

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

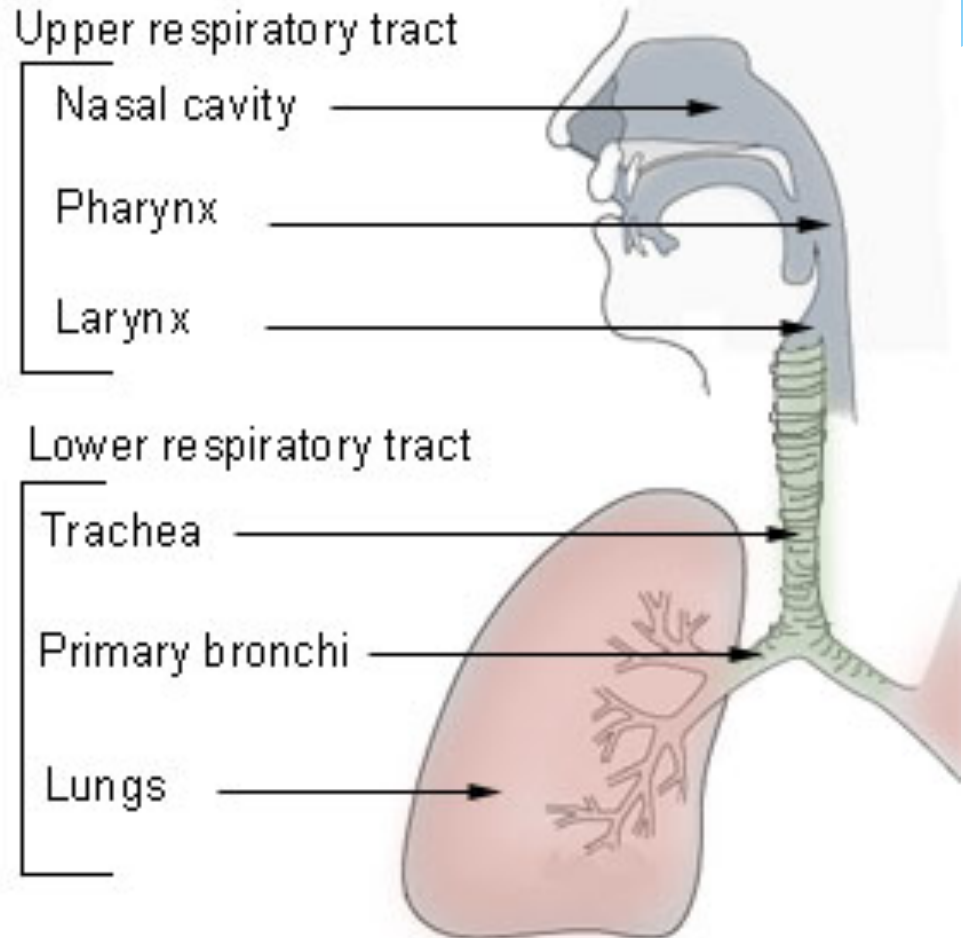
Larynx

Lower respiratory tract

Trachea

Primary bronchi

Lungs



Pharyngitis

- * Epidemiology

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

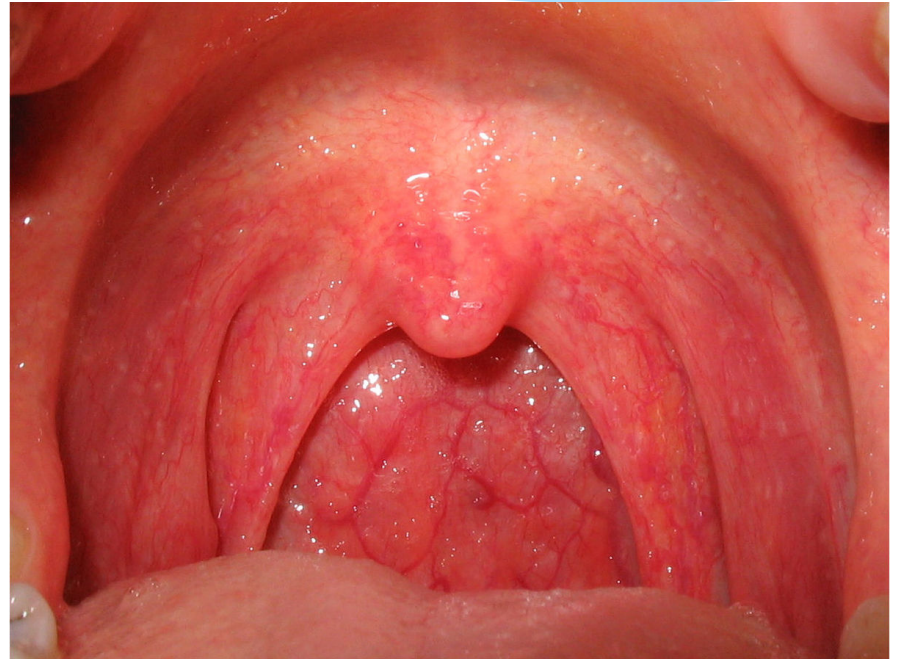
- * Etiology

- * 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

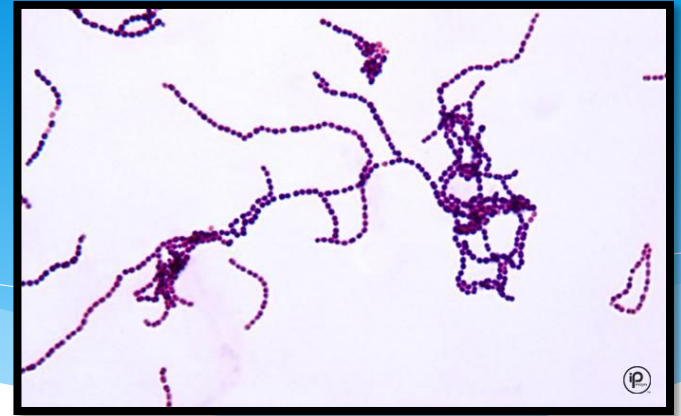
- * Signs and symptoms:

- * 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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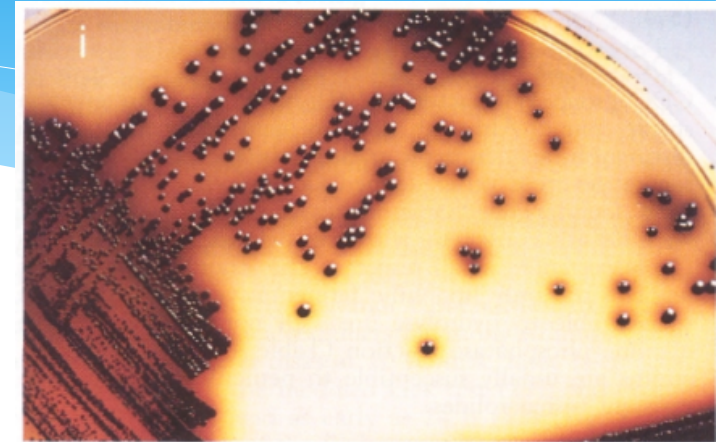
Corynebacterium diphtheriae

* Diagnosis:

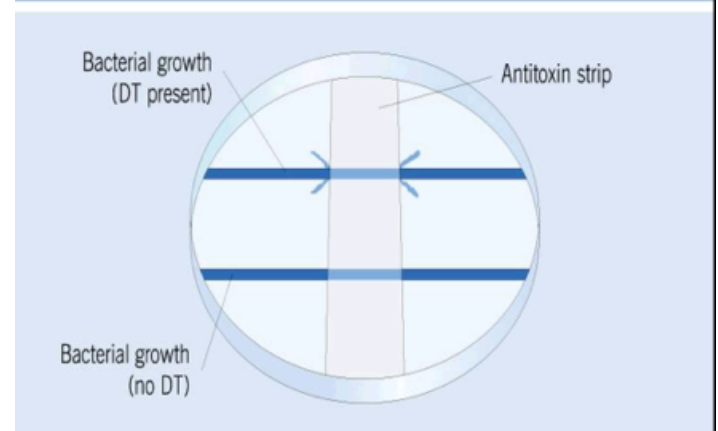
- Throat swab
- Culture on special media containing tellurite (e.g. Tinsdale media)
- ELEK's Test for confirmation of toxin production

➤ Treatment:

- Antitoxin + antibiotic
 - Penicillin or erythromycin

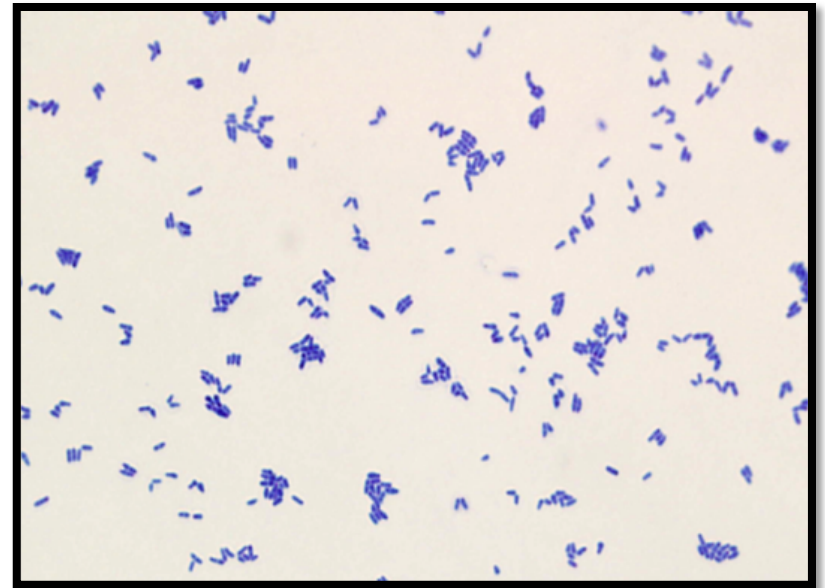


DETECTION OF DIPHTHERIA TOXIN PRODUCTION



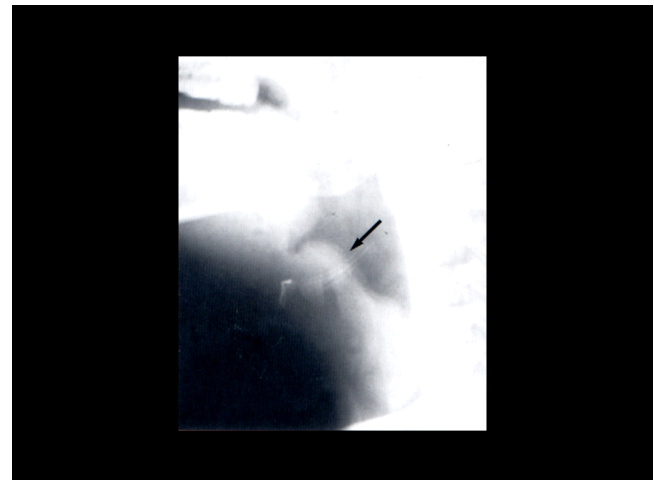
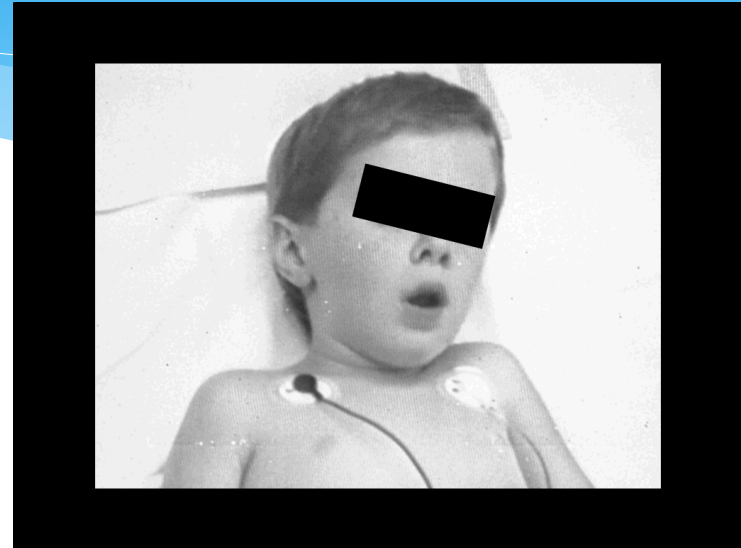
Corynebacterium diphtheriae

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



Epiglottitis

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



Epiglottitis

- * Diagnosis:

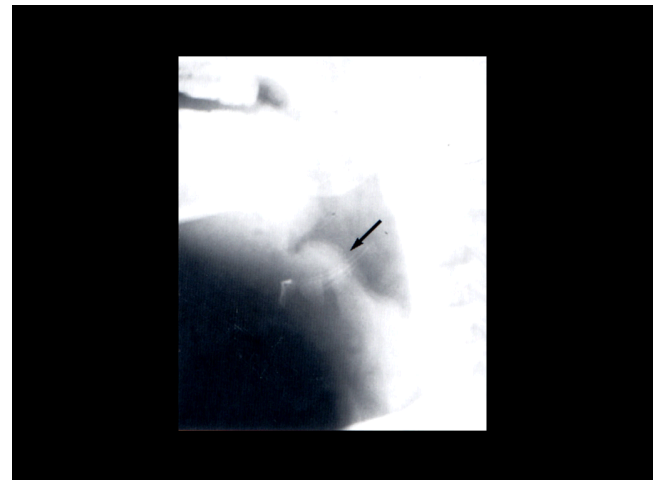
- Blood cultures
- Culture of epiglottic surface (under controlled setting)



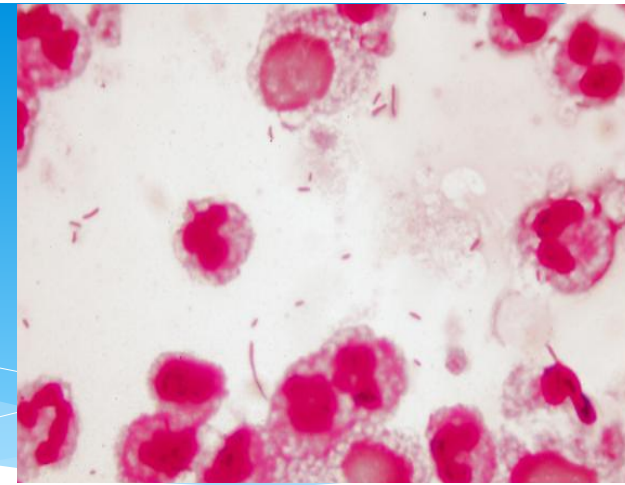
- * Management:

- * Maintenance of airway
- Empiric treatment:
 - Ceftriaxone + Vancomycin

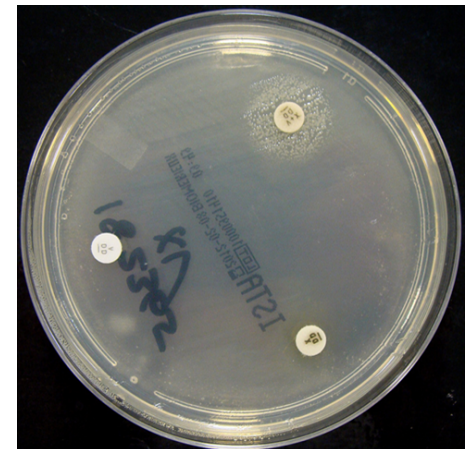
- * Prevention: HiB vaccination



H. influenzae



- * Gram negative pleomorphic, coccoid to rod-shaped cells (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. epiglottitis, meningitis)
 - * Nonencapsulated (nontypable) strains
 - * Causes local infections (e.g. sinusitis, otitis, pneumonia in elderly)
- * Treatment:
 - * Amoxicillin-clavulanate, 2nd or 3rd 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)

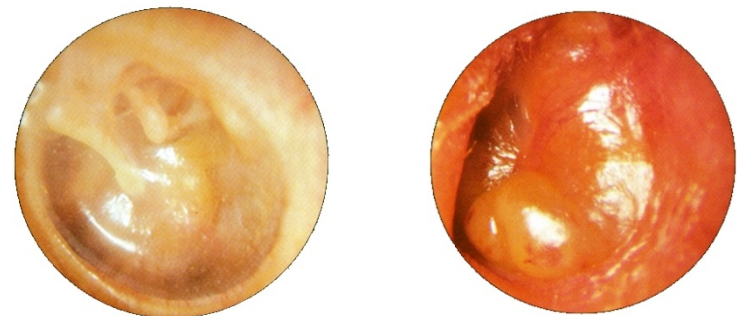
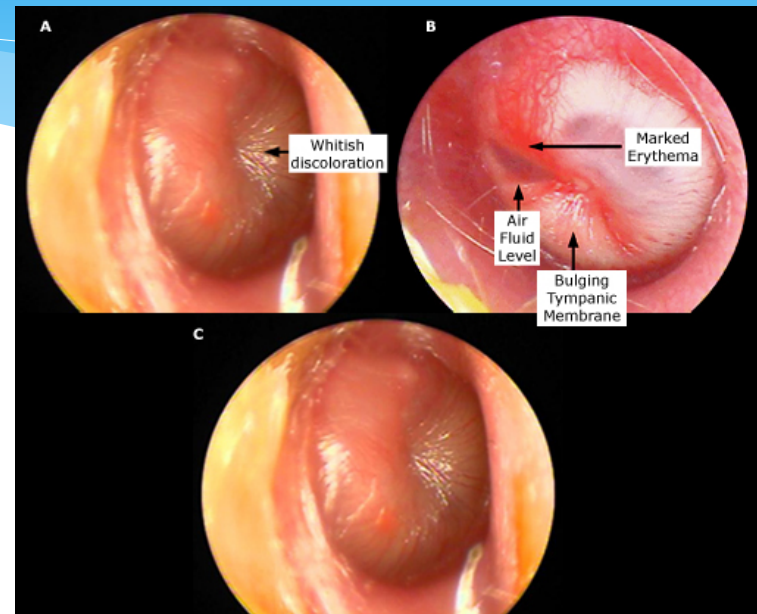
- * Prevention by vaccination

- * 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)

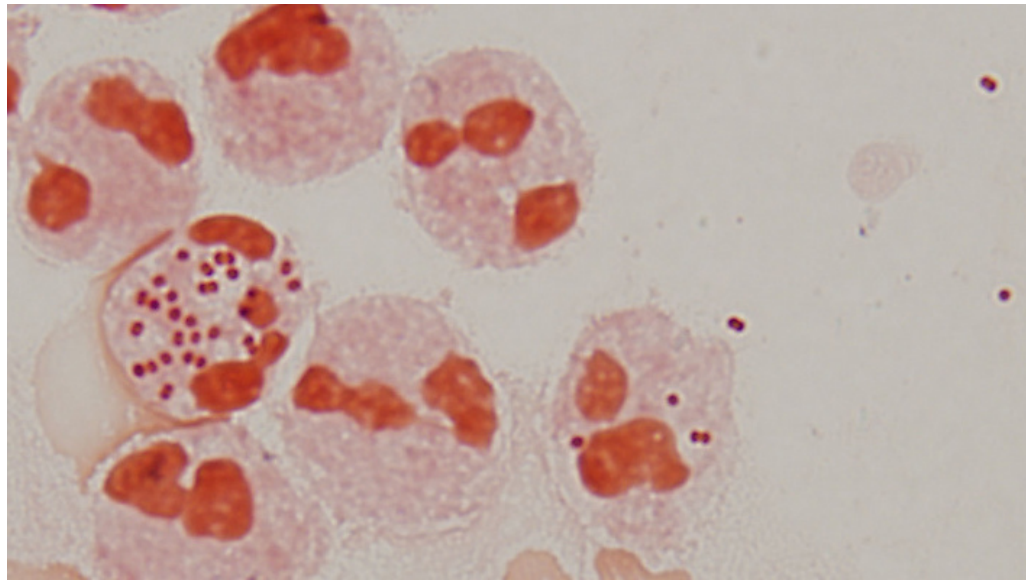


Acute Otitis Media

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

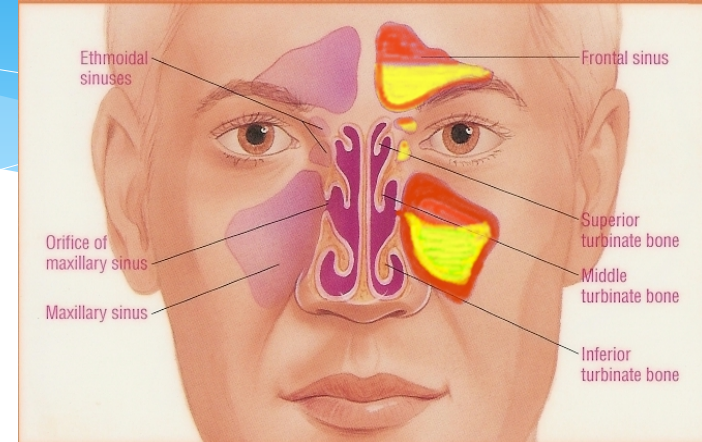
Moraxella catarrhalis

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

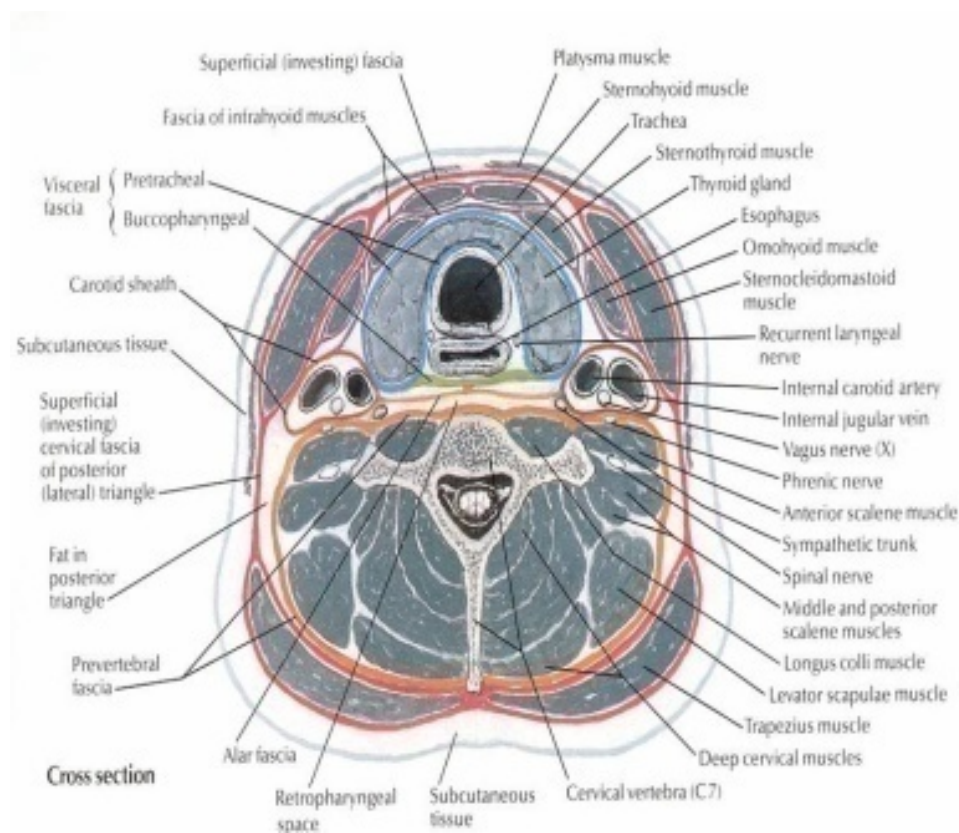
- * Meropenem

- * Piperacillin

- * Clindamycin

- * Duration

- * 2~3 weeks



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