Evaluation of the Dizzy Patient

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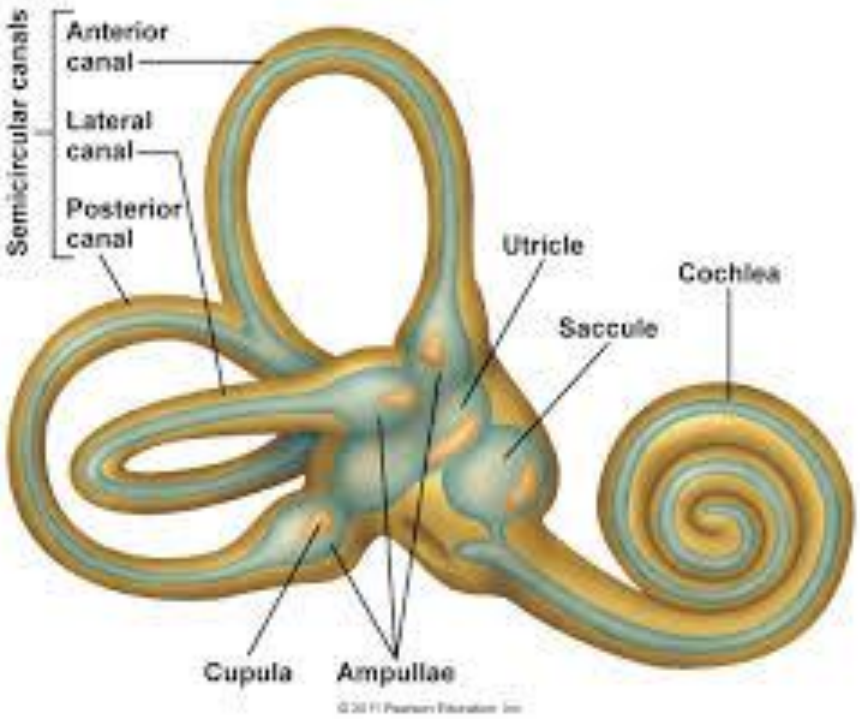
Outline

- Vestibular anatomy
- Defining and describing dizziness
- History
- Physical exam
- Differential diagnosis
  - Central versus peripheral
- Treatment

Vestibular Anatomy

- 3 semicircular canals: horizontal, superior, posterior
  - Detect rotational/angular acceleration
  - Canals are positioned at right angles
  - Organized in functional pairs
    - Any rotation in that plane is excitatory to one and inhibitory to the other
- 2 otolith organs: saccule, utricle
  - Detect linear movement and changes in gravity


Semicircular canals
Anterior canal
Lateral canal
Posterior canal
Utricle
Cochlea
Saccule
Cupula
Ampullae

Various Etiologies

- 40% peripheral vestibular dysfunction
- 10% central brainstem vestibular lesion
- 15% psychiatric disorder
- 25% other

- Diagnosis is not discovered in about 10% of patients

Dizziness

- Dizzy: “having or causing a feeling of spinning around and being unable to balance”. Spatial disorientation. Non-specific.

- Vertigo: “a feeling that everything is spinning around”.
  - False sense of motion. Spinning sensation.

- Lightheaded: “having a feeling that you may fall over or become unconscious”
  - Vague symptoms: Feeling disconnected

- Presyncope: An episode of near-fainting.
  - May include lightheadedness, dizziness, severe weakness, blurred vision, which may precede a syncopal episode.

- Disequilibrium: Sense of imbalance, instability. Occurs primarily with walking.
  - Off balance, wobbly

History

- Describe your dizziness
- Onset
  - Sudden vs. gradual
- Continuous vs. episodic
- Duration of symptoms/episodes
- Triggers, exacerbating factors
  - Positional
  - Noise
  - Pressure
  - Diet
- Associated symptoms:
  - Nausea/vomiting
  - Hearing loss
  - Ear pain
  - Neurologic symptoms
- Head trauma
- Falls
- Recent viral infection, ear infection
- Past medical history: HTN, otologic disease, neurologic disease, cardiovascular disease, migraine
- History of otologic surgery: Tympanoplasty, tubes, cholesteatoma, stapes surgery
- Medications
  - Prescription
  - Caffeine/nicotine/EtOH

Medications

- Alpha blockers
- Beta blockers
- Ace inhibitors
- Diuretics
- Clonidine
- Methyldopa
- Nitrates
- Psychiatric medications: tricyclic antidepressants, antipsychotics
- Phosphodiesterase inhibitors
- Urinary anticholinergics
- Opioids
- Parinsonian drugs: Levodopa, bromocriptine, carbidopa
- Muscle relaxants: Baclofen, cyclobenzaprine
- Aminoglycosides
- Chemotherapeutic agents
- >5 medications associated with dizziness

Post et al., 2010

Physical Exam

- Vital signs and orthostatic blood pressures
- Cardiovascular
  - Carotid auscultation
  - Arrhythmia
- Neuro exam
  - Cranial nerves
  - Romberg
  - Gait
  - Fakuda step
  - Head thrust
  - Strength/sensation
- Otologic exam
  - Pneumatic otoscopy
  - Tuning forks
  - Dix-Hallpike
  - Audiogram

Nystagmus

- Acute vestibular lesion fast phase away from the affected side
- Gaze away from the side of the lesion will increase the nystagmus
- Visual fixation suppresses nystagmus due to peripheral lesion, but not a central lesion

Nystagmus

NYSTAGMUS	Peripheral	Central
Direction	Unidirectional Fast phase toward the affected ear	Sometimes reverses direction Vertical
Type	Horizontal with torsional component Never purely torsional or vertical	Can be any direction
Visual fixation	Suppresses	Does not suppress

Gait

- Unilateral peripheral disorder will cause leaning toward the side of the lesion
- Romberg test: fall toward the side with the lesion
- Acute cerebellar stroke
  - Ataxia
  - Slow, wide based, irregular
  - Unable to walk without falling
- Parkinsonian
  - Shuffling
  - Wide based
  - Small steps

Dix Hallpike

Sensitivity: 50-88%

Parnes LS, Agrawal SK, Atlas J. Diagnosis and management of benign paroxysmal positional vertigo (BPPV). CMAJ. 2003:169:681-693

Dix Hallpike

- Posterior canal
- Geotropic, rotary nystagmus
- Latent onset
- Fatigable

Head Impulse Test

- Patient focuses eyes on target
- Gentle shake head
- Turn head quickly and unpredictably
  - Normal vestibular function will allow patient to maintain fixation on target
  - Deficient VOR on the side of the head turn will result in saccade back to the target after the head turn

Head Shake Test

- Patient leans forward 30 degrees
- Gently shake patient's head from side to side for 20 seconds
- Nystagmus indicates a peripheral lesion in the ipsilateral direction of the nystagmus
  - Fast phase toward the right indicates a right-sided lesion

Fakuda Step Test

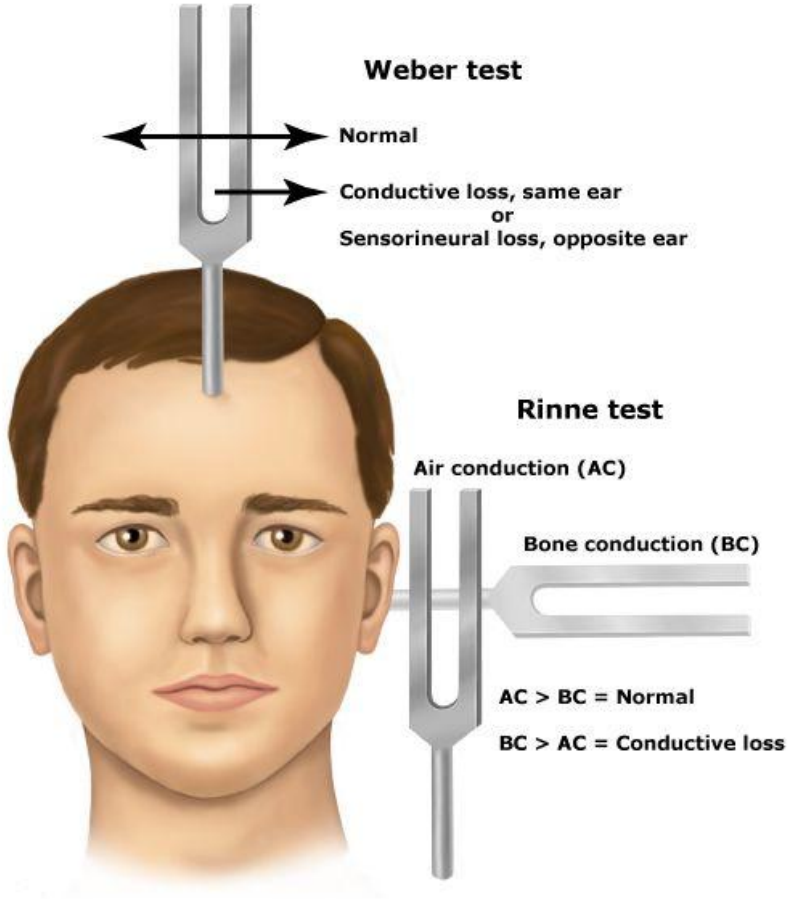
- Eyes closed
- March in place 20-30 seconds

- Positive test is a 30 degree turn
- Indicates weakness in the vestibular apparatus on the side the patient turns toward

Otologic exam

- Otorrhea
- Tympanic membrane
- Effusion
- Purulence
- Pneumatic otoscopy

Tuning fork exams



Uptodate.com

Hearing loss

- Conductive hearing loss
  - Acute otitis media
  - Cholesteatoma
  - Superior canal dehiscence
- Sensorineural hearing loss
  - Labyrinthitis
  - Meniere's disease
  - CPA pathology
- Normal hearing
  - Vestibular neuronitis
  - Migraine

Caloric Testing

- Warm/cold water irrigation of the EAC

- Cold illicits nystagmus with fast phase away from the ear
  - Inhibits the horizontal canal
- Warm illicits nystagmus with fast phase toward the ear
  - Activates the horizontal canal

- Maximum slow phase velocity
  - Standard measure of caloric response
  - Determined by dividing the duration by the amplitude of the slow phase

- Unilateral caloric weakness
  - The response of one side to a stimulus is reduced compared to the opposite side
  - A 20-25% difference between the ears suggests a unilateral peripheral weakness

Differential diagnosis

- Central vs. Peripheral
  - Concern for a central source should prompt imaging, stroke work up, neurology consult
    - Ataxia, vomiting, headache, diplopia, visual loss, slurred speech, numbness, weakness, incoordination
  - Peripheral pathology can be referred to ENT

Central vs. Peripheral

	PERIPHERAL	CENTRAL
Other neurologic signs	Absent	Present
Hearing loss	May be present	Absent
Gait	Unidirectional instability Walking preserved	Severe instability, ataxia Falls with walking

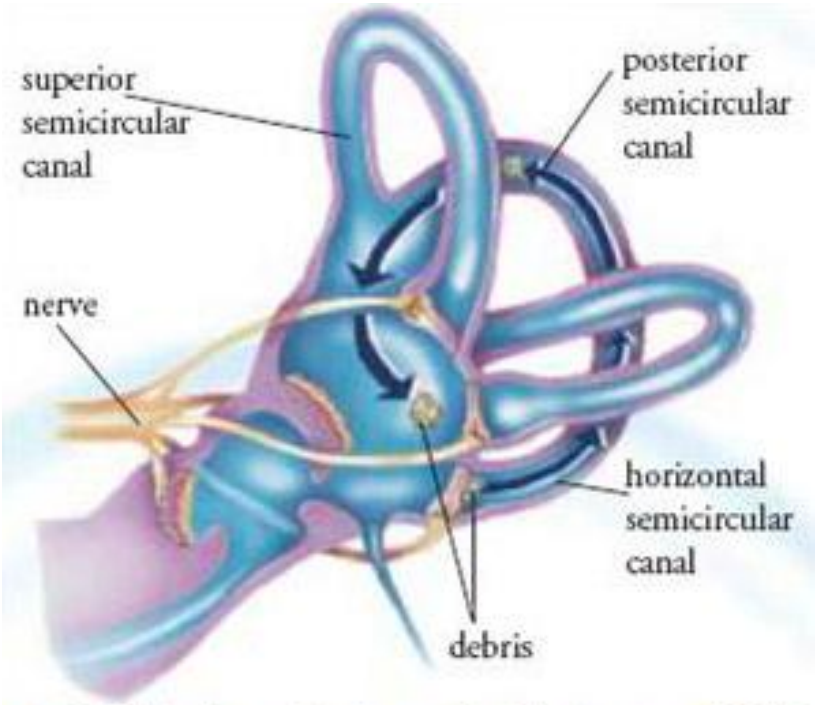
Time course

- Episodic
  - Seconds to minutes: BPPV, Superior canal dehiscence
  - Minutes to hours: Meniere's disease, migraine
- Constant
  - Days: Vestibular neuronitis, Labyrinthitis, cholesteatoma

BPPV

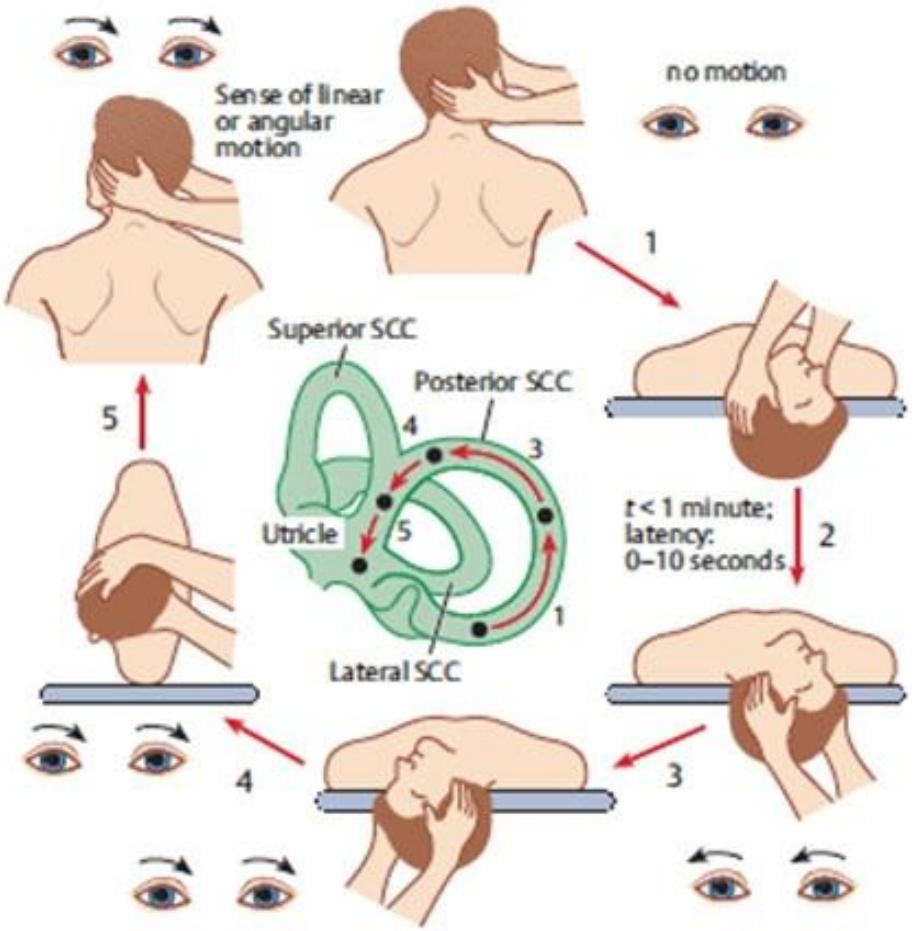
- Most common cause of vertigo
- Brief episodes (seconds)
- Triggered by positional changes
  - Rolling over in bed
  - Reaching overhead
- Most commonly involves the posterior canal
- Possible association with head trauma
- More common in older patients

Pathophysiology



▲ *Debris in the semicircular canals of the inner ear (BPPV)*

Epley Maneuver



D. Epley repositioning maneuver (right side affected).

Anatomy-physiotherapy.com

Surgical Treatment of Refractory BPPV

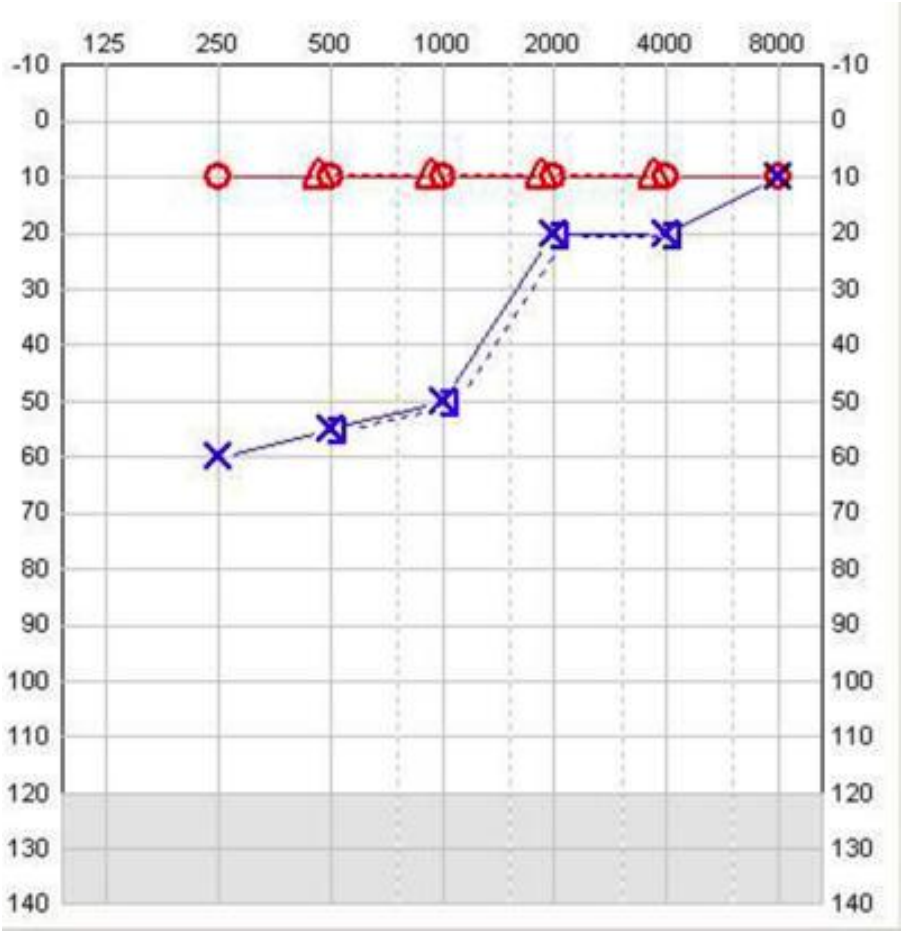
- Reserved for refractory, severe cases of BPPV

- Posterior Semicricular Canal Occlusion
- Singular neurectomy
- Labyrinthectomy
  - Permanent deafness

Meniere's Disease

- Episodes lasting hours-days
  - Vertigo
  - Aural fullness
  - Tinnitus
  - Hearing loss
    - Low frequency sensorineural loss
    - Recovery of hearing loss between episodes
    - Over time recovery between episodes can be incomplete and result in permanent hearing loss

Meniere's Audiogram



Diagnostic Criteria

1. Definite MD

A. Two or more spontaneous[1] episodes of vertigo, each lasting 20 minutes to 12 hours[2]

B. Audiometrically documented low- to medium-frequency sensorineural hearing loss[3,4] in the affected ear on at least one occasion before, during or after one of the episodes of vertigo [5,6]

C. Fluctuating aural symptoms (hearing, tinnitus or fullness) in the affected ear[7]

E. Not better accounted for by another vestibular diagnosis [8]

2. Probable MD

A. Two or more episodes of vertigo or dizziness, each lasting 20 minutes to 24 hours

B. Fluctuating aural symptoms (hearing, tinnitus or fullness) in the reported ear[1]

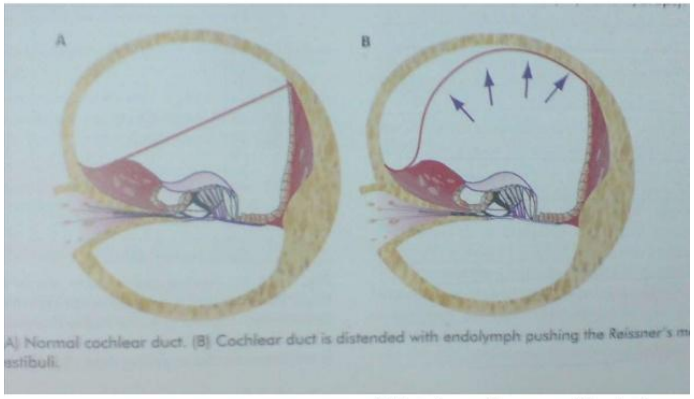
D. Not better accounted for by another vestibular diagnosis [2]

Variants of Meniere's Disease

- Cochlear hydrops
  - Isolated cochlear variant
  - Hearing loss, fullness, tinnitus
  - No vertigo
- Vestibular hydrops
  - Episodic vertigo
  - No hearing loss, fullness, tinnitus
- Lermoyez Syndrome
  - Increasing tinnitus, hearing loss, fullness
  - Sudden relief after a spell of vertigo
- Crisis of Tumarkin
  - Sudden loss of extensor function causing a drop attack
  - No loss of consciousness
  - Complete recovery
- Delayed Endolymphatic hydrops
  - Loss of hearing later followed by typical Meniere's symptoms

Pathophysiology

- Cochleovestibular hydrops
- Fluid imbalance
- Dilation of inner ear membranous labyrinth



Normal membranous labyrinth

Dilated membranous labyrinth in Meniere's disease (Hydrops)

Treatment

- Salt/caffeine restriction
- Dyazide
- Oral steroid
- Intratympanic steroid injection
- Intratympanic gentamicin injection

- Surgical treatment reserved for severe cases unresponsive to medical therapy
  - Endolymphatic sac decompression
  - Vestibular neurectomy
  - Labyrinthectomy
    Hearing loss

Cogan Syndrome

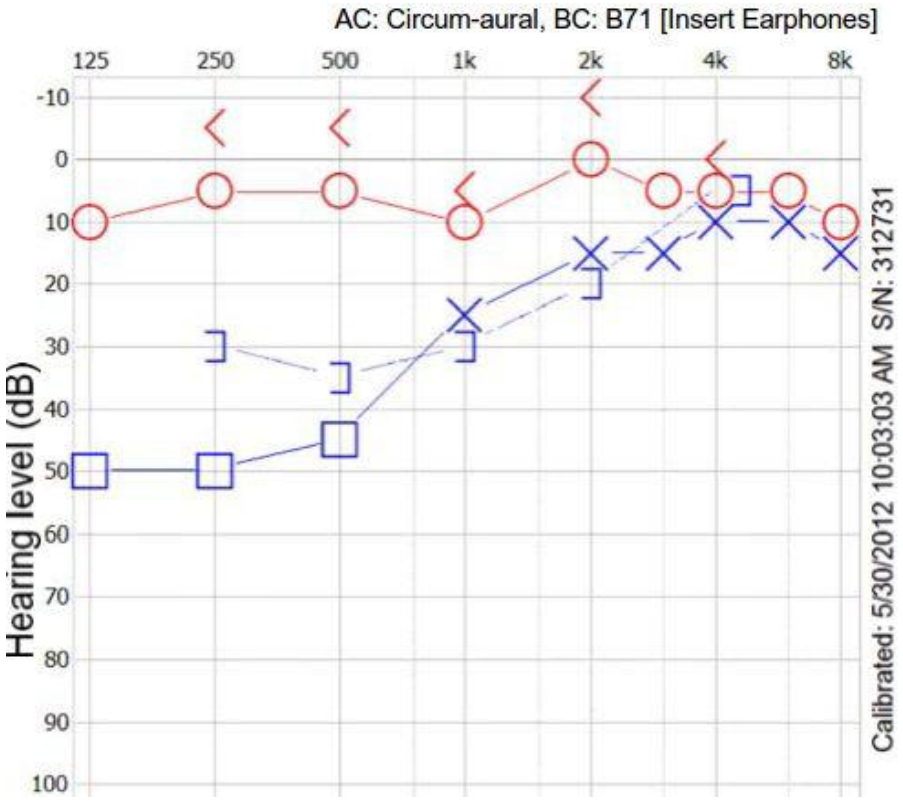
- Autoimmune disease
- Episodic vertigo, bilateral fluctuating SNHL with tinnitus
- Interstitial keratitis

- Consider in patients with known autoimmune disease or elevated inflammatory markers
- Referral to rheumatology

Superior Canal Dehiscence Syndrome

- Superior canal is dehiscent in the floor of the middle cranial fossa creating a 3rd window within the bony labyrinth
- Vertigo triggered by loud noises (Tullio phenomenon), pressure changes, valsalva
- Conductive hearing loss with suprathreshold bone line
- Autophony
- Normal otoscopy
- Pneumatic otoscopy may induce vertigo
- Diagnosed by temporal bone CT

Superior Canal Dehiscence



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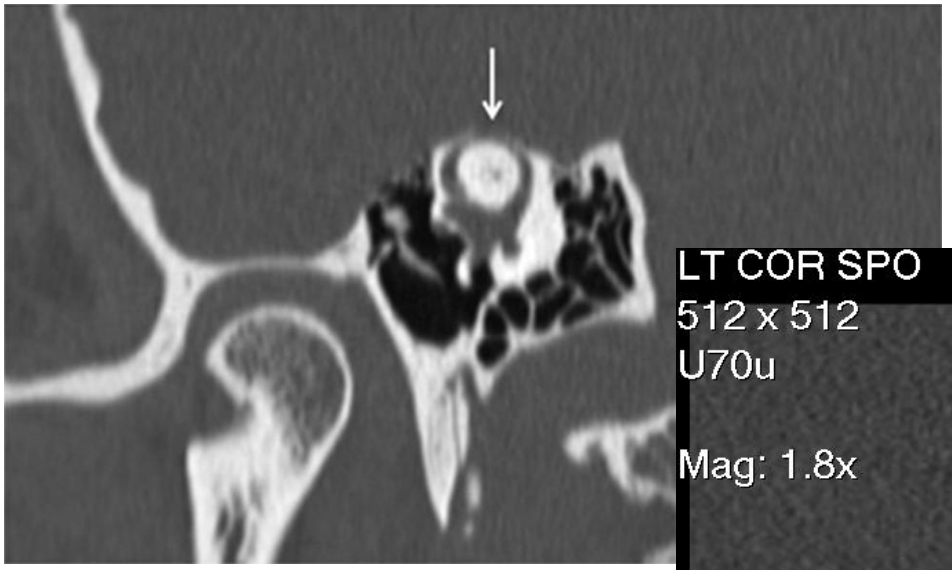
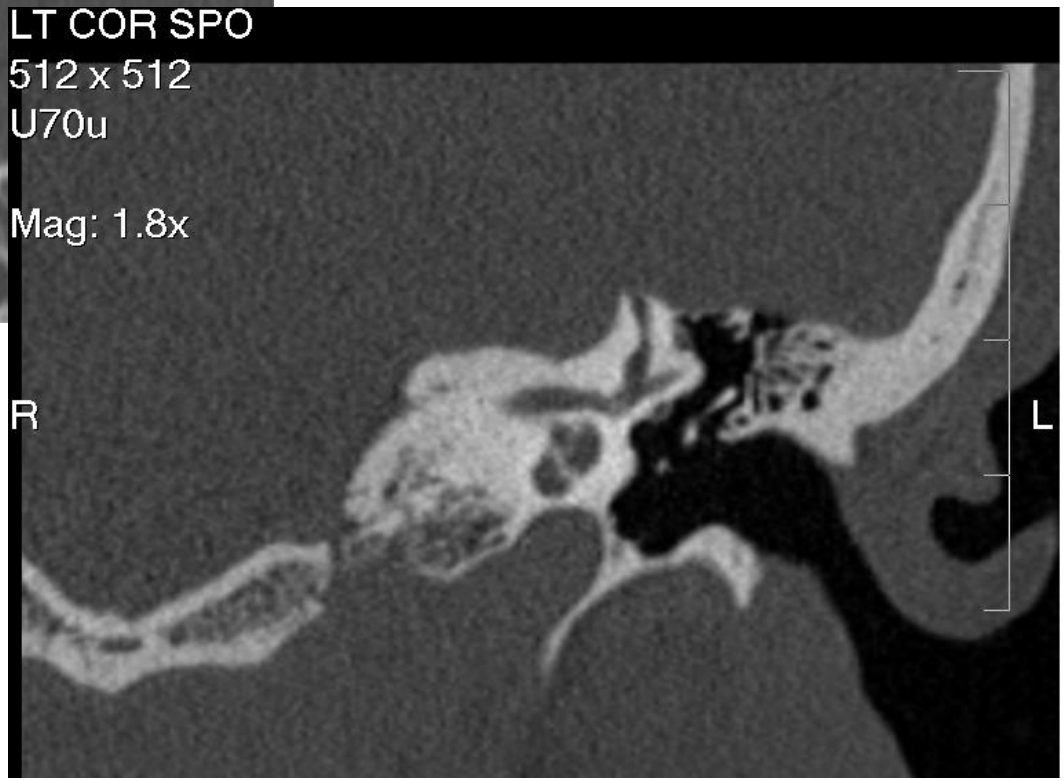
SCD





Poschl plane: 45 degrees from sagittal and coronal

Neurology.org

Treatment of SCDS

- Superior canal occlusion
  - Middle cranial fossa approach
  - Transmastoid

Vestibular Migraine

- Episodes lasting hours
- Associated with headache
- Visual disturbances
- Photo/phonophobia
- No hearing loss

- Treatment: dietary modifications, migraine management

Vestibular neuronitis

- Acute onset, intense vertigo
- Generally associated with URI or flu-like illness
  - Viral infection of the vestibular nerve
- Nausea/vomiting
- Hearing is usually not affected
- Vertigo lasts 24-48 hours and then gradually subsides
- Persistent unsteadiness/disequilibrium is common for several weeks as the CNS compensates
- Symptomatic management, reassurance
  - Steroid, anti-emetics, short term vestibular suppressants
  - Vestibular rehabilitation

Labyrinthitis

- Bacterial infection of the labyrinth from the middle ear space (AOM)
  - Through the round window, oval window or bone erosion with spread to the otic capsule
- Associated with permanent hearing loss
  - Audiogram
- Can progress to meningitis
  - Rarely secondary to meningitis via invasion through the cochlear aqueduct
- Tx: IV antibiotics with CSF penetration, surgical management of AOM (PE tube, mastoidectomy)

Cerebellopontine Angle Tumors

- Acoustic neuroma/vestibular schwannoma
  - Asymmetric sensorineural hearing loss
  - Unilateral tinnitus
  - Disequilibrium/vertigo
  - MRI: enhancing lesion at the IAC/CPA

- Meningioma
  - Enhancing lesion of the CPA, dural tail

Indications for Imaging SNHL

- Asymmetry of 15dB across 3 frequencies
- Asymmetry of 15dB at 3K Hz
- Asymmetry in WRS of >20%

- Sudden SNHL

Cholesteatoma

- Erosion of the horizontal canal can cause perilymphatic fistula
  - Vertigo
  - Otorrhea
  - Hearing loss
  - History of cholesteatoma or ear surgery

- CT temporal bone

Trauma

- Post-concussive syndrome
- BPPV
- Perilymphatic fistula
  - Temporal bone fracture

Aging

- Medications
- Co morbidities (Diabetes, heart disease, neurologic disease)
- Peripheral neuropathy
- Decreased proprioception
- Vision loss
- Decreased strength/muscle mass
- Fall risk

Medications for Acute Vertigo

- Meclizine
  - Vestibular suppressant
  - Long term use can prolong central compensation
- Ativan

- Anti-emetics

Conclusions

- Rule out acute central and cardiac pathology
  - Stroke
  - Acute cardiac disease
- Historical features with associated symptoms can suggest a diagnosis in many cases
- Physical exam
  - Dix-Hallpike
  - Audiogram/tuning forks
- Review medications and co-morbidities
- ENT referral
  - Associated with sudden hearing loss
  - Localizing or unilateral symptoms/physical exam findings
  - History of otologic pathology: cholesteatoma, ear surgery
  - Unclear diagnosis

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