate , gargle , nasal washings)

the main four diagnostic tools of viruses :

1. Cell culture in primary monkey kidney or madindarby canine kidney cells
2. Hemagglutination (inhibition)
Hemadsorption (inhibition)
3. IFA/ ELISA
- 4- diagnostic BCR

{ الوقاية خير من العلاج مع الفيروسات }

Prevention

1- vaccination

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2-decrease contact with animals and patients

- Vaccines at best give about 70% protection.
the highest percentage it can reach
- This constant antigenic change down the years means that new vaccines have to be made on a regular basis.

#how can we differentiate between bacterial and viral infection :

- 1- culturing
- 2- bacterial infection characterized by high fever (higher than viral infection)
- 3- bacterial infection characterized by pus formation

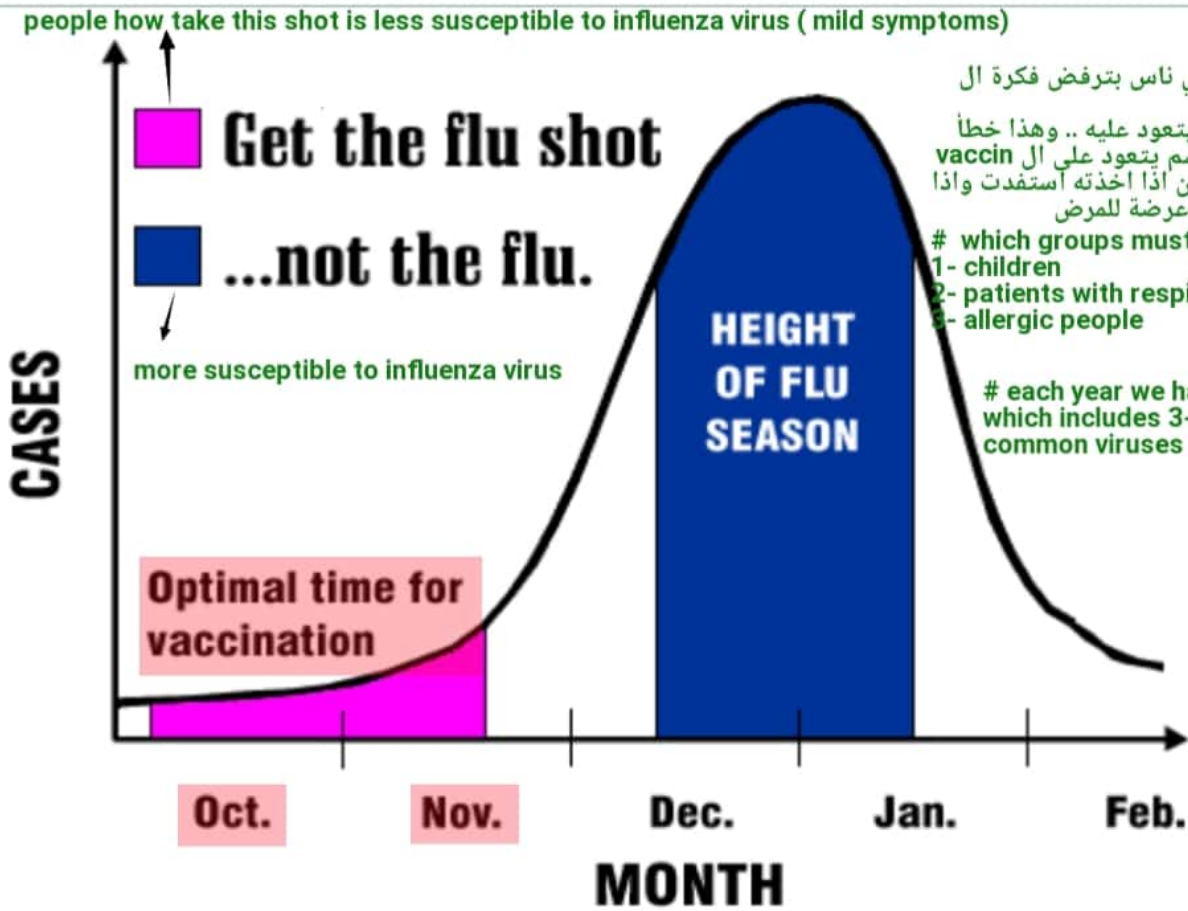
Types of Vaccine

1- أغلب الأهل لما يكون حد من العيلة مصاب بالفيروس بخلوا اخوانه يقربوا منه حتى يخذوا الفيروس ويعملوا immune response وهيكل بقوى جهاز المناعة للطفل ، لانه كل ما تعرض لمسببات امراض أكثر كل ما كان أقوى بالإستجابة

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- **Killed Whole Virus**
Rather pyrogenic, not used today. # the best response of the immune system is at actual infection
- **Live Virus** >> the best one and initiate immune response
Attenuated strains were widely used in Russia but not elsewhere.
- **Virus Subunit**
HA extracted from recombinant virus forms the basis of today's vaccines.
For example, the WHO Recommendation for Influenza Vaccine, 1995-1996, contains two A strains and one B strain:-[A / Singapore / 6 / 86 (H1N1)+A / Johannesburg / 33 / 94 (H3N2) +B / Beijing / 84 / 93]
- **Synthetic** 2- وينستنتج من ملاحظة 1 انه استخدام bacteriostatics افضل من ال bacteriocidal عشان بتعطي لجهازك المناعي الفرصة بالمشاركة على القضاء على مسببات الأمراض
Much research is being done to try and find a neutralising epitope that is more stable, and can therefore be used for a universal vaccine.

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معلومة خاطئة : في ناس بترفض فكرة ال vaccin

من ناحية انه الجسم يتعود عليه .. وهذا خطأ ما في بشي اسمه الجسم يتعود على ال vaccin .. هيه وحدة من ثنتين اذا اخذته استفدت واذا ما اخذته بتكون اكثر عرضة للمرض

which groups must be vaccinated :

- 1- children
- 2- patients with respiratory disorder
- 3- allergic people

each year we have new vaccine which includes 3-4 of the most common viruses in that season

Treatment

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- Amantadine and rimantadine are active against influenza A viruses.
- The action of these closely related agents is complex and incompletely understood,

العلاج الطبيعي هو الأفضل بهيك حالات
: 1- إبقاء المريض بدرجة حرارة مناسبة
2- الراحة
3- تزويدة بالسوائل بشكل مستمر

Parainfluenza virus

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Important Characteristics

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- Typing: Four types (1-4) : distinguished antigenically, by cytopathic effect, and pathogenically
- Hemeagglutinin and fusion F protein is found in the envelope

#symptoms are similar to influenza but mild and it doesn't have epidemics or pandemics , so it doesn't threatening human.

Pathogenesis and Immunity

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- Cause acute respiratory infections of man ranging from relatively mild influenza-like illness to bronchitis, croup (narrowing of airways which can result in respiratory distress) and pneumonia; common infection of children.
- Transmitted by aerosols.

Lab Diagnosis

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- Nasopharynx specimen is culture in a surrogate cell line in AGMK. Infected cell are detected by hemeadsorption or DFA
- DFA also can be done rapidly to identify the agent in direct specimen
- Serotypes 1-3 are confirmed by hemeagglutination inhibition using standardized antisera

Treatment

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- No antiviral therapy is available
- Nursing the patient in a humidified atmosphere was commonly advised
- Dexamethasone and budesonide have been approved (for outpatient treatments)

- Vaccines is not available

Respiratory syncytial virus

Important Characteristics

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- RSV is highly infectious, transmission by respiratory secretions.
- Primary multiplication occurs in epithelial cells of URT producing a mild illness.
- In ~50% children less than 8 months old, virus subsequently spreads into the LRT causing bronchitis, pneumonia and croup.
- Has been suggested as a possible factor in **cot death and asthma.**

الطفل يلي بموت ومحددا داري عنه وبكون معه pneumonia

Clinical Disorder

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- Bronchiolitis
- Febrile rhinitis
- Pharyngitis
- Common cold

Lab Diagnosis

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- DFA
- Cell culture of nasopharyngeal specimen
- A rise in antibody titre using ELISA

Treatment

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- Ribavirin aerosol is recommended for pneumonia in infants
- RSV - IGIV has been approved for infants born prematurely
- IFN

Prevention

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- Currently no effective vaccine! Also, infection does not result in lasting protection (c.f. mumps, measles) therefore repeated infections ('colds') occur throughout life - usually without serious consequences in adults.

Adenoviruses

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#can hit the respiratory and gastrointestinal tract ,, so symptoms show diarrhea and vomiting at the same time .

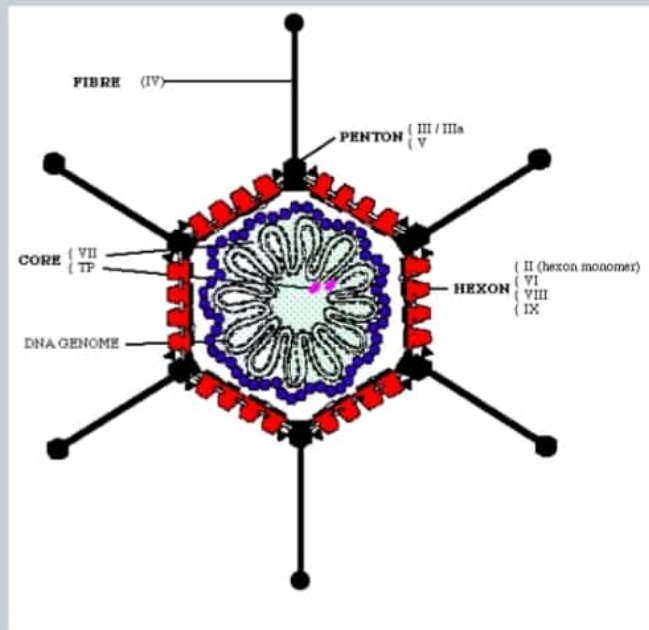
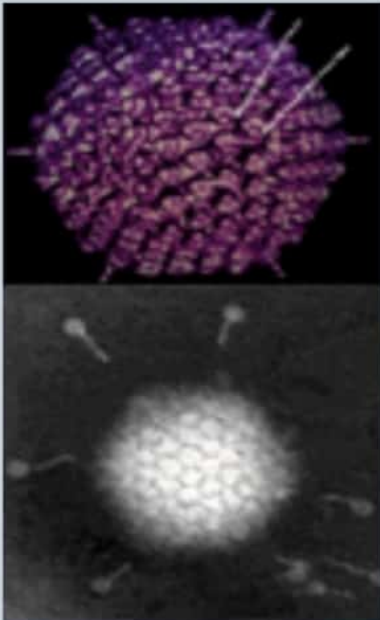
General Concepts

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- Most Adenovirus infections involve either the respiratory or gastrointestinal tracts or the eye.
- Adenovirus infections are very common, most are asymptomatic.
- Most people have been infected with at least 1 type at age 15.

Adenovirus

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Pathogenesis and Immunity

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Disease:	At Risk:
• Acute Respiratory Illness	Military recruits, boarding schools,
• Pharyngitis	Infants
• Gastroenteritis	Infants
• Conjunctivitis	All
• Pneumonia	Infants, military recruits
• Keratoconjunctivitis	All
• Acute Haemorrhagic Cystitis	Infants
• Hepatitis	Infants, liver transplant patients

Lab Diagnosis

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- Isolation of adenovirus can be accomplished in cell cultures derived from epithelial cells
- Immunoassays, including fluorescent antibody and enzyme-linked immunosorbent assays,
- PCR can be used to detect and type the virus in clinical samples and tissue cultures
- Serological assays such as CFA, HI, EIA and neutralization techniques have been used to detect specific antibodies.

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Treatment

{ اللهم كثر من هيك سلايدات }

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- No

Prevention

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- Inactivated vaccines have been developed and are routinely used for military recruits in some countries

Coronavirus

تحذير: يرجى ارتداء الكمامات منطقة خطر

firstly discovered at 60s

Important Characteristics

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- Virion: Spherical, 80-160nm in diameter, helical nucleocapside
- Genome: +ssRNA, linear, nonsegmented
- Envelope: contains large, widely spaced, club-or petal-shaped spikes. crown-like

1- (SARS) in 2003, china , transmission of the virus from the cats , death rate 10% , number of infected people 2500 , there is no person to person transmission

#there are 3 important outbreaks:

2-(MERS) in 2012 , saudi arabia , camels , death rate 35% , number of infected people 8000 , there is no person to person transmission

3- (corona) in 2020 , china (Wuhan) , bats , death rate 3% , number of infected people 75000 , there is person to person transmission , symptoms are sequel to or lower than SARS and MERS

+++ لحد اللحظة لم يتم تصنيفة على انه pandemics والسبب لانه اعداد انتشاره حول

Pathogenesis and Immunity

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- These viruses infect a variety of mammals & birds. The exact number of human isolates are not known as many cannot be grown in culture.
- They cause: common colds and have been implicated in gastroenteritis in infants. → similar to adenovirus
- Transmitted by aerosols of respiratory secretions

Rhinovirus

Important Characteristics

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- Rhinoviruses are isolated commonly from the nose and throat but very rarely from feces.
- These viruses cause upper respiratory tract infections, including the common cold

Reovirus

Important Characteristics

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- **Virion:** Icosahedral, 60-80nm in diameter, double capsid shell
- **Genome:** dsRNA
- **Envelope:** none
- **Diseases:** Acute respiratory tract infection and Gastrointestinal infections