

# ENT COURSE 1

## Ear Pathophysiology



# COURSE LEARNING OBJECTIVES

**By the end of this course, you will be able to answer the following essential questions:**

Lesson 1: What are the components of an ear exam?

Lesson 2: What are common disorders of the outer ear?

Lesson 3: What are common disorders of the middle ear?

Lesson 4: What are common disorders of the inner ear?

Lesson 5: What is the difference between sensorineural and conductive hearing loss?



# COURSE VOCABULARY

**Antiemetics:** Drugs that decrease nausea such as Zofran or Phenergan

**Effusion:** Fluid in a body cavity

**Hematoma:** Swelling of clotted blood in tissues

**Myringotomy:** Ear tube placement

**Meclizine:** Drug that decreases dizziness

**Nystagmus:** “Bouncing” of the eyes due to eye, brain and/or inner ear pathology

**Otalgia:** Ear pain

**Otorrhea:** Drainage from the ear

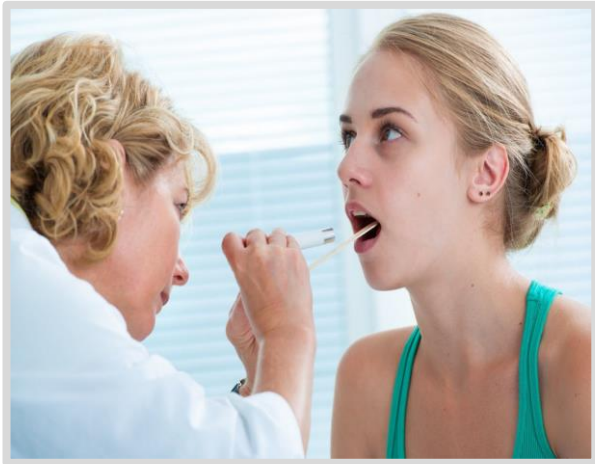
**Pruritis:** Itching

**Seropurulent:** Drainage with blood and infectious debris

**Vertigo:** “Room spinning” aka dizziness



# LESSON 1.1: EAR EXAM



## [Video of ENT Exam](#)



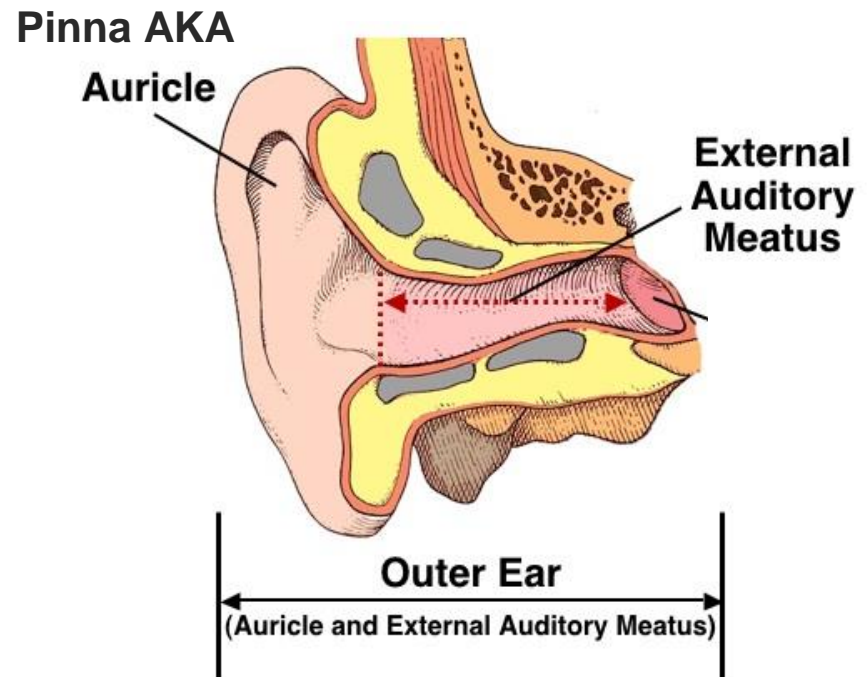
# 1.1: EAR EXAM - OUTER EAR ANATOMY

## Pinna:

- Surrounds the external acoustic meatus
- Composed of elastic cartilage
- Selectively filters sound frequencies to pinpoint sound source

## External Acoustic Meatus:

- Short tube from pinna to TM
- Lined with hairs and glands
- Ceruminous glands produce cerumen (earwax) to trap foreign bodies



# 1.1: EAR EXAM - MIDDLE EAR ANATOMY

**The middle ear** increases the pressure of sound waves 200-fold so the signal transfers from the air-filled external ear to the fluid-filled middle ear.

## **Tympanic Membrane (eardrum):**

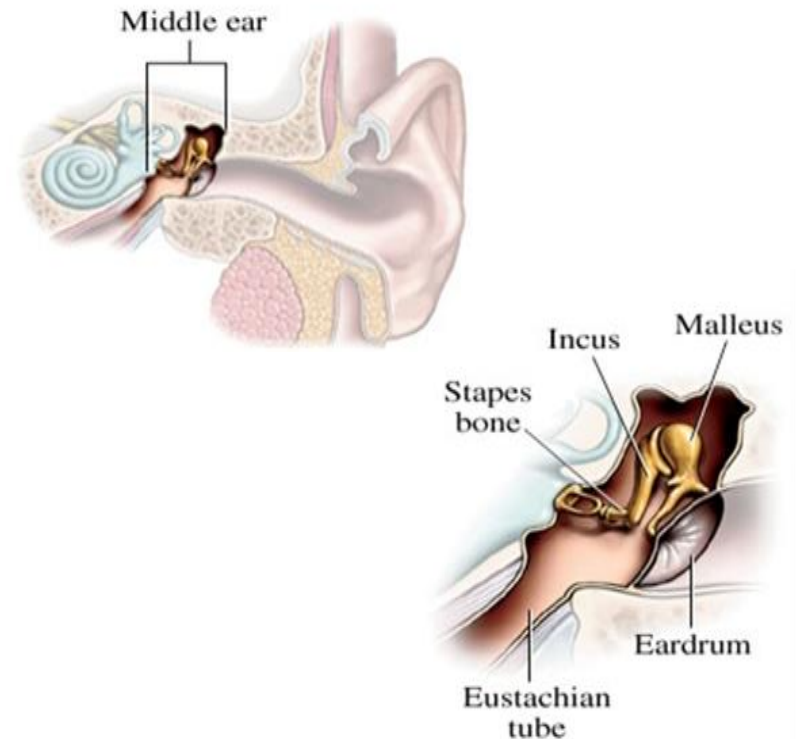
- Vibrates when touched by sound wave

## **Auditory Ossicles:**

- Malleus, incus, and stapes
- Transmit vibration from TM to oval window

## **Oval Window:**

- Smaller secondary window to increase pressure of the sound wave



# 1.1: EAR EXAM - INNER EAR ANATOMY

## **Perilymph:**

- Fluid similar to CSF that surrounds the “bony labyrinth”

## **Vestibule:**

- Houses the saccule and utricle that have equilibrium receptors
- Sense changes in head position and gravity

## **Semicircular canals:**

- Three canals that house the “crista ampullaris”
- Senses angular movements of the head

## **Cochlea:**

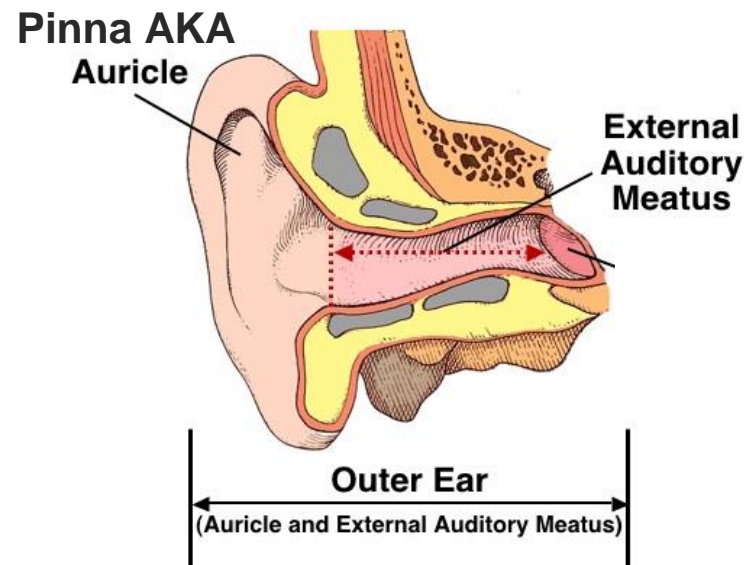
- Houses basilar and vestibular membrane
- Critical in sound interpretation and reception



# LESSON 1.2: OUTER EAR DISORDERS

In this lesson, we will address the following question:

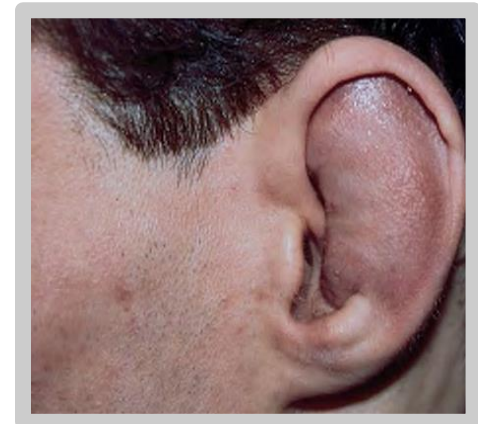
**What are common disorders of the outer ear?**





# 1.2: AURICULAR HEMATOMA

<b>ETIOLOGY</b>	Auricle injury due to trauma from wrestling or close contact
<b>CHIEF COMPLAINT</b>	Auricle (pinna) pain
<b>ASSOCIATED Sx</b>	None
<b>PHYSICAL EXAM</b>	Bruising or hematoma to the auricle
<b>DIAGNOSED BY</b>	Clinically
<b>TREATMENT</b>	Evacuation of blood from hematoma If severe, cauterization of superior and inferior temporal artery
<b>SCRIBE ALERT</b>	Without treatment, excessive pressure causes occlusion of the external acoustic canal



# 1.2: OTITIS EXTERNA



ETIOLOGY	Infection of External Auditory Meatus due to increased humidity causing bacteria build-up
CC	Otalgia exacerbated by pulling on auricle
ASSOCIATED Sx	Pruritus, otorrhea, hearing impairment, ear canal swelling
PHYSICAL EXAM	Obstruction of EAC with erythema, edema and seropurulent drainage.
DIAGNOSED BY	Clinically
TREATMENT	Topical antibiotics and analgesics
SCRIBE ALERT	If topical ABx are ineffective, a cotton ear wick with ABx is left in the ear for 5-7 days



# 1.2: OTOMYCOSIS

<b>ETIOLOGY</b>	Fungal infection of the outer ear that occurs in those who spend time outdoors and then scratch their ear
<b>CHIEF COMPLAINT</b>	Unilateral otalgia
<b>ASSOCIATED Sx</b>	Feeling of fullness in affected ear, mild conductive hearing loss
<b>PHYSICAL EXAM</b>	“Wax-like” grey-white debris
<b>DIAGNOSED BY</b>	Black spores on microscopy
<b>TREATMENT</b>	Debridement, long term acidification, topical antifungals



# 1.2: CERUMEN IMPACTION



ETIOLOGY	Cerumen becomes impacted in ear canal
CC	Unilateral otalgia NOT worse with pulling pinna
ASSOCIATED Sx	Conductive hearing loss, tinnitus, vertigo
PHYSICAL EXAM	Cerumen impaction in EAC
DIAGNOSED BY	Clinically with otoscope
TREATMENT	Cerumen disimpaction
SCRIBE ALERT	Very common in elderly wearing hearing aids



## 1.2 QUIZ: OUTER EAR DISORDERS

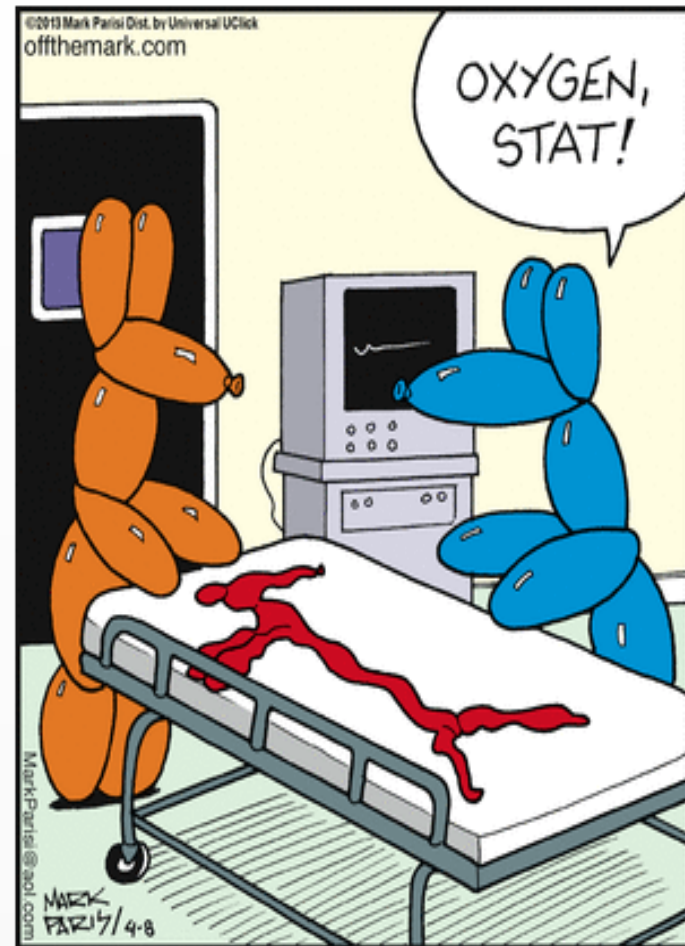
1. A child presents to the ENT office with complaints of outer ear pain after spending her summer days swimming. What disease is at the top of your differential?
1. Your physician states the patient has “wax-like” grey debris in the EAC. What condition is this associated with?
1. A wrestler is diagnosed with an auricular hematoma. How is this treated?
1. An elderly male presents for a cerumen disimpaction. What signs and symptoms could be alleviated by this procedure?



# LESSON 1.3: MIDDLE EAR DISORDERS

In this lesson, we will address the following question:

**What are common disorders of the middle ear?**



# 1.3: ACUTE OTITIS MEDIA

<b>ETIOLOGY</b>	Infection of the tympanic membrane causing ear pain. Can come after a URI
<b>CHIEF COMPLAINT</b>	Unilateral otalgia
<b>ASSOCIATED Sx</b>	Hearing loss, otorrhea, fever, ear pulling (children)
<b>PHYSICAL EXAM</b>	Erythematous, bulging TM with loss of landmarks
<b>DIAGNOSED BY</b>	Clinically
<b>TREATMENT</b>	OP antibiotics
<b>SCRIBE ALERT</b>	Without treatment, excessive pressure causes occlusion of the external acoustic canal



# 1.3: CHRONIC OTITIS MEDIA



<b>ETIOLOGY</b>	Recurrent ear infections
<b>CHIEF COMPLAINT</b>	Persistent unilateral otalgia
<b>RISK FACTORS</b>	Down Syndrome, cleft palate, smoke exposure, daycare, immune deficiencies.
<b>ASSOCIATED Sx</b>	Hearing loss, otorrhea, ear pulling (children)
<b>PHYSICAL EXAM</b>	CHL, TM perforation w/ otorrhea vs effusion.
<b>DIAGNOSED BY</b>	Clinically, Audiogram
<b>TREATMENT</b>	OP Abx vs myringotomy tube insertion





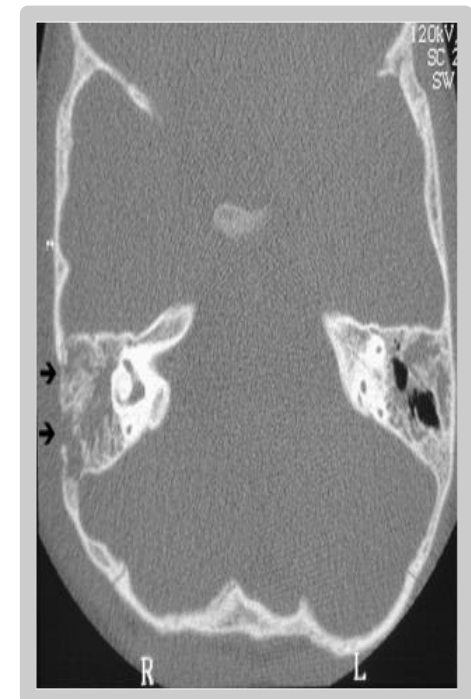
# 1.3: RUPTURED TM

<b>ETIOLOGY</b>	Perforation of TM due to infection or trauma
<b>CHIEF COMPLAINT</b>	Sudden otalgia
<b>ASSOCIATED Sx</b>	Hearing loss, otorrhea, tinnitus
<b>PHYSICAL EXAM</b>	Erythematous, ruptured TM.
<b>DIAGNOSED BY</b>	Clinically via otoscope No TM movement when small amount of air is applied
<b>TREATMENT</b>	Abx ear drops for infection, surgical repair after 6 months. Water precautions, analgesics

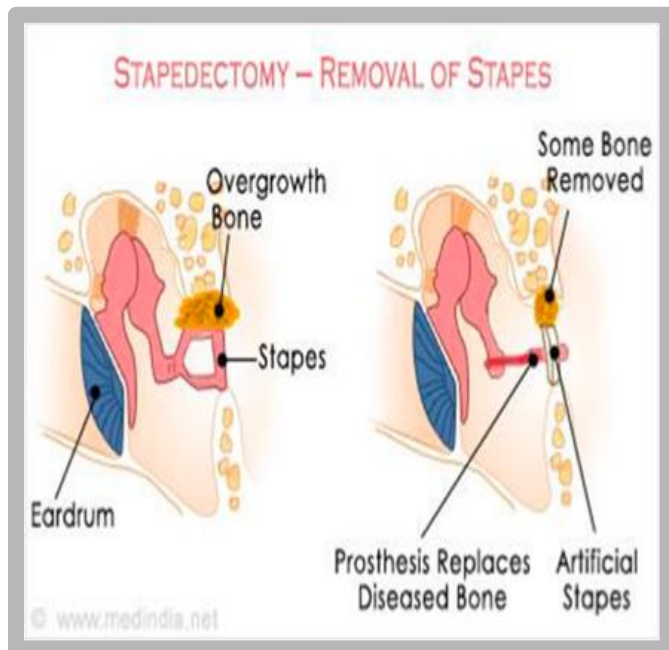


# 1.3: MASTOIDITIS

<b>ETIOLOGY</b>	Infection of mastoid bone due to untreated COM
<b>CHIEF COMPLAINT</b>	Pain behind ear
<b>ASSOCIATED Sx</b>	Hearing loss, HA, Fever
<b>PHYSICAL EXAM</b>	Swelling and erythema behind the ear, exudate from TM.
<b>DIAGNOSED BY</b>	CT Head
<b>TREATMENT</b>	Abx, myringotomy, mastoidectomy (removal of mastoid bone if ABx are ineffective)



# 1.3: OTOSCLEROSIS



<b>ETIOLOGY</b>	Overgrowth of bone in middle ear, causing deafness
<b>CC</b>	Progressive CHL
<b>ASSOCIATED Sx</b>	None
<b>PHYSICAL EXAM</b>	Normal TM, tuning fork test, possible Schwartz sign (pink tinge of cochlear promontory)
<b>DIAGNOSED BY</b>	Audiometry, CT head
<b>TREATMENT</b>	Hearing aids, stapedectomy



# 1.3 QUIZ: MIDDLE EAR DISORDERS

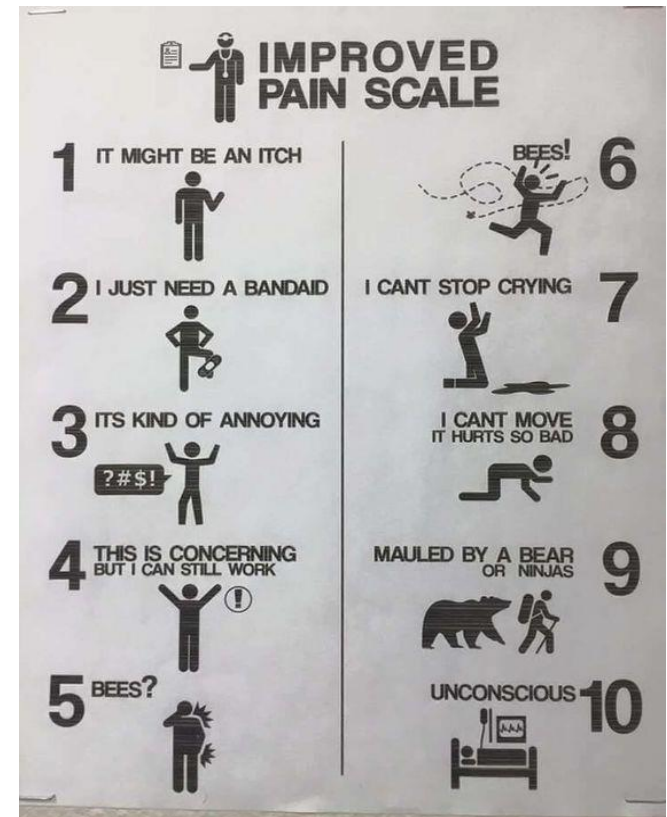
1. A child presents for pulling at the L ear, increased fussiness and fever after a viral URI. What disease is at the top of your differential?
2. The patient presents with HA, fever, and pain **behind** the ear. Exam shows swelling from behind the ear and exudate coming from the TM. What disease does the patient have?
3. How is chronic otitis media treated differently than acute otitis media?
4. How does otosclerosis cause hearing loss and how is it treated?



# LESSON 1.4: INNER EAR DISORDERS

In this lesson, we will address the following question:

**What are common disorders of the inner ear?**



# 1.4: DIFFERENTIAL FOR DIZZINESS

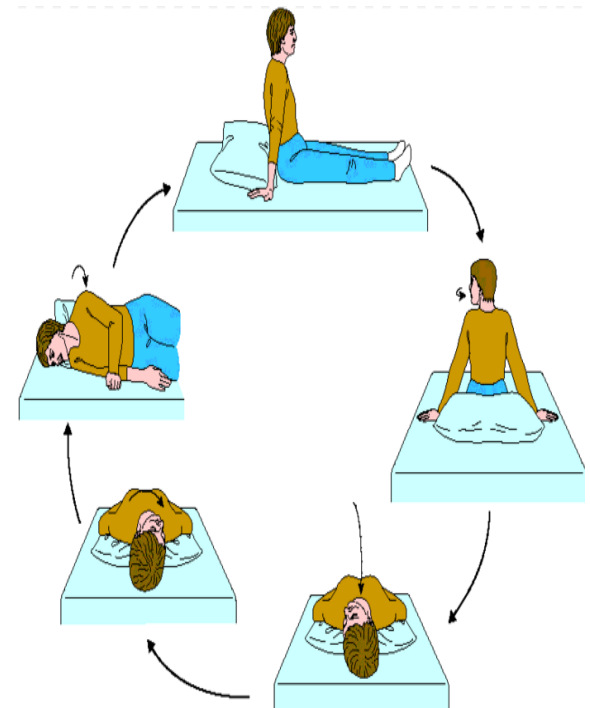
- **Stroke:** Acute onset associated with focal neurological deficits such as facial nerve palsy and possible change in mental status
- **BPPV:** Dizziness exacerbated by certain head movements. Not present at rest.
- **Meniere's Disease:** recurrent vertigo “attacks” lasting less than 2 hours. Associated with low frequency hearing loss.
- **Vestibular Neuronitis:** Sudden onset, severe vertigo lasting 1-8 days without hearing loss.
- **Labyrinthitis:** Vertigo that persists at rest with unilateral hearing loss

THESE DIFFERENTIALS ARE EXPLAINED IN MORE DETAIL ON THE  
FOLLOWING SLIDES



# 1.4: BENIGN PAROXYSMAL POSITIONAL VERTIGO (BPPV)

<b>ETIOLOGY</b>	Crystals in inner ear lodge in the canal causing dizziness
<b>CHIEF COMPLAINT</b>	Vertigo exacerbated by change in head positioning.
<b>ASSOCIATED Sx</b>	N/V, blurred vision, unsteadiness, gait imbalances.
<b>PHYSICAL EXAM</b>	<a href="#">+ Dix-Hallpike</a> , no change in audiogram
<b>TREATMENT</b>	Treat symptoms, antiemetics, <a href="#">Epley Maneuver</a> * then: <ul style="list-style-type: none"><li>- Sleep sitting up for 2 days</li><li>- No sleep on affected side 2 wks</li><li>- No bending over for 48 hrs</li></ul>



# 1.4: MENIERE'S DISEASE

<b>ETIOLOGY</b>	Disorder of the inner ear, possibly due to autoimmune disorder or excessive salt intake, that causes repeated episodes of vertigo
<b>CC</b>	Intense vertigo lasting 30 min.- 2 hrs.
<b>ASSOCIATED Sx</b>	Fluctuating hearing loss, roaring tinnitus, aural fullness, N/V, gait imbalance
<b>PHYSICAL EXAM</b>	Nystagmus, <a href="#">+ Romberg</a> , <a href="#">+ Dix-Hallpike</a> , low frequency hearing loss, PE normal when not in attack
<b>TREATMENT</b>	Sx Tx (antiemetic, Meclizine), diuretic, <2000 mg salt/day, reduce EtOH and caffeine.





# 1.4: VESTIBULAR NEURONITIS

<b>ETIOLOGY</b>	Inflammation of the vestibulocochlear nerve which sends head position and balance info to the brain, usually following viral infection
<b>CHIEF COMPLAINT</b>	Sudden onset, severe vertigo* that persists even at rest
<b>ASSOCIATED SX</b>	Gait abnormalities, N/V, lack of hearing loss. Sx can last 1-8 days, but balance issues sometimes last >3 days
<b>PHYSICAL EXAM+</b>	+ Head thrust test, MRI to r/o tumor or other causes, hearing tests
<b>TREATMENT</b>	Vestibular suppressants, antiemetics, balance rehabilitation.



# 1.4: LABYRINTHITIS

<b>ETIOLOGY</b>	Bacterial or viral infection that causes inflammation of both branches of the vestibulocochlear nerve.
<b>CHIEF COMPLAINT</b>	Vertigo
<b>ASSOCIATED SX</b>	Unilateral hearing loss, N/V, gait abnormalities, visual disturbances.
<b>RISK FACTORS</b>	Chronic allergies, AOM, acute bacterial meningitis.
<b>PHYSICAL EXAM</b>	+ Romberg, +Dix-Hallpike, possible TM abnormalities.
<b>TREATMENT</b>	Abx or antivirals, vestibular suppressants, corticosteroids, antiemetics.



Labyrinth



# 1.4 QUIZ: INNER EAR DISORDERS

1. Patient presents with hearing loss. Physical exam shows an abnormal Rinne and the Weber indicated the tone is perceived in the affected ear. These findings are most consistent with what disease?
2. What condition is treated by the Epley Maneuver?
3. If the patient has **fluctuating** hearing loss, tinnitus and severe “attacks” of vertigo, what is the most appropriate treatment?
4. When a patient presents with new onset dizziness, what is the life threatening ailment that must be ruled out?



# LESSON 1.5: HEARING LOSS

In this lesson, we will address the following question:

**What is the difference between sensorineural and conductive hearing loss?**



# 1.5: TINNITUS

<b>ETIOLOGY</b>	Abnormal cochlear perception of sound. Seen in 5-10% of population.
<b>CHIEF COMPLAINT</b>	Persistent “ringing” in ears worse in quiet environments
<b>RISK FACTORS</b>	Hearing loss due to aging, exposure to loud noises, ETD, Meniere's Disease, infection
<b>ASSOCIATED Sx</b>	Hearing loss
<b>PHYSICAL EXAM</b>	Benign
<b>TREATMENT</b>	Treat underlying cause. Sound replacement technology (white noise). Healthy lifestyle, making the symptoms bearable.

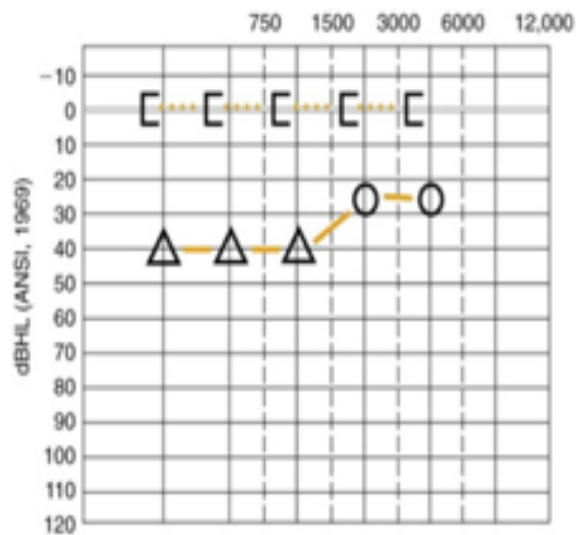


# 1.5: HEARING LOSS

	CONDUCTIVE	SENSORINEURAL
<b>Etiology</b>	Decreased sound conduction from outer ear to tympanic membrane	Damage to the cochlea or auditory nerve
<b>DDx</b>	<b>External or middle ear problem</b> Perforated TM, cerumen impaction, otitis media/externa, foreign body	<b>Inner ear problem</b> Meniere's disease, medications toxic to hearing
<b>Assoc Sx</b>	Tinnitus	Tinnitus
<b>PE Findings</b>	Erythematous/bulging TM, cerumen impaction or completely benign	Ears are benign. May present with balance problems.
<b>Dx</b>	Audiometry/tympanometry hearing tests	
<b>Treatment</b>	Depends on cause	Corticosteroids vs Hearing Aids

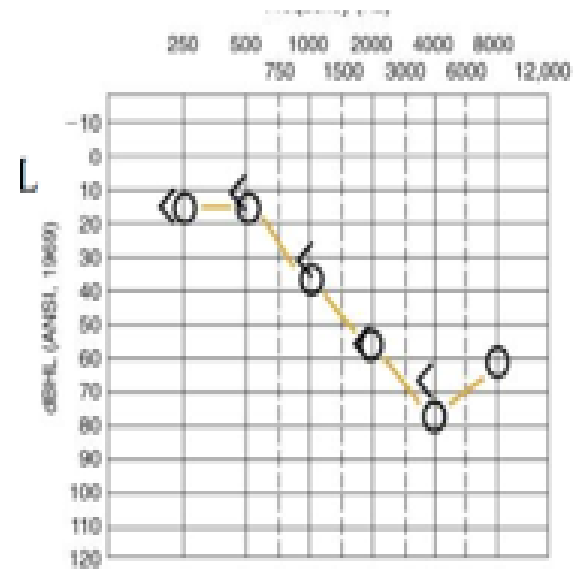
# 1.5: AUDIOGRAMS

## Conductive



Conductive HL

## Sensorineural



Sensorineural HL  
Frequency in Hertz (Hz)



# 1.5: TUNING FORKS

	Conductive Hearing Loss	Sensorineural Hearing Loss
<b>Weber</b>	Tone perceived in affected ear	Tone perceived in unaffected ear
<b>Rinne</b>	Abnormal (bone > air)	Normal (air > bone)





# 1.5 QUIZ: HEARING LOSS

1. Patient presents with hearing loss. Physical exam shows an abnormal Rinne and the Weber indicated the tone is perceived in the affected ear. These findings are most consistent with what disease?
2. What condition is treated by the Epley Maneuver?
3. If the patient has **fluctuating** hearing loss, tinnitus and severe “attacks” of vertigo, what is the most appropriate treatment?
4. When a patient presents with new onset dizziness, what is the life threatening ailment that must be ruled out?



# COURSE SUMMARY

## Essential Questions:

**Lesson 1:** What are the components of an ear exam?

**Lesson 2:** What are common disorders of the outer ear?

**Lesson 3:** What are common disorders of the middle ear?

**Lesson 4:** What are common disorders of the inner ear?

**Lesson 5:** What is the difference between sensorineural and conductive hearing loss?

