



# Microbiology of middle ear infection (otitis media)

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# Objectives

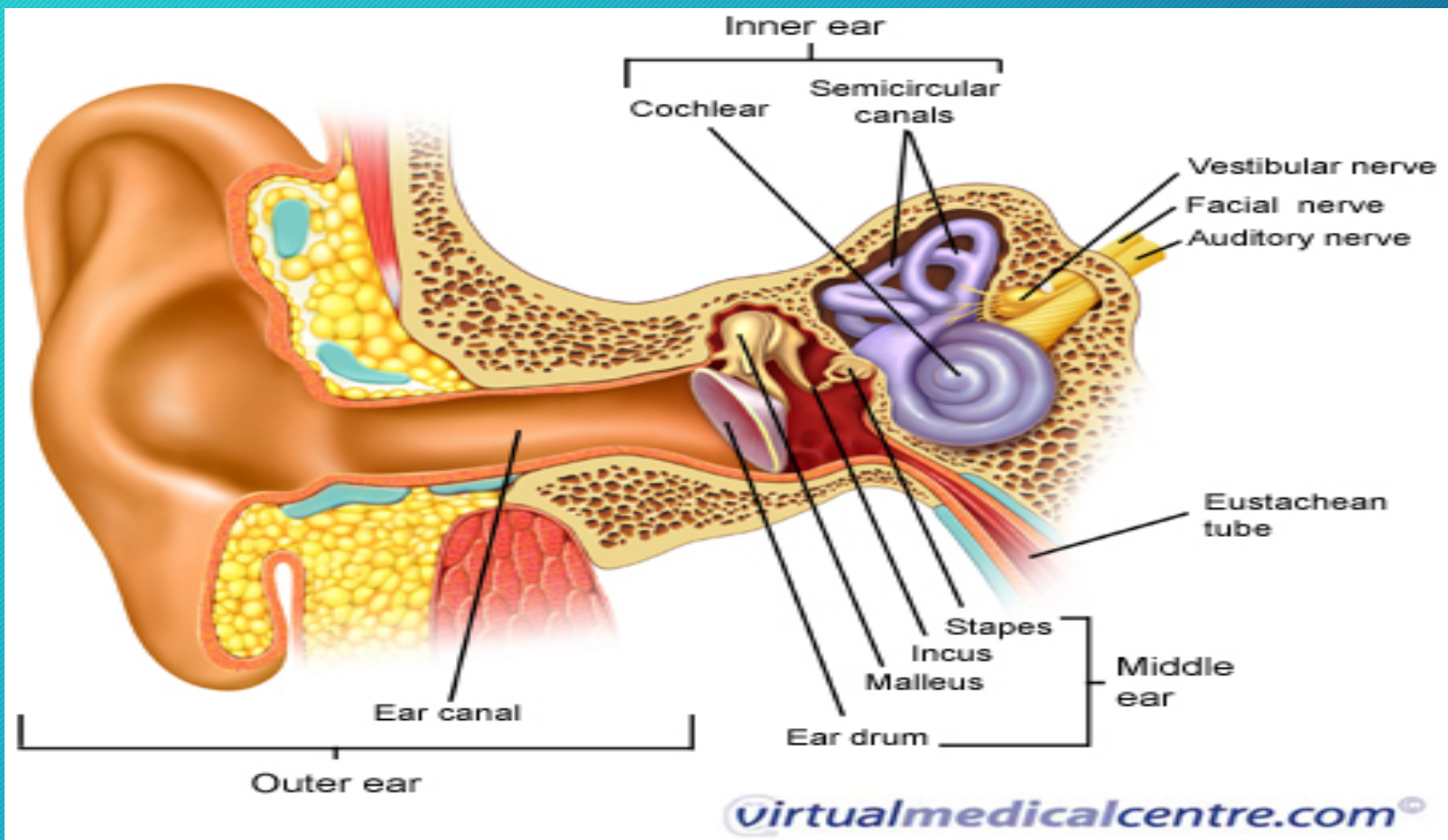
Upon completion of the lecture , students should be able to:

- Define middle ear infection
- Know the classification and etiology of otitis media (OM).
- Know the epidemiology of OM
- Know the pathogenesis & risk factors of OM.
- List the clinical features of OM.
- Know the diagnostic approaches of OM.
- Know the management of OM.
- Recall common complications of OM.

# Definitions

- Middle ear is the area between the tympanic membrane and the inner ear including the Eustachian tube.
- **Otitis media (OM)** is inflammation of the middle ear.

# Anatomy of the Middle Ear



# Classification of OM

- Acute OM
- Secretory ( *Serous*) OM
- Chronic OM



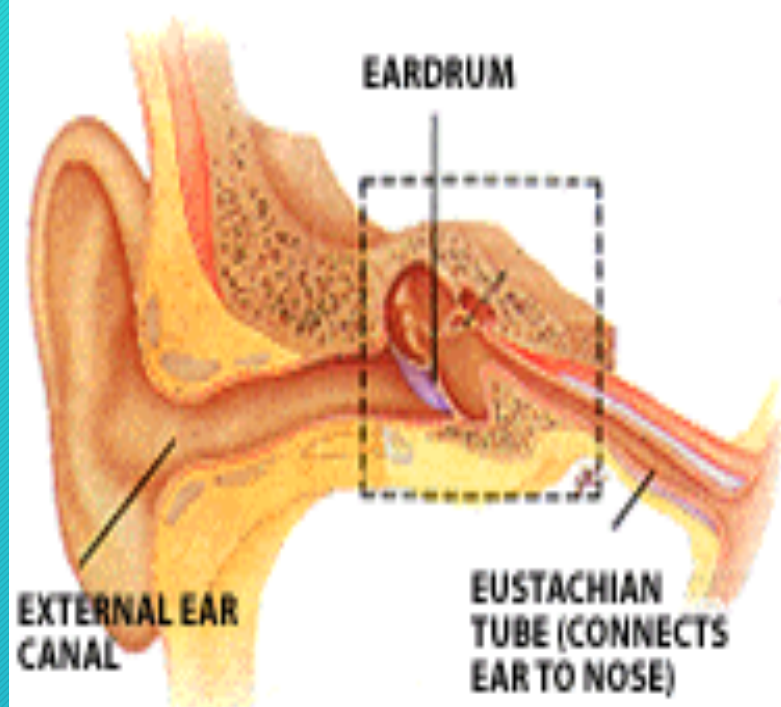
# Epidemiology

- Most common in infants 6 to 18 months of age (2/3 of cases).
- Improves with age, why ?
- The *Eustachian Tube* which vents the middle ear to the Nasopharynx is horizontal in infants, difficult to drain naturally, its surface is cartilage ,and the lymphatic tissue lining is an extension of adenoidal tissue from the back of the nose.
- Often preceded by viral upper respiratory infection .

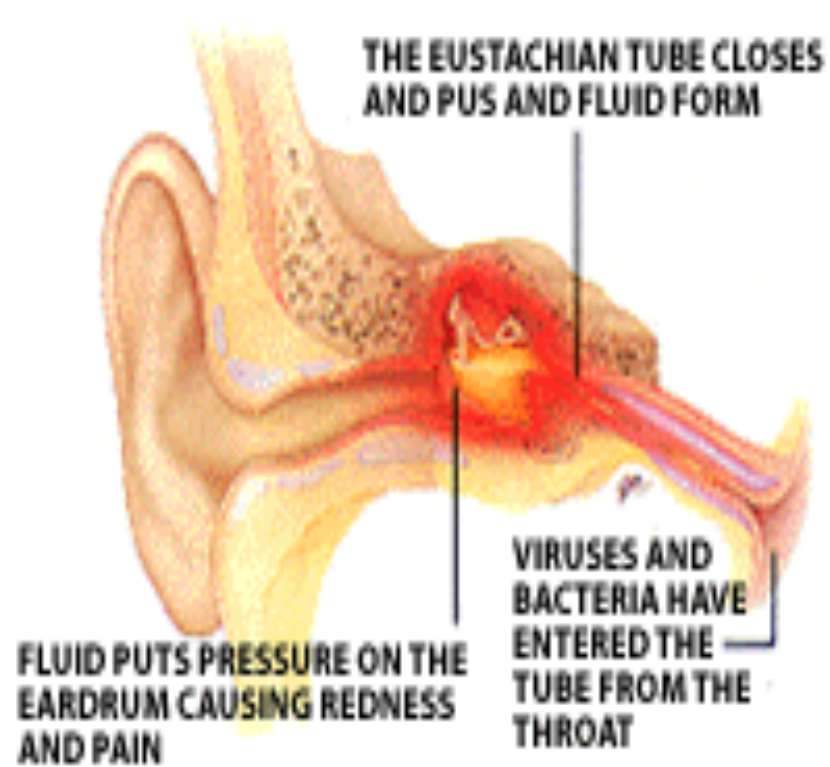
# Pathogenesis and Risk Factors

- Functions of the tube ( ventilation, protection and clearance ) disturbed.
- URTI or allergic condition cause edema or inflammation of the tube.
- Oxygen lost leading to negative pressure
- Pathogens enter from Nasopharynx into the middle ear.
- Colonization and infection result.

## THE NORMAL EAR



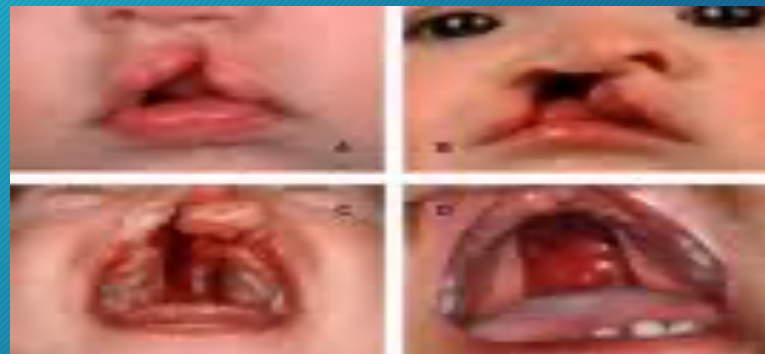
## THE INFECTED MIDDLE EAR

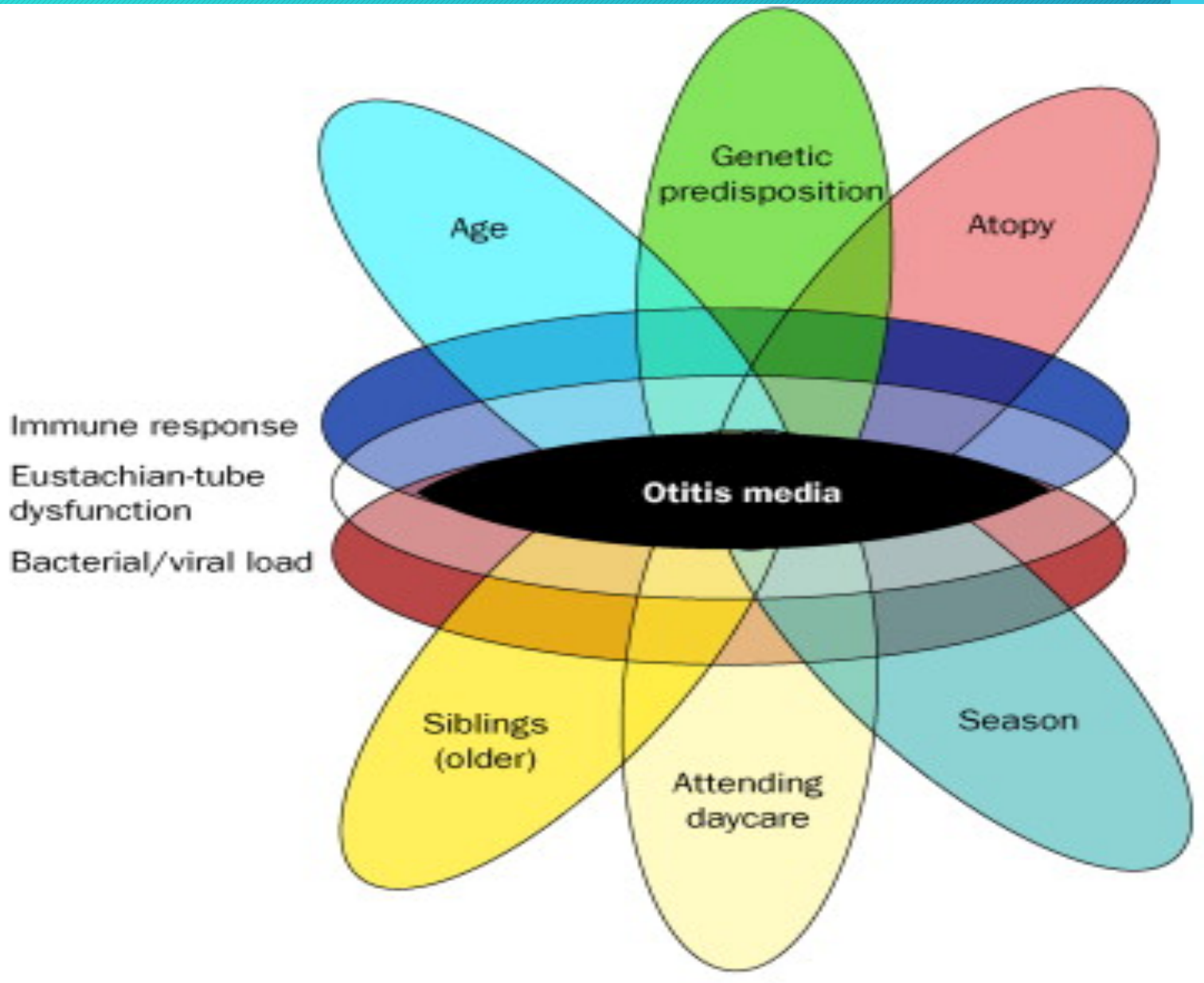




# Other risk factors

- Anatomic abnormalities
- Medical conditions such as **Cleft palate**, obstruction due to adenoid or Nasogastric tube tube or malignancy, immune dysfunction.
- Exposure to pathogens from day care.
- Exposure to smoking.





# Clinical presentation

- Acute OM

Mostly Bacterial ,often a complication of viral URTI. Pain often severe and continuous in bacteria causes.

**First 1-2 days:**

Fever (39 C), irritability, earache , muffled nose.

Bulging tympanic membrane ,poor mobility and obstruction by fluid or inflammatory cells on otoscopic examination.

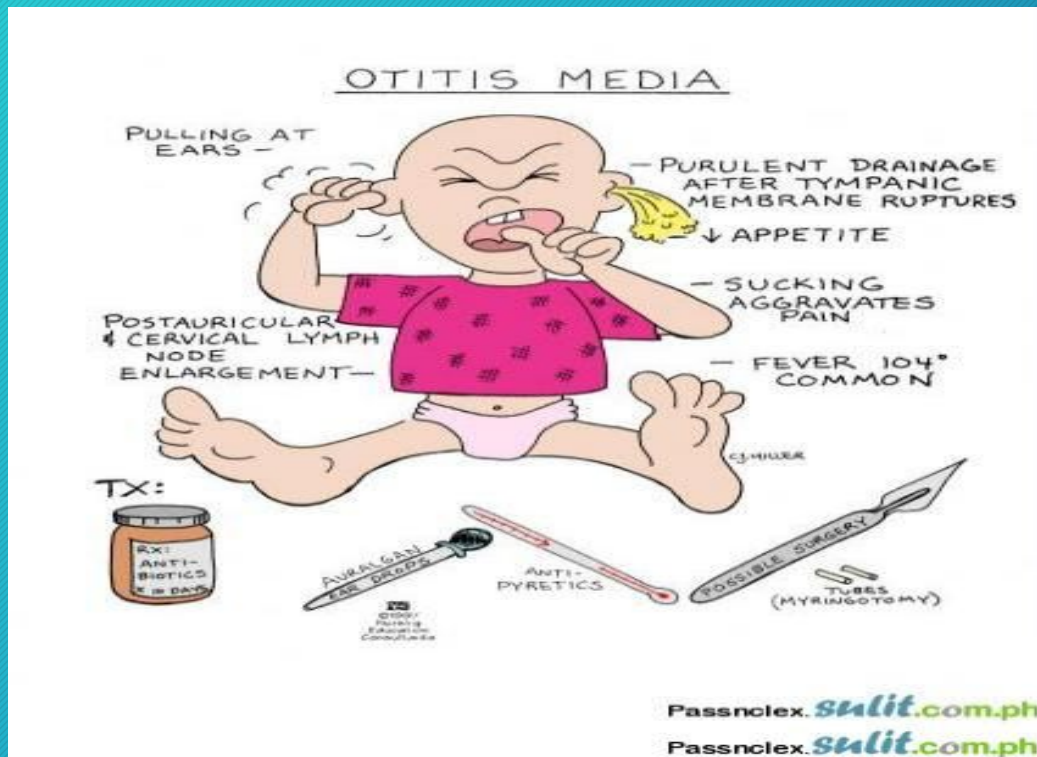
**3-8 days:**

Pus and ear exudative discharge released *spontaneously* then pain and fever begin to decrease.

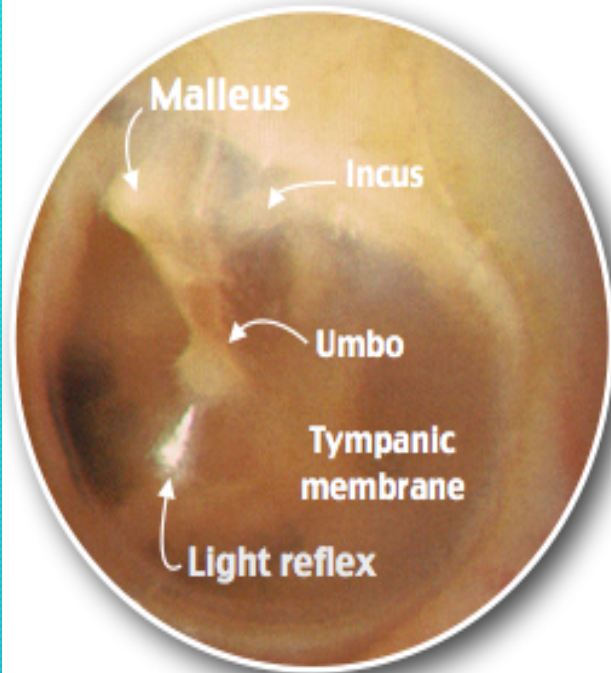
**2-4 weeks :**

Healing phase, discharge clears and hearing becomes normal.

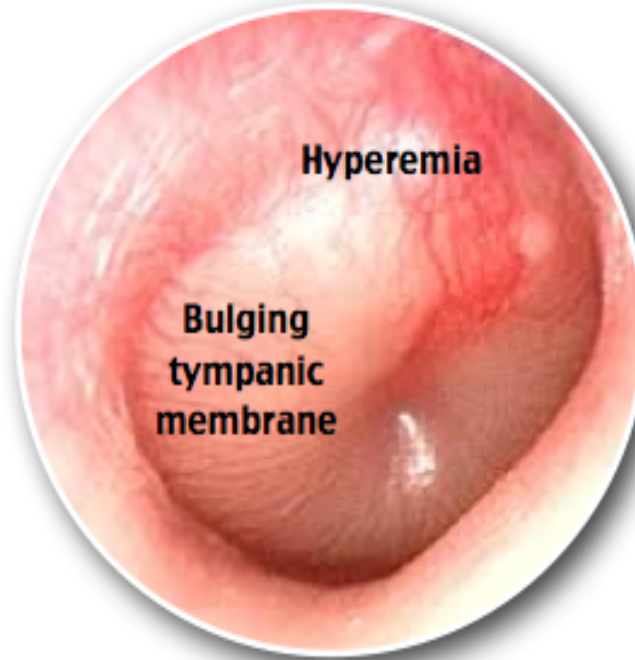
# Clinical presentation



# Acute Otitis Media



**Normal**



**Acute Otitis Media**

## **Most common bacterial causes**

- *Streptococcus pneumoniae*
- *Haemophilus influenzae* (non-typeable)
- *Moraxella catarrhalis*

# Serous OM (OM with effusion)

- Collection of fluid within the middle ear as a result of negative pressure produced by altered Eustachian tube function.
- Represents a form of chronic OM or allergy-related inflammation.
- Over weeks to months, middle ear fluid become very thick and glue like( *glue ear*)
- Tends to be chronic , with non -purulent secretions.
- Leads to conductive hearing impairment.

# Images of serous OM





# Chronic OM

- Usually result from unresolved acute infection due to inadequate treatment or host factors that perpetuate the inflammatory process.
  - Involves perforation of tympanic membrane and active bacterial infection for long period.
- Pus may drain to the outside (*otorrhea*).
- Results in destruction of middle ear structures and significant risk of permanent hearing loss.

# Images of chronic OM



# Microbiology (Bacterial Causes)

- Acute OM

- < 3 months of age

- S.pneumoniae*, (40%)  
group B *Streptococcus*,  
*H.influenzae* (non  
typeable) ,

- Gram negative bacteria  
including *P. aeruginosa*

- > 3 months of age

- S.pneumoniae*,

- H.influenzae*

- S.pyogenes*,

- Moraxella catarrhalis*,

- S.aureus*

# OM: Microbiology-cont.

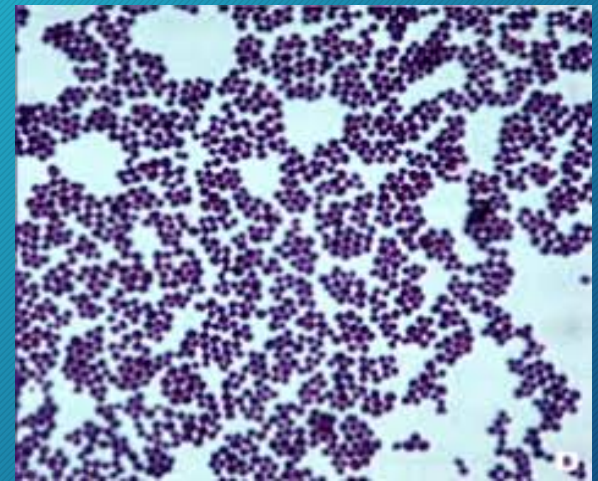
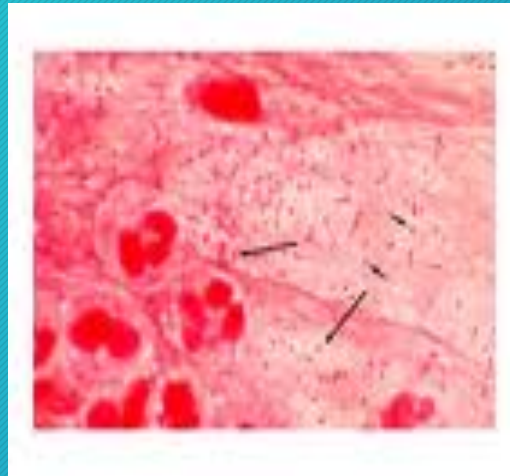
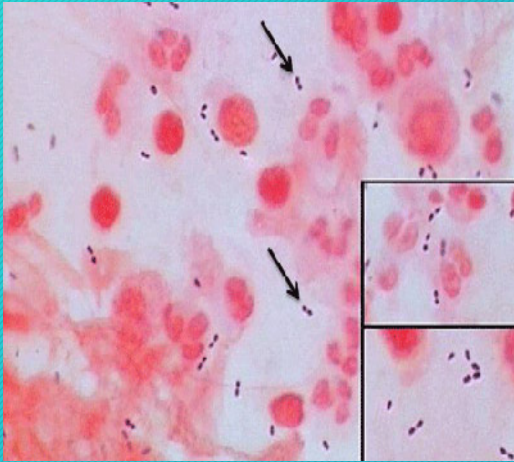
## Chronic OM

- Mixed flora in 40% of cases
- *P.aeruginosa*,  
*H.influenzae*,  
*S.aureus*, *Proteus*  
species,  
*K.pneumoniae*,  
*Moraxella catarrhalis*,  
anaerobic bacteria.

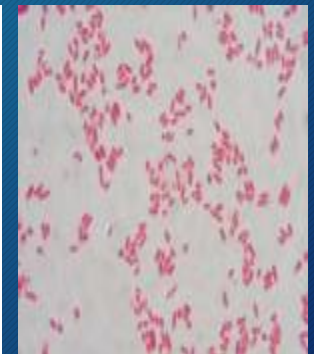
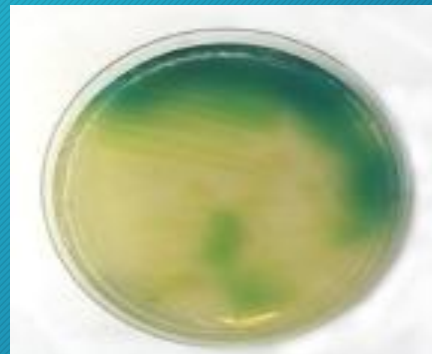
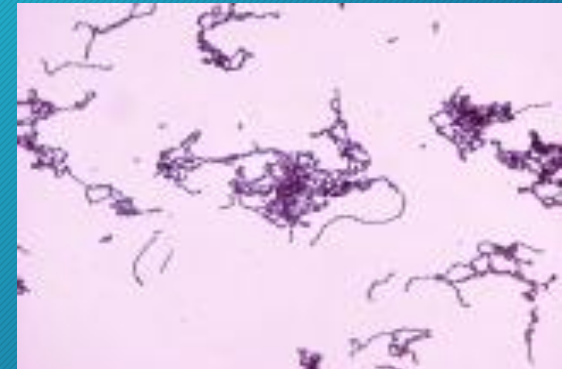
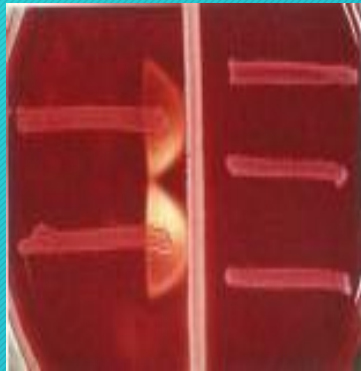
## Serous OM

- Same as chronic OM, but most of the effusions are sterile
- Few acute inflammatory cells

# Microbiology of OM

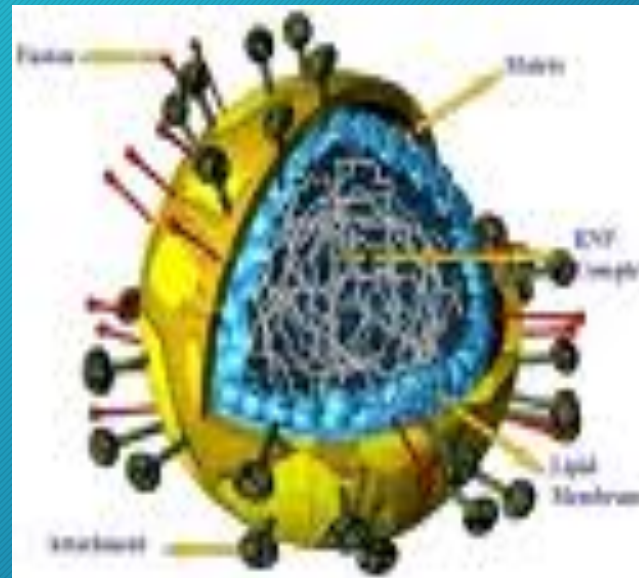


# Microbiology of OM



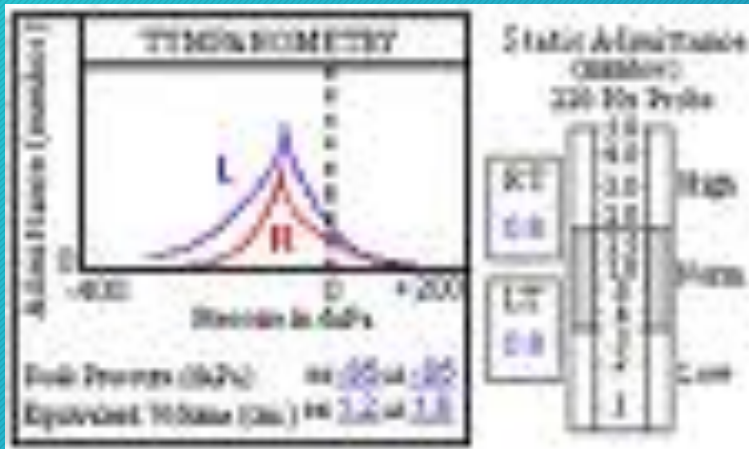
# Microbiology (Viral causes)

- RSV( Respiratory Syncytial Virus) -74%
- Rhinovirus
- Para-influenza virus
- Influenza virus



# Diagnostic approaches of OM

- Clinical examination
- Tympanometry ( detects the presence of fluid)
- Gram stain and culture of aspirated fluid to determine the etiologic agents.





# Management of OM

- Acute OM requires antimicrobial therapy & careful follow up.
- Antimicrobial usually empirical depending on the most likely bacterial pathogens, usually to cover *S.pneumoniae* and *H.influenzae*.
- Drainage of exudates may be required.
- Chronic or serous OM need complex management, possibly surgical.

# Complications of OM

## Extracranial

- Hearing loss
- Tympanic membrane perforation
- Mastoiditis
- Cholestatoma
- Labyrinthitis
- others



## Intracranial

- Meningitis
- Extradural abscess
- Subdural empyema
- Brain abscess
- others



# Reference book

*Sherris Medical Microbiology, an Introduction to Infectious Diseases.*

Latest edition, Kenneth Ryan and George Ray.  
Publisher : McGraw Hill .