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+team 436 group A

Done by: Waled Alaskah + Abdullah Aleidan, Lara Alsaleem + Yara Aldigi + Najd Altheeb

Edited by: khalid alhusainan, Safa Al-Osaimi

Revised by: Abdulaziz ALMohammed, Shrooq Alsomali

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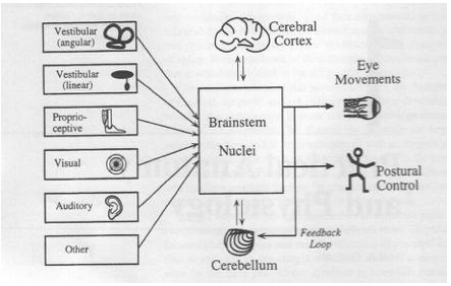
Introduction :

❖ 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)**.** To know the position of your joints
5. Cerebral cortex.
6.

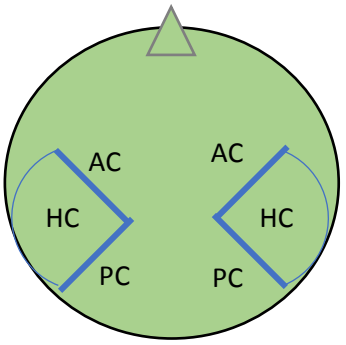


❖ Anatomy:

All these inputs (stimulus of an organ) integrate and go to the brain in a systematic way that allows the brain to generate a reflex

❖ The semicircular canals are paired:

We have Horizontal, Anterior, and Posterior (the left and right sides are parallel to each other). They act as sensors to detect any angular movement of the head.



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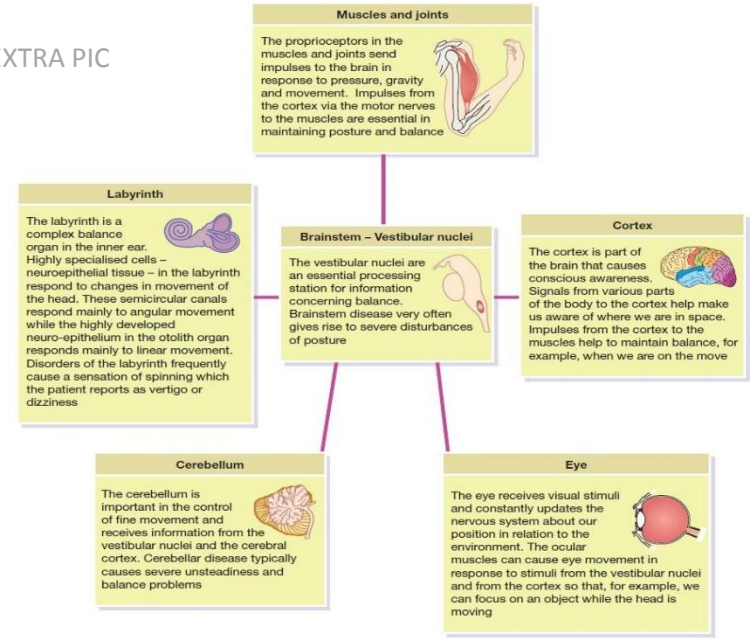


❖ Physiology:

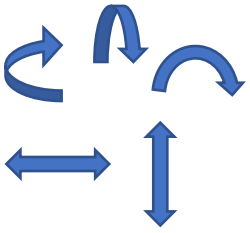
- The body's sense of equilibrium is maintained by input from a number of sources. These include the (**eyes**, **proprioceptive organs** especially in the muscles and joints of the neck, peripheral nerves, the **labyrinth** or 'balance organ' in the inner ear which includes the vestibule and semicircular 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).

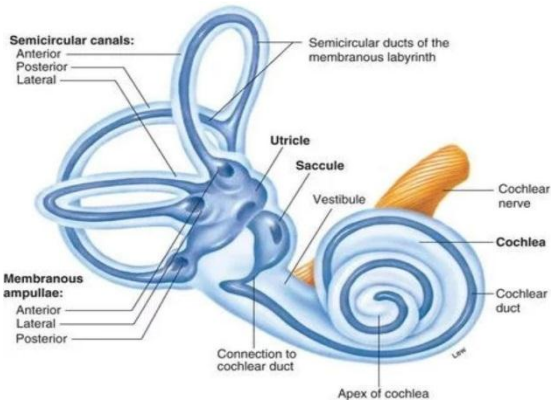
❖ Types of Spatial Movement:

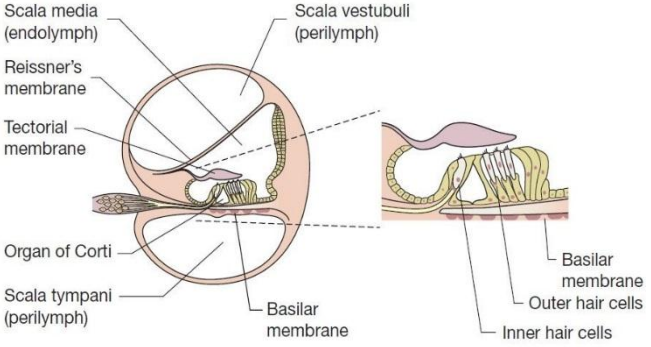
- Rotational – 3 degrees of freedom (semicircular canals)
- Translational – 3 degrees of freedom (otolith organs)



❖ Function of vestibular system:

- Head acceleration and gravity (stimulus) → biological signals → brain develops subjective awareness of head position (orientation) → produce motor reflexes (contracts and relaxes certain muscles) → maintains posture and ocular stability
  e.g; If someone were to ask you to concentrate on something and shakes your head, you will keep the object of interest in sight (keeping your eye mobility) and the clarity of vision despite the shaking.





❖ What is Dizziness?

- **An Illusion of movement of self or environment**.
- Exact description is important:
  - True spinning?
  - Lightheadedness?
  - Unsteadiness?
  - Fainting, passing out?

❖ Definitions:[1]

- 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.

- **Instability:** impossibility to maintain one's body in desire 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).

[1] 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.

❖ How to approach a patient with vertigo (MANEGMENT IN 5 MINTES) :

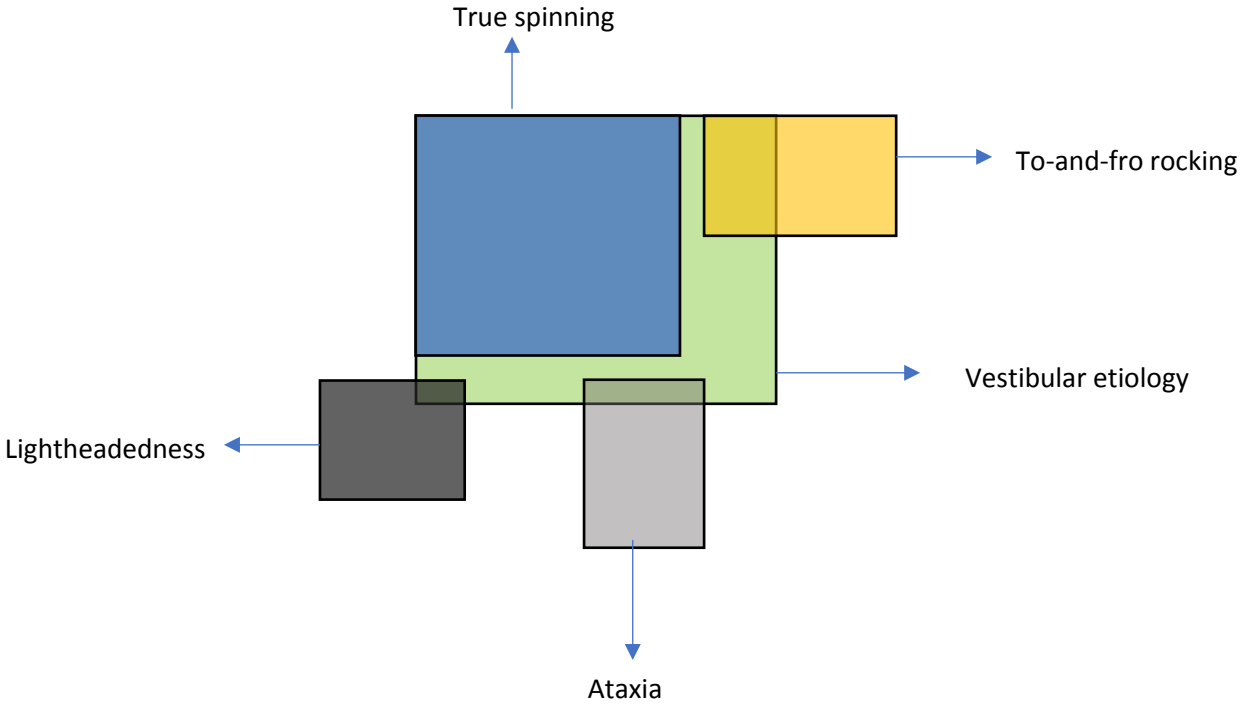
- Vestibular or Non vestibular?
- Central or Peripheral? Stroke or Otitis media? Your approach and Rx would be different
- Duration and auditory system hearing loss Was it for sec, min, or days? Was it hearing loss or tinnitus or any other symptom?
- Physical exam (10%).
- Treatment.

❖ Common peripheral diseases (vestibular apparatus+ VIII): (main first 3, you don't need to know about the rest)

- Vestibular neuritis. Inflammation of vestibular nerve
- BPPV. Benign Paroxysmal Positional Vertigo
- Menier's disease.
- Labyrinthine fistula.
- Superior semicircular canal dehiscence.
- Autoimmune inner disease.
- Vestibulopathy.
- Vestibular nerve tumor (vestibular schwannoma).

❖ Hint #1: Significance of True spinning.

- Almost all true spinning is vestibular. After R/O other causes of dizziness such as anemia and vit d deficiency.
- All vestibular is not true spinning.



❖ Vestibular vertigo features:

- Spinning sensation
- Nausea and vomiting
- Worse with head movement
- Ataxia
- Nystagmus

❖ Hint #2: Central vs. Peripheral.

- Central:
  - Neurologic symptoms
    - New severe headache
    - LOC
    - Numbness
  - Type of nystagmus
  - Risk factors (HTN, DM, if they're on Anticoag like warfarin)
  - No improvement within 48 hours
- Peripheral:
  - Ex. Meniere's
  - Ear symptoms

❖ Hint #3: Duration and Hearing loss

Vertigo	With Hearing Loss	Without Hearing Loss
Seconds-Minutes		BPPV usually less than a minute.
Minutes-Hours	Meniere's Disease	RV, MAV
Hours-Days	Labrynthitis (SSHL with vertigo)	Vestibular Neuronitis Lasts for days

❖ 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[2], finger to nose test, unterberger test[3].
- **Vestibular examination**: Caloric (ENG), swivel chair.

❖ 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

Episodic with ear symptoms
- Migraine
- Menie`re's disease

Episodic without ear symptoms
- Migraine
- Benign paroxysmal positional vertigo
- Transient ischaemic attacks
- Epilepsy
- Cardiac dysrhythmia
- Postural hypotension
- Cervical spondylosis

Constant with ear symptoms
- Chronic otitis media with labyrinthine fistula
- Ototoxicity
- Acoustic neuroma

Constant without aural symptoms
- Multiple sclerosis
- Intracranial tumour
- Cardiovascular disease
- Degenerative disorder of the vestibular labyrinth
- Hyperventilation
- Alcoholism

Solitary acute attack with ear symptoms
- Viral infection, e.g. mumps, herpes zoster
- Vascular occlusion
- Labyrinthine fistula
- Round-window membrane rupture/head injury

Solitary acute attack without aural symptoms
- Acute labyrinthitis
- Vasovagal faint
- Vestibular neuronitis
- Trauma

[2] In the **Romberg test**, the patient stands upright and asked to close his eyes. A loss of balance is interpreted as a positive **Rom**

[3] ask the patient to undertake stationary stepping for one minute with their eyes closed. A positive test is indicated by rotational movement of the patient towards the side of the lesion.

Disorders of vestibular system cause vertigo and are divided into:

Peripheral Vestibular loss	Central Vestibular loss
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. They are responsible for 85% of all cases of vertigo. **Examples (will be discussed in details):** 1-Vestibular neuritis 2-BPPV (benign paroxysmal positional vertigo) 3- Meniere's disease	involve central nervous system after the entrance of vestibular nerve in the brainstem and involve vestibulo-ocular, vestibulospinal and other central nervous system pathways. **Examples:** 1- CVA 2- Acoustic neuroma If there is any neurological symptoms never call an ENT consultant:)

EXTRA PIC

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.

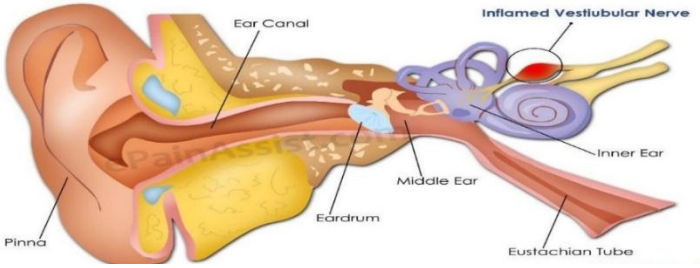
- Mostly preceded by Viral infection of vestibular organ (Measles, mumps, herpes zoster) Or URTI.
- Affect all ages but rare in children.
- Affected patient presents acutely (spontaneously) with:
  - nystagmus.
  - Vertigo and nausea & vomiting.
  - Imbalance **WITHOUT** hearing loss that resolves over 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.
- Patient required only symptomatic treatment
- It takes 3 weeks to recover from vestibular neuritis

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:

- Audiogram
- Videonystagmography
- v-HIT
- CT Scan
- MRI



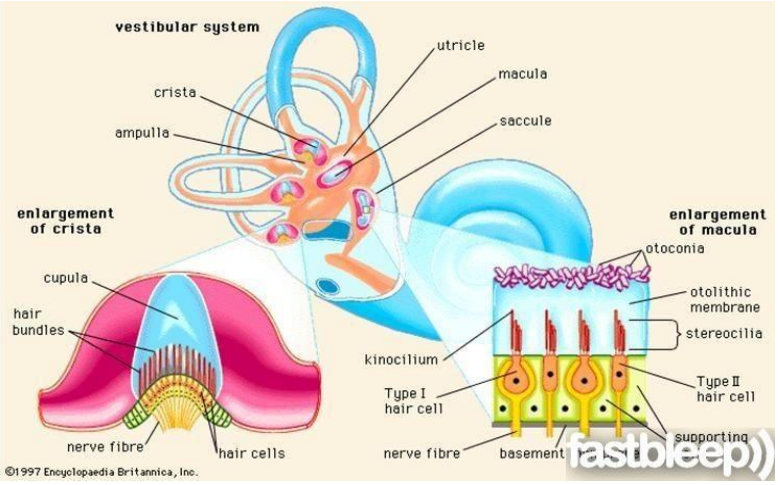
Treatment: usually self-limiting

- The patient requires only symptomatic treatment: you may give steroids
  - **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):** In short; Crystals or Particles enter the SC canals by mistake and cause dizziness.

- **Pathophysiology :**
  - **Calalithiasis theory: degenerative debris from utricle (otoconia) → floating freely in the endolymph.(migration of free floating otoliths within the endolymph of the semicircular canal).**
  - **Cupulolithiasis theory: Debris adhering to the capula. (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 peripheral 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
  - 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 او 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 3 جاك مريض يقولك انا دايخ من الساعة لازم تساله تقول اذا حركت راسك وجتك دوخة كم تستمر ؟ غالبا بيقولك اقل من دقيقة

- **Examination:**

- **Dix-Hallpike maneuver** (Video),

Five Signs of BPPV Seen with DixHallpike Maneuver: You're removing the particles back to where they came form.

- 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/decrescendo vertigo lasting 20 s.

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

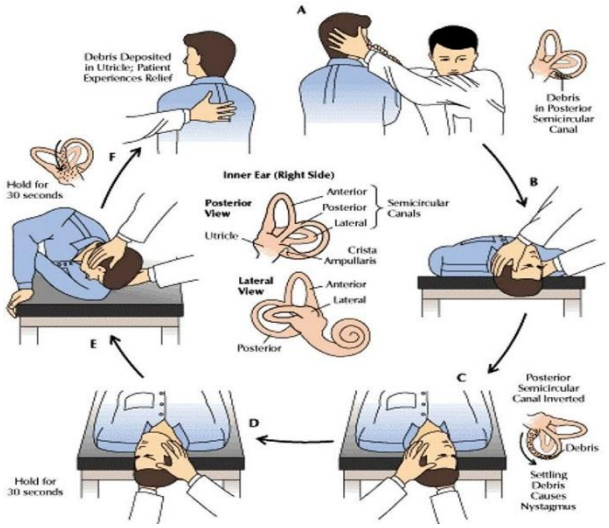
Nystagmus in BPPV:

- 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 is not imp, remember the 4 VERY IMP symptoms.

- 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)

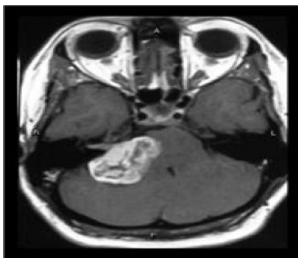
Diagnosis: **There is a typical triad of symptoms of:**

1. **Vertigo** usually spinning sensation; lasts minutes to hours (20 minutes - 5hours) accompanied by nausea and vomiting with ataxia and nystagmus towards the unaffected ear.
2. **Fluctuating SNHL** (deafness) (improves after the attack) (Low frequency fluctuating SNHL - Although deafness is fluctuant repeated attacks can cause significant sensorineural hearing loss) May start in one side and jump to another.
3. **Tinnitus** (usually low-tone roaring).

4. **Aural fullness** Acoustic neuritis is similar but DOES NOT HAVE FULLNESS of the ear, to differentiate between them you do an MRI of levator palpebrae.
    - 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:

- Audiology assessment
    - 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 ≥20 minutes.
- Audiometric confirmation of SNHL (often low frequency).
- Tinnitus and/or aural fullness
- Radiology
    - Image on the right→ CPA CerebelloPontine Angle tumor



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.

❖ Conclusion:

- Proper history is the most important key for diagnosis of a dizzy patient.
- A multi specialty (Cardiac, Optha, Psych) approach is sometimes appropriate for some complicated cases.
- Investigations should be tailored to the most likely diagnosis. Don't do unnecessary tests when they're not needed

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

(لو شلنا الجملة الاخيرة ممكن تكون Meniere's)

Questions

1. Young female complaining of acute persistent vertical vertigo no hearing loss no tinnitus no fullness, but she reported a history of respiratory infection last week. what is the diagnosis?

A- BPPV

B- Vestibular neuritis

C- Meniere's disease

Ans: B

2.A 60-year-old man, complaining of severe tinnitus, episode of vertigo, and hearing loss in his right ear. PTA showed SNHL in the right ear, while the left was normal. What are the suspected finding in tuning fork test in this patient?

A- Weber test is lateralized to the right, Rennes test is negative

B- Weber test is lateralized to the left, Rennes test is positive.

C- Weber test is central, Rennes test is negative.

D- Weber test is central, Rennes test is positive.

The Answer: B

3.A patient presented with history of hearing loss and vertigo. Pure tone audiometry showed SN hearing loss. ABR showed abnormal waves. What is the diagnosis?

A. Vestibulitis

B. Acoustic neuroma

C. Meniere disease

D. BPPV (Benign Paroxysmal Positional Vertigo)

Answer: B

4.28-year-old female presented with vertigo which last for minutes with hearing loss and tinnitus. What is most likely the diagnosis?

A- Benign paroxysmal positional vertigo

B- Vestibular neuritis

C- Meniere's disease

D- Acoustic neuroma

Answer: C

5. 26 years old female comes with 6 days history of severe vertigo associated with right sided hearing loss. She had a history of chronic suppurative otitis media for many years. On examination there is marginal moist perforation on the right ear drum. There is horizontal nystagmus. What is the most likely cause of vertigo? (vertigo)

A- Acute labyrinthitis

B- Benign paroxysmal positional vertigo.

C- Meniere’s disease

D- Vestibular neuritis

Answer: A