Microbiology 437

MED437 KING SAUD UNIVERSITY

OTITIS MEDIA

MIDDLE EAR INFECTIONS

Objectives:

- ❑ Define middle ear infection
- ❑ Know the classification 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.

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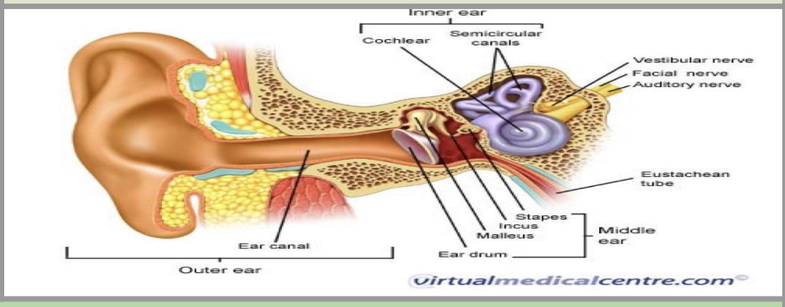
Definitions

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

1. Acute 2. Secretory (Serous) 3. Chronic

Epidemiology

Most common in infants 6 to 18 months of age (2/3 of cases). (Due to disappearance of IgG)

★ Improves with age, why ?

The Eustachian Tube which vents the middle ear to the Nasopharynx is <u>horizontal</u> 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. (1)

- Often preceded by viral upper respiratory infection (URTI).

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1 Eustachian tube in this age is still not developed well (still cartilage and horizontal) so due to its shape & if there's an inflammation it well lead to O2 loss and negative pressure.

↓

"ينسد المكان" nasopharynx للـ Eustachian tube ماراح يكون فيه تهوية من

↓

It will be a good environment to bacterial growth.

OM: 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.

OM: Other risk factors

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



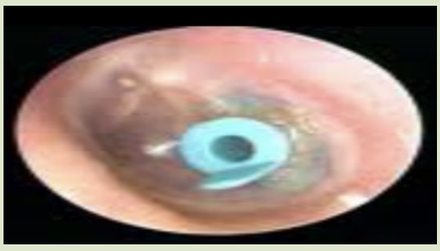

Otitis Media

Types	Acute	Chronic	Serous
Bacterial Causes	A. < than 3 months of age: - Strep. pneumoniae (40%) - group B Streptococcus - Non-typeable H. influenzae (1) - Gram negative Pseudo. aeruginosa B. > than 3 months of age: - Strep. pneumoniae. - H. influenzae - Strep. pyogenes - Moraxella catarrhalis - Staph. aureus	- Mixed flora (40%) - Pseudo. aeruginosa - H. influenzae - Staph. aureus - Proteus species - K. pneumoniae - Moraxella catarrhalis - Anaerobic bacteria	Same as chronic otitis media, but most of the effusions are sterile with few acute inflammatory cells.
Viral Causes	- RSV (74%) (2) - Rhinovirus - Para-influenza virus - Influenza virus		
Clinical Presentation	- Mostly bacterial → severe & continuous pain. - A complication of viral URTI First 1-2 days - Fever 39C, irritability & earache. - Muffled nose. (3) - Bulging tympanic membrane, poor mobility & obstruction by fluid or inflammatory cells. (4) 3-8 days - Pus & ear exudative discharge released spontaneously → pain & fever begin to decrease. 2-4 weeks Healing phase, discharge clears and hearing becomes normal.	- Usually result from unresolved acute infection due to inadequate treatment or host factors that perpetuate the inflammatory process. - Involves perforation of tympanic membrane & active bacterial infection for long period. - Pus may drain to the outside (otorrhea) - Results in destruction of middle ear structures & significant risk of permanent hearing loss. (5)	- Collection of fluid within the middle ear as a result of negative pressure produced by altered Eustachian tube function. (6) - Represents a form of chronic otitis media or allergy related inflammation. - Weeks to months, middle ear fluid become very thick & glue like 'glue ear' (7) - Tends to be chronic, with non-purulent secretions. - Cause conductive hearing impairment.

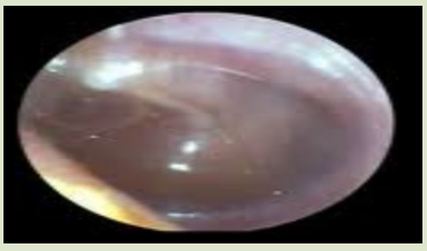
1 H. influenza is arranged depending on its capsule to 6 types (a-f) but there's also another type which is non-encapsulated called non-typeable and it's the 2nd most common cause of Otitis Media.
2 Respiratory Syncytial Virus. After getting infected the patient is most likely to get a bacterial infection.
3 Stuffed nose
4 When examined by a physician using otoscope (clinical examination)
5 If the thick glue like fluid (glue ear) isn't treated → destruction of the middle → risk of hearing loss
6 Edema to the tube → negative pressure → fluid accumulation → close tube
7 After weeks there will be continuous inflammation and the middle ear will become sticky & shiny (glue ear)




Tube to decrease the tension and the ear discharge in serous OM



Sticky fluid (glue ear)



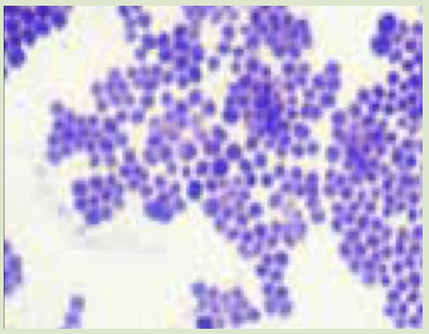
Ear discharge in chronic OM

Microbiology of Otitis Media

Gram + diplococci
Strep. pneumonia

Gram - coccobacilli

Gram + cocci in clusters
Staph. Aureus



Strep. pneumonia sensitive to optochin
Viridans streptococci resistant to optochin

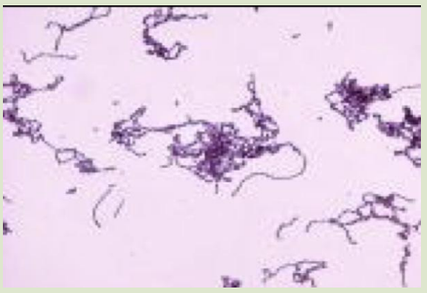
X+V factor test to identify H. influenzae by its unique growth

DNase test to identify Staph. Aureus

Pseudo. Aeruginosa

Beta hemolytic streptococci sensitive to bacitracin

Gram + streptococci in chains



Diagnostic approaches of Otitis Media

Clinical examination

Tympanometry (detect the presence of fluid)

Gram stain & culture of aspirated fluid to determine the etiologic agents. (sample not swab)

Management of Otitis Media

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.

Antibiotics (Alsomily only mentioned amox-clav)

Amoxicillin/clavulanic acid, erythromycin[1], ceftriaxone[2], cefuroxime[3], cloxacillin & flucloxacillin[4].

Complications of Otitis Media

<u>Extracranial</u>

- Hearing loss
- Tympanic membrane
- Perforation
- Mastoiditis
- Cholesteatoma
- Labyrinthitis & others

<u>Intracranial</u>

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

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1 If the child is allergic to penicillin.

2 It's a 3rd generation cephalosporin and its used when the infection is severe and it's not resolving bc its injectable.

3 2nd generation cephalosporin used in less severe cases where the baby can swallow and won't vomit the drug (oral)

4 Used in when the infection is caused by Staph. Aureus




Alsomily's notes

- Otitis media can be clinically diagnosed
- Middle ear is more susceptible for infections because it's opened into the nasopharynx through the eustachian tube
- The function of eustachian tube is to equalize the pressure b/w the ear and the nasopharynx

- بنتكلم عن (symptoms, common microorganism, diagnosing and treatment)
- (eustachian tube) مهمة في توازن الضغط بين البلعوم والاذن و لكن لو فيه اي التهاب او مشاكل وراثية ممكن تنسد ويكون الضغط (negative) وتنشفط السوائل داخل الأذن

the fluid that comes from the oropharynx isn't sterile so it's filled with normal flora like moraxella, strep. pneumoniae, haemophilus, neisseria which will cause inflammation to the middle ear.

Types of otitis: acute(2-3 days)- chronic (if untreated)

- **Secretory Otitis media is not an infection but maybe a result of infection**

- Infants from 6-18 months are predisposed to otitis media, why? Bc eustachian tube is short and horizontal (wide)
- Why not at risk from 1st month? Because of mother antibodies
- **Breastfeeding** can prevent otitis media

- Otitis media can occur with a viral infection or after a viral infection
- Risk factors are the characteristic that increase the risk of developing an infection or a disease so we should know them in order to avoid them and to also avoid recurrent infection
- For example ppl who have viral upper respiratory tract infection or ppl who have allergies.

Pathogenesis:

1. functional abnormalities in the tube that would lead to ineffective clearance
2. oxygen loss leading to negative pressure

Risk factors:

1. congenital abnormalities like cleft palate bc the palate will elongate and reach the nasopharynx and also bc of the abnormal position of the muscles and tendons in children with **cleft palate**, the eustachian tube cannot drain the **ear.**
2. ppl who has nasogastric tube, why? because it might affect the pressure of the ear which will affect the function of the eustachian tube.
3. tumor or immune dysfunction
4. children attending day care centers might be infected with resistant organisms and when they get a viral infection they will mostly treat it using antibiotic for sensitive organisms and it won't help since the kid is suffering from an infection caused by resistant organism
5. smoking bc it will destroy the cilia therefore it increase the secretions which will cause edema then inflammation

Microbiology: Whats the **normal flora** of the oropharynx?
Haemophilus, streptococcus pneumonia, moraxella, and staph aureus less common
the most common organisms in children who are younger than 3 months, are group b strep. pneumonia, gram negative bacteria, and normal flora.
(**In chronic** we can find **any organism**) and in (serous nothing)
It also can be **viral** so we usually wait for 2-3 days if the patient isn't really sick
Most commonly (RSV, rhinovirus) virus infect directly from blood




AlSomily's notes cont.

Clinical presentation:

- They will have initially fever, ear pain (otalgia) and if you examine them you will find (a bulging tympanic membrane)
- In babies they will have fever, lethargy (lack of energy) &, poor feeding (general symptoms) their mom will notice and know. Some children will try to hit their ear (bc of the pain)

- فيه قصص اطفال زي واحد عمره سنتين اتصلو من مستشفى فقالو البيبي عنده strep pneumonia in CSF قبلها ب 3 ايام فحصة الدكتور قال عنده التهاب في الحلق المهم جانا بعد 3 ايام braindead due to stroke فعند الأطفال مهم متى تعالج متى تنتظر بس ال decision صعب عليكم لكن اعرفوا المبدأ

some infections at certain age group is very dangerous and has to be diagnosed properly otherwise in can lead to morbidity and mortality

After three days from the infection pus is formed and exudate discharge & pain might be present.
Serous is not an infection but might occur as a result of an infection.
Chronic is complication of acute and it will be caused by multiple organisms.

Diagnosis is mainly clinical: otoscope, history, and physical examination.
- you don't touch the tympanic membrane and take sample if the baby is well. Like when the fever isn't that high, and he's stable
- If the baby is sick or young (less than 2 years) you give him antibiotics

- Treatment: amoxi-clav (amoxicillin-clavulanic acid) and drainage may be required in chronic.
(EXTRA)In adult we use fluoroquinolones esp. in diabetics because the most common cause organism is pseudomonas

- Complications: extracranial and intracranial
Extracranial (related to ear):hearing loss, mastoiditis, tympanic m. proliferation
Intracranial: meningitis, subdural empyema (pus), and brain abscess.




Summary

Otitis media: inflammation of the middle ear.

Epidemiology:	common in infants 6-18 months.	Due to: The Eustachian Tube is horizontal in infants, difficult to drain naturally.		
Pathogenesis:	1-URTI or allergic condition cause edema or inflammation of the eustachian tube. 2-O2 lost lead to negative pressure. 3-Pathogens enter from nasopharynx into the middle ear. 4-Colonization and infection result.			
Risk factors:	1-Anatomic abnormalities. 2-Cleft palate. 3-Exposure to pathogens from day care.		4-Exposure to smoking. 5-obstruction due to adenoid or Nasogastric tube or malignancy 6-immune dysfunction.	
Types:	Acute OM		Chronic OM	Serous OM
	Younger than 3months	Older than 3 months		
Microbiology	**H.influenzae**			
	S.pneumoniae		**-Mixed flora.** **-P.aeruginosa.** **-S.aureus.** **- Proteus species.** **-K.pneumoniae.** **-Moraxella catarrhalis.** **-anaerobic bacteria.**	Same as chronic, but most of the effusions are sterile **Few acute inflammatory cells.**
	- group B Streptococcus. **-Gram negative bacteria, including P.aeruginosa.**	**-S.pyogenes.** **-Moraxella catarrhalis.** **-S.aureus.**		
	◆ **RSV(Respiratory Syncytial Virus).** ◆ **Rhinovirus.** ◆ **Para-influenza virus.** ◆ **Influenza virus.**			
Clinical presentation:	1-2 days: Fever (39 C), irritability, Bulging tympanic membrane.		- result from unresolved acute infection. -Involves perforation of tympanic membrane and active bacterial infection. - otorrhea.	Over weeks to months, fluid become very thick and glue like (glue ear). -Collection of fluid within the middle ear. -Tends to be chronic
	3-8 days: Pus and ear exudative discharge, pain and fever begin to decrease.			
	2-4 weeks: Healing phase, discharge clears and hearing becomes normal.			
Result in:			destruction of middle ear structures. risk of permanent hearing loss.	conductive hearing impairment.
Diagnosis:	1-Clinical examination 2-Tympanometry 3-Gram stain and culture of aspirated fluid to determine the etiologic agents.			
Management:	◆ Acute OM requires antimicrobial therapy (empirical) . ◆ Drainage of exudates may be required. ◆ Chronic or serous OM need complex management, possibly surgical.			
Complications:	Extracranial:		Intracranial:	
	◆ Hearing loss ◆ Tympanic membrane perforation ◆ Mastoiditis ◆ Cholestatoma ◆ Labyrinthitis		◆ Meningitis ◆ Extradural abscess ◆ Subdural empyema ◆ Brain abscess	




MCQs:

1- When does the healing phase begin?
A- First two days
B- Three to eight days
C- Two to four weeks
D- None of the above

2-The pathogens is more likely to enter the middle ear to cause OM from?
A- External ear.
B- Nasopharynx.
C- Bloodstream.
D- Lesion behind the ear.

3- Which one has higher chance to develop OM?
A- Adult 20-30.
B- Children less than year and half.
C- Old people.
D- Children older than 2 years.

4- After car accident the patient isn't able to eat properly, the doctors has decided to insert a plastic tube (nasogastric tube) in order to feed him. This increases his chance at developing??
A- Coma
B- Fever
C- Otitis media.
D- Septicemia.

5- Which one in an intracranial complication of OM?
A- Cholesteatoma.
B- Mastoiditis.
C- Meningitis.
D- Labyrinthitis

6-A patient has suffered from recurrent acute infection, he is at risk to develop ?
A- Chronic OM.
B- Acute OM.
C- Serous OM.
D- None of the above.

SAQ:

1- List the names of virus the could cause OM?

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

2- A 2 years child is febrile, the mother had notice that he keep hitting his ears. What is your diagnosis? And what is the most likely organism?

Acute OM / S.pneumoniae - H.influenzae - S.pyogenes - Moraxella catarrhalis - S.aureus

3- Describe the course of the disease ?

Slide 4

4- What are the diagnostic approaches would you use ?

1-Clinical examination -2-Tympanometry -3-Gram stain and culture of aspirated fluid to determine the etiologic agents.



1-C 4-C
2-B 5-C
3-B 6-A

THANK YOU!

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