RS

MICROBIOLOGY

MODIFIED NO. 4

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Bacterial Infections of the Respiratory Tract

Color code

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	Additional info
	Important

Bacterial Rhinosinusitis

Rhinosinusitis is a combination between rhinitis & sinusitis.
Usually, the term rhinosinusitis is interchangeable with sinusitis.

Remember:
Bacteria are more localised, so we use the term sinusitis
Viruses are more diffused and affect the nose, so we use the term rhinosinusitis.

- The most common causes of bacterial rhinosinusitis are similar to those for AOM acute otitis media, including
  - S. pneumoniae,
  - H. influenzae,
  - M. catarrhalis
- Secondary infections after a viral infection, which effectively compromises the immune defenses and allows the opportunistic bacteria to establish themselves.

The most common cause of sinusitis is viral infection, but the bacterial can happens.
The bacterial usually superinfected on URTIs by viral causes. (Consider the most important risk factor)

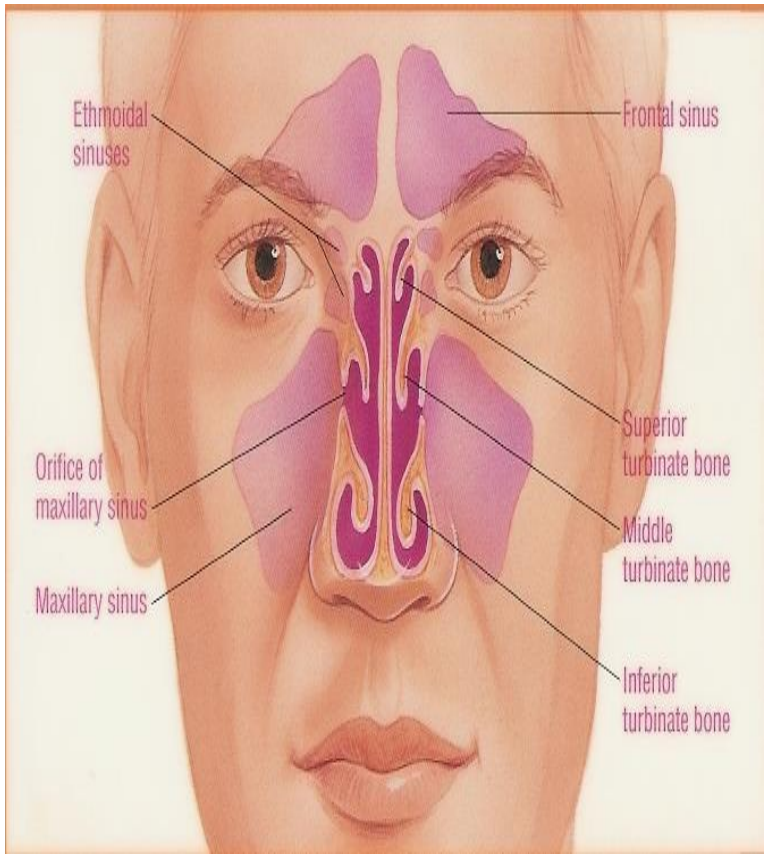
Sinusitis

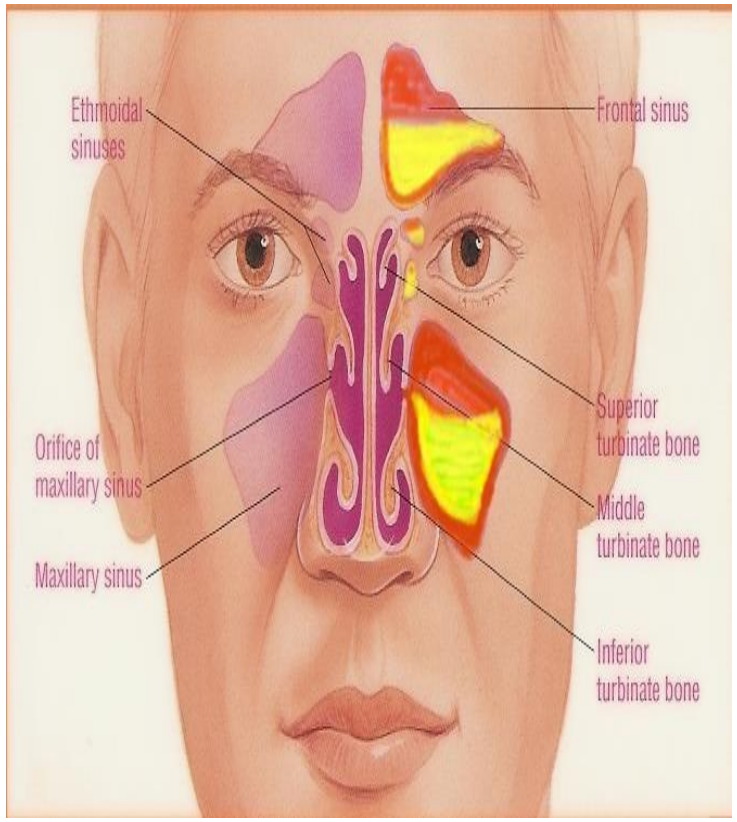
A typical clinical presentation of sinusitis:

A kid (more common in children) starts with viral URTI, with runny nose, sneezing, coughing, low-grade fever, 1-2 days he starts to improve, but suddenly he deteriorates and has severe pain, high fever, and sinusitis symptoms.

- An acute inflammatory process involving one or more of the **paranasal sinuses.**
- A complication of 5%-10% of URIs in children.
- Persistence of URI symptoms >10 days without improvement.
- Maxillary and ethmoid sinuses are most frequently involved.
- Most acute cases result from infection, other causes include allergy called chronic sinusitis.

Anatomy





Air-filled cavities located within the bones of the face and around the nasal cavity and eyes. Maxillary sinus, Ethmoid sinus, Frontal and Sphenoid.

usually, they all drain in the nasal cavity

Mainly we are studying the acute bacterial sinusitis

Sinusitis

- Usually follows rhinitis, which may be viral or allergic.
- May also result from abrupt pressure changes (air planes, diving) or dental extractions or infections, especially in the upper teeth.
- Inflammation and edema of mucous membranes lining the sinuses cause obstruction.
- This provides for an opportunistic bacterial invasion

The viral infection initiates the symptoms and blocks the drainage of the sinuses .

When the sinuses drainage gets blocked, stasis will happen, leading to overgrowth of the microorganisms and infection.

To recap sinusitis causes:

1) infection
2) pressure changes
3) allergy
4) dental extraction

We really care about the acute

Sinusitis

- Sinusitis can be classified on the basis of symptoms persistence into
  - ***acute*** (symptoms persisting less than four weeks)
  - ***subacute*** (4-8 weeks)
  - ***chronic*** (8 weeks or more)

Different causes result in different types of sinusitis. Usually, chronic sinusitis not related to infection, may related to obstruction, tumor, allergy.

- Recurrent acute bacterial sinusitis:

The patient comes with recurrent sinusitis , defined as :

- four or more episodes of acute bacterial sinusitis within a 12-month(one year) period, with each episode lasting less than 4 weeks and a return to normal function in between. 4 times a year with four weeks separation between each attack

- All three types of sinusitis have similar symptoms and are often difficult to distinguish.

Acute sinusitis

Acute sinusitis also called acute bacterial rhinosinusitis

- Acute bacterial rhinosinusitis are less common than Acute sinusitis of viral origin.

- Acute sinusitis is often caused by an upper respiratory tract infection generally of viral origin.

- In case of **bacterial infection**, three are the most common etiological agents:
  - ***Streptococcus pneumoniae 30%***
  - ***Haemophilus influenzae 20%***
  - ***Moraxella catarrhalis 20%***

The same bacteria which make otitis media

Acute sinusitis: other causes

- Other sinusitis causing bacterial pathogens include:
  - ***Staphylococcus aureus*** and other **streptococci** species
  - **Anaerobic bacteria**
  - Less common **Gram negative bacteria**
  - **Viral sinusitis typically lasts for 7 to 10 days, bacterial sinusitis is more persistent.**
  - Acute episodes can also result from **fungal** invasion. These infection are typically seen in patients with diabetes or other immune deficiencies syndromes

Usually, any fungal infection causes superficial skin manifestation, however in immunocompromised it's causes URTIs.

Subacute sinusitis

- **Subacute sinusitis**: infection is present for more than four weeks but less than eight weeks. Symptoms may be less severe than acute and include nasal congestion or post-nasal drip.

Chronic sinusitis

Different factors than infections , but might be infection tumor , obstruction , allergy

- Chronic sinusitis, by definition, lasts more than three months and can be caused by different diseases.

- Symptoms may include any combination of nasal congestion, facial pain, headache, night-time coughing, general malaise etc. These symptoms start in the acute, and decrease their severity when they become chronically.

- Often chronic sinusitis can reduce sense of smell. And affects the olfactory nerve ending , affecting the smell

- In a small number of cases chronic sinusitis is associated with a dental infection. Might irritate the sinus mucosa and leading to sinusitis

Symptoms of acute Sinusitis

- History of viral URI or allergic rhinitis (already irritation present in the nasal mucosa) -> risk factor
- Pressure, pain, or tenderness over the anatomical locations of sinuses -> symptoms
- Increased pain in the morning, subsiding in the afternoon,

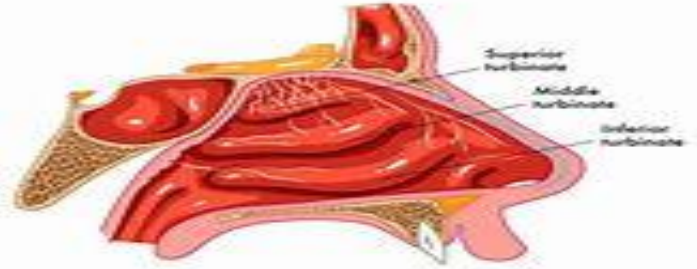
  When mucous gets drained during the day by movement of the patient, the pressure decreases, so the pain decrease
- Malaise
- Low-grade temperature (the dr corrected it as high grade fever)
- Persistent nasal discharge (because of inflammation), often purulent
- Postnasal drip :refers to the sensation of mucus accumulating or dripping down the back of the throat from the nasal passages. If you did examination, you could see the mucus discharge throat
  - Mucus from the nose or sinuses drips down the back of the throat.
- Cough, worsens at night Due to irritation & mucus
- Mouthing breathing, snoring
- Sore throat, bad breath
- Headache

Clinical Presentations of Sinusitis

- Nasal mucosa is reddened or swollen, due to nasal irritation. Inflamed , painful (look to the pic)
- Percussion or palpation tenderness over a sinus
- Nasal discharge, thick, sometimes yellow or green
- Postnasal discharge in posterior pharynx

Mucus not moving outside the body instead moving to the throat , increased complication at night

- Swelling of turbinates
- Boggy pale turbinates



Diagnostic Tests

Generally, the diagnosis of sinusitis is made clinically based on the symptoms mentioned.

However, X-rays or a CT scan are used to visualize the sinuses especially in children and confirm the diagnosis.
This is done in two cases: First, when there is no response to treatment, and second, in chronic cases.

- Imaging studies, such as sinus radiographs, ultrasonograms, or CT scanning
  - Indicated if child is unresponsive to 48 hours of antibiotics and if the child has a toxic appearance, chronic or recurrent sinusitis, and chronic asthma.
- Laboratory studies, such as culture of sinus puncture aspirates.

Sinusitis treatment

Usually symptomatic treatment

If viral —> resolves without antibiotics
If bacterial —> antibiotics: amoxicillin\ clavulanate
If bacterial but the patient has allergies or not responding to the 1st line therapy —> fluoroquinolones and macrolides

We can use corticosteroids to decrease the inflammation, leading to respiration improvement

Treatment of sinusitis

- Nasal irrigation may help in cases of chronic sinusitis, decongestant sprays may provide relief.

- **Antibiotic treatment**
  - Most cases of sinusitis are caused by viruses and resolve without antibiotics.
  - If symptoms do not resolve within 7 days, **amoxicillin/clavulanate (Augmentin)** is used. (first line therapy)
  - **2° line : respiratory fluoroquinolones (levofloxacin)and macrolide antibiotics are indicated in patients allergic to penicillins.**

- **Corticosteroids**
  - Intranasal corticosteroids are used in combination with antibiotics.

Symptomatic treatment done by:

Important

- Acetaminophen or ibuprofen to relieve pain
- Decongestants
- Antihistamines, If allergies are the cause.
- Nasal saline, to facilitate the drainage

Complications of Sinusitis

- Orbital cellulitis or abscess
- Meningitis
- Brain abscess
- Cavernous sinus thrombosis
- Subdural empyema

If the disease is not treated properly, especially in immunocompromised patients, the infection can spread to the orbits, causing **orbital cellulitis**. In more severe cases, it may extend to the brain, leading to conditions such as:

- **Meningitis**
- **Brain abscess**
- **Cavernous sinus thrombosis**
- **Subdural empyema**

Condition	First-Line Antibiotic	Alternative for Resistance or Allergy second line
Sinusitis	Amoxicillin-clavulanate acid Augmentin	Doxycycline, fluoroquinolones (levofloxacin), macrolide
Otitis Media	Amoxicillin	Amoxicillin-clavulanate, 3rd generation, azithromycin

We have the same microorganism but different treatment because of the anatomical and physiological difference , The treatment is similar but not the same, usually we use more aggressive treatment to treat the sinusitis .

To justify why we have different treatment

Anatomical and Physiological Differences

- **Sinuses**:
  - Poor vascular supply and narrow sinus make it harder for antibiotics to reach and clear the infection.
- **Middle Ear**:
  - The middle ear is a smaller, well-vascularized cavity with easier access to systemic antibiotics.

Drug Penetration and Efficacy

- **Otitis Media**:
  - Amoxicillin achieves high middle ear concentrations

Resistance Patterns

- **Sinusitis**: More resistance bacteria are found at sinus , because it usually contain normal flora
  - Sinus infections are often caused by beta-lactamase-producing bacteria

Duration of Treatment

- **Sinusitis**:
  - Requires a longer course (10–14 days for acute bacterial sinusitis) because sinus infections can be harder to eradicate due to poor drainage.
- **Otitis Media**:
  - Shorter courses (5–10 days, depending on age and severity) are usually sufficient, as the middle ear infection resolves more quickly with proper antibiotic penetration.

Adjunct Factors in Antibiotic Choice

- **Sinusitis**:
  - Broad-spectrum agents are more commonly used to account for the polymicrobial nature of some sinus infections and the chronic or recurrent nature in certain patients.
- **Otitis Media**:
  - Narrow-spectrum antibiotics are often effective, reducing the risk of resistance and minimizing side effects.

- In sinusitis, there is reduced blood supply to the affected area, which is why stronger and higher-dose antibiotics are prescribed. Additionally, the causative organisms in sinusitis tend to show some resistance to amoxicillin, which is why a combination of amoxicillin and clavulanate (Augmentin) is often used. The duration of treatment for sinusitis is typically longer than for otitis media.

- Because sinusitis is closely related to the nasal cavity, it is often polymicrobial (involving multiple types of bacteria). This is another reason why more potent antibiotics at higher concentrations are required to effectively treat the condition.

A 35-year-old woman presents with a 3-month history of persistent nasal congestion, facial pressure, reduced sense of smell, and intermittent headaches. She denies fever or acute illness. Examination reveals pale, boggy nasal turbinate, thick yellow nasal discharge, and postnasal drip.

What is the most likely diagnosis?

A. Acute sinusitis
B. Subacute sinusitis
C. Chronic sinusitis
D. Allergic rhinitis
E. Orbital cellulitis

Answer:
C. **Chronic sinusitis**

Explanation:
The duration of symptoms (>3 months), along with persistent nasal congestion, facial pressure, and reduced sense of smell, is consistent with **chronic sinusitis**. Acute and subacute sinusitis have shorter durations, while allergic rhinitis typically presents with clear nasal discharge and does not involve thick yellow discharge. Orbital cellulitis is more severe and involves ocular symptoms like pain, swelling, or vision changes.

A 10-year-old child presents with a 2-week history of nasal congestion, facial pain, and thick yellow nasal discharge. The child also complains of a worsening cough at night, headache, and High-grade fever. Examination reveals swollen and reddened nasal mucosa, tenderness over the maxillary sinuses, and postnasal discharge in the posterior pharynx. The child's symptoms have not improved after initial supportive care.

What is the most appropriate next step in management?

A. **Prescribe amoxicillin/clavulanate (Augmentin)**
B. Prescribe respiratory fluoroquinolones (levofloxacin)
C. Order a CT scan of the sinuses
D. Use intranasal corticosteroids alone
E. Perform sinus puncture for culture

Answer:
A. **Prescribe amoxicillin/clavulanate (Augmentin)**

Explanation:
The child has symptoms consistent with that have persisted for more than 10 days without improvement, suggesting a bacterial cause**acute sinusitis** . The first-line treatment is **amoxicillin/clavulanate**. CT scan or further diagnostic tests are reserved for unresponsive or severe cases, and intranasal corticosteroids are used in combination with antibiotics, not as standalone therapy.

The dr read everything

Laryngitis

- Voice box or vocal cords become inflamed from overuse, irritation, or infection.
- Acute (short-term <3w).
  - **Viral infections*** **most common cause*.**
  - Straining your vocal cords by talking or yelling
  - **Bacterial infections**
  - Drinking too much alcohol

The dr read everything

Laryngitis

- Chronic (long-term> 3w)
  - Frequent exposure to harmful chemicals or allergens
  - Acid reflux, Frequent sinus infections
  - Smoking or being around smokers
  - Overusing your voice
  - low-grade yeast infections caused by frequent use of an asthma inhaler

The dr read everything

Symptoms of laryngitis

- The most common symptoms of laryngitis include:
  - weakened voice change in voice بحة
  - loss of voice
  - hoarse, dry throat
  - constant tickling or minor throat irritation
  - Dry cough

Laryngitis is the inflammation of the larynx, which can be either acute or chronic.

- **Acute laryngitis** is most commonly caused by viral infections . Patients typically present with fever, cough, but primarily **hoarseness of the voice**. Other causes can include bacterial infections, prolonged vocal strain (like singing for long periods), or alcohol consumption.
- **Chronic laryngitis** occurs when the patient experiences hoarseness for an extended period. It is rarely caused by infection.

The symptoms primarily affect the voice, and the patient may also have a dry cough or a burning sensation in the throat.

In general, laryngitis is a mild condition that is not dangerous and tends to resolve on its own.

A 50-year-old man presents with a 3-month history of persistent hoarseness. He works as a public speaker and has been using his voice extensively for long hours. He also reports occasional dry cough and a burning sensation in his throat but denies fever or difficulty swallowing. On examination, there is no significant swelling or redness in the throat.

What is the most likely diagnosis?

A. Acute laryngitis
B. Chronic laryngitis
C. Laryngeal cancer
D. Gastroesophageal reflux disease (GERD)
E. Vocal cord polyps

Answer:
B. **Chronic laryngitis**

Explanation:
The patient's symptoms of persistent hoarseness lasting for several months, along with excessive vocal strain due to his occupation, suggest **chronic laryngitis**. This condition is rarely caused by infection and typically affects people who use their voice extensively. While GERD can also cause hoarseness, the lack of other typical GERD symptoms (like heartburn) makes chronic laryngitis more likely. Vocal cord polyps or laryngeal cancer would present with more severe or different symptoms, such as a noticeable mass or blood in the sputum.

The dr read everything

Epiglottitis

- Inflammation of the epiglottis due to infection
- Usually occurs in the winter months
- Causative Organisms:
  - H. Influenzae type b (now rare),
  - Streptococcus pneumonia
  - Moraxella catarrhalis:
  - S. pyogenes,
  - Staphylococcus aureus

Epiglottitis is a severe, life-threatening condition characterized by inflammation of the epiglottis, most commonly caused by bacterial infections, particularly *Haemophilus influenzae* type b (H. influenzae type b). This bacterium is also responsible for severe meningitis and epiglottitis.

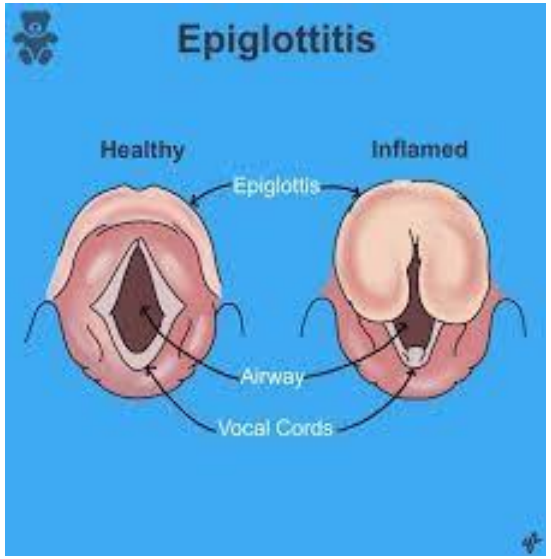
In general, **epiglottitis** is a rare disease, especially in countries like Jordan, where there is a vaccination against *H. influenzae* that significantly reduces the incidence of the condition.

The dr read everything

Epiglottitis--Pathophysiology

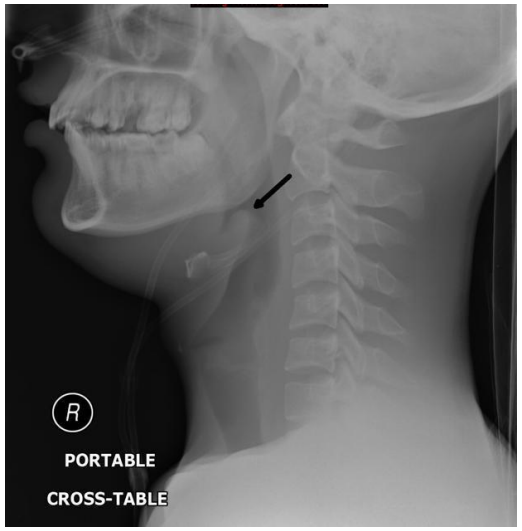
Having an inflammation in the mucosa of epiglottis , leading to thick ,swelling and redness .By swelling it will not move leading to closure of the air ways , and obstruction.

- Supra-glottic swelling
- Epiglottis turns bright, cherry red & swollen
- Inflammation leads to a/w narrowing and dysphagia
- If severe, a/w can become completely obstructed

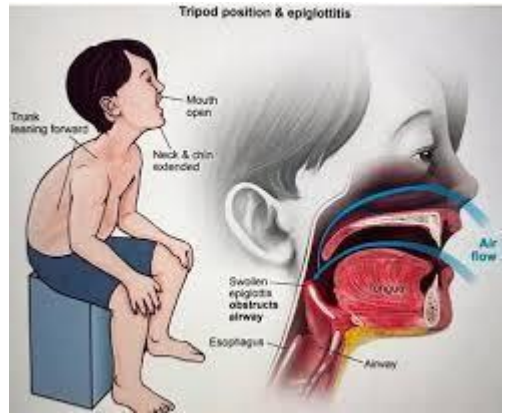


The dr read everything

Epiglottitis--Clinical Manifestations



- Patient appears acutely ill
- Rapid Onset
- Affects mainly children 1 - 5 years old
- **Drooling**, sore throat, dysphagia
- Muffled **hot potato voice.** **(important)**
- Stridor (extra-thoracic region) & hoarseness w/diminished breath sounds in lung regions
- High fever
- Classic **tripod position**
- Lateral neck x-ray: Balloon-shaped epiglottis/"**thumb sign**"



Epiglottitis typically presents with a very toxic and severely ill patient, especially in children. The condition is acute and requires urgent medical attention. The common symptoms include:

- **Dysphagia (difficulty swallowing)**
- **Drooling**
- **Sore throat**
- **Hot potato voice** (a muffled, raspy voice due to swelling of the epiglottis)
- **Hoarseness**
- **High-grade fever**

One of the hallmark signs of epiglottitis is the **tripod position**. This refers to a posture in which the patient sits upright, leans forward, and supports themselves with their hands on their knees or a surface. This position helps open the airway and makes breathing easier, which is critical in preventing complete airway obstruction. The tripod position can be life-saving by allowing the patient to breathe while awaiting medical intervention.

Diagnosis of epiglottitis largely depends on the patient's **history** and clinical presentation. During the **physical examination** , it is crucial to avoid any invasive maneuvers, such as examining the patient's throat with a tongue depressor or lying them flat on the bed, as this can cause sudden airway obstruction and worsen the condition.

An **X-ray** of the neck may be performed, revealing the **thumb sign**, which is caused by the swollen epiglottis appearing as a thumb-shaped mass on the radiograph.

PHYSICAL EXAMINATION CONSIDER CONTRAINDICATION

The dr read everything

Epiglottitis-Treatment

- Minimal patient stimulation-keep patient calm!
- O_2
- **IV Antibiotics** and fluids (steroids generally not effective)
- If severe obstruction, intubation shouldn't be attempted in ER
- **Intubate patient** in OR as trachestomy may be necessary and patient may need to be paralyzed
- Empirical therapy often includes:
  - **Third-generation cephalosporins** (e.g., ceftriaxone (rocephin) or cefotaxime (claforan))

Clinical Case: A 4-year-old boy is brought to the emergency department with a 24-hour history of fever, difficulty swallowing, and drooling. His parents note that he has become increasingly irritable and is unable to lie down comfortably. On examination, the child is in a tripod position and has a muffled voice. Stridor is noted, and the child is breathing with difficulty. A lateral neck X-ray shows the "thumb sign" of a swollen epiglottis. His vital signs are significant for a temperature of 39.5°C (103.1°F), heart rate of 120 bpm, and respiratory rate of 30 breaths per minute.

Question: What is the most likely causative organism for this child's condition?

A) Streptococcus pneumoniae
B) Haemophilus influenzae type b (Hib)
C) Staphylococcus aureus
D) Moraxella catarrhalis
E) Streptococcus pyogenes

Answer: B) **Haemophilus influenzae type b (Hib)**
Explanation: The presentation of this child — including fever, difficulty swallowing, drooling, stridor, and the "thumb sign" on a lateral neck X-ray — is characteristic of epiglottitis. Historically, Haemophilus influenzae type b (Hib) was the leading cause of epiglottitis in children. However, due to widespread vaccination against Hib, its incidence has decreased. Despite this, Hib remains the most likely causative organism in unvaccinated children or those with incomplete vaccination. Streptococcus pneumoniae, Staphylococcus aureus, Moraxella catarrhalis, and Streptococcus pyogenes can also cause epiglottitis but are less common than Hib

Diphtheria

الخانوق

In the past, it was a very dangerous disease that threatened life, caused by *Corynebacteria diphtheriae*.

Our normal oral flora primarily contains a group called diphtheroids, which are a type of *Corynebacteria*, but they are non-pathogenic. However, there is one harmful member of this group, *Corynebacteria diphtheriae*, which causes the disease diphtheria.

Thankfully, a vaccine for it has been found.

Bacteria – Gram Positive Bacilli

Corynebacterium Diphtheria - Corazon de la Corrida

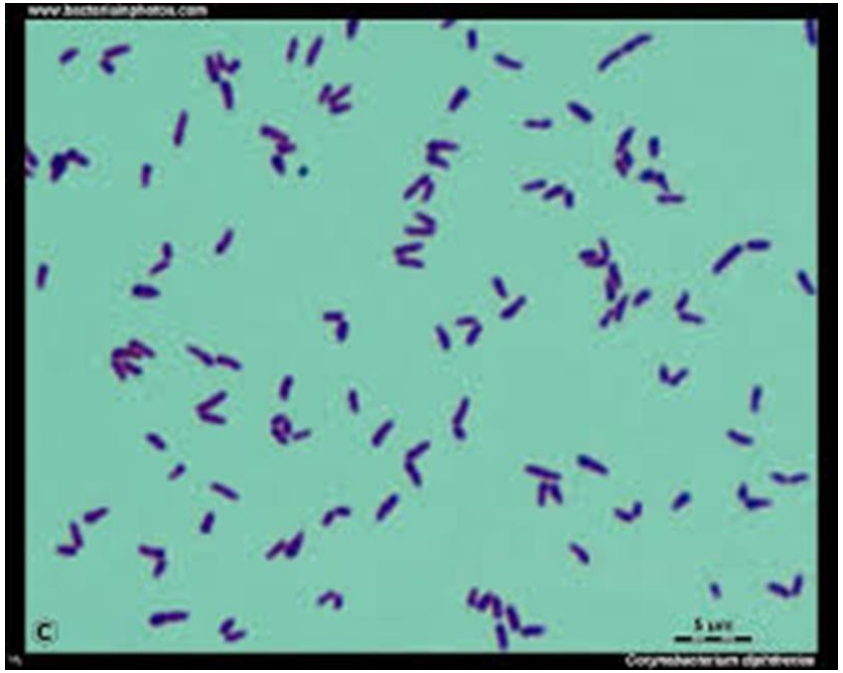
1. Purple Hues - Gram Pos, non-spore forming
2. Guy playing Morocco's that are blue and red – Bacteria is club shaped and y or v shaped, Metachromatic granules that stain with aniline dyes, Metachromatic granules will stain red and the rest of the cell will stain blue.
3. Zig Zag shape in the morocco - V or y shape the bacteria will form
4. 2 subunits A and B, A is active and B is binding
    1. Man playing an accordion wearing a bow tie - Toxin causes Ribosylation of elongation factor 2, this will inhibit ribosome function inhibiting protein synthesis leading to cell death
    2. Kids in the stand eating grey cotton candy wrapped with a plastic wrap - This will lead to pseudomembranous exudate that will be found in the oral pharynx
5. Bull extending its neck with droplets coming out of the mouth and nose - Found in throat and tonsils because the infection is transmitted by respiratory droplets, Can cause airway obstruction and lymphopathy, this will cause bulls neck (thickening of the neck)
6. Cape in the shape of a heart - Can lead to myocarditis like arrhythmias and heart block. Lethal effect of diphtheria
7. Man eating the sausage links - Will damage the myelin of nerve fibers, the sausage man eating the myelin having a neuropathy.
8. Television and kid laughing - Lab diagnosis -plate on Tellurite and Loeflers media (tele like television and loughlers will be the kid laughing like enjoying a show)
9. Bulls tongue sticking out and licking the matador - Eleks test – in-vitro assay that has antitoxin on it.
10. Why it's in another language - Immigrants most likely to get this
11. Syringes in the bull - DTaP vaccine is used, given with tetanus and pertussis. Toxoid Vaccine

Corynebacteria Group

- Pleomorphic Gram-positive Bacilli.
- *Diphtheroides*: (non pathogenic) Aerobic, Normal Flora - Respiratory-Urinary tract and Skin. Mostly Nonpathogenic.

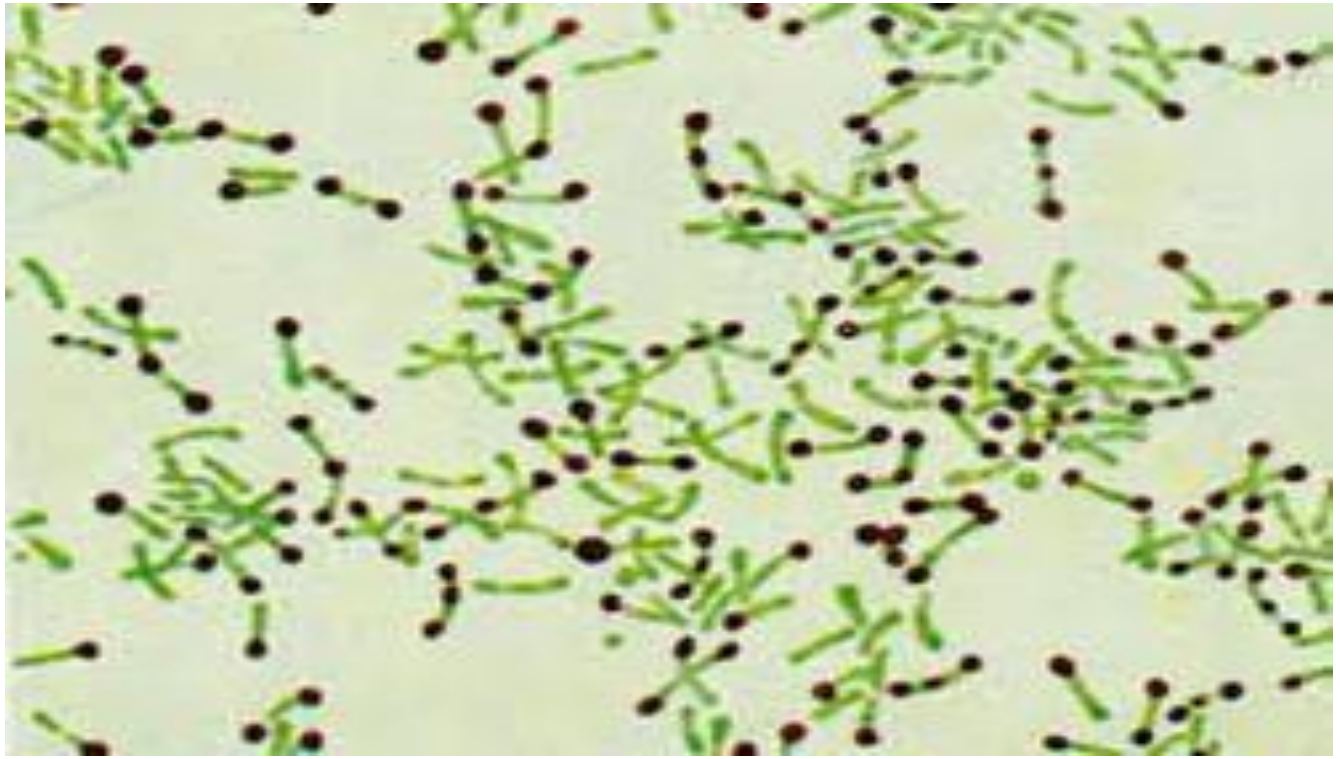
Corynebacterium diphtheriae: (pathogenic)

- Diphtheria is an acute, severe, serious, highly infectious disease.
- Strains are facultative aerobes,
- Non-motile
- Non-sporing pleomorphic
- Gram positive bacilli



Corynebacterium diphtheriae

It has a distinctive appearance under the microscope, called:
Chinese-character arrangement (clubbed end to end, remain attached after division)



Albert stain [special stain] is a type of differential stain used for staining the volutin granules also known as Metachromatic granules or food granules found in Corynebacterium diphtheriae.

C. diphtheriae produces large number of granules.

- Diphtheria is typically a respiratory infection of the **oropharynx** part of the URTIs.
- It tends to be most severe in those **younger than 5 years or older than 40 years**.
- Transmitted **in the droplets and aerosols produced by coughing** and sneezing
- After colonizing the throat, the bacterium remains in the oral cavity and begins producing the **diphtheria toxin**.

This bacteria are considered dangerous due to their ability to produce diphtheria toxin.

Corynebacterium diphtheriae

DT diphtheria toxin:

- A-B toxin, has both A subunit which responsible of the Action of the toxin, and B subunit responsible of Binding.
- Inhibit cytoplasmic protein synthesis irreversibly
- The action of the toxin is: targeting elongation factor 2 (EF2), leading to protein synthesis inhibition in the cell by blocking the elongation step in it --> no elongation factors --> no protein synthesis --> cell necrosis --> cell death --> inflammation [neutrophils] makes fibrin accumulation called pseudomembranes.

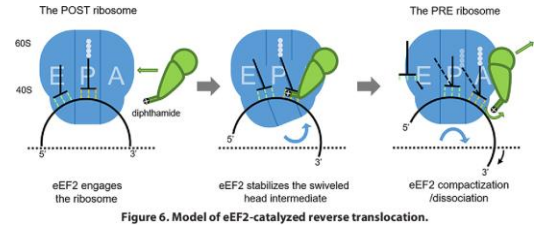
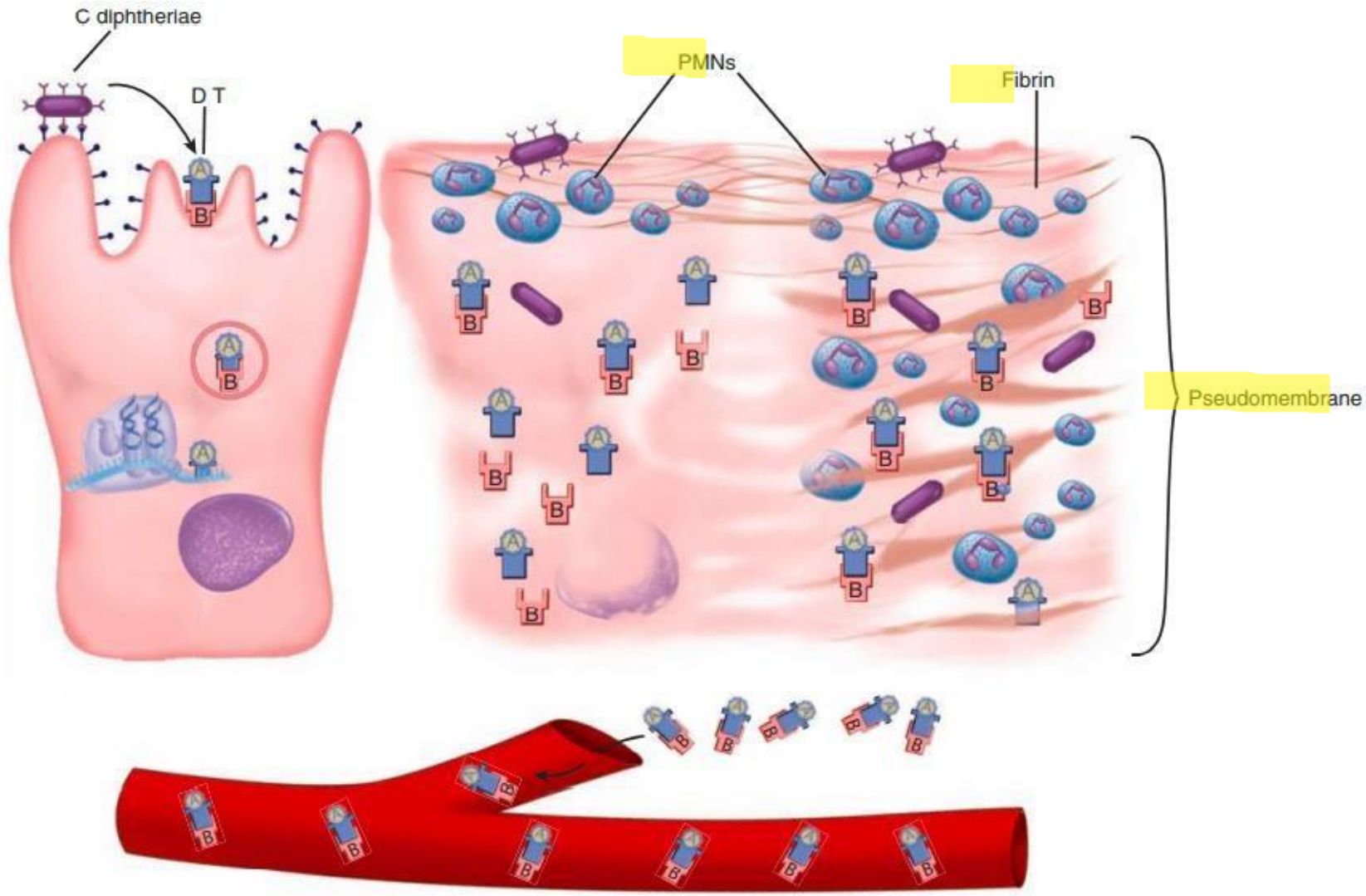


Figure 6. Model of eEF2-catalyzed reverse translocation.

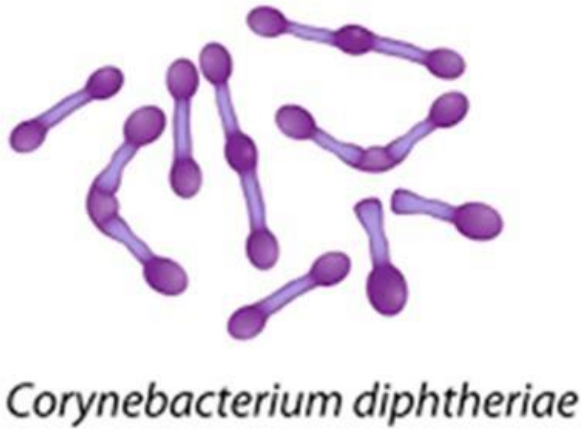
- Inflammation and Necrosis in the throat, pharynx and larynx (**pseudomembranes**). Is a characteristic for diphtheriae



An accumulation of grayish exudate consisting of dead host cells, pus, red blood cells, fibrin, and infectious bacteria

Corynebacterium diphtheriae

- 2-4 days incubation,
- Pharyngitis, tonsillitis
- Exudate or membrane
- Gray-white **psudomembrane**
- Cervical adenitis (bull neck)
- Comp: mechanical obstruction, **myocarditis** (2-3w), cardiac enlargement, arrhythmias, CHF



Corynebacterium diphtheriae

There are two types of pseudomembranes:
1. **Pseudomembrane in pharyngitis** caused by *Corynebacterium diphtheriae*
2. **Pseudomembranous colitis** caused by *Clostridioides difficile*

In the case of **pharyngitis caused by *C. diphtheriae***, the pseudomembrane forms in the throat and is tightly adherent to the underlying tissue. Attempting to remove it can lead to **bleeding**, and its presence may cause **mechanical obstruction of the airway**, leading to respiratory distress. This makes it a life-threatening condition requiring immediate attention.

- As the disease progresses, the **pseudomembrane** can enlarge to obstruct the fauces of the pharynx or trachea and can lead to suffocation and death.
  - Sometimes, intubation, the placement of a breathing tube in the trachea, is required in advanced infections.
- If the diphtheria toxin spreads throughout the body, it can damage other tissues as well. This can include myocarditis (heart damage) and nerve damage that may impair breathing

Diagnosis

- The presumptive diagnosis of diphtheria is primarily based on the clinical symptoms **(i.e., the pseudomembrane)** and **vaccination history**,
- Typically confirmed by identifying **bacterial cultures** obtained from throat swabs. (Then culture)
- The diphtheria toxin itself can be directly detected in vitro using **polymerase chain reaction (PCR)**-based, direct detection systems for the diphtheria tox gene.

The diagnosis of **diphtheria** is primarily **clinical**, based on the patient's symptoms and physical examination findings, such as the presence of a pseudomembrane in the throat.

Taking the patient's **vaccination history** is essential, as lack of vaccination significantly increases the risk of the disease.

Other diagnostic tools, such as **PCR** and **culture**, can be used to confirm the diagnosis, but they are less commonly employed due to the urgency of clinical recognition and treatment.

Treatment

- Penicillin and erythromycin (effective against the bacteria itself)
  - no effect against preformed toxins.
- Antitoxins (preformed antibodies against the toxin)
  - effective in neutralizing the toxin,

Vaccine

- Diphtheria Toxoid (**Triple Vaccine, DTP** diphtheria, pertussis (whooping cough), and tetanus): given to children at 2, 4, and 6 months of age.

VERSIONS	SLIDE #	BEFORE CORRECTION	AFTER CORRECTION
V1→ V2	8 24 24	are the most common Low Subacute sinusitis	are less common than Acute sinusitis of viral origin. High acute sinusitis
V2→V3			

امسح الرمز و شاركنا بأفكارك لتحسين أدائنا !!