

MICROBIOLOGY

Sheet

Slide

Handout

Number

3

Subject

Upper Respiratory Tract Infection

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Price:

Notes:

This sheet was written according to section 2 recording.
The arrangement of topics differ slightly from the record.

Infection syndromes:

The infections and symptoms that can be seen in the upper respiratory tract are:

1-Common cold: caused commonly by rhinovirus and corona virus.

2- Pharyngitis/Tonsillitis: commonly caused by **viral** infection (in 85% - 90% of cases).

Only 10% - 15% of cases are caused by bacterial infection: the most common bacteria here is group A beta hemolytic streptococcus pyogenes.

3- Quinsy: it's a tonsillar/peritonsillar abscess (pus), as a result of a non treated bacterial infection. It requires drainage of the formed pus accompanied by antibiotics treatment.

4- Epiglottitis: inflammation and infection of the epiglottis. Caused commonly by Haemophilus Influenza type b.

It's a medical emergency, you can't use the tongue depressor to examine the patient, or do any manipulation in the pharyngeal region (because this may provoke airway spasm). This infection will lead to spastic paralysis, and an increase in the severity of this inflammation will lead to obstruction of the airways (thus the patient will require intubation or tracheostomy).

5- Otitis media

6- Sinusitis

Note: parts of the upper respiratory tract are: nasal cavity, sinuses, pharynx, the larynx above the vocal cords, the ear (connected by the eustachian tube).

Both otitis media and sinusitis commonly occur as super infections (on the top of another existing infection), this existing infection is commonly viral, and as a result the patient will develop inflammation.

Pathogenesis for otitis media: inflammation caused by an existing virus → the upper respiratory tract cavities (like eustachian tube/sinuses) will become obstructed (because of swelling), and it will be filled with secretions (more obstruction) → the middle ear requires oxygen for its metabolic activities, but the cavity (eustachian tube) is occluded, and this occlusion will lead to negative pressure → this negative pressure will lead to withdrawing of normal flora to the middle ear → otitis media. (the same concept applies for sinusitis).

The most common normal flora that is present in the upper respiratory tract:

- Staph aureus: found around the nasal cavities.
- Neisseria gonorrhoeae/neisseria meningitidis: could be found in the mouth.

neisseria gonorrhoeae is a genital infection, but can be transmitted as a normal flora to the oropharynx in some patients.

- Viridans streptococci
- Pyogens
- H. Influenza
- Moraxella catarrhalis
- Streptococcus pneumoniae

Note: normal flora is bacteria living in harmony in the human body without causing illness.

For otitis media and sinusitis, the positive bacteria for these infection are: **H. Influenza, Moraxella catarrhalis, and streptococcus pneumoniae** (remember it's caused by normal flora).

Note: in sinusitis, the stagnation (ركود) of fluid in sinuses will present a good culture media for the normal flora to travel to the sinuses and replicate there causing the infection, OR, sinusitis could be also to negative pressure (same as otitis media).

Common Cold

Caused commonly by **rhinovirus and coronavirus** in adults, and by RSV in children. the rest are due to adenoviruses, enteroviruses, influenza, and parainfluenza viruses.

***These features apply almost to all the causative organisms:**

It's usually common in the winter months, presented as runny nose (rhinitis), could be associated with fever, sneezing, coughing, conjunctival effusion (redness of the conjunctiva).

Management for common cold is symptomatic treatment (antipyretic for fever, cough suppressant, Vit. C which induces the immune system...), so it's an acute self limiting short lasting illness (usually 5-7 days the patient will be fully recovered and the virus will be eradicated) .

Common colds account for one-third to one-half of all acute respiratory infections in humans, rhinoviruses and coronavirus cause together 50%-60% of common cold, and influenza leads to common cold much less than both.

- How to differentiate between viral rhino/corona or influenza infection?

In influenza the infection has longer duration, the patient will suffer from more pronounced symptoms of arthralgia, myalgia, general fatigue, and the patient will become more bedridden. (bed rest is the best treatment here because of the symptoms above).

Causes of common cold:

***Rhinoviruses:**

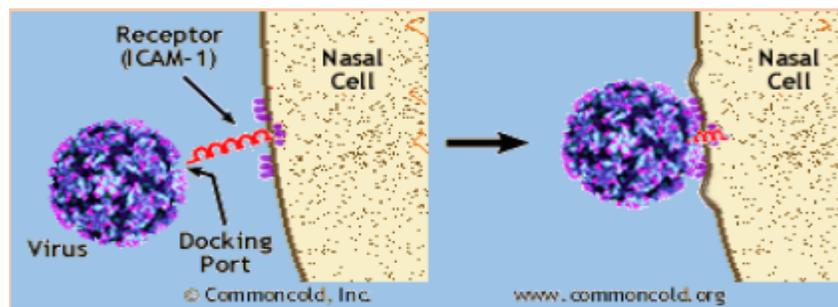
Accounts for 1/3 to 1/2 of all acute respiratory infections in humans (it rarely causes lower respiratory tract infections).

There are more than 100 serotypes of rhinovirus, so you can be infected with two or more serotypes of the virus in the same winter season, and since it has that big number of serotypes, it's very difficult to make a vaccine for it.

Clinical presentation: it's self limiting, associated with URT symptoms: fever, runny nose, coryza (inflammation of the mucous membrane of the nose), sneezing, rhinorrhea, also it involves increased levels of bradykinin: increased secretions, vasodilation, cough and sore throat.

Transmission: occurs through aerosols/droplets.

This virus attaches to Intracellular adhesion molecule I (ICAM-1) receptor in our cells - one of the treating options for rhinovirus is blocking this receptor, but since it's found in our cells it will cause a lot of side effects, so they made recombinant soluble like-receptor which can bind the floating viruses and thus neutralize it (it's similar to antibody function).



Most viral replication occurs in the nose, and the **severity** of symptoms correlates with the **quantity (titer) of virus in nasal secretions**. so if someone was infected with 100 organism of rhinovirus, the symptoms will be less severe compared with another that has been infected with 1000 organism of this virus.

Complications:

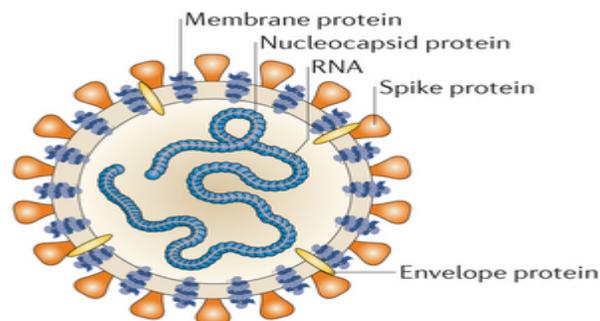
- Acute bacterial sinusitis (on top of viral infection)
- Acute bacterial otitis media (on top of viral infection)
- Asthma attacks in children
- Exacerbation of chronic bronchitis

Note: The illness peaks in three to four days and last up to 7 days, it's diagnosed based on the clinical picture, it involves symptomatic treatment, and we must pay a lot of attention to hygiene in order to prevent the infection.

***Coronaviruses:**

The group was so named because of the *crown-like projections on its surface*. At present, at least 10 species are recognized, of which human coronavirus is one. The other viruses are found in animals.

Properties: Positive sense helical *ssRNA* enveloped viruses.



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Epidemiology:

- Human coronavirus infections occur during the *winter and early spring*.
- High infection rates during the year are caused by *either 229E or OC43* group viruses. This pattern is observed throughout the world.
- Human coronaviruses are responsible for 10 - 30% of all *common colds*.

Treatment and clinical picture same as rhinovirus.

Corona virus has genetic variations, they found out that it has a lot of deletion mutations, and high frequency of recombination during replication (which is Copy Choice Recombination: RNA polymerase can jump between RNA template number 1 and number 2 and that gives us a hybrid viral genome) which is unusual for an RNA virus with unsegmented genome (normally positive

sense ssRNA are the most stable viruses). This will give us different characteristics which will be manifested of the virus having different structural proteins (most of them are defective proteins). This high rate of mutations has come up with new strains of corona virus: MERS and SARS.

***Other causes of common cold:**

- Coxsackievirus
- Adenovirus
 - Pharyngitis
 - common cold syndrome
 - Bronchitis
 - pneumonia (types 3, 4, 7 and 21) ($3+4=7$, $7*3=21$:D)
- Influenza C (it causes subclinical infection)

Upper Respiratory Tract Infections Manifestations

***Pharyngitis:**

Definition: Inflammatory Syndrome of the pharynx caused by several microorganisms.

Causes: mostly viral, may occur as part of common cold or influenza syndrome.

The most bacterial cause is Group A Streptococcus (*Streptococcus pyogenes*) 5%-20%, the second bacterial cause is Group C beta-haemolytic streptococci (Remember in 85%-90% of the cases it's viral infection).

How to differentiate between bacterial/viral infection in pharyngitis or tonsillitis?

1- in bacterial infection we have exudates (white dots). Note: adeno virus, EPV, CMV may also result in pharyngeal exudates. But mostly it's bacterial (in 95% of cases), so once we see exudates we must start treatment with antibiotics.

2- Ulcers are present more with viral infections.

3- Clinical picture: the infection is more severe and toxic in bacterial infection (specially in children).

Redness are present in both.



Clinical Presentation: soreness of the throat, may be dysphagia and pain on swallowing, fever and additional upper respiratory symptoms may also be present, Tender cervical lymphadenopathy, rhinorehya, coughing, sneezing (common viral infection symptoms, but pain on swallowing and dysphagia could be in bacterial or viral infection).

-Exudative or Diffuse erythema: Can be associated with *Group A , C, G Streptococcus , EBV, Neisseriae gonococcus C.diphtheriae, A.haemolyticum, Mycoplasma pneumoniae.*

-Vesicular, ulcerative lesions - can be associated with *Coxsackie A9, B 1-5, ,ECHO, Enterovirus 71, Herpes simplex 1 and 2.*

-Pseudo Membrane- can be associated with *Corynebacterium diphtheriae or Vincent Angina (anaerobes/spirochetes).*

Diagnoses: based on the clinical picture. In order to identify the causing organism we make culture and antibiotic sensitivity test.

Now in the clinics, there's what's called Antigen Kit, that allows the physician to determine if pyogens are present after taking a pus sample from the patient in a duration almost equal to 15 minutes. If it's pyogens then we must treat with the right antibiotic for it, if it's not pyogens we should treat it empirically (without knowing the specific organism).

***Quinsy:** tonsillar Abscess with pain ,fever, difficulty swallowing.

Treatment: drainage of abscess and antimicrobial therapy.

***Epiglottitis:**

Definition: inflammation of the epiglottis due to infection.

usually occurs in the winter months.

Causative Organisms: H.Influenzae (most important-85% to 90% of cases) ,S.pyogenes, Pneumococcus, Staphylococcus aureus.

***Otitis media:**

In order to diagnose otitis media:

- Confirmation of acute onset (this point wasn't explained by the doctor)
- Signs of Middle Ear Effusion (examination of the ear drum by pneumatic otoscopy): you should notice bulging of tympanic membrane, limited mobility, air-fluid level, otorrhoea, and

redness . Otorrhoea could be the single presentation specially in children, and it means fluid coming out from the ear, and that indicates that the tympanic membrane has been ruptured. The hearing ability will not be affected in this case, and after treatment with antibiotics the tympanic membrane will regenerate.

Clinical Presentation: normally the patient will visit you having viral infection, fever, cough, runny nose and 2 weeks later the patient will start complaining of fever (also), pain in the ear or the sinus.

Notes: acute otitis media is the leading cause for prescribing antibiotics in pediatric population. otitis media is more seen in children, because their eustachian tube diameter is small so a little amount of fluid will obstruct it...etc.

Causative Organisms:

Bacterial:(discussed before)

Streptococcus pneumoniae-25-50%

Haemphilus Influenzae-15-30%

Moraxella catarrhalis-3-30%

And another VIRAL infections (75%) - predisposing factors - super infection...

Treatment: treatment with antibiotics in all age groups, but initially we must decrease the pain with analgesic drugs.

***Sinusitis:**

Sinusitis and otitis media both can be acute infections or on top of viral infections. Acute sinusitis is more common than acute otitis media.

Chronic sinusitis is more pronounced in adults, and this group of people will suffer more from viral sinusitis (Extra: that means chronic sinusitis could be a result of allergy or other factors, if someone suffers from chronic sinusitis or any other sinus problem, he will be affected more with viral sinusitis after viral infections than healthy people)

Causative Organisms: *(discussed before)*

Streptococcus pneumoniae-25-50%

Haemphilus Influenzae-15-30%

Moraxella catarrhalis-3-30%

Thank You!