



# 6-Vertigo

## Objectives:

- To know anatomy of balance organs.
  - Physiology of balance.
  - Relevant history in dizzy patients.
  - Classification of vertigo.
  - Common peripheral causes of vertigo, clinical features, investigation and management.
  - Common central causes of vertigo, clinical features, investigation and management
- Vertigo Central Peripheral Meniere's disease BPPV Vestibular neuritis CVA Acoustic Neuroma Multiple Sclerosis Migraine.

**Resources:** Slides+Lecture notes of ENT+Notes+435team

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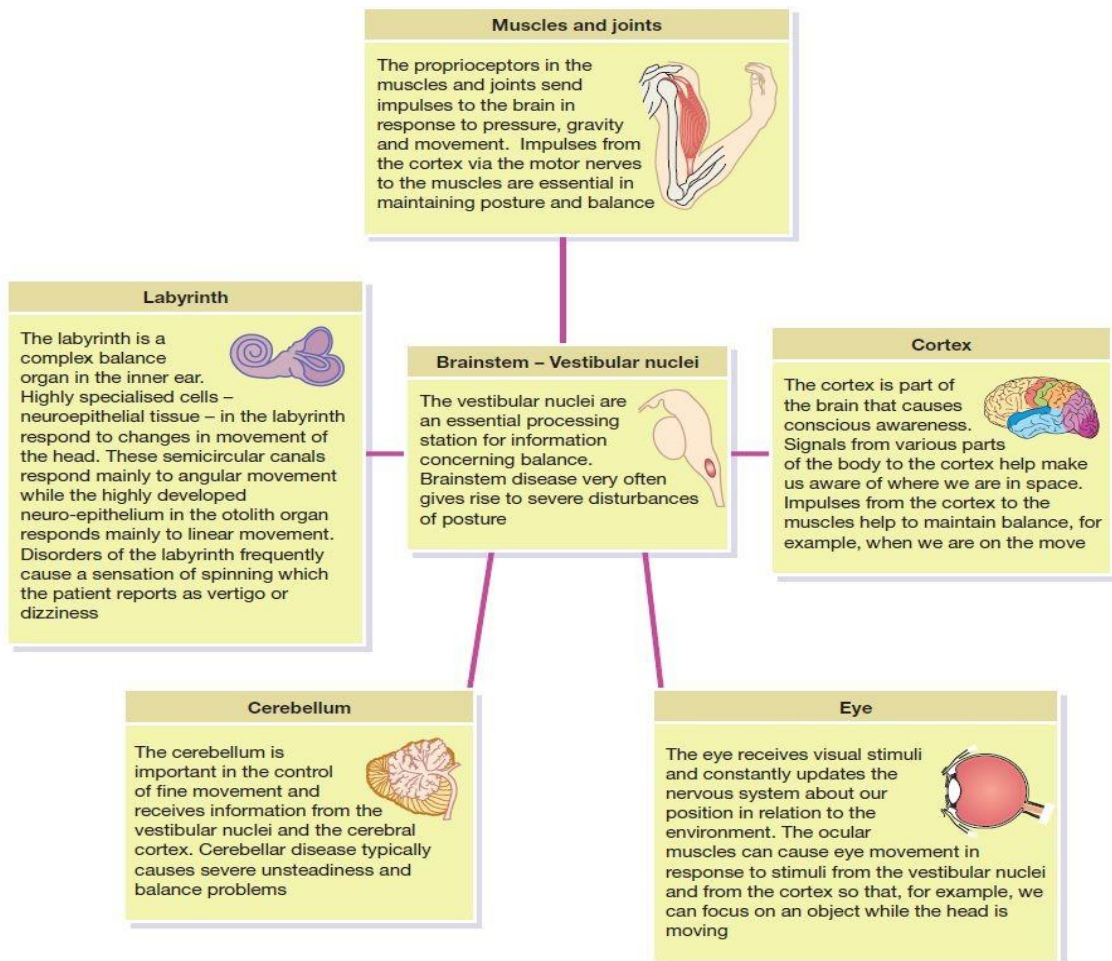
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## Introduction :

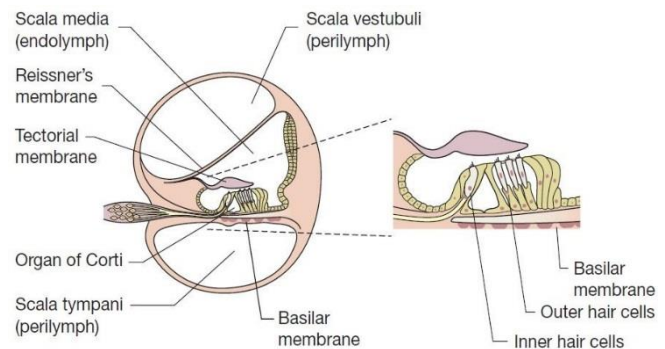
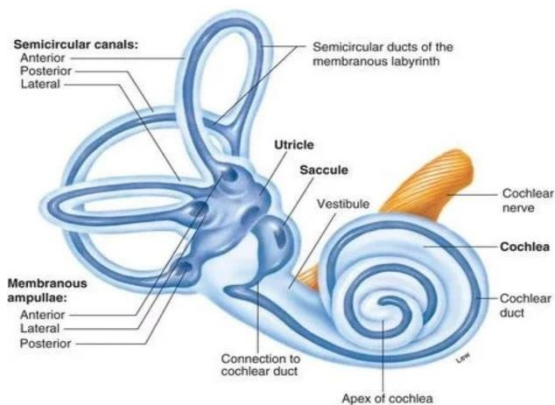
### What are the balance organs?

1. **Inner ear** (3 semicircular canals and otolith organ).
2. **Cerebellum.**
3. **Vision** (VOR-Vestibulo Ocular reflex):
  - To stabilize images on the retina during head movement by moving the eye in direction opposite to the direction of the head, thus keeping image on the center of the visual field.
  - The anatomical component of VOR are:
    - a. Semicircular canals.
    - b. Vestibular and oculomotor nuclei in the brainstem.
    - c. Extra-ocular muscles.
4. **Proprioception** (Muscles & Joints).
5. Cerebral cortex.



## ❖ Physiology:

- The body's sense of equilibrium is maintained by input from a number of sources. These include the (**eyes, proprioceptive organs** especially in the muscles and joints of the neck, peripheral nerves, the **labyrinth** or 'balance organ' in the inner ear which includes the vestibule and semicircular canals and the **cerebral cortex** and **cerebellum**).
- Input from all these sources converges in the brain stem; dysfunction of any of these systems may lead to imbalance, a feeling of unsteadiness, 'vertigo' – a sensation of movement – and a tendency to fall.
- Vertigo may be accompanied by 'nystagmus' – a rapid beating of the eyes to one side as impulses from the brainstem to the ocular muscles attempt to correct the patient's balance.
- **Vestibular System:** It is the apparatus of the inner ear that provides stable vision during head movements. It transforms the forces associated with head acceleration and gravity into biological signals that the brain can use to develop:
  - Subjective awareness of head position in space (**orientation**).
  - Produce **motor reflexes** that will maintain posture and ocular stability keep the eye focused on the object of interest.
  - Semi-circular Canals **Angular** Acceleration.
  - Utricle & Saccule:
    - Macule of the utricle: plan horizontal.
    - Macule of the saccule: plan vertical.
    - **Linear** acceleration horizontal & Vertical (gravity).



## ❖ Definitions:<sup>1</sup>

- The word "vertigo" comes from the Latin "vertere", to turn + the suffix "-igo", a condition = a condition of turning about.
- It is an allusion of rotary moving.

<sup>1</sup>What are the common types of dizziness?

**vertigo:** the illusion of movement of the self or nearby object.

**presyncope:** lightheadedness or faintness. **disequilibrium:** unsteadiness of the feet. **others:** usually a floating sensation.

- **Instability:** impossibility to maintain one's body in desired position. (كأنك فوق سفينة) and could be caused by low BP and low blood sugar.
- **Nystagmus:** Is an involuntary conjugated rapid repetitive eye movement.
  1. Side to side (horizontal).
  2. Up and down (vertical).
  3. In a circle (torsional/rotatory).

❖ **History:** (History is the most important key to diagnosis for a patient with dizziness)

- The diagnosis of the cause of vertigo or imbalance depends **mostly on history**, much on examination and little on investigation.
- Patients will use various terms to describe their imbalance including 'dizziness', 'vertigo', 'funny turns' and 'giddiness'.
- Pay particular attention to timing, i.e. are the symptoms:
  - Constant or episodic.
  - Short lived as in the **few minutes** of dizziness associated with **benign positional vertigo**.
  - Last for a **few hours** as in **Menière's disease**.
  - Are there associated **ear symptoms**:
    - deafness, tinnitus, earache or discharge, and are there neurological features (loss of consciousness, weakness, numbness, dysarthria and diplopia, or seizures).
  - Note the past medical history and make a record of the patient's medications (ototoxic drug intake: gentamicin and other aminoglycoside antibiotics).
- **What are the questions to ask in history? EXTRA**
  - Frequency: Recurrent, Non -Recurrent.
  - Duration: Seconds, Minutes, Hours to days.
  - Associated auditory symptoms: Tinnitus, Deafness, Fullness (إن حاس يقولك (المريض مليانة أذني).
  - Aggravating and relieving factors: Rolling over in bed, getting up from bed, looking up, Consume salty food.
  - Ear disease or ear surgery.
  - Trauma.
  - Migraine.

❖ **Examination:**

- BP (HTN), Pulse, Eye movement (nystagmus)
- **Hearing test:** Tone Audiogram, Speech Audiogram, examining the CN.8.
- **Balance test:** Romberg<sup>2</sup>, finger to nose test, unterberger test<sup>3</sup>.
- **Vestibular examination:** Caloric (ENG), swivel chair.

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<sup>2</sup>In the **Romberg test**, the patient stands upright and asked to close his eyes. A loss of balance is interpreted as a positive **Romberg sign**.

### ❖ Investigation:

- CT: Skull Fracture, tumor?
- MRI: Of brain, Tumor?
- Duplex sonography cervicals.
- VNG.
- Audiogram.
- Head impulse test.
- v-HIT.

### Extra:

**Table 14.1 Guide to causes of vertigo**

<b>Episodic with ear symptoms</b>
<ul style="list-style-type: none"> <li>• Migraine</li> <li>• Menie're's disease</li> </ul>
<b>Episodic without ear symptoms</b>
<ul style="list-style-type: none"> <li>• Migraine</li> <li>• Benign paroxysmal positional vertigo</li> <li>• Transient ischaemic attacks</li> <li>• Epilepsy</li> <li>• Cardiac dysrhythmia</li> <li>• Postural hypotension</li> <li>• Cervical spondylosis</li> </ul>
<b>Constant with ear symptoms</b>
<ul style="list-style-type: none"> <li>• Chronic otitis media with labyrinthine fistula</li> <li>• Ototoxicity</li> <li>• Acoustic neuroma</li> </ul>
<b>Constant without aural symptoms</b>
<ul style="list-style-type: none"> <li>• Multiple sclerosis</li> <li>• Intracranial tumour</li> <li>• Cardiovascular disease</li> <li>• Degenerative disorder of the vestibular labyrinth</li> <li>• Hyperventilation</li> <li>• Alcoholism</li> </ul>
<b>Solitary acute attack with ear symptoms</b>
<ul style="list-style-type: none"> <li>• Viral infection, e.g. mumps, herpes zoster</li> <li>• Vascular occlusion</li> <li>• Labyrinthine fistula</li> <li>• Round-window membrane rupture/head injury</li> </ul>
<b>Solitary acute attack without aural symptoms</b>
<ul style="list-style-type: none"> <li>• Acute labyrinthitis</li> <li>• Vasovagal faint</li> <li>• Vestibular neuronitis</li> <li>• Trauma</li> </ul>

Disorders of vestibular system cause vertigo and are divided into:

Peripheral Vestibular loss	Central Vestibular loss
<p>involve vestibular end organs and their 1st order neurons (i.e. the vestibular nerve). The cause lies in the internal ear or the VIIIth nerve.</p> <p><u>They are responsible for 85% of all cases of vertigo.</u></p> <p><b>Examples (will be discussed in details):</b></p> <ol style="list-style-type: none"> <li>1-Vestibular neuritis</li> <li>2-BPPV (benign paroxysmal positional vertigo)</li> <li>3-Meniere's disease</li> </ol>	<p>involve central nervous system after the entrance of vestibular nerve in the brainstem and involve vestibulo-ocular, vestibulospinal and other central nervous system pathways.</p> <p><b>Examples:</b></p> <ol style="list-style-type: none"> <li>1- CVA</li> <li>2- Acoustic neuroma</li> </ol> <p>If there is any neurological symptoms never call an ENT consultant:)</p>

Symptoms	Peripheral	Central
Imbalance	Moderate-severe	Mild-moderate
Nausea and vomiting	Severe	Variable
Auditory symptoms	Common	Rare
Neurologic symptoms	Rare	Common
Compensation	Rapid	Slow

## Peripheral vestibular loss

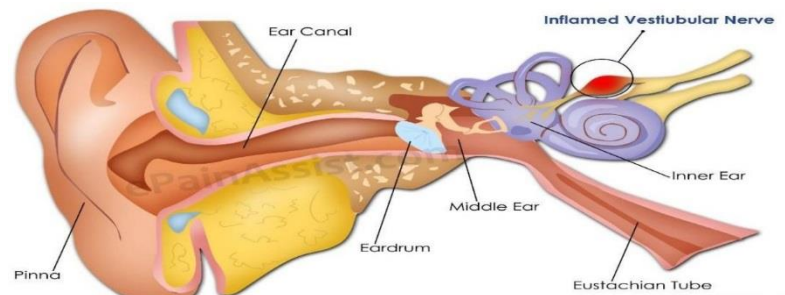
- ❖ **Vestibular neuritis:** (**labyrinthitis:** a similar syndrome, but with hearing symptoms) Caused by inflammation of the nerve cells in the balance portion of the inner ear.
  - **Mostly preceded by Viral infection** of vestibular organ (Measles, mumps, herpes zoster) Or URTI.
  - Affect all ages but rare in children.
  - Affected patient presents acutely with:
    - nystagmus.
    - Vertigo and nausea & vomiting.
    - Imbalance **WITHOUT hearing loss** that resolves over days leaving the residual imbalance that last days to weeks.
    - Patient is fully awake.
  - Neurological origin (stroke....) Should be eliminated.
  - Recovery from vestibular neuritis depend on the age of the patient.

### Clinical Features:

- **Acute phase:** severe vertigo (vertigo could turn into instability) with nausea, vomiting, and imbalance lasting 1 to 5 d, Irritative nystagmus (fast phase towards the offending ear) Patient tends to veer towards affected side.
- **Convalescent phase:** imbalance and motion sickness lasting days to weeks, Spontaneous nystagmus away from affected side, gradual vestibular adaptation requires weeks to months.

### investigation:

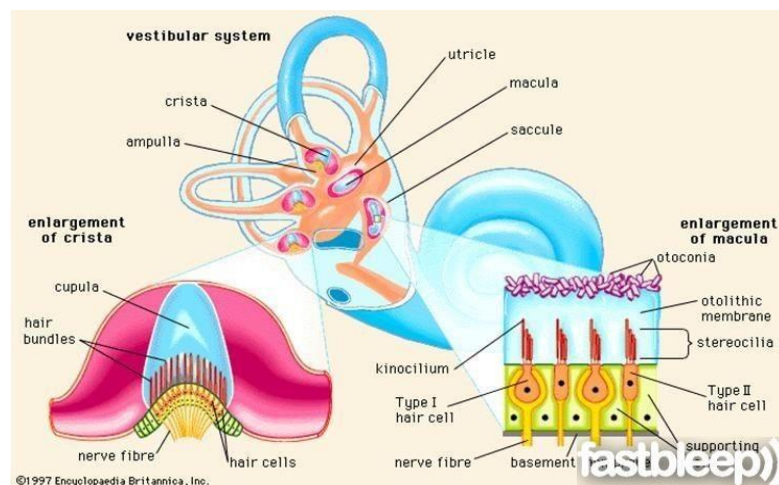
- Audiogramme
- videonystagmography
- v-HIT
- CT Scan
- MRI



### Treatment: usually self-limiting

- **The patient requires only symptomatic treatment:**
  - **Acute phase:** bed rest, vestibular sedatives (Gravol®), and diazepam.
  - **Convalescent phase:** progressive ambulation especially in the elderly, vestibular exercise: (involve eye and head movements, sitting, standing, and walking).

- **BPPV (benign paroxysmal positional vertigo):** Self-limited condition that resolves spontaneously over weeks to months.
  - **Etiology:**
    - Due to canalithiasis (migration of free floating otoliths within the endolymph of the semicircular canal) or cupulolithiasis (otolith attached to the cupula of the semicircular canal) can affect each of the 3 semicircular canals, although the posterior canal is affected in >90%.
  - BPPV is the most common cause of vertigo seen by otolaryngologists. ( in patient > 40 years.)
  - Represent 20% to 40% of patients with peripheral vestibular disease.
  - Posterior semicircular canal (Post SCC) is mostly affected in BPPV.
  - may occur spontaneously or following head injury. It is also seen in chronic otitis media.
  - The most common known cause was thought to be: closed head injury followed by vestibular neuronitis or Post ear surgery or dehydration.
  - Steady resolution of BPPV is to be expected over a period of weeks or months. It may be recurrent.



## Diagnosis:

- **History:**
  - Repeated attacks (episodic) of vertigo usually of short duration less than a minute.
  - Provoked by certain positions (rolling in beds, looking up for shaving, and head rotations, Getting a haircut). يقولك المريض انها تجيه اذا حركت رأسي يمين أو يسار أو انسدحت أو نزلت رأسي .. كل هالحركات يجي بعدها دوخة
  - A sensation that the head is 'spinning' occurs following a latent period of several seconds.
  - Not associated with any hearing impairment.
  - Never last for more than a 1 minute جاك مريض يقولك انا داخ من الساعة ٣ لازم تساله تقول اذا حركت راسك وجنك دوخة كم تستمر ؟ غالبا بيقولك اقل من دقيقة

- **Examination:**

- **Dix-Hallpike maneuver** ([Video](#)),

Five Signs of BPPV Seen with DixHallpike Maneuver:

- Geotropic rotatory nystagmus (**nystagmus MUST be present for a positive test**)..
- Fatigues with repeated maneuver and fixation.
- Reversal of nystagmus upon sitting up.
- Latency of ~20 s
- Crescendo/decrecendo vertigo lasting 20 s.

- Nystagmus will be seen but repeated testing results in abolition (canceling) of the vertigo.

### **Nystagmus in BPPV:**

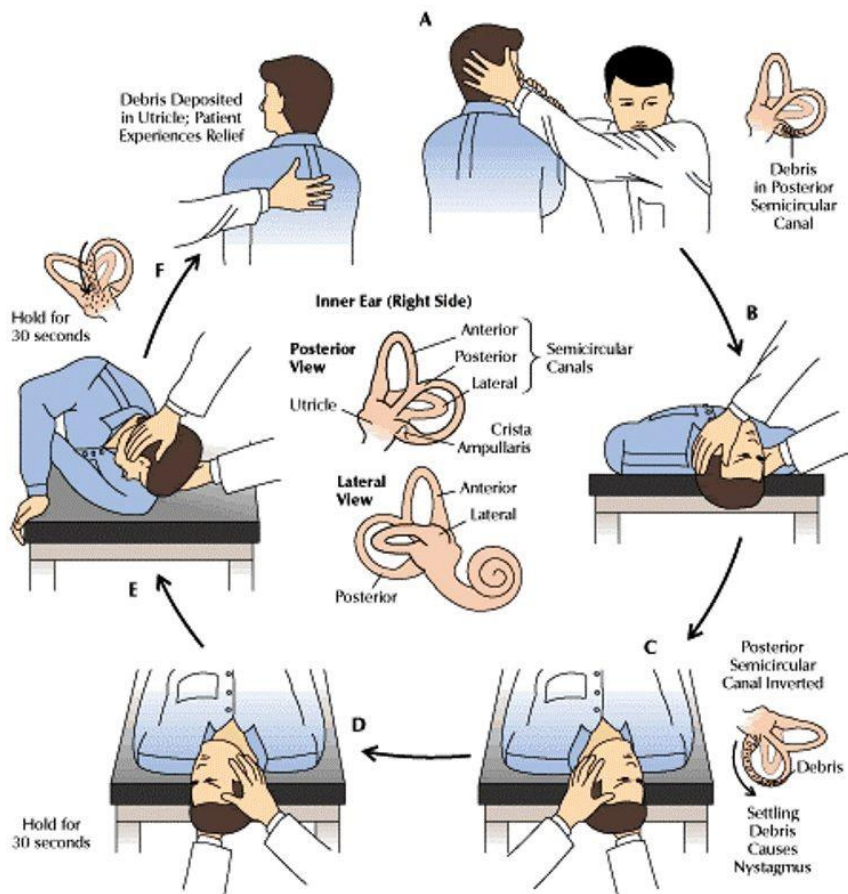
- The nystagmus is a combined vertical upbeating and rotary (torsional) component beating toward the downward eye.
- There is often a latency of onset of nystagmus (seconds).
- Duration of nystagmus is short (<1 minute).
- The nystagmus disappears with repeated testing (fatigable).

### **Treatment:**

- Aim of the treatment is to move the debris (otoconia) out of the affected semicircular canal back into the vestibule.
- Anti-emetics for nausea/vomiting.
- Particle repositioning maneuvers: **Epley maneuver** ([video](#)):  
Placement of the head into the Dix-Hallpike position. There is a 180-degree roll of the head to the position in which the offending ear is up. Patient is then brought to the sitting upright position.



# Dix-Hallpike maneuver



## ❖ Endolymphatic hydrop (Meniere's disease):

- Pathophysiology: Unknown etiology, but interest has focused on ↑ production of fluid within inner compartment or inadequate absorption of endolymph leads to endolymphatic hydrops. (Normally, endolymph is secreted by stria vascularis, fills the membranous labyrinth and is absorbed through the endolymphatic sac)
- Menière's disease is fortunately uncommon, but may be incapacitating.
- It usually **starts in one ear**, but the second becomes affected in 25% of cases.
- In 10 - 20% of cases the disease later involves the opposite ear.
- It can occur at any age, but its onset is most common between **40 and 60** years.
  - Causes: autoimmune, ischemia, mumps, syphilis, hypothyroidism, head trauma, previous infection, hormonal (pregnant women are more prone)

### Diagnosis:

- There is a typical triad of symptoms of:

1- **vertigo** (usually spinning sensation; lasts 20 minutes - 5hours) accompanied by nausea and vomiting with ataxia and nystagmus towards the unaffected ear

2- **deafness** (improves after the attack)(**Low frequency fluctuating SNHL** - Although deafness is **fluctuant** repeated attacks can cause significant sensorineural hearing loss)

3-**tinnitus** (usually low-tone roaring).

4- Aural fullness

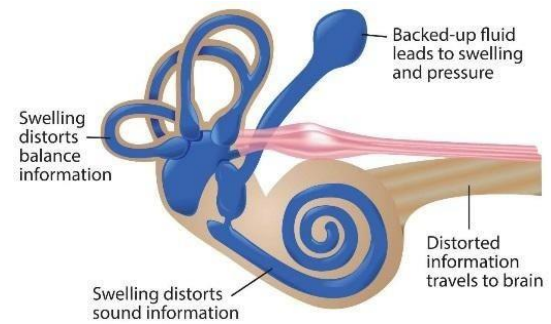
- fullness of the ear "**pressure**" (it's also happens before the onset of attack). Due to increased hydraulic pressure within the inner ear endolymphatic system.
- Vomiting is common during attacks.
- **Triggers: High salt intake, caffeine, stress, nicotine and alcohol.**
- The attacks can last from a few hours to several days
- it's usually unilateral.
- **Severe attacks may be accompanied by other symptoms of vagal disturbances such as abdominal cramps, diarrhea, cold sweats, pallor and bradycardia**
- Males are affected more than females.

### Investigations:

- PTA (pure tone audiometry).
- Speech audiometry
- Special audiometry tests: Positive recruitment test, SISI (short increment sensitivity index) test and tone decay test
- Electrocochleography
- Must monitor the other ear as bilaterally occur in 35% of cases, so the diagnostic criteria for Meniere's Disease (must have all three):
  - Two spontaneous episodes of rotational vertigo  $\geq 20$  minutes.
  - Audiometric confirmation of SNHL (often low frequency).
  - Tinnitus and/or aural fullness

## Treatment:

- Decrease intake of **CATS** (Chocolate, Alcohol, Tea, Salt).
  - Cessation of smoking
  - Avoid stress and bring a change in lifestyle
  - Medical therapy.
- **Acute attack:** Bed rest, vestibular sedatives (dimenhydrinate, promethazine theoclate or prochlorperazine), vasodilators.
- **Chronic phase:** Vestibular sedatives, vasodilators, diuretics, elimination of allergen, hormones (in case of hypothyroidism)
- Meniett device. apply pressure to your ear canal through a tube. This improves how fluid moves through your ear.
  - Chemical perfusion. Intratympanic gentamicin therapy, It reduces the function of the affected ear (destroy inner ear) so that the “good” ear takes over the balance.)
  - Surgery. (**destroying inner ear** -cut the nerve-)



## ❖ Vertigo consequences:

- Mental stress (possibly psychotherapy)
- Impairment of the quality of life
- possibility of deafness (M. Menière)
- Increased danger of falling (fractures, especially older patients)
- Serious health and social consequences.
- drive prohibition (safety issue - occupations requiring driver's license)
- loss of occupations.

## Central vestibular loss:

Wasn't mentioned in the lecture

### 1- CVA:

Elderly patient with chronic disease like (DM, HTN) with sudden attack of vertigo +neurological symptoms. **Vertigo is abrupt in onset, lasts several minutes and is associated with nausea and vomiting. Other neurological symptoms like visual disturbances, drop attacks, diplopia, hemianopia, dysphagia and hemiparesis resulting from ischaemia to other areas of brain may also accompany vertigo.**

### 2- Acoustic neuroma:

Benign tumor.

Arise from vestibular division of VIII. Pathogenesis:

- Starts in the internal auditory canal and expands into cerebellopontine angle (CPA), compressing cerebellum and brainstem
- When associated with type 2 neurofibromatosis (NF2): bilateral acoustic neuromas, café-au-lait skin lesions, and multiple intracranial lesions

### Clinical presentation:

- Unilateral tinnitus
- Hearing loss
- Dizziness But true vertigo is rare as tumor growth slowly thus compensation occurs.
- Facial nerve palsy and trigeminal (V1) sensory deficit (corneal reflex) are late complication.

**DDx: Acoustic neuroma mimics Meniere's disease in presentation and imaging is the only way to differentiate between them.**

### Diagnosis:

- History
- PTA (Unilateral SNHL)
- Radiology (CT, MRI)
- MRI with Gadolinium contrast is the gold standard.

### Treatment:

- Expectant management if tumor is very small, or in elderly. Definitive management is surgical excision.

**case scenario 1:**

50-year-old patient, medically free came with Sudden dizziness with head movement 3 days ago there is Horizontal Nystagmus to the left, No problems without Head movement. Accompanying symptoms (nausea, vomitus) and there is No hearing problems, no tinnitus).

Answer:

benign paroxysmal positional vertigo

**case scenario 2:**

32-year-old female patient with recurrent episodes of vertigo and Relapsing accompanying hearing loss, tinnitus, Frequently nausea and vomiting, Fall inclination both sides, Persistent hearing loss in the interval (weeks), Recurrent inflammation of both eyes.

Answer:

cogan syndrome

(Meniere's لو شلنا الجملة الاخيرة ممكن تكون)