URT Infections
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
Introduction:

Upper respiratory tract infection (URTI)

- Pharyngitis
  - Diphtheria
  - GAS
  - Epiglottis
    - Haemophilus

- Pertussis

- Sinusitis
  - Deep neck space infections
  - Otitis Media
**GRAM POSITIVE COCCI, FACULTATIVE ANAEROBIC, IN CHAINS (CATALASE -VE), BETA HEMOLYTIC.**

**CAUSES:**
- **Respiratory infections:**
  - Pharyngitis. (Streptococcus pyogenes).
  - Otitis.
  - Sinusitis.
- **Other infections:**
  - Skin and soft tissue.

**VIRULENCE FACTORS:**
- Capsule. work as Antiphagocytic for the bacteria.
- M protein in cell wall. work as Antiphagocytic for the bacteria.
- Streptolysin O. toxin that capable of lysing erythrocytes, leukocytes, and platelets.
- Streptolysin S. toxin that capable of lysing erythrocytes, leukocytes, and platelets.
- Streptococcal pyrogenic exotoxins (SPE). Superantigen toxin.

**GAS (GROUP A STREPTOCOCCUS)**

**MORAXELLA CATARRHALIS**

**GRAM NEGATIVE DIPLOCOCCCI, CATALASE POSITIVE, AND OXIDASE POSITIVE.**

**INFECTIONS:**
- Otitis.
- Sinusitis.
- Pneumonia.

**TREATMENT:**
- Amoxicillin-Clavulanic acid
**Haemophilus influenzae** (divided into 2 types)

<table>
<thead>
<tr>
<th>Gram negative pleomorphic, coccoid to rod-shaped cells (coccobacilli). (facultatively anaerobic)</th>
<th>Oxidase and catalase positive.</th>
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</thead>
<tbody>
<tr>
<td>Requires X (heme) and V (NAD) factors for growth (need chocolate agar to grow which is heated blood and contains the nutrients needed for its growth).</td>
<td>There are two types of strains: encapsulated (typable) and non-encapsulated (nontypable).</td>
</tr>
<tr>
<td>Used to confirm ID.</td>
<td><strong>treatment:</strong></td>
</tr>
<tr>
<td>Amoxicillin-clavulanate</td>
<td>2nd or 3rd generation cephalosporin</td>
</tr>
</tbody>
</table>

**1-Encapsulated (typable) strains**

- Encapsulated (main virulence factor)
- A to F (A,B,C,D,E,F)
- Most important is type b (has a special capsule)
- Prevention through vaccination
- Causes invasive disease (e.g. epiglottis, meningitis)
- More severe.

**2-Nonencapsulated (nontypable) strains**

- Non-Encapsulated
- Causes *local infections*:
  1. sinusitis
  2. otitis
  3. pneumonia in elderly
Pharyngitis:

- Sore throat.
- Very common in Late fall, winter, early spring.
- Mainly affects children from 5 to 15 years old.

**Etiology**

- Viruses (i.e. respiratory viruses) are the most common cause.
- Bacterial causes include:
  - **Group A streptococcus** (streptococcus pyogenes)
  - **Corynebacterium diphtheriae** (rare)
  - **Fusobacterium necrophorum** (Anaerobic bacteria, cause of Lemierre’s syndrome)
  - **Neisseria gonorrhoeae**

**Signs and symptoms**

**Sore Throat**
Pharyngeal erythema, edema, Fever.

The 3 C’s:
1- Coryza (pathology) Inflammation of the mucous membranes lining the nasal cavity, usually causing a running nose, nasal congestion and loss of smell.
2- Cough
3- Conjunctivitis

The 4 E’s:
1- Exudate of tonsils.
2- Enlarged, tender of lymph nodes > 1 cm.
3- Edema
4- Erythema & Fever 38.4 to 39.4º C.
**GAS Pharyngitis:**

**Diagnosis:**
- Throat swab:
  - Rapid Bacterial antigen detection. Imp in ER.
  - Culture on blood agar.
- **Antistreptolysin O.**

**Treatment:**
- **Drug of choice:** *Penicillin* x 10 days
- In case of Allergy to penicillin, we use: *Clindamycin* or macrolide (e.g. *Clarithromycin*). Clarithromycin is a new type which has fewer side effects, better penetration, & longer half-life.

**Complications:**

<table>
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<th>Suppurative (Formation of pus):</th>
<th>Non-suppurative:</th>
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</table>

**Occurs 1-6 weeks after acute S. pyogenes infection.**

**Rheumatic fever:**

**When it happens?** after respiratory tract infection.
**what does it do to the body?** mainly cause inflammation of heart (pancarditis) and inflammation of joints, blood vessels, and subcutaneous tissue.
**How it happens?**
results from cross reactivity of anti-M protein Ab and the human heart tissue.

**Acute Glomerulonephritis:**

**When it happens?** after infection of the skin or respiratory tract.
**What are the Symptoms?**
- Edema, hypertension, hematuria, and proteinuria.
**Why it happens?**
Initiated by Ag-Ab complexes on the glomerular basement membrane.

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**Diphtheria:**

**Etiology:**
- Pharyngitis caused by a gram +ve bacilli, *Aerobic, non-spore forming.* *(Corynebacterium diphtheriae).*
- Found most in **Non-developing** countries.
- Mainly presents as URTI.
- one of its characteristic is formation of **pseudomembranes** in the throat.
- **Virulence:**
  - **Diphtheria toxin:**
    - It’s a toxin produced by C. diphtheriae, which inhibit the protein synthesis of the cell and cause cell death, targets: heart/ nerves/epithelium.

**Diagnosis:**
- Throat swab.
- Culture on special media containing tellurite (e.g. *Tinsdale* media).
- **ELEK’s Test for confirmation of toxin production.** A test strip of filter paper containing diphtheria antitoxin is placed in the center of the agar plate. Strains to be tested (patient’s isolate), known positive and negative toxigenic strains are also streaked on the agar’s surface in a line across the plate and at a right angle to the antitoxin paper strip.

**Complications:**
- **Myocarditis** also known as inflammatory cardiomyopathy, is inflammation of the heart muscle.
- **Neuritis** it is inflammation of a nerve or the general inflammation of the peripheral nervous system. Symptoms depend on the nerves involved.

**Treatment:**
- **Antitoxin + antibiotic** *Penicillin or erythromycin* if the child is allergic to penicillin.

**Prevention:**
- Vaccination with diphtheria toxoid.
Epiglottitis:

<table>
<thead>
<tr>
<th>Epiglottitis</th>
<th>Etiology</th>
<th>Diagnosis</th>
<th>Management</th>
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</thead>
<tbody>
<tr>
<td>● Usually young unimmunized children. (life threatening condition as it affects breathing)</td>
<td>● <strong>H. influenzae Type b.</strong>&lt;br&gt;● S. pneumoniae.&lt;br&gt;● S. aureus.&lt;br&gt;● Beta hemolytic streptococci.</td>
<td>● Blood cultures&lt;br&gt;● Culture of epiglottic surface (under controlled setting)&lt;br&gt;● You can't take swab, because the patient can't breath.</td>
<td>● Maintenance of airway.&lt;br&gt;● Empiric treatment: <strong>Ceftriaxone + Vancomycin</strong>&lt;br&gt;● Prevention: <strong>HiB vaccination</strong></td>
</tr>
</tbody>
</table>

- The 3 D's:
  1. Dysphagia.
  2. Drooling.
  3. Respiratory distress.

- Blood cultures
- Culture of epiglottic surface (under controlled setting)
  - You can't take swab, because the patient can't breath.
Pertussis (Whooping cough):

- **Etiology**: Bordetella pertussis (GNB).

- **Virulence**: Pertussis toxin, Filamentous hemagglutinin, Pertactin.

- **Diagnosis**:
  - Sample: Nasopharyngeal (NP) swabs.
  - Special media needed:
    - Charcoal blood (Regan-Lowe)
    - Bordet-Gengou

- **Treatment**:
  - Treated by: Macrolide (erythromycin)
  - (Antibiotics that inhibit protein synthesis).

- **Prevention**:
  - Acellular pertussis-containing vaccine.

- **Epidemiology & Phases**:
  - mainly in infants and children (most severe & deadly).
  - adults can get infected also.
  - associated with vomiting.

The course of the disease:

1. Incubation period (1 to 3 weeks), (No symptoms).
2. Catarrhal Stage (1 to 2 weeks), (mild occasional cough and runny nose).
3. Paroxysmal Stage (2 to 4 weeks), (severe & rapid cough, vomiting and dangerous).
4. Convalescent Stage (1 to 2 weeks), (Gradual recovery, The cough being to calm).
<table>
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<tr>
<th><strong>Acute Otitis Media</strong></th>
<th><strong>Acute Bacterial Sinusitis</strong></th>
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<td>Fluid + inflammation of the mucosal lining of the middle ear.</td>
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### Epidemiology

- More common in children.

### Clinical features

- **Acute Otitis Media**
  - Fever
  - Tympanic membrane (TM) will look erythematous (red)

- **Acute Bacterial Sinusitis**
  - Occurs with viral URTI.
  - Nasal discharge
  - Sinus pain, and low grade fever.

### Etiology

- **Acute Otitis Media**
  - Streptococcus pneumoniae
  - H. influenzae (non typable)
  - Moraxella catarrhalis
  - Group A streptococcus, Staph aureus, and Anaerobic bacteria also can cause both of otitis & sinusitis.
  - Viral (alone or with bacteria) → (E.g. RVS, Rhinovirus).

- **Acute Bacterial Sinusitis**
  - Can be acute or chronic.
  - Complication:
    1. Periorbital cellulitis.
    2. Brain abscess & meningitis.

### Diagnosis

- **Acute Otitis Media**
  - Mainly clinical diagnosis.
  - Tympanocentesis sometimes needed; middle ear fluid can be sent for culture.

- **Acute Bacterial Sinusitis**
  - Mainly clinical diagnosis.
  - Imaging (CT/MRI) when there is suspension of complications.

### Treatment

- **Acute Otitis Media**
  - Amoxicillin or Amoxicillin Clavulanic acid

- **Acute Bacterial Sinusitis**
  - Amoxicillin Clavulanic acid for 1 to 2 weeks
### Deep neck space infections: for your own knowledge

<table>
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<th>Deep neck space infections</th>
<th>Etiology</th>
<th>Management</th>
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<tr>
<td>● Lateral pharyngeal, retropharyngeal or prevertebral space. &lt;br&gt;● Patients are very sick and toxic &lt;br&gt;● Neck stiffness can occur with retropharyngeal space infection/abscess &lt;br&gt;● Retropharyngeal (danger space) infection may extend to mediastinum and present as mediastinitis</td>
<td>● Usually polymicrobial &lt;br&gt;● Mainly streptococci and oral anaerobes</td>
<td>● Surgery &lt;br&gt;● <strong>Antibiotics:</strong> &lt;br&gt;1. Meropenem &lt;br&gt;2. Piperacillin &lt;br&gt;3. Clindamycin &lt;br&gt;● <strong>Duration:</strong> &lt;br&gt;➢ 2-3 weeks</td>
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<tr>
<td>Infection</td>
<td>Etiology</td>
<td>Diagnosis</td>
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<td>GAS Pharyngitis</td>
<td>Group A streptococcus (streptococcus pyogenes)</td>
<td>Throat swab</td>
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<td>Rapid Bacterial antigen detection</td>
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<td>Diphtheria</td>
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<td>Acute Otitis Media</td>
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<td><strong>Tympanocentesis</strong> sometimes needed</td>
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<td>M. catarrhalis</td>
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<td>Anaerobes</td>
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<td>Viral</td>
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</table>
1) An 8-year-old boy has been listless and irritable for a week. The mother says he had a sore throat 3 weeks ago but did not see a physician because the family lacks health care coverage and “it wasn’t that bad.” Examination reveals arthritis in two joints and a heart murmur. His antistreptolysin O (ASO) titer is elevated. His cardiac findings are most likely due to antibody stimulated by:

| A. Pyrogenic exotoxin | B. M protein | C. Streptolysin O | D. Lipoteichoic acid |

2) A 5-year-old girl has a sore throat. She is febrile and has a scant exudate on one tonsillar pillar. The most sensitive way to detect whether this infection is due to group A streptococci is:

| A. Streptococcal M protein antigen detection | B. Gram stain | C. ASO titer | D. Throat culture |

3) With otitis media. If a patient is particularly unwell what antibiotic is the first line therapy?

| A. amoxicillin | B. benzylpenicillin | C. benzylpenicillin | D. Macrolides |

1) A 17 year-old student has an upper respiratory infection with nasal discharge and quite severe pain over her maxillary sinuses. It started five days ago and does not seem to be improving. Her temperature is 39.1°C, She has no allergies. What is the most likely diagnosis? Which antibiotics would you prescribe?

\[ \text{bacterial sinusitis} \]
\[ \text{Amoxicillin} \]

2) 6 month old was seen in the ER, with severe cough started by runny nose, then cough that got worse and after a week the baby still coughing, then lead to vomiting. What is the most likely diagnosis and organism?

\[ \text{Pertussis, Bordetella pertussis} \]
**Team Leaders**

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<td>Boys</td>
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<td>Faisal Alkoblan</td>
<td>Noura Almazrou</td>
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<td>Rema Almutawa</td>
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<td>Mohammed Alshoieer</td>
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<td>Abdullah Allothman</td>
<td>Ghada Alsadhan</td>
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<td>Girls</td>
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<td>Groundbreaking</td>
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<td>Abdullah Alassaf</td>
<td>Elaf Almusahel</td>
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<td>Microbiology</td>
<td>Lina Alosaimi</td>
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<td>Team</td>
<td>Ghada Alsadhan</td>
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<td>Leaders</td>
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<td>Badr AlQarni</td>
<td>Amerah Alzahrani</td>
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<td>Team Sub-Leader</td>
<td>Rawan Alzayed</td>
</tr>
<tr>
<td>Abdullah Alassaf</td>
<td>Sarah Alkhalife</td>
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