# Bacterial Upper Respiratory Tract Infections (URTI)

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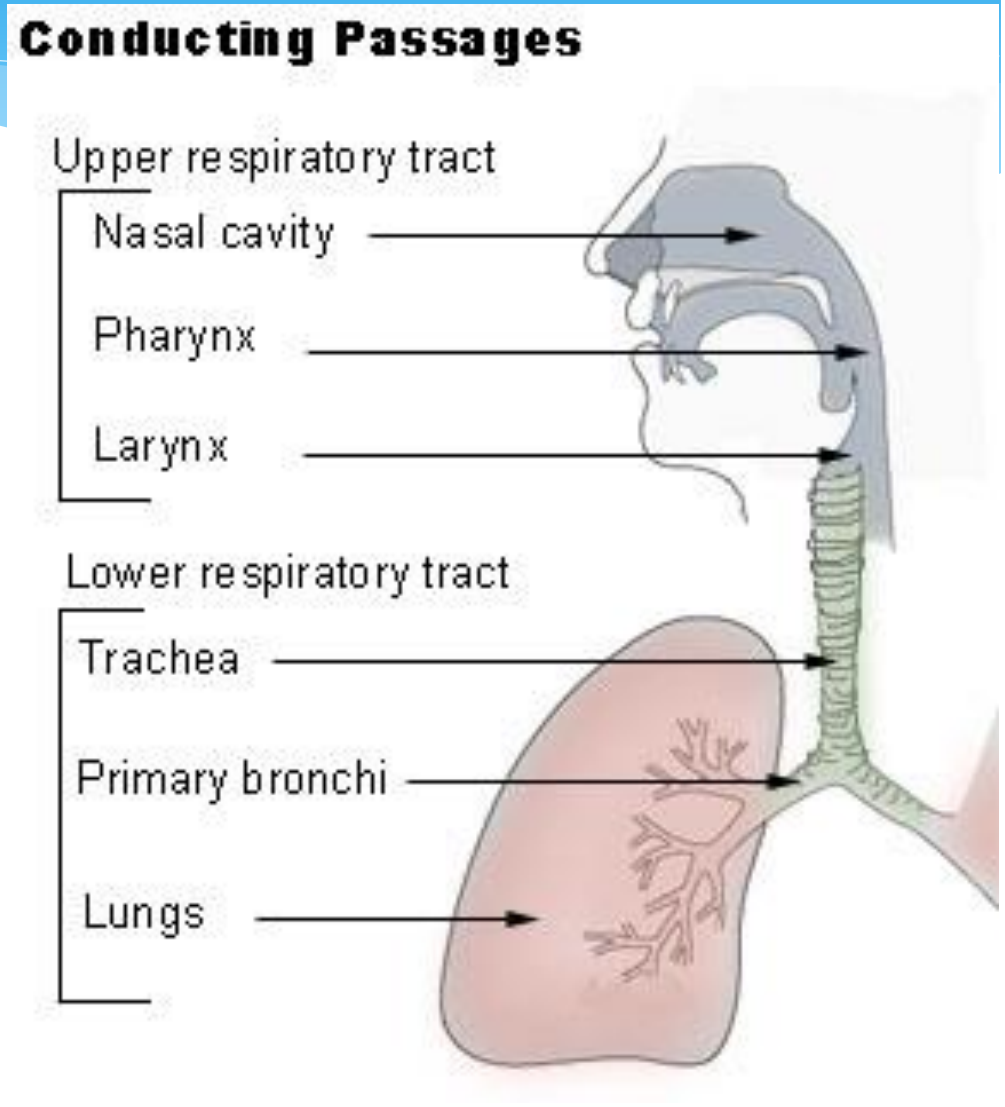
# Objectives

* 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



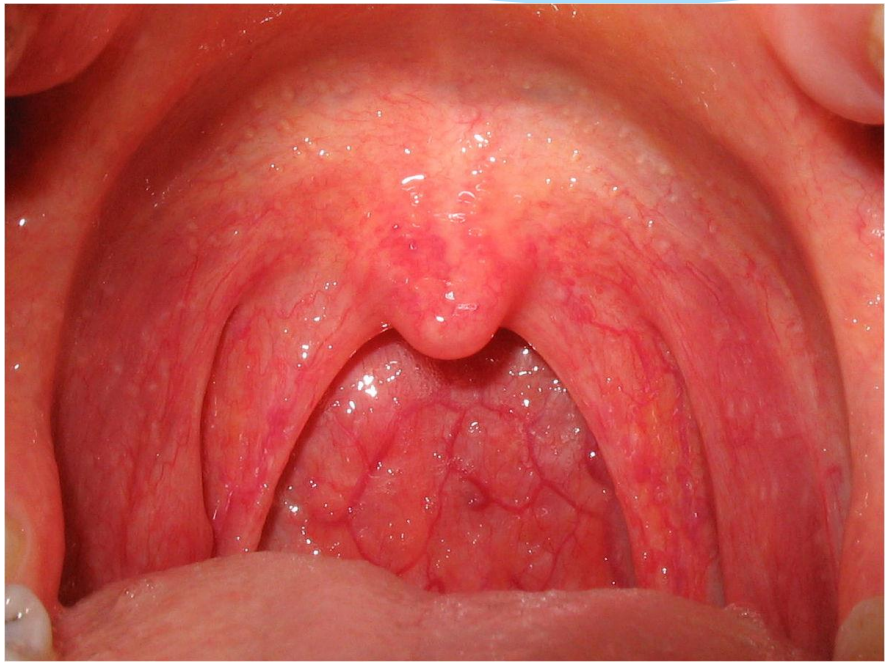
# Pharyngitis

* 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

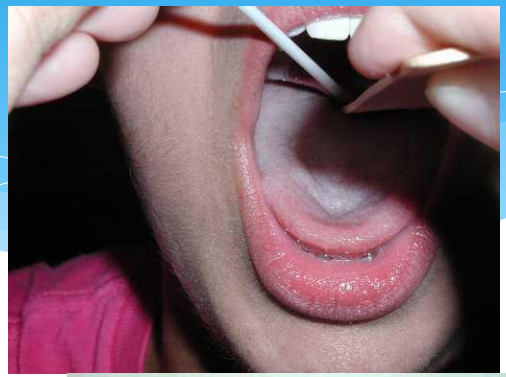
* More consistent with viral:
  * Coryza
  * Cough
  * Conjunctivitis
* More consistent with bacterial (GAS):
  * Tonsillar exudates
  * Tender, enlarged >1 cm lymph nodes
  * Fever 38.4 to 39.4° C

# 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

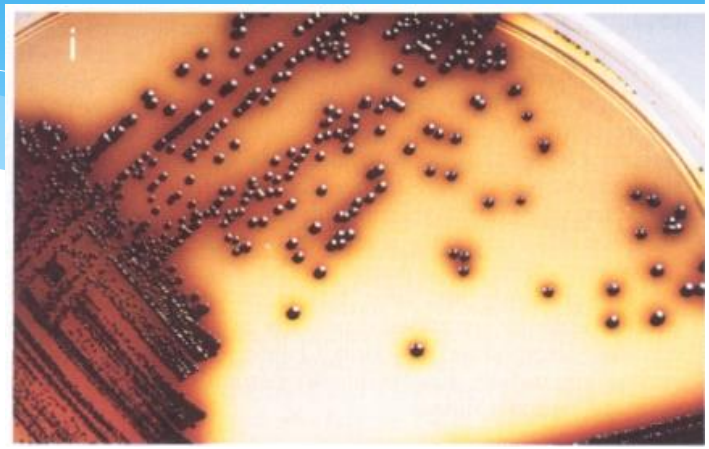


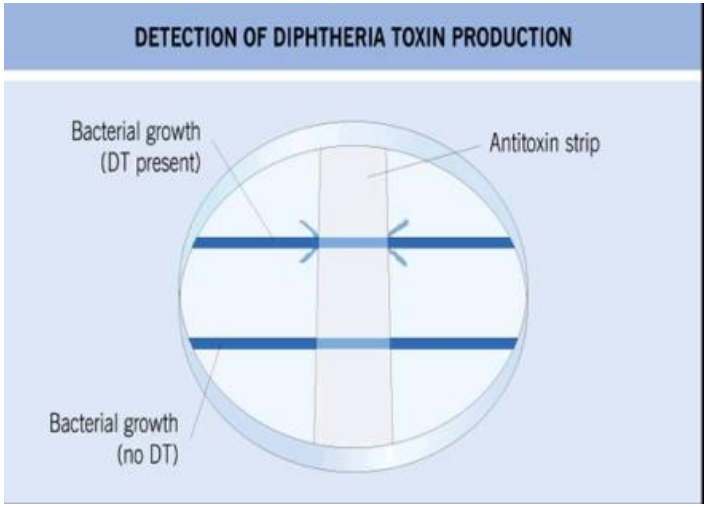
* Virulence
  * Diptheria toxin

# Corynebacterium diphtheriae

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

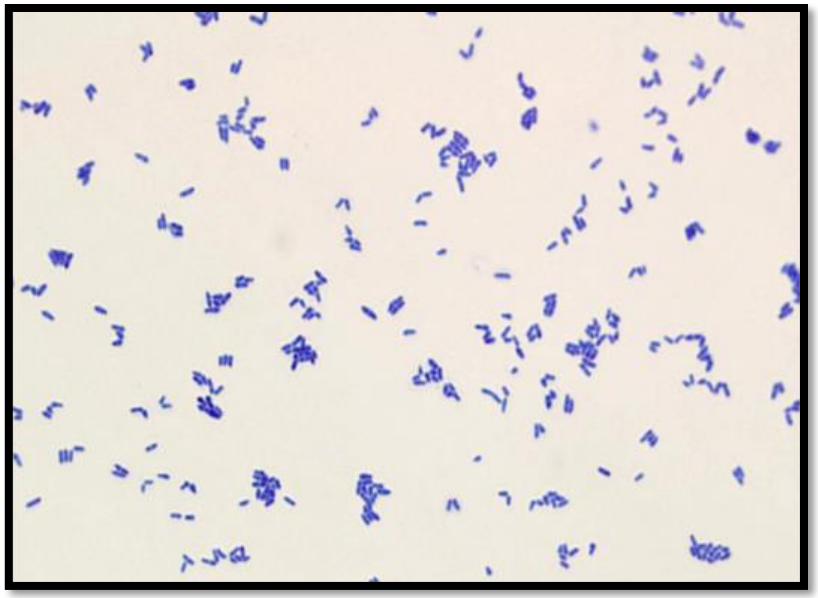
- Treatment:
  - Antitoxin + antibiotic
    - Penicillin or erythromycin





# Corynebacterium diphtheriae

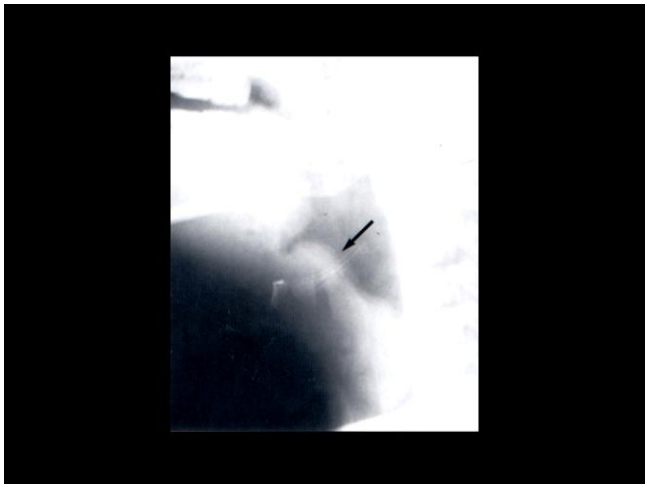
- Prevention:
  - Vaccination with diphtheria toxoid containing vaccine



- Complications:
  - Myocarditis
  - Neuritis

# Epiglottitis

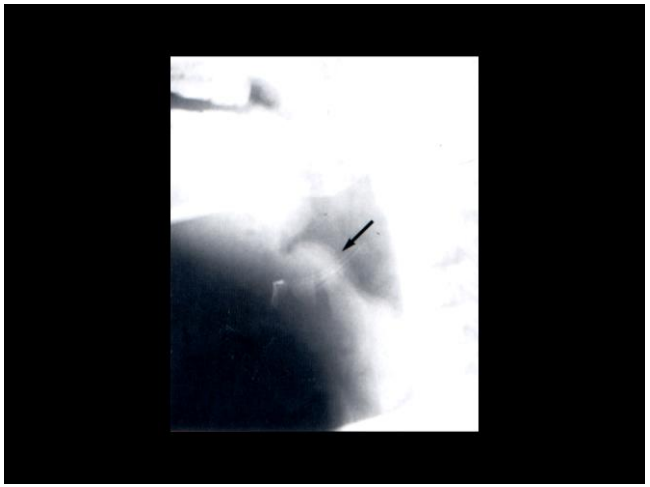
* Usually young unimmunized children presented with dysphagia, drooling, and respiratory distress
* ***Etiology***
  * ***H. influenzae* Type b**
  * *S. pneumonae*
  * *S. aureus*
  * Beta hemolytic streptococci



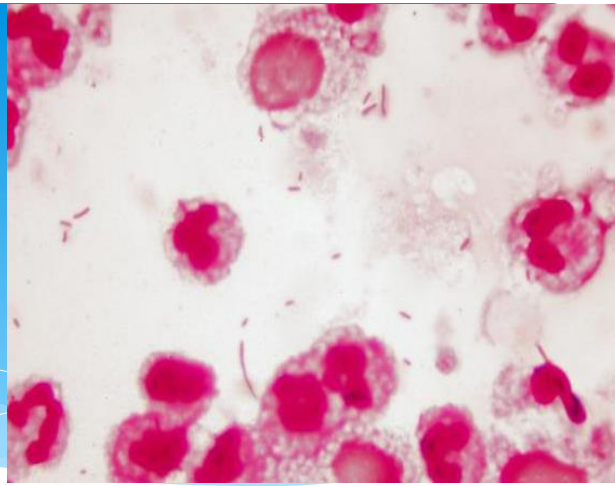
# Epiglottitis

* Diagnosis:
  - Blood cultures
  - Culture of epigoltic surface (under controlled setting)

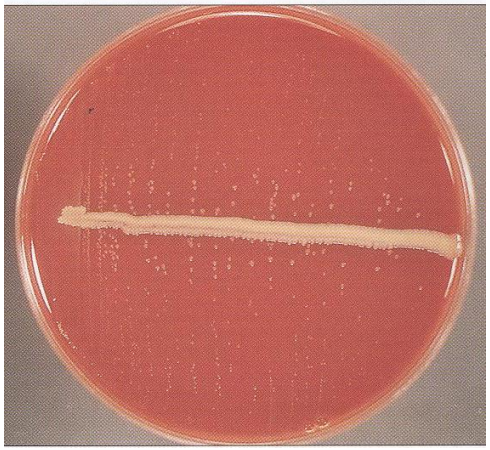
* Management:
  * Maintenance of airway
  - Empiric treatment:
    - Ceftriaxone + Vancomycin
* Prevention: HiB vaccination

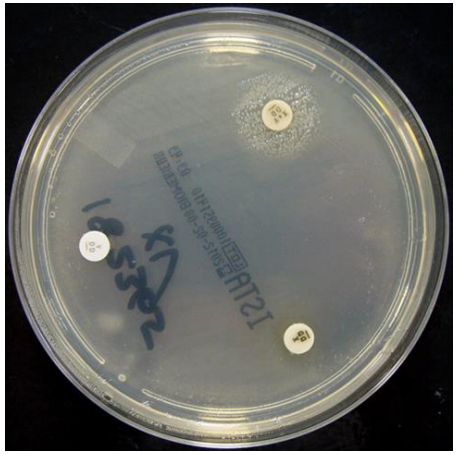


# *H. influenzae*



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





# *H. influenzae*

* Divided into:
  * Encapsulated (typable) strains (main virulence factor)
    * A-F
    * Most important is type b
      * Prevention through vaccination
    * Causes invasive disease (e.g. epiglottis, meningitis)
  * Nonencapsulated (nontypable) strains
    * Causes local infections (e.g. sinusitis, otitis, pneumonia in elderly)
* Treatment:
  * Amoxicillin-clavulanate, 2$^{nd}$ or 3$^{rd}$ generation cephalosporin

# Pertussis (whooping cough)

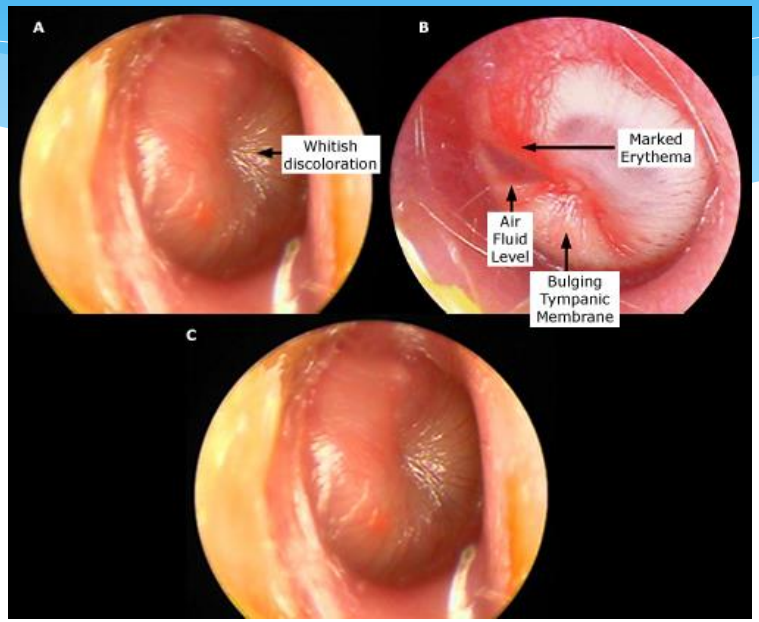
* *Bordetella pertussis (GNB)*
  * Virulence
    * Pertussis toxin *
    * Filamentous hemagglutinin
    * Pertactin
* Incubation period 1 to 3 wks
  * Catarrhal Stage 1-2 weeks
  * Paroxysmal Stage 2-4 weeks
  * Convalescent Stage 1-2 weeks

# 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)



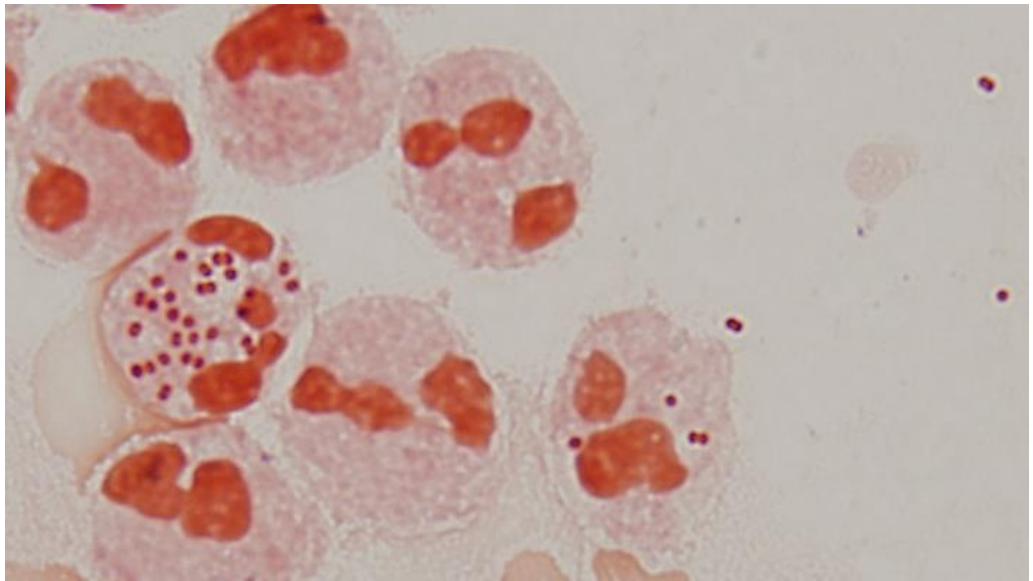

# Acute Otitis Media

* Diagnosis:
  * Mainly clinical diagnosis
  * Tympanocentesis sometimes needed
    * Middle ear fluid can be sent for culture

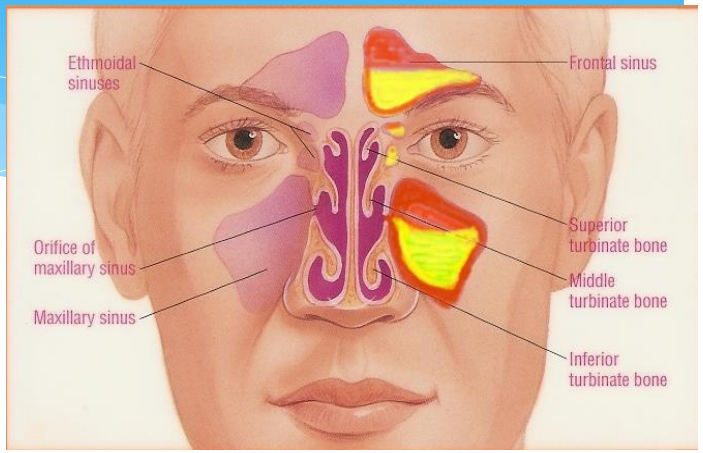
* Treatment
  - Amoxicillin or Amoxicillin Clavulanic acid

# *Moraxella catarrhalis*

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



# Acute Bacterial Sinusitis

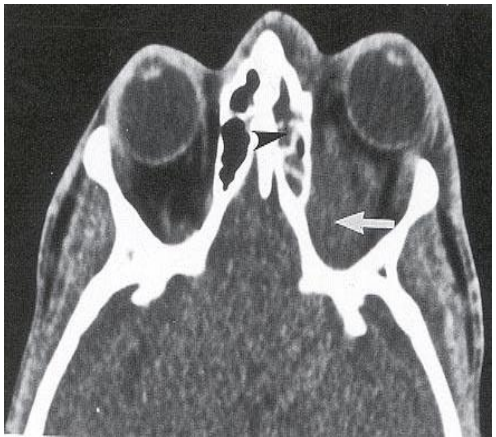



* More common in children
* Occurs with viral URTI
* *Etiology:*
  * *S. pneumoniae,*
  * *H. infuenzae* (non typable)
  * *M. catarrhalis*
  * *Anaerobes*
  * Viral

# Acute Bacterial Sinusitis

* Diagnosis:
  * Mainly clinical diagnosis
  * Imaging (CT/MRI) when there is suspension of complications

* Treatment
  * Amoxicillin Clavulanic acid For 1~2 weeks

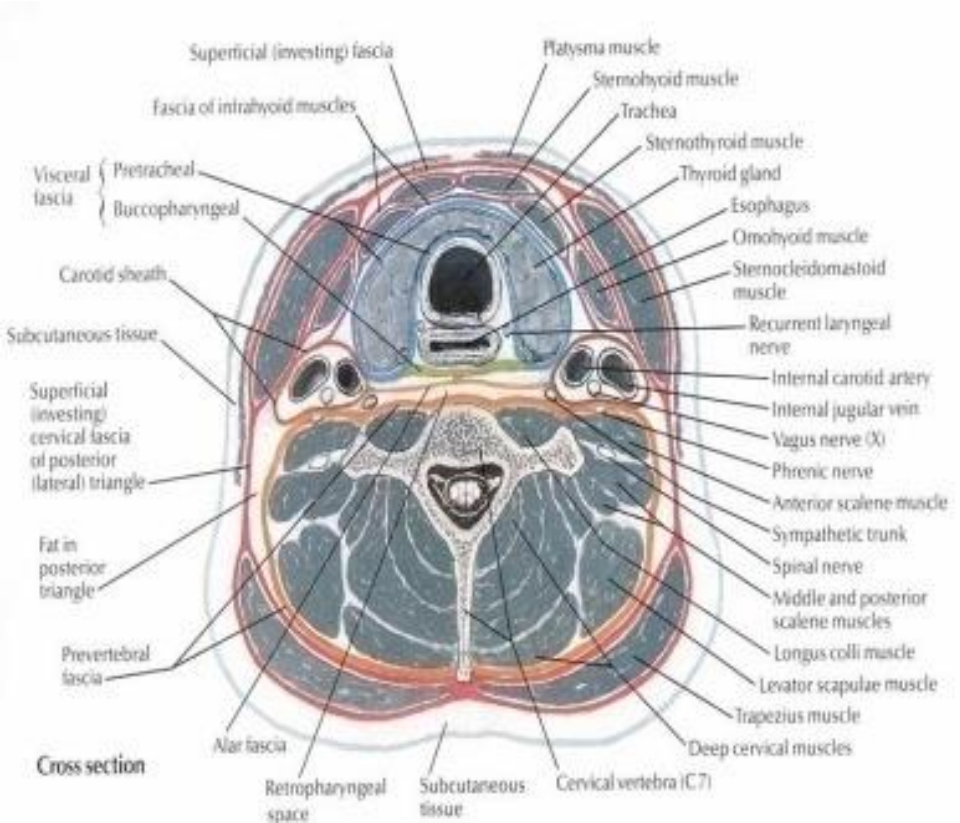


# Deep neck space infections

* 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



# References


* Ryan, Kenneth J.. Sherris Medical Microbiology, Seventh Edition. McGraw-Hill Education.

  * Ear and sinus infections, part of the chapter on Infectious Diseases: Syndromes and Etiologies
  * Upper respiratory tract infections, part of the chapter on Infectious Diseases: Syndromes and Etiologies
  * Streptococci, chapter 25
  * Corynebacterium, chapter 26
  * Haemophilus & Bordetella, chapter 31