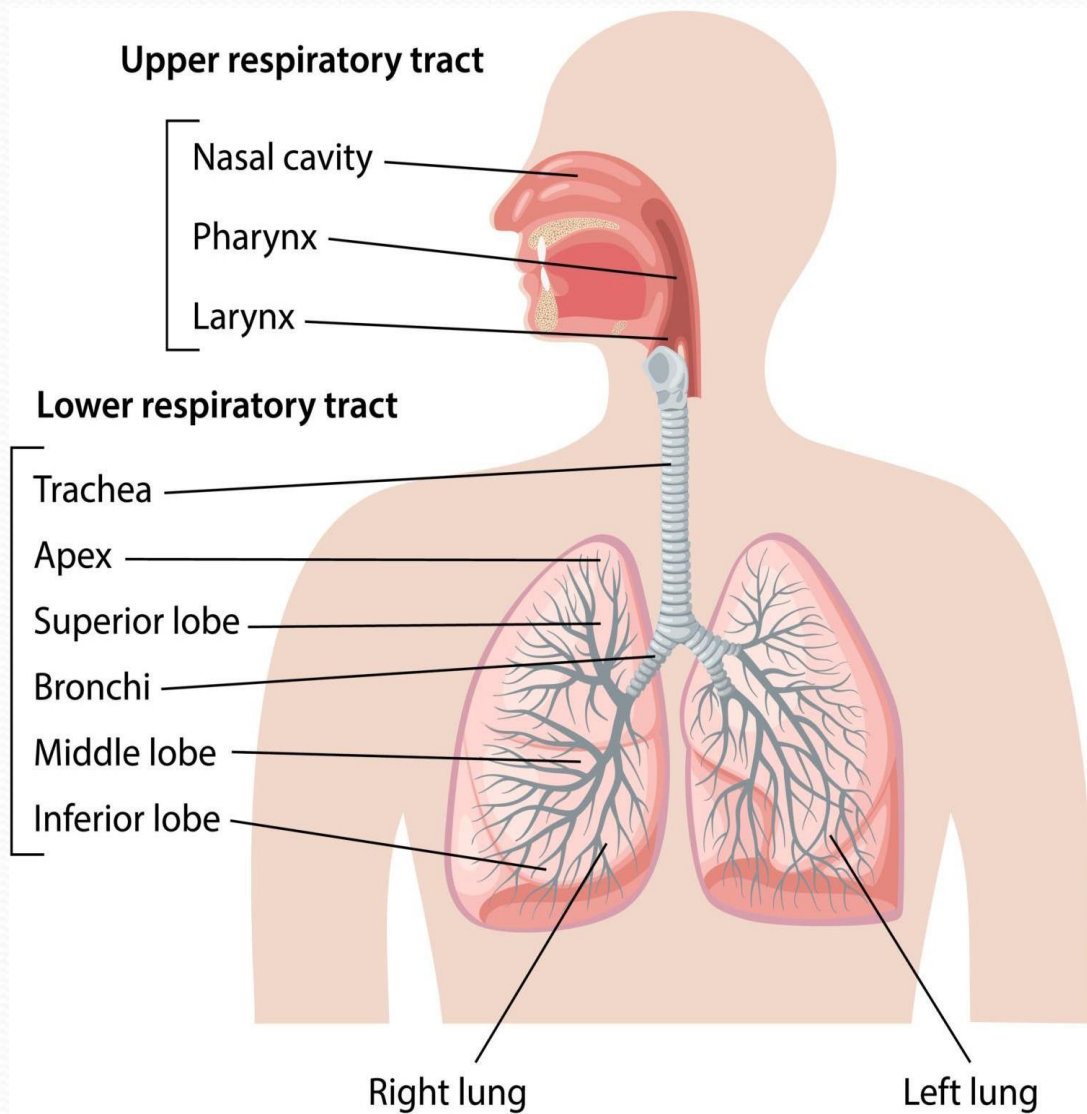


# Bacterial Infections of the Respiratory Tract

# Bacterial Respiratory tract infections



## Sinusitis

Streptococcus pneumoniae  
Haemophilus influenzae

## Upper respiratory tract infections

Streptococcus pyogenes  
Haemophilus influenzae

## Tracheitis

Staphylococcus aureus

## Bronchitis

Mycoplasma pneumoniae  
Streptococcus pneumoniae  
Haemophilus influenzae  
Mycoplasma catarrhalis

## Pneumonia

Streptococcus pneumoniae  
Haemophilus influenzae  
Staphylococcus aureus

## Atypical Pneumonia

Mycoplasma pneumoniae  
Chlamydia pneumoniae  
Legionella pneumonia

## Tuberculosis

Mycobacterium tuberculosis

# URTI

- Illnesses caused by an acute infection which involves the upper respiratory tract including the nose, sinuses, pharynx or larynx.
- This commonly includes common cold, tonsillitis, pharyngitis, laryngitis, sinusitis and otitis media

# Pharyngitis

- Inflammatory Syndrome of the pharynx caused by several microorganisms
- Mostly viral
- The most bacterial cause is Group A Streptococcus (*Streptococcus pyogenes*)-  
5-20%

# Viral pharyngitis

- **90% of pharangitis**
- Sore throat, pain with swallowing, red throat
- Runny nose, congestion, headache ,fever
- Viruses
  - Respiratory viruses: Rhinoviruses, Coronaviruses, **Adenoviruses\*** (conjunctivitis)
  - Influenza and **parapinflunza Viruses\***
  - Herpesviruses: Epstein-Barr Virus (EBV), Herpes Simplex Virus (HSV)
  - Enteroviruses
    - **Coxsackie virus (hand foot mouth diseases)**
  - **Cytomegalovirus (CMV)**
  - **RSV**

# Streptococcal Infections

- Streptococcal pharyngitis (strep throat) is caused by *Streptococcus pyogenes*
- *S. pyogenes* is the sole member of the Lancefield group A streptococci and is often referred to as GAS, or **group A strep**

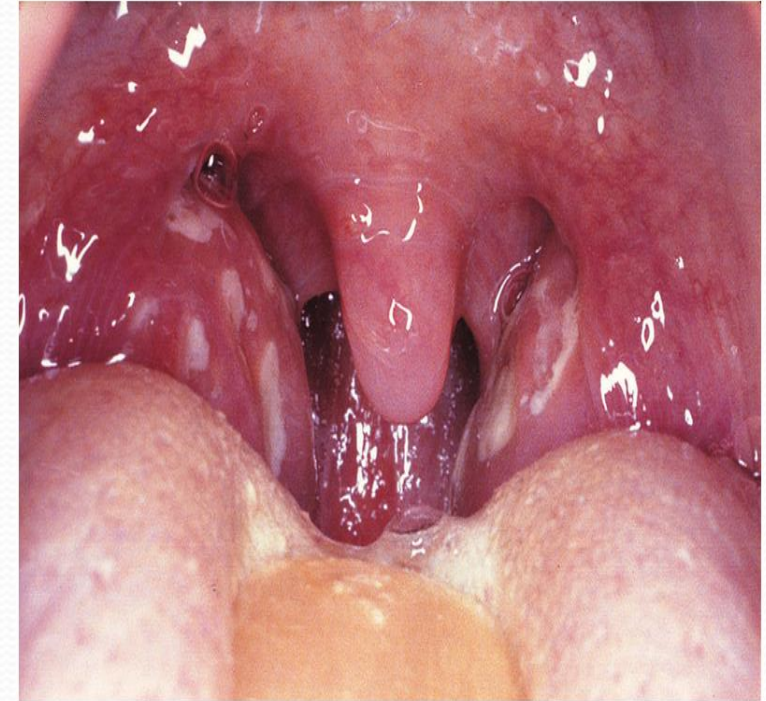
## Group A $\beta$ -hemolytic streptococci

- Include only *S. pyogenes*
- Group A streptococcal infections affect all ages peak incidence at 5-15 years of age
- 90% of cases of bacterial **pharyngitis (Strep throat)**
- Direct contact or droplet transmission
  - coughing and sneezing
- Infection can lead to severe complications including **rheumatic fever and glomerulonephritis**

The classic signs of streptococcal pharyngitis are:

- Fever higher than 38 °C (100.4 °F);
  - Intense pharyngeal pain;
  - Erythema associated with pharyngeal inflammation;
  - Swollen, dark-red palatine tonsils, often dotted with patches of pus;
  - Petechiae (microcapillary hemorrhages) on the soft or hard palate (roof of the mouth)
  - Cervical tender LN
- 
- **Usually no runny nose, no cough, no conjunctivitis**

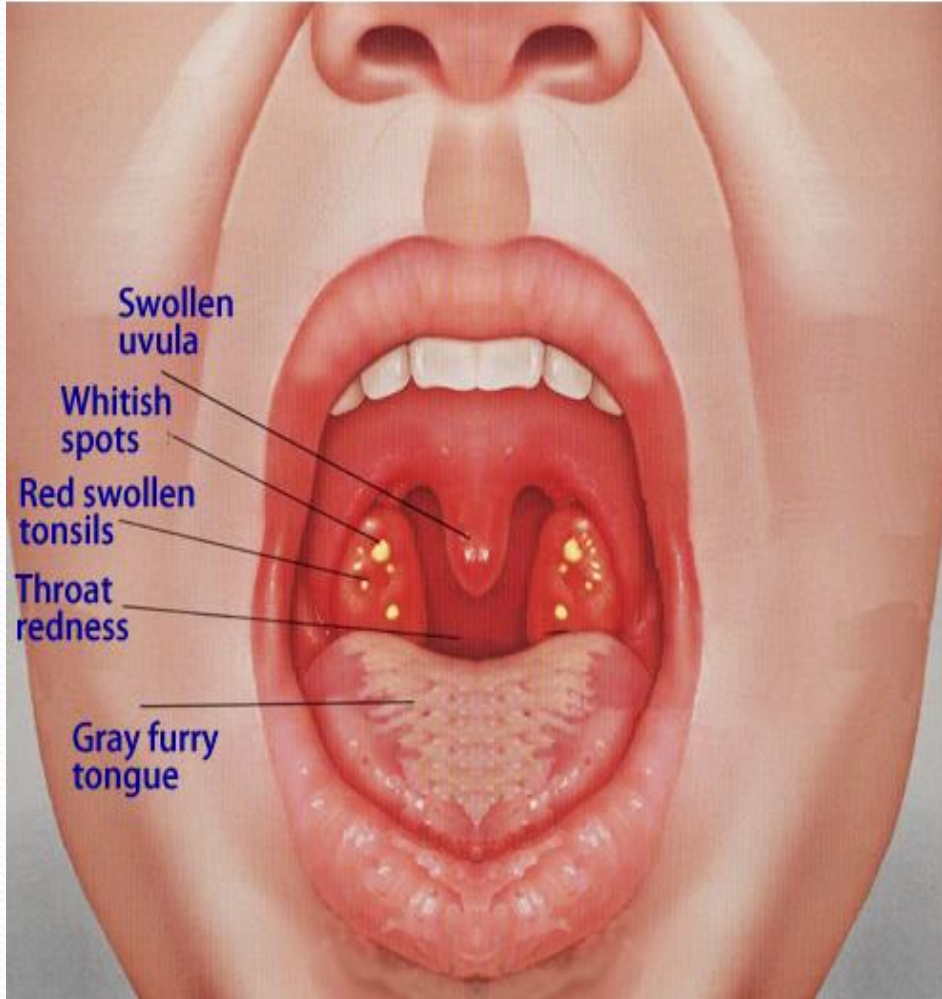
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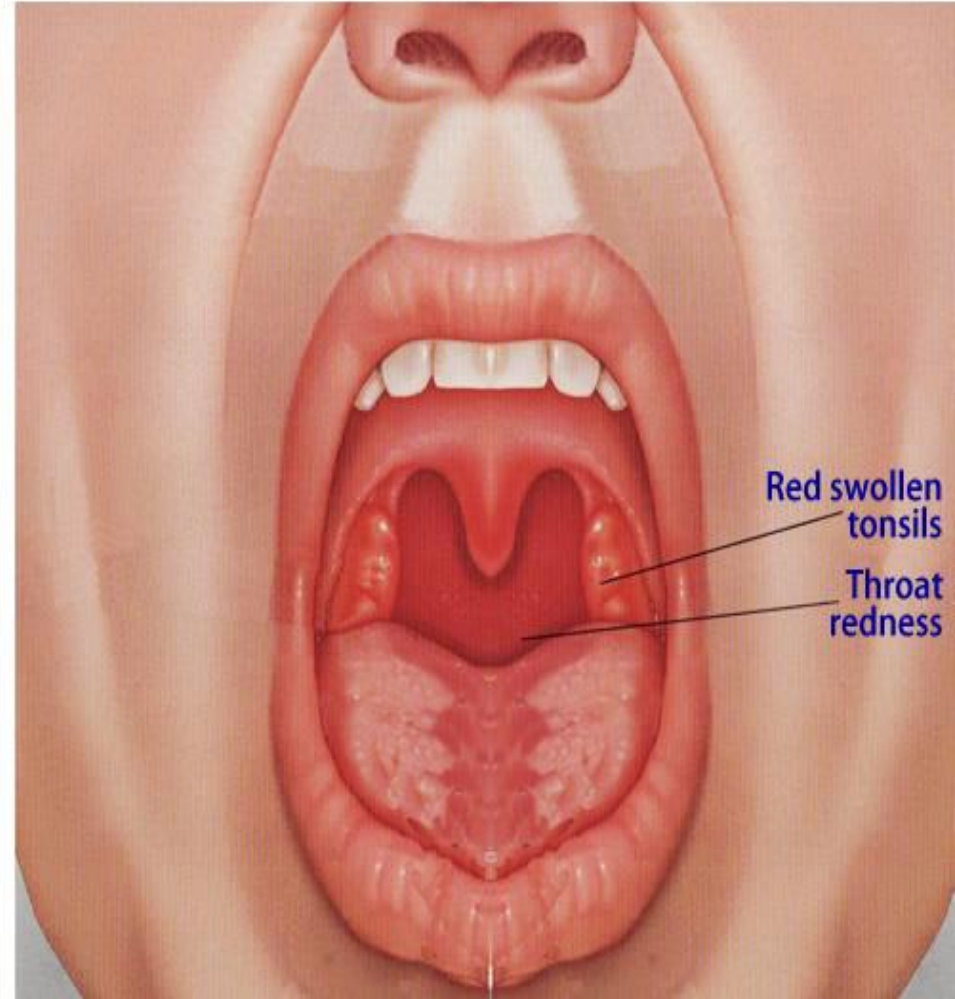
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# Bacterial



# Viral



# Scarlet fever (or scarlatina)

- Some strains of group A streptococci produce **erythrogenic toxin**.
- The toxin attacks the plasma membranes of **capillary** endothelial cells and leads to **scarlet fever** (or scarlatina)
  - Disseminated fine red rash on the skin, and strawberry tongue ( a red rash on the tongue )

## Characteristics of rash:

- begins on the chest and stomach
- Appears 12-48 hours after the fever



# Pharyngitis Diagnosis

## Clinical Presentation

- Determine if Group A Streptococcus is present by throat swab onto blood agar
- Antigen Kit may also be used
- Important to determine if present as treatment reduces risk of acute rheumatic fever and will reduce duration of symptoms



## Centor Score (Modified/McIsaac) for Strep Pharyngitis

**Table 2. Clinical Scoring System and Likelihood of Positive Throat Culture for Group A Streptococcal Pharyngitis.\***

Criteria	Points†
Fever (temperature >38°C)	1
Absence of cough	1
Swollen, tender anterior cervical nodes	1
Tonsillar swelling or exudate	1
Age	
3 to <15 yr	1
15 to <45 yr	0
≥45 yr	-1

## Step 2. Suggested management strategy based on total sore throat score:

Total score	Likelihood of GAS infection (%)*	Suggested management
-1 or 0	2-3	No culture or antibiotic required
1	4-6	No culture or antibiotic required
2	10-12	Culture all; treat patients with positive result
3	27-28	Culture all; treat patients with positive result
4 or 5	38-63	Treat (penicillin or erythromycin)

2-3:

RADT

Positive: treat

Negative with high suspicious: culture to confirm

Interpretation of Scores:

- 0-1: Symptomatic treatment, no testing needed
- 2-3: RADT or throat culture.

Positive: treat

Negative with high suspicious: culture to confirm

- 4-5: empiric antibiotics

# Diagnosis

- Culture identification is still the gold standard to confirm pharyngitis due to *S. pyogenes*.
  - catalase-negative, beta hemolytic bacterium that is susceptible of bacitracin.

# Sequelae of *S. pyogenes* Infections

- 1%–3% of untreated *S. pyogenes* infections can be followed by nonsuppurative (without the production of pus) sequelae that develop 1–3 weeks after the acute infection has resolved.
  - Acute rheumatic fever and acute glomerulonephritis.

# Acute rheumatic fever

- Can follow pharyngitis caused by specific rheumatogenic strains of *S. pyogenes* (strains 1, 3, 5, 6, and 18).
- Molecular mimicry between the **M protein** of rheumatogenic strains of *S. pyogenes* and heart tissue is thought to initiate the autoimmune attack damage to and inflammation of the heart (carditis).



# Acute glomerulonephritis

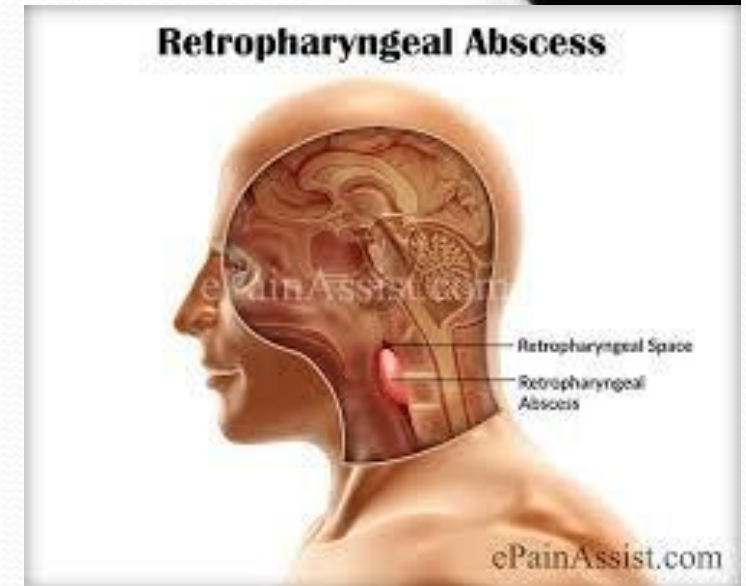
- Results from an immune response to streptococcal antigens following **pharyngitis** and **cutaneous infections**
  - 6–10 days after pharyngitis, but can take up to 21 days after a cutaneous infection
  - Dark urine, hypertension, periorbital edema
- The primary mechanism of acute glomerulonephritis appears to be the formation of **immune complexes** between *S. pyogenes* antigens and antibodies, and their deposition between endothelial cells of the glomeruli of kidney.
- Inflammatory response against the immune complexes leads to damage and inflammation of the glomeruli (glomerulonephritis).

# Treatment of strep throat

- Antibiotic resistance is limited for this bacterium, so most  $\beta$ -lactams **remain effective; oral amoxicillin and intramuscular penicillin G** are those most commonly prescribed.
- One reason strep throat infections are aggressively treated with antibiotics is because they can lead to serious sequelae, later clinical consequences of a primary infection.

# Retropharyngeal abscess

- It is collection of pus
- Rare but potentially life-threatening infections
- Painful neck
- Decrease range of movement of neck/jaw
- Muffled hot potato voice
- Foul breath



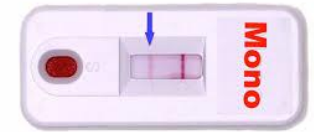
# Peritonsillar abscess (Quinsy)

- It is collection of pus in the peritonsillar space
- Tonsillar Abscess with pain, fever, difficulty swallowing, foul breath
- Deviated uvula
- Drooling
- Dx: physical finding, CT can confirm the abscess
- Drainage of Abscess and antimicrobial therapy, steroid



# Glandular fever/ Infectious mononucleosis

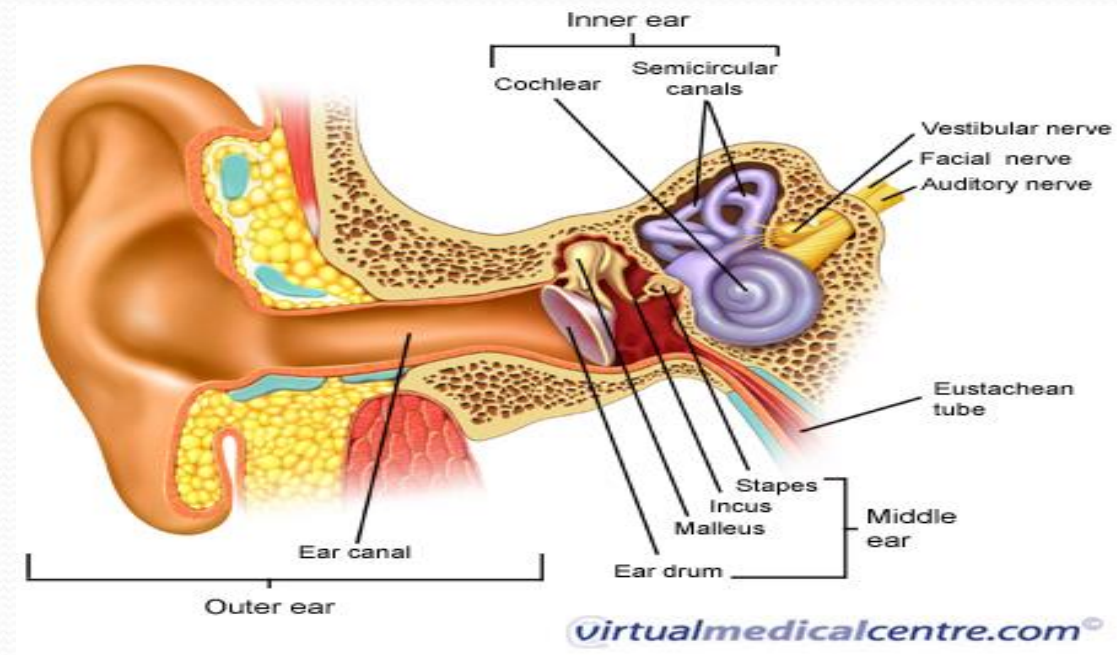
- Mono is often called the kissing disease.
- Symptom and sign of strep throat (with Negative rapid test and culture) and **splenomegaly**
- The virus is spread through **saliva**.
- Diagnosis: positive monospot
- Epstein Barr virus or cytomegalovirus
- Treatment: supportive care and avoid contact sport
- If misdiagnosis and treated with antibiotic: patient develops itchy **maculopapular rash**



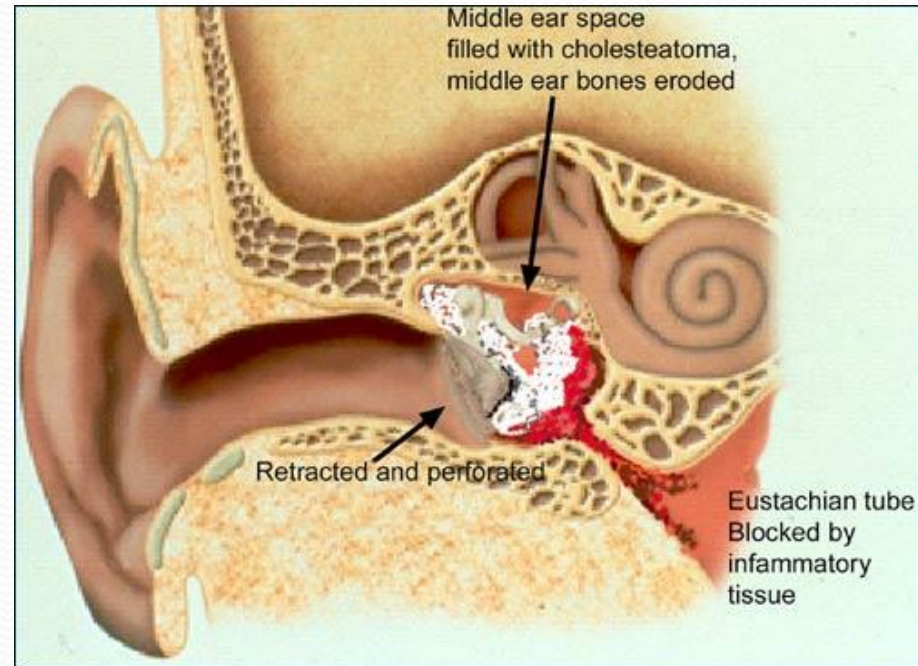


# OTITIS MEDIA

# Ear anatomy



# Otitis media



- Otitis media is defined by the presence of fluid in the middle ear accompanied by signs or symptoms
- Pain, fever, abnormalities of hearing and vertigo

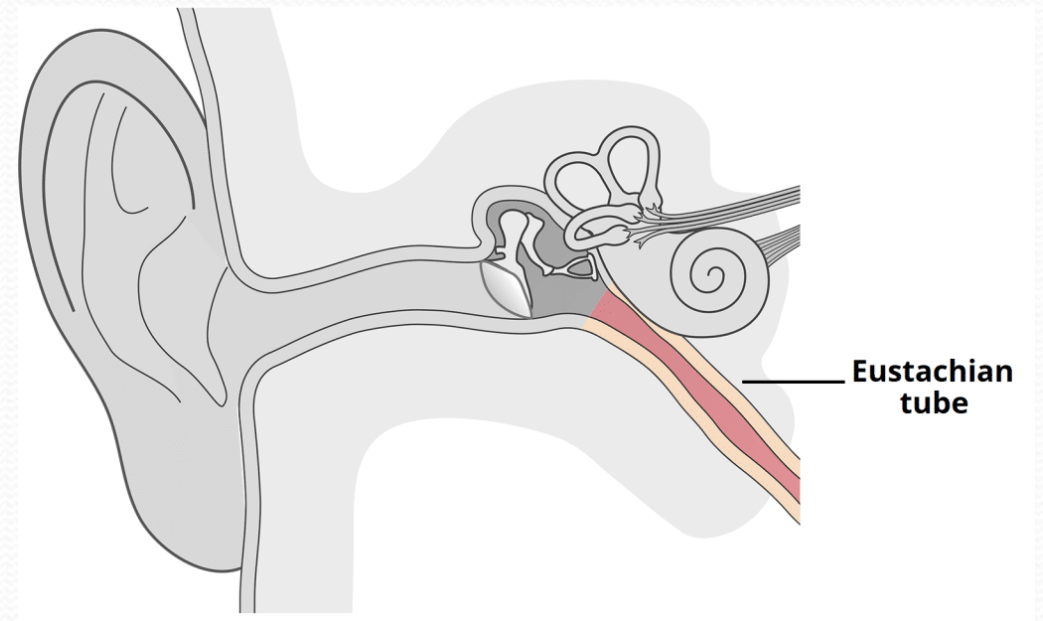


# Otitis media: pathogenesis

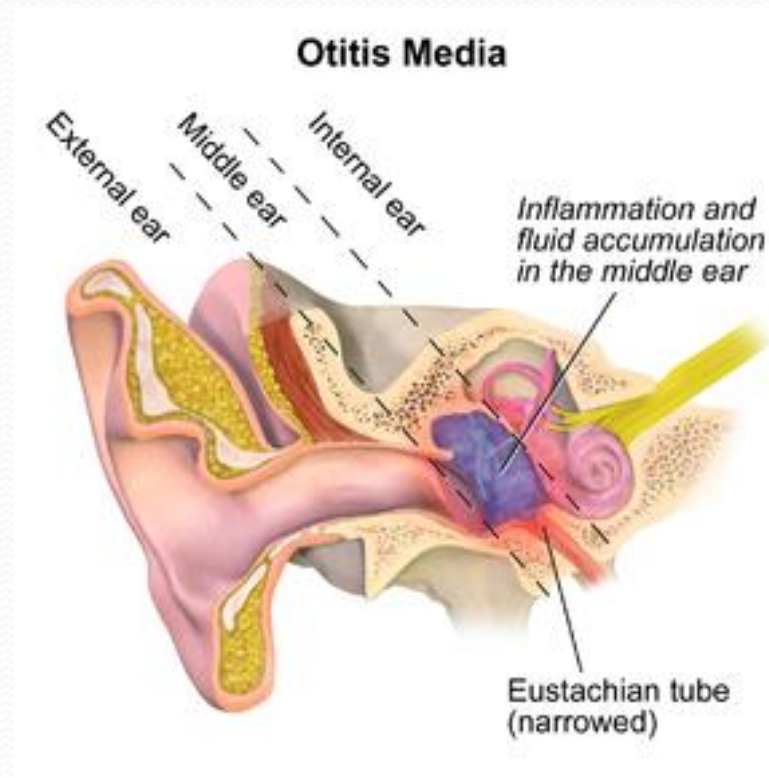
Anatomical or functional dysfunction of the eustachian tube appears to play an important role in the development of otitis media.

**Eustachian tube has three physiologic functions:**

- Drainage of secretions into the nasopharynx
- Ventilation of the middle ear to equilibrate air pressure



- When one or more of these functions are compromised, the result is the development of fluid and infection in the middle ear. Congestion of the mucosa of the eustachian tube may result in obstruction, and if bacterial pathogens are present a **suppurative otitis** can occur



# Otitis media: epidemiology

- Otitis media is a paediatric disease.
- The highest incidence of acute otitis media occurs between 3 months and 3 years of age
- Otitis media is infrequent in adults, but the bacteriology and therapy is similar to those in Children
- **AOM** most common cause of antibiotic prescribing in paediatric population

# The higher incidence in children

- Children have more upper respiratory infections,
- Their eustachian tubes
  - Shorter, more horizontal and narrower eustachian tubes
- Spend more time lying down than adults,
  - Facilitates drainage from the nasopharynx through the eustachian tube and into the middle ear.
- Bottle feeding while lying down
  - the sucking action on the bottle causes negative pressure to build up within the eustachian tube, promoting the movement of fluid and bacteria from the nasopharynx.

# Otitis Media

- Causative Organisms:
  - *Streptococcus pneumoniae*-25-50%
    - Gram-positive, lancet-shaped bacterium
  - *Haemophilus Influenzae*-15-30% (Non type able)
    - Gram-negative, non-motile, coccobacillary, facultatively anaerobic, capnophilic pathogenic bacterium of the family
  - *Moraxella catarrhalis*-3-30%
    - nonmotile, Gram-negative, aerobic, oxidase-positive diplococcus
  - Rhinovirus/RSV/Coronaviruses/Adenoviruses/Enteroviruses 25%

# Otitis Media Clinical Presentation

- Acute otitis media is defined by the presence of fluid in the middle ear accompanied by symptoms and acute illness.
- Specific symptoms
  - Ear pain
  - Ear drainage
    - formation and accumulation of pus in the middle ear. Unable to drain, the pus builds up moderate to severe bulging of the tympanic membrane and otalgia (ear pain).
- Nonspecific symptoms
  - Fever
  - Lethargy
  - Irritability



# Otitis Media Clinical Presentation

## Symptoms:

- Infant excessive crying, pulling ear, rubbing of the ear, as well as uncharacteristic crying or distress in response to the pain
- Toddler: irritability , earache
- Both may have otorrhoea
- May also be additional upper respiratory symptoms

- Signs: Fever , Signs of Middle Ear Effusion -Bulging of TM, Erythema of TM Limited mobility, Air-fluid level, otorrhoea





# Antimicrobial treatment

- **Amoxicillin** remains the drug of choice for initial treatment.
- For patients with known and severe allergy to  $\beta$ -lactam antibiotics, a **macrolide** (**erythromycin, azithromycin, or clarithromycin**) is preferred.
- Analgesia
- Signs and symptoms usually resolve with antimicrobial treatment

# Recommendation

- If there is no clinical improvement in 48-72 hours
- Reassess and confirm or exclude diagnosis of AOM
  - If Observation arm: treat
  - If Treatment arm: Change therapy
- Duration of therapy:
- if 2 years or less or severe :10 days ,
- if > 2 years: 5-7 days

# Vaccine

- The pneumococcal conjugate vaccine (PCV<sub>13</sub>)
- Although there is a conjugate vaccine available for the **invasive serotype B of H. influenzae**, this vaccine does not impact the incidence of H. influenzae AOM.
  - Because unencapsulated strains of H. influenzae are involved in AOM

# Otitis media with effusion (OME)

- Otitis Media (Acute Otitis Media - AOM):
  - An infection of the middle ear, typically caused by bacteria or viruses, leading to inflammation and the presence of pus in the middle ear.
- Otitis Media with Effusion (OME)
  - A condition in which fluid (effusion) is present in the middle ear without signs of active infection.
- Any blockage of the eustachian tubes, with or without infection, can cause fluid to become trapped and accumulate in the middle ear.
- The accumulated fluid offers an excellent reservoir for microbial growth and, consequently, secondary bacterial infections