

# **Bacterial Upper Respiratory Tract Infections (URTI)**

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# Objectives

- \* Discuss the epidemiology and various clinical presentations of URTIs
- \* Identify the most important etiological agents causing different URTIs, and discuss their virulence factors, laboratory diagnosis and potential preventative strategies
- \* Determine the antibiotic of choice for the different URTIs
- \* Discuss complications of GAS and *C. diphtheriae* infections

# Outline

- \* Pharyngitis
  - \* GAS
  - \* Diphtheria
- \* Epiglottitis
- \* Whooping cough
- \* Otitis Media
- \* Sinusitis
- \* Deep neck space infections

## Conducting Passages

Upper respiratory tract

Nasal cavity

Pharynx

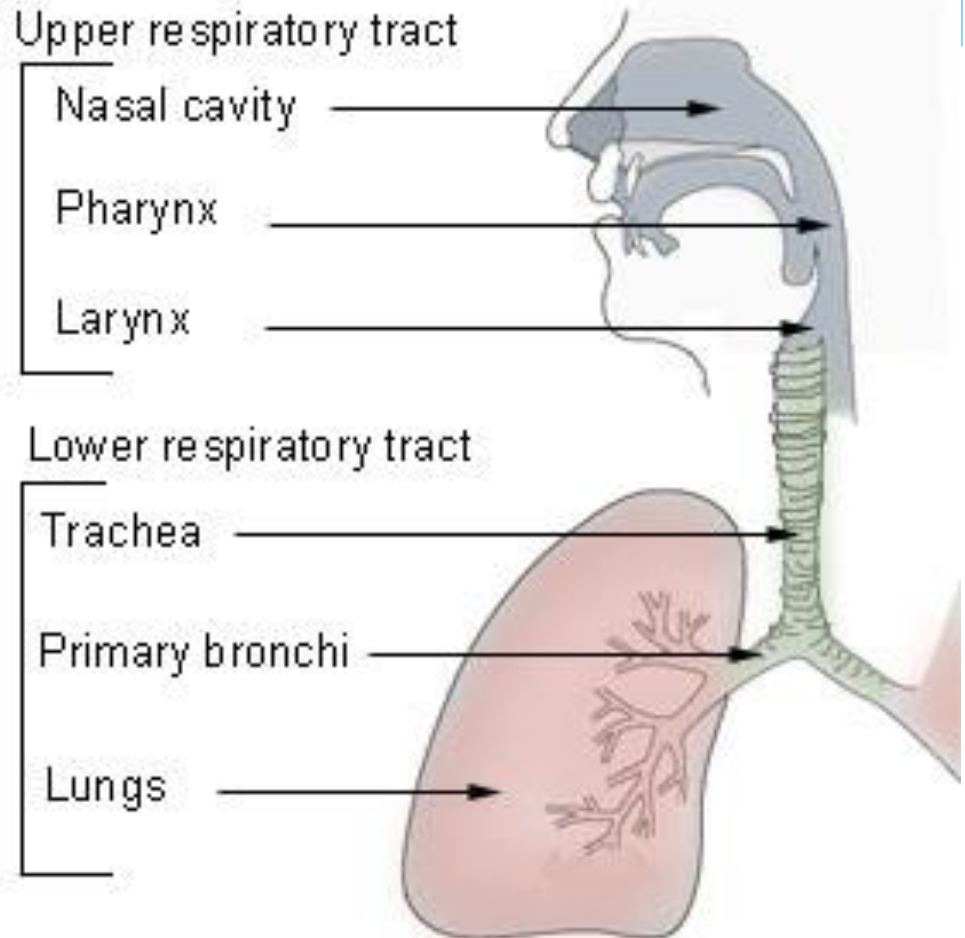
Larynx

Lower respiratory tract

Trachea

Primary bronchi

Lungs



# Pharyngitis

- \* Epidemiology

- \* Late fall, winter, early spring
- \* 5 to 15 years

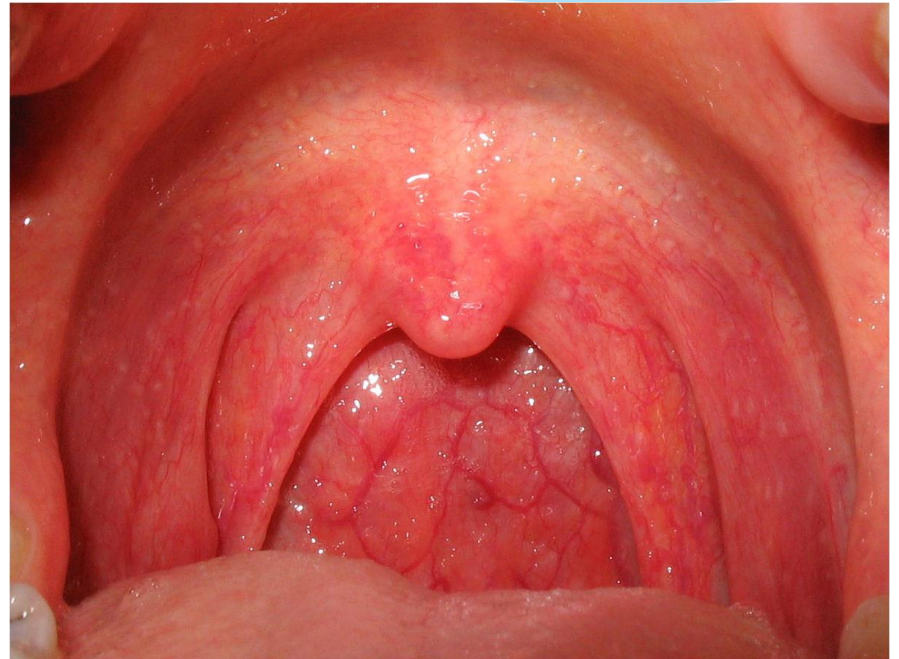
- \* Etiology

- \* Viruses (i.e. respiratory viruses) are the most common cause
- \* *Streptococcus pyogenes* is the most important bacterial cause



# Pharyngitis

- \* Bacterial causes include:
  - \* Group A streptococcus \*
  - \* *Corynebacterium diphtheriae*
  - \* *Fusobacterium necrophorum* (Anaerobic bacteria, cause of Lemierre's syndrome)
  - \* *Neisseria gonorrhoeae*



# Pharyngitis

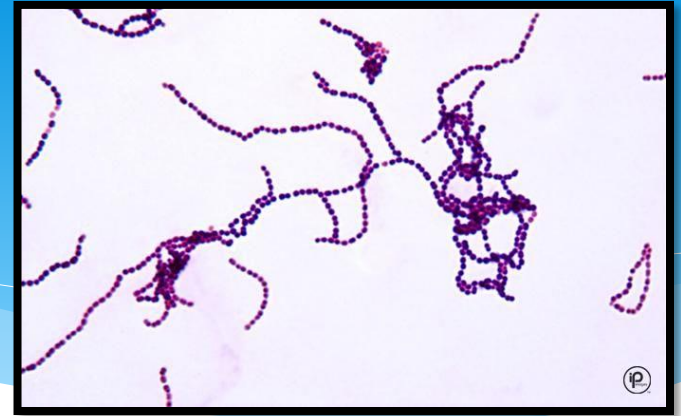
- \* Signs and symptoms:

- \* Sore Throat
- \* Pharyngeal erythema, edema
- \* Fever



- \* More consistent with viral:
  - \* Coryza
  - \* Cough
  - \* Conjunctivitis
- \* More consistent with bacterial (GAS):
  - \* Tonsillar exudates
  - \* Tender, enlarged >1 cm lymph nodes
  - \* Fever 38.4 to 39.4° C

# GAS



- \* Gram positive cocci in chains
- \* Facultative anaerobe
- \* Beta haemolytic
- \* Catalase negative
- \* Causes:
  - \* Respiratory infections
    - \* Pharyngitis
    - \* Otitis
    - \* Sinusitis
  - \* Other infections
    - \* Skin and soft tissue
- \* Virulence factors
  - \* Capsule
  - \* M protein in cell wall
  - \* Streptolysin O & S
  - \* Streptococcal pyrogenic exotoxins (SPE)



# GAS Pharyngitis

- \* **Diagnosis:**

- **Throat swab**

- \* Rapid Bacterial antigen detection
    - \* Culture on blood agar

- \* **Antistreptolysin O**

- \* **Treatment:**

- \* **Penicillin x 10 days**

- \* **Allergy?**

- \* **Clindamycin or macrolide (e.g. Clarithromycin)**





# GAS Pharyngitis Complications

- \* Suppurative

- \* E.g. Peritonsillar abscess, parapharyngeal space abscess

- \* Non suppurative

- \* Occurs 1-6 weeks after acute *S. pyogenes* infection
  - \* Rheumatic fever
  - \* Glomerulonephritis

# GAS Pharyngitis Complications

- \* Rheumatic fever:
  - \* After infection of the respiratory tract.
  - \* Inflammation of heart (pancarditis), joints, blood vessels, and subcutaneous tissue.
  - \* Results from cross reactivity of anti-M protein Ab and the human heart tissue.
- \* Acute glomerulonephritis:
  - \* After infection of the skin or the respiratory tract.
  - \* Symptoms: edema, hypertension, hematuria, and proteinuria.
  - \* Initiated by Ag-Ab complexes on the glomerular basement membrane.

# Corynebacterium diphtheriae

- \* Rare in developed countries
  - \* Why? How is it prevented?
- \* Mainly presents as URTI
- \* Formation of membranes in the throat is characteristic
  
- \* Virulence
  - \* Diphtheria toxin



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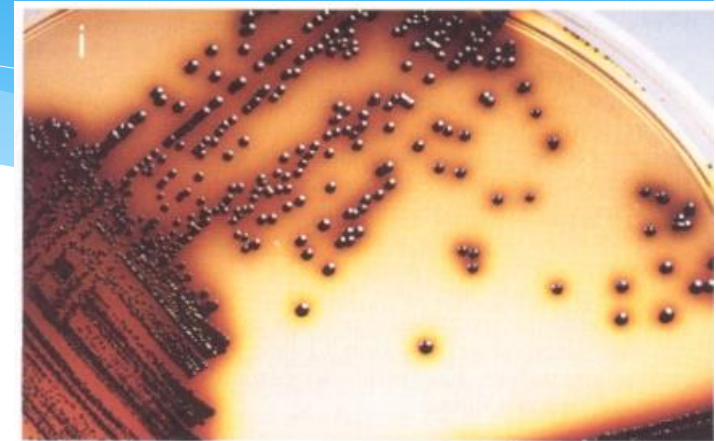
# Corynebacterium diphtheriae

## \* Diagnosis:

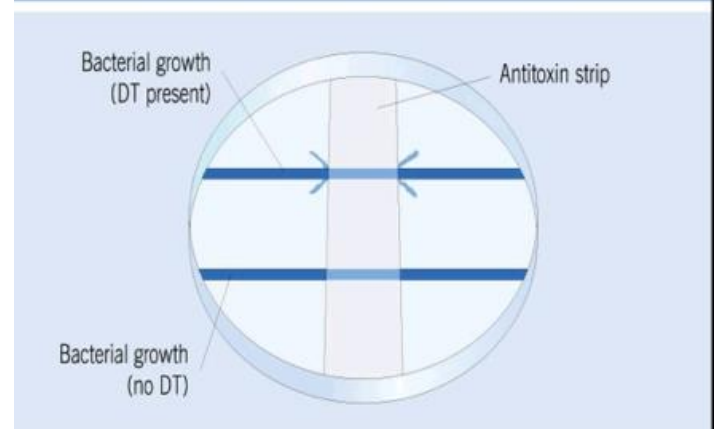
- Throat swab
- Culture on special media containing tellurite (e.g. Tinsdale media)
- ELEK's Test for confirmation of toxin production

## ➤ Treatment:

- Antitoxin + antibiotic
  - Penicillin or erythromycin

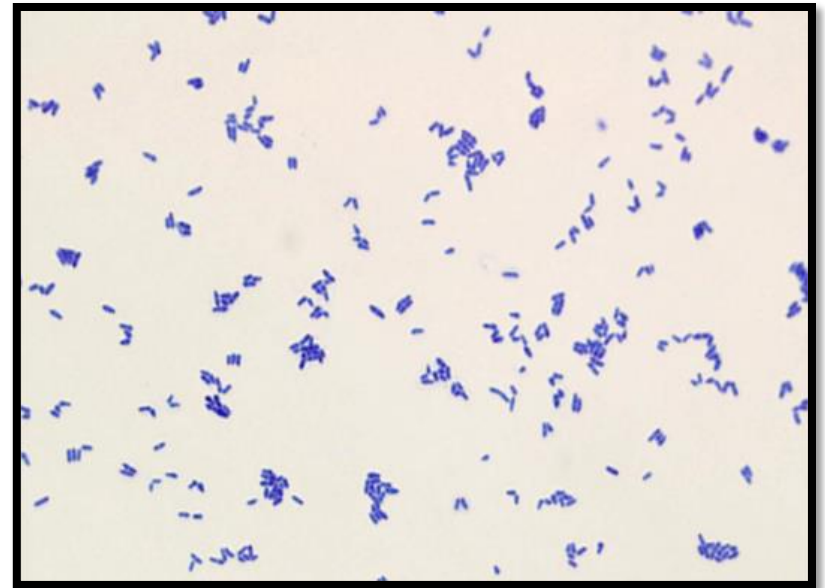


DETECTION OF DIPHTHERIA TOXIN PRODUCTION



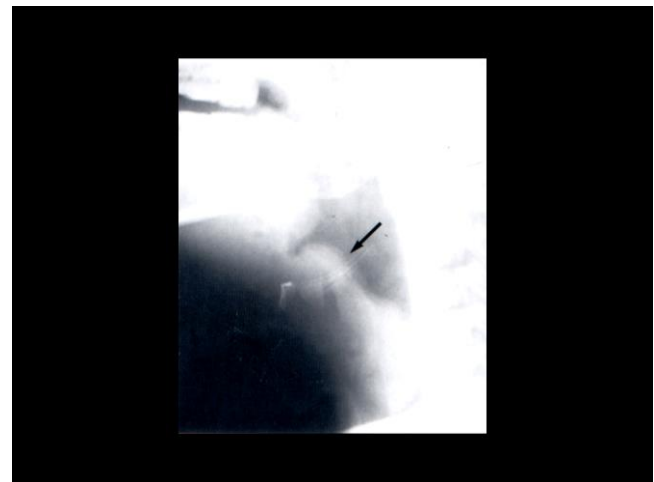
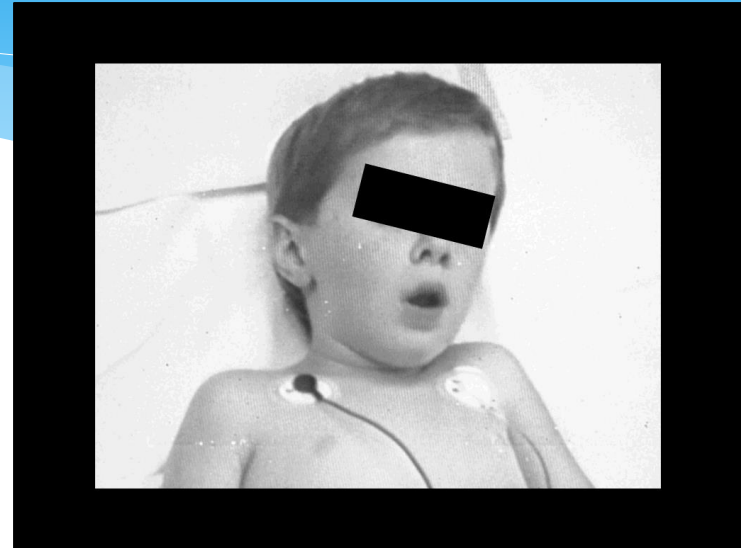
# Corynebacterium diphtheriae

- Prevention:
  - Vaccination with diphtheria toxoid containing vaccine
  
- Complications:
  - Myocarditis
  - Neuritis



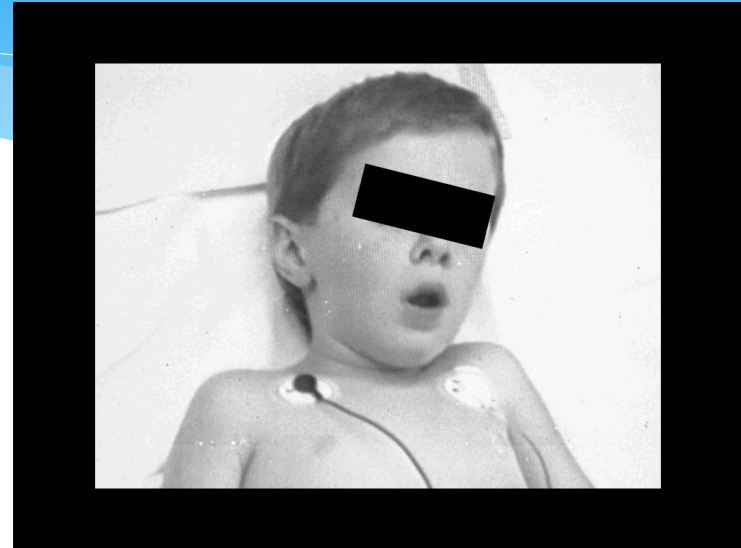
# Epiglottitis

- \* Usually young unimmunized children presented with dysphasia, drooling, and respiratory distress
- \* *Etiology*
  - \* *H. influenzae* Type b
  - \* *S. pneumoniae*
  - \* *S. aureus*
  - \* Beta hemolytic streptococci



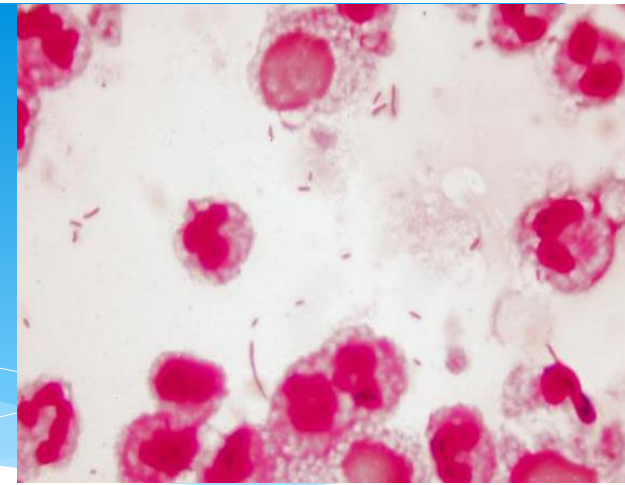
# Epiglottitis

- \* Diagnosis:
  - Blood cultures
  - Culture of epiglottic surface (under controlled setting)
  
- \* Management:
  - \* Maintenance of airway
  - Empiric treatment:
    - Ceftriaxone + Vancomycin
  
- \* Prevention: HiB vaccination

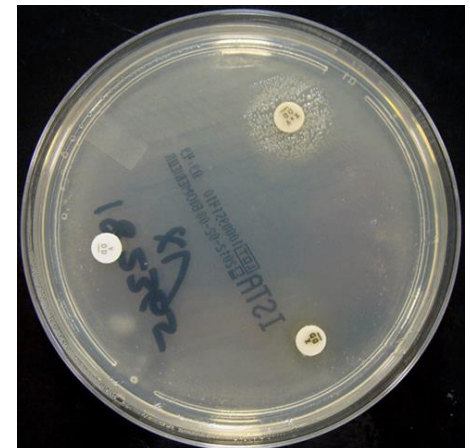




# *H. influenzae*



- \* Gram negative pleomorphic, coccoid to rod-shaped cells (cocci)
- \* Oxidase and catalase positive
- \* Requires X (heme) and V (NAD) factors for growth



# *H. influenzae*

- \* Divided into:
  - \* Encapsulated (typable) strains
    - \* A-F
    - \* Most important is type b
      - \* Prevention through vaccination
    - \* Causes invasive disease (e.g. epiglottitis, meningitis)
  - \* Nonencapsulated (nontypable) strains
    - \* Causes local infections (e.g. sinusitis, otitis, pneumonia in elderly)
- \* Treatment:
  - \* Amoxicillin-clavulanate, 2<sup>nd</sup> or 3<sup>rd</sup> generation cephalosporin

# Pertussis (whooping cough)

- \* *Bordetella pertussis* (GNB)
- \* Virulence
  - \* Pertussis toxin (PT )\*
  - \* Filamentous hemagglutinin (FHA)
  - \* Pertactin (PRN)
- \* Incubation period 1 to 3 wks
- \* Catarrhal Stage 1~2 weeks
- \* Paroxysmal Stage 2~4 weeks
- \* Convalescent Stage 1~2 weeks



# Pertussis (whooping cough)

- \* Diagnosis:

- Sample:

- Nasopharyngeal (NP) swabs

- Special media needed

- Charcoal blood (Regan-Lowe)

- Bordet-Gengou

- \* Treatment:

- \* Macrolide (erythromycin)

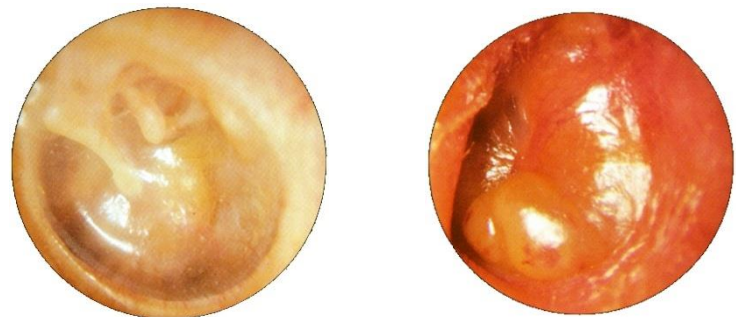
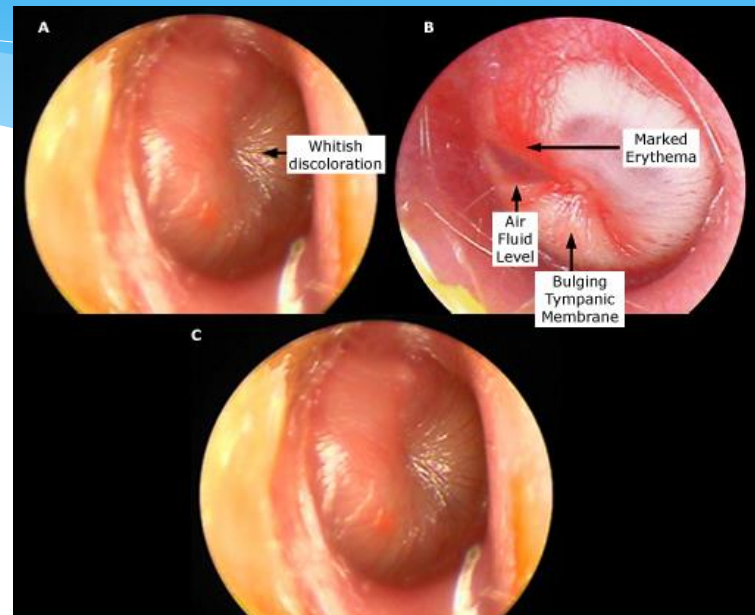
- \* Prevention by vaccination

- \* Acellular pertussis-containing vaccine



# Acute Otitis Media

- \* Fluid + inflammation of the mucosal lining of the middle ear
- \* More common in children
- \* Etiology:
  - \* *S. pneumoniae*
  - \* *H. influenzae* (non typable)
  - \* *S. aureus*
  - \* *Moraxella catarrhalis*
  - \* GAS
  - \* **Viral** (alone or with bacteria)



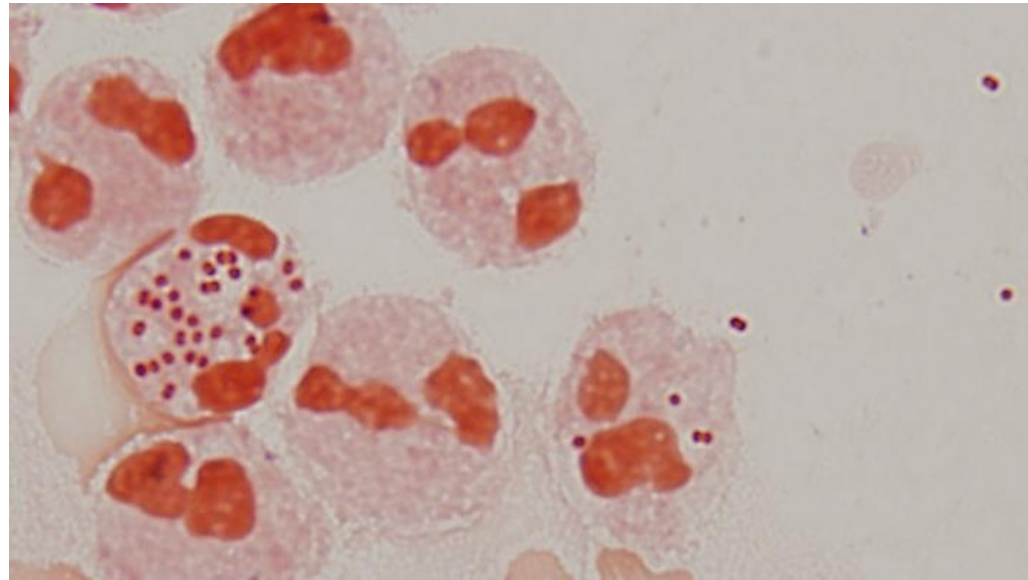
# Acute Otitis Media

- \* Diagnosis:
  - \* Mainly clinical diagnosis
  - \* Tympanocentesis sometimes needed
    - \* Middle ear fluid can be sent for culture
- \* Treatment
  - Amoxicillin or Amoxicillin Clavulanic acid



# *Moraxella catarrhalis*

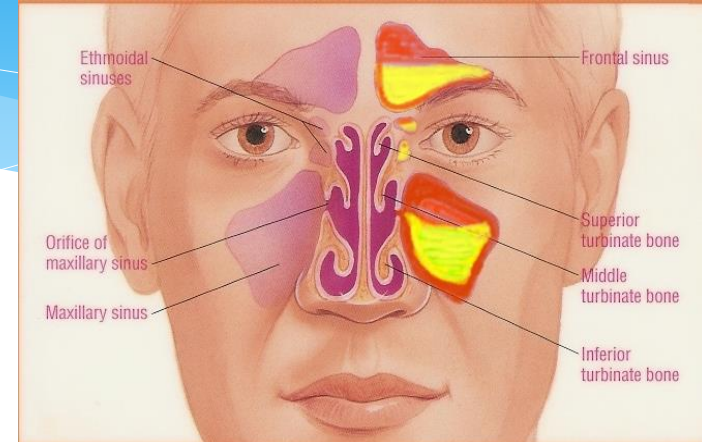
- \* Gram negative diplococci
- \* Catalase and oxidase positive
- \* Causes:
  - \* Otitis
  - \* Sinusitis
  - \* Pneumonia
- \* Treatment:
  - \* Amox-Clav





# Acute Bacterial Sinusitis

- \* More common in children
- \* Occurs with viral URTI
- \* *Etiology:*
  - \* *S. pneumoniae*,
  - \* *H. influenzae* (non typable)
  - \* *M. catarrhalis*
  - \* *Anaerobes*
  - \* Viral



# Acute Bacterial Sinusitis

- \* Diagnosis:
  - \* Mainly clinical diagnosis
  - \* Imaging (CT/MRI) when there is suspicion of complications
- \* Treatment
  - \* Amoxicillin Clavulanic acid For 1-2 weeks

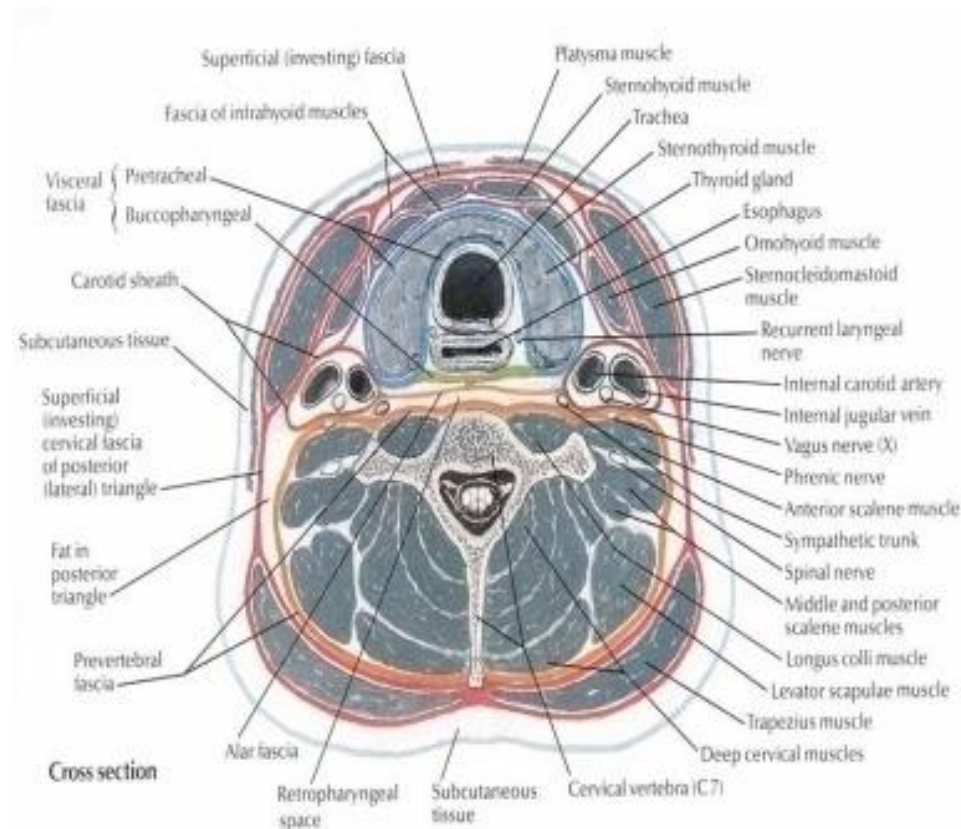


# Deep neck space infections

- \* Lateral pharyngeal, retropharyngeal or prevertebral space
- \* Patients are very sick and toxic
- \* Neck stiffness can occur with retropharyngeal space infection/abscess
- \* Retropharyngeal (danger space) infection may extend to mediastinum and present as mediastinitis

# Deep neck space infections treatment

- \* Usually polymicrobial
  - \* Mainly streptococci and oral anaerobes
- \* Management
  - \* Surgery
  - \* Antibiotics
    - \* Meropenem
    - \* Piperacillin
    - \* Clindamycin
- \* Duration
  - \* 2~3 weeks



# Lemierre's syndrome

- \* Complication of pharyngitis or peritonsillar abscess
- \* Patient presents with sore throat, fever and shock due IJV thrombophlebitis, which leads to multiple septic emboli to the lung
- \* *Fusobacterium necrophorum*
- \* Medical treatment same as deep neck space infection
- \* Venotomy if doesn't respond to medical treatment

