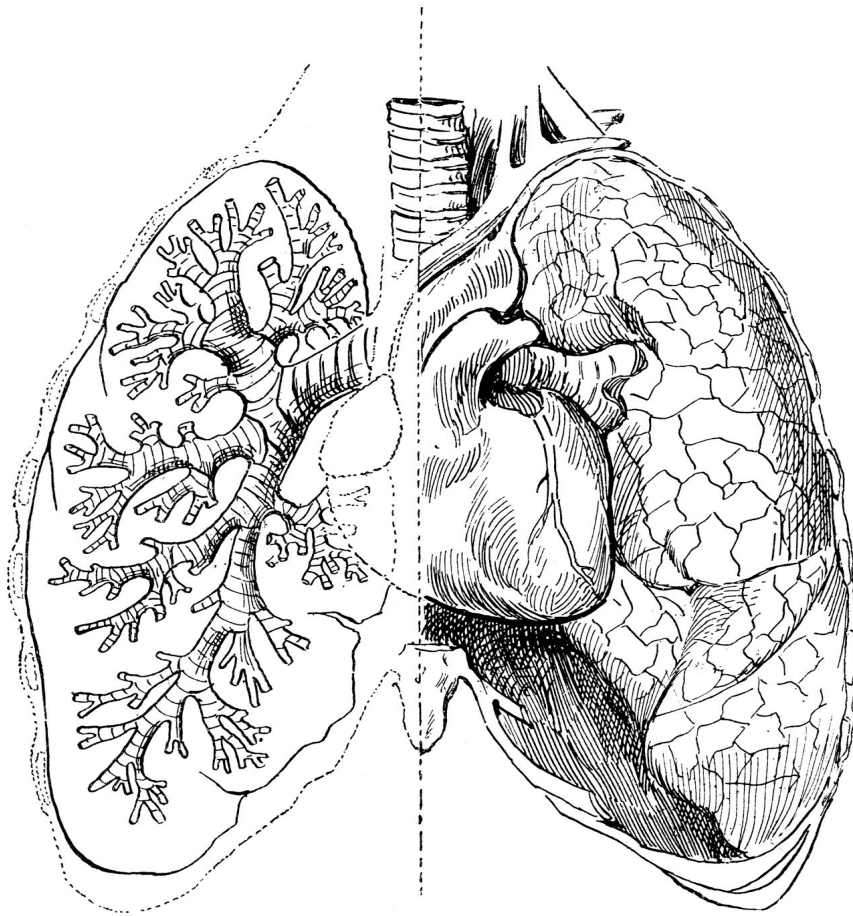


Microbiology

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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Upper Respiratory Tract Infections

- Lecture Three -

Learning Objectives:

- Learn the **epidemiology** and various **clinical presentation** of URTI.
- Identify the **common etiological agents** causing these syndromes.
- Study the laboratory **diagnosis** of these syndromes.
- Determine the antibiotic of choice for **treatment**.

The respiratory tract is divided into the upper airways and lower airways .	
Upper airways (URT)	Lower airways (LRT)
<ul style="list-style-type: none">- Nose and nasal passages.- Paranasal sinuses.- Pharynx.- Larynx above the vocal cords.	<ul style="list-style-type: none">- Larynx below the vocal cords.- Trachea.- Bronchi.- Bronchioles.- Lungs can be included in the lower respiratory tract or as a separate organ.

We will address 6 main infections in this lecture:

1. Pharyngitis¹
2. Diphtheria²
3. Pertussis³
4. Otitis Media⁴
5. Sinusitis⁵
6. Epiglottitis⁶

¹ Inflammation of the pharynx, causing sore throat. التهاب البلعوم.

² الديفتيريا مرض الخناق.

³ Whooping cough السعال الديكي.

⁴ Inflammation of the middle ear. التهاب الأذن الوسطى.

⁵ Inflammation of the nasal sinus. التهاب الجيوب الأنفية.

⁶ Inflammation of the epiglottis. التهاب لسان المزمار.

Pharyngitis

Epidemiology

- Most common in **children from 5 to 15 years old**.
- Occurs in late fall, **winter**, and early spring.

Signs and symptoms

- **Remember the 4 E's:**
 - 1) Erythema⁷
 - 2) Edema⁸
 - 3) Exudates⁹ (sometimes).
 - 4) Enlarged, tender lymph nodes (>1 cm)¹⁰.
- **Fever 38.4 to 39.4°C or even 40°C.**
- **Sore Throat¹¹**



Etiology

Bacterial (30%)

1) *Group A streptococcus*

Diagnosed by:

- Antistreptolysin O (ASO)¹².
- **Culture.**
- **Rapid Bacterial antigen detection.**

2) *Neisseria gonorrhoeae*.

3) Anaerobic bacteria (Causes Lemierre's syndrome¹⁶).

4) *Corynebacterium diphtheriae*.

Viral (most common 70%)

Respiratory viruses

Enterovirus

HSV¹³

EBV¹⁴

HIV¹⁵

⁷ A skin condition characterized by redness or rash.

⁸ A condition characterized by an excess of watery fluid collecting in the cavities or tissues of the body.

⁹ Mass of cells and fluid that has seeped out of blood vessels or an organ, especially in inflammation.

¹⁰ Children are more susceptible because they have large lymph nodes.

¹¹ In bacterial infections, the patient usually presents with fever and sore throat without any upper symptoms such as runny nose.

¹² A test that measures antibodies against streptolysin O.

These antibodies are made when you are exposed to group A Streptococcus (GAS).

¹³ Herpes simplex virus.

¹⁴ Epstein–Barr virus.

¹⁵ Human immunodeficiency virus.

¹⁶ A complication of a bacterial sore throat. ([More](#)).

Diphtheria

Epidemiology

- One of the most common causes of **death** in **unvaccinated** children **1-5 years**.
- **Toxin mediated disease**¹⁷.

Pathogenesis

Rapid progression, tightly adhering **gray membrane** in the throat¹⁸.

Etiology

*Corynebacterium diphtheriae*¹⁹.

Diagnosis

- **Tinsdale medium**²⁰.
- **ELIK's Test**²¹.

Treatment

Penicillin, or **Erythromycin** if the child is **allergic** to penicillin.



¹⁷ The bacteria will produce toxins that will move from throat and affect the target organs which are the heart and the peripheral nerves and sometimes the adrenal glands and cause the damage.

¹⁸ The patient will present with a sore throat, difficulty in breathing and swallowing and drooling of the saliva. The membrane can get bigger and bigger until it obstructs the airway and will cause suffocation and death (which is why they call this disease الخانقة)

¹⁹ Diphtheria is present as normal flora in our bodies but it is non-toxigenic. When it gets infected with a bacteriophage (which is a virus), it transmits a toxin and becomes toxigenic.

²⁰ Tinsdale Agar is used to isolate and identify *Corynebacterium diphtheriae* ([more](#)).

²¹ Test for toxigenicity of *Corynebacterium diphtheriae* ([more](#)).

Epiglottitis²²

Epidemiology

Affects young **unimmunized** children.

Signs and symptoms

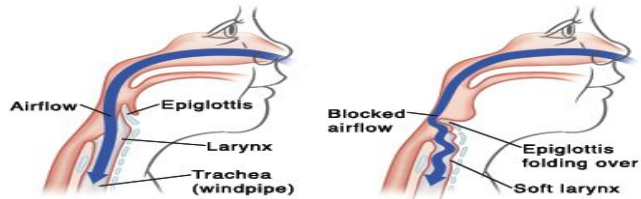
- **Remember the 3 D's:**

1) **Dysphagia**²³.

2) **Droling**²⁴.

3) **Distress**²⁵.

- **Short of breath.**



Etiology

Bacterial	Viral	Fungal
<i>Haemophilus influenzae Type B</i> ²⁶ . <i>Streptococcus pneumoniae</i> . <i>Staphylococcus aureus</i> . <i>Beta hemolytic streptococcus</i> .	-	<i>Candida</i> .

Treatment

Ceftriaxone.

²² In case epiglottitis is suspected, the doctor should not try to examine the airway by opening the mouth because it will cause suffocation and the patient might die. Instead we use the x-ray to diagnose epiglottitis. It is very rare nowadays because of the development of the vaccine against Haemophilus Influenzae Type B.

²³ Difficulty or discomfort in swallowing.

²⁴ Dropping saliva uncontrollably from the mouth.

²⁵ Anxiety.

²⁶ Type B is encapsulated so it can invade the blood. We also used the capsule to develop the vaccine against this bacteria.

Pertussis (whooping cough)

Etiology

Bordetella pertussis (Gram Negative Bacilli).

Pathogenesis

1. The bacteria **attach** to the cilia of the respiratory epithelial cells.
2. It produce toxins (**Pertussis toxin**) that **paralyze** the cilia which cause inflammation of the respiratory tract and **interferes** with the clearing of the pulmonary secretions.
3. It also produce **Filamentous hemagglutinin**²⁷ (**FHA**) and **Pertactin**²⁸ (**PRN**), these products are responsible for the clinical features²⁹.
4. **Causes Leukocytosis and Lymphocytosis**³⁰.

Clinical Course

Incubation period	1-3 weeks	No symptoms.
Catarrhal Stage	1-2 weeks	Mild occasional cough.
Paroxysmal Stage	1-6 weeks	Rapid cough.
Convalescent Stage	3-6 weeks	Gradual recovery.

Diagnosis

Nasopharyngeal swabs ³¹	Charcoal media (Regan-Lowe)	Bordetella selective media (Bordet-Gengou).
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Treatment

Erythromycin³².

Prevented by **vaccination**.

²⁷ Large, filamentous protein that gives attachment factor for adherence to host ciliated epithelial cells.

²⁸ Highly immunogenic virulence factor of *Bordetella pertussis*.

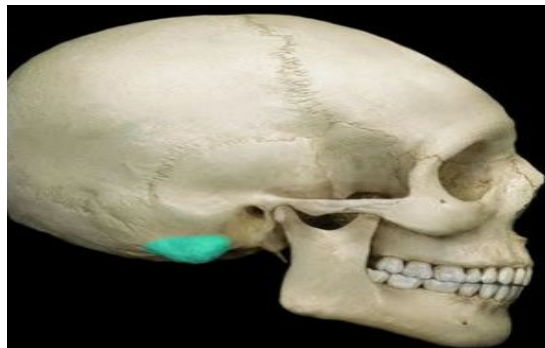
²⁹ Pertussis in infants less than 6 months will present with cyanosis because these toxins will produce a thick mucus that will block their tiny trachea and prevent air from flowing in. In older children the disease will present with whooping cough. In adults, the patients will have a chronic cough.

³⁰ It is the only bacterial infection that causes lymphocytosis.

³¹ The only bacterial infection that we would need a nasopharyngeal swab for diagnosis. Usually the nasopharyngeal swabs are used for the diagnosis of viral infections.

³² It is also given as a prophylactic treatment to the people who were in contact with an infected individual until the antibodies against the bacteria are produced as a response to the vaccine to prevent further spread of the infection.

Acute otitis media ³³		
Etiology		
Bacterial	Viral	Fungal
<i>Streptococcus pneumoniae.</i> <i>Haemophilus influenzae.</i> <i>Group A streptococcus.</i> <i>Staphylococcus aureus.</i> <i>Moraxella catarrhalis.</i>	-	-
Diagnosis		
Tympanocentesis ³⁴		
Treatment		
<ul style="list-style-type: none"> ● Amoxicillin or AMC³⁵. ● If mastoiditis³⁶, treat for 2 weeks. 		



³³ It's cause by the stagnant accumulation of contaminated fluid coming from the nasopharynx into the middle ear causing the infection and inflammation of the middle ear. In the sever cases the middle ear can rupture and cause the fluid or pus to come out.

It usually occurs in the winter when the patient has an URTI and can lead to ear pain, headache, sometimes mild fever and maybe difficulty in hearing. In children the symptoms are different. The child may present with nausea and vomiting and they be pulling their ear.

³⁴ Drainage of fluid from the middle ear.

³⁵ Amoxicillin + clavulanate (known as Augmentin).

³⁶ Inflammation of the mastoid process. (Seen in the picture above).

Sinusitis		
	Acute sinusitis	Chronic sinusitis
Epidemiology	Mostly in <u>children</u> .	-
Bacterial Etiology	<p><i>Streptococcus pneumoniae.</i> <i>Haemophilus influenzae.</i> <i>Moraxella catarrhalis.</i></p>	
Viral Etiology	13% of cases	-
Signs and symptoms	-	<p>Presents with less local symptoms than acute sinusitis.</p> <p>Memic to allergic rhinitis.</p> <p>Pain while bowing the head forward.³⁷</p>
Diagnosis	<p>Aspiration if the patient was immunocompromised, or the treatment did not work.</p> <p>X-rays CT/MRI to rule out periorbital cellulitis³⁸.</p>	<p>Imaging is less useful than acute because changes persist after treatment.</p> <p>Obtain odontogenic³⁹ X-rays if maxillary sinus⁴⁰.</p>
Treatment	<p>Quinolones or Ceftriaxone for 1-2 weeks.⁴¹</p>	

³⁷ عند السجود مثلاً.

³⁸ Inflammation of the eyelid and portions of skin around the eye, anterior to the orbital septum.

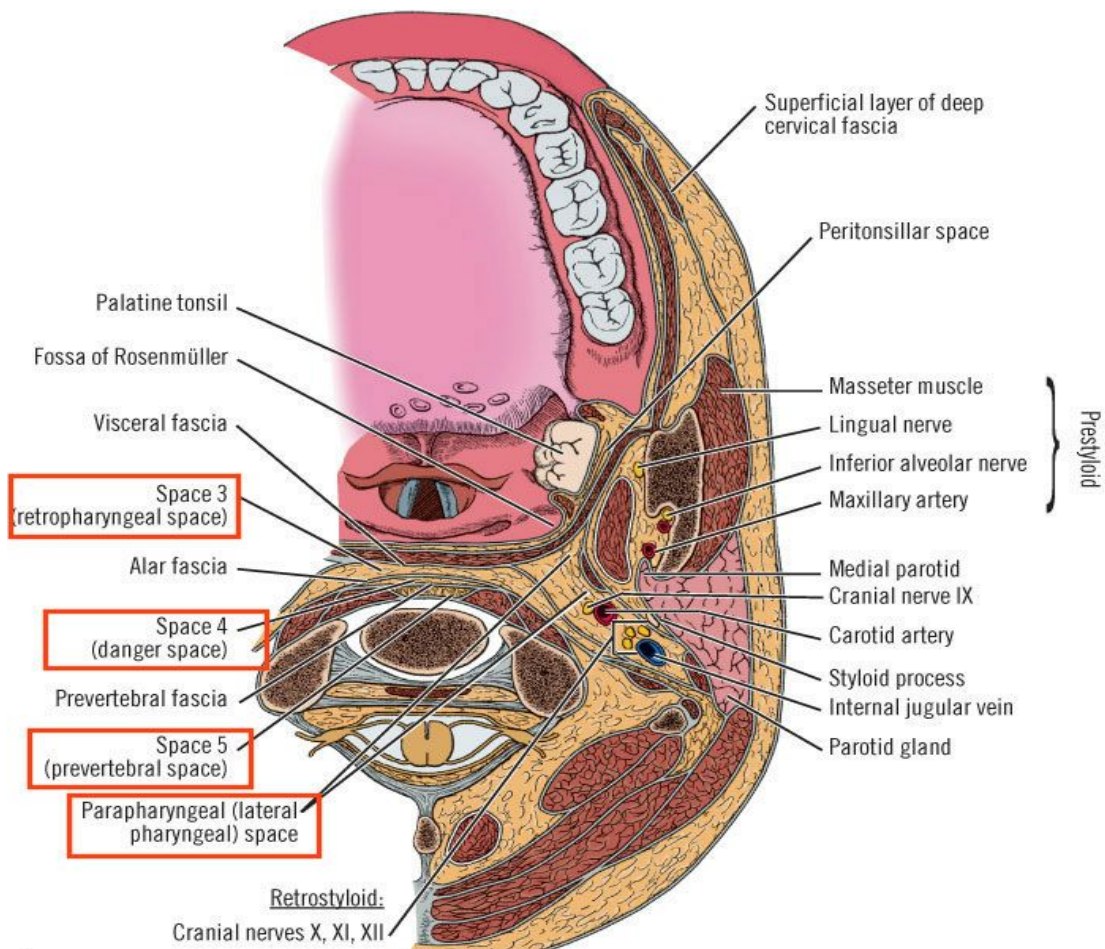
³⁹ Tooth or the closely surrounding tissues.

⁴⁰ The maxillary sinus is one of the four paranasal sinuses, which are sinuses located near the nose.

⁴¹ If the acute sinusitis was not treated it will develop into chronic sinusitis.

Deep neck space infections⁴² (Read it only)

- Lateral pharyngeal, retropharyngeal or prevertebral space. (See the picture)
- Patients are **toxic** with unilateral posterior pharyngeal soft tissue mass on oral exam.
- Neck stiffness with retropharyngeal space infection/abscess.
- Retropharyngeal (danger space) infection may extend to mediastinum and present as mediastinitis.
- Prognosis is poor if surgical drainage has not been done.
- Usually the pathogens that cause Deep Neck Space infections are Streptococci and **Anaerobes**⁴³.
- Treatment: Meropenem or Piperacillin or Clindamycin⁴⁴ for 2 weeks.



⁴² Usually a complication of another infection and is very rare nowadays.

⁴³ They cause Deep Neck Space infections because they are already there as normal flora.

⁴⁴ All of these antibiotics cover Anaerobes

Other infections

Lemierre's Syndrome:

- It is a complication of a peritonsillar **abscess** or a post-dental infection.
- Clinical Presentation:
 - **Sore Throat**
 - Fever
 - Shock
- The presenting symptoms are due to IJV⁴⁵ **thrombophlebitis**⁴⁶ which leads to multiple septic **emboli**⁴⁷ **in the lung**.
- It is caused by *Fusobacterium Necrophorum*⁴⁸.
- Treatment is the same as Deep Neck Space infection⁴⁹.
- **Meropenem** or **Piperacillin** or Clindamycin⁵⁰ for **2 weeks**.
- If the patient does not respond to the treatment, **venotomy** must be done.

⁴⁵ Internal jugular vein.

⁴⁶ Inflammation of the wall of a vein with associated thrombosis.

⁴⁷ A blood clot, fat globule, gas bubble or foreign material in the bloodstream that is caused by bacteria.

⁴⁸ This can go to the internal jugular vein and cause an infection and will create a thrombosis that will ultimately end up in the lung causing the pulmonary embolism. It's diagnosed by X-ray.

⁴⁹ We also give a thrombolytic to dissolve the thrombus.

⁵⁰ All of these antibiotics cover Anaerobes.



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

Heartful thanks to Microbiology 435's Team

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