Vertigo

Quick Bedside Assessment
Nothing to Disclose
Your patient presents with dizziness, dysequilibrium or nystagmus

- How do I ask the right questions?
- Is this vertigo?
- Does the patient have peripheral or central vertigo?
- Can I examine the patient in 10 minutes and know what is going on?
- Should I order an MRI?
- Will the MRI really answer the question or just make me feel less anxious?
Balance
When we lose balance, we get...

....anxious
Vestibular System Function

• **Balance**

  Dizziness occurs when the brain cannot resolve sensory conflict between visual, vestibular and proprioception systems.

• **Maintenance of visual fixation**

  Clinicians can use visual fixation disturbance signs to figure out where the problem is.

• **Muscle tone**
Vestibular Cochlear Complex
Three specialized hair cell organs for hearing, rotational sensation and acceleration/deceleration sensation.
Macula of Utricle and Saccule

Upright section of the utricular macula
- Otoliths (ear stones)
- Sensory hairs
- Hair cells

Displaced section of the utricular macula
- Gel-like substance

Head upright

Head bent forward
Semicircular Canal Function

<table>
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<tr>
<th>Semicircular Canal</th>
<th>Muscles that canal stimulates</th>
<th>Muscles that canal inhibits</th>
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<tbody>
<tr>
<td>Horizontal</td>
<td>Ipsilateral medial rectus</td>
<td>Ipsilateral lateral rectus</td>
</tr>
<tr>
<td></td>
<td>Contralateral lateral rectus</td>
<td>Contralateral medial rectus</td>
</tr>
<tr>
<td>Anterior</td>
<td>Ipsilateral superior rectus</td>
<td>Ipsilateral inferior rectus</td>
</tr>
<tr>
<td></td>
<td>Contralateral inferior oblique</td>
<td>Contralateral superior oblique</td>
</tr>
<tr>
<td>Posterior</td>
<td>Ipsilateral superior oblique</td>
<td>Ipsilateral inferior oblique</td>
</tr>
<tr>
<td></td>
<td>Contralateral inferior rectus</td>
<td>Contralateral superior rectus</td>
</tr>
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</table>
Internal Auditory Artery
May arise from basilar artery or AICA
# Neural Pathways for Oculomotor Control

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<tr>
<th>Pathway</th>
<th>Purpose</th>
<th>Anatomical structures</th>
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<tr>
<td>Vestibuloocular Reflex</td>
<td>Stabilization of gaze during impulsive head movement</td>
<td>Vestibular nucleus, MLF, Nucleus of VI, Nucleus of IV</td>
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<tr>
<td>Saccadic Eye Movement</td>
<td>Refixation on new target</td>
<td>Frontal Eye Fields, Cerebellum, Brainstem</td>
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<td>Smooth Pursuit</td>
<td>Track slow objects with foveal vision</td>
<td>Occipital and Parietal Cortex, Brainstem</td>
</tr>
<tr>
<td>Optokinetic Pursuit</td>
<td>Tracking with peripheral vision</td>
<td>Occipital and Parietal Cortex, Brainstem</td>
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</table>
Dog after ear cleansing flush into right ear with cold water.

The eyes deviate toward the cold or dead labyrinth (slow phase). When nystagmus occurs, it is a corrective saccade away from the nonfunctioning labyrinth (quick phase).
Optokinetische Nystagmus
Pendular Nystagmus
Differential Diagnosis of Dizziness

Medullary or Cerebellar infarct due to PICA occlusion (Wallenberg syndrome), Cerebellar infarct due to AICA occlusion, Vertebrobasilar insufficiency, Multiple sclerosis, seizures, Chiari malformation, cerebellar tumor or hemorrhage, Cerebellopontine angle tumor (acoustic neuroma, meningioma), Infection (Lyme, syphilis), Migraine, Labyrinthine disease, visual impairment (new glasses, retinal disease etc.), cervical myelopathy with posterior column involvement (cervical spondylosis, B12 deficiency), polyneuropathy (diabetes, chemotherapy etc.), vestibular neuronitis/labyrinthitis/ischemic labyrinthine injury, otitis media/cholesteatoma/meningitis etc., syphilis/ Lyme, medication, trauma/surgery, benign paroxysmal positional vertigo (BPPV), disorders of endolymphatic pressure regulation (Meniere’s disease, superior canal dehiscence, perilymphatic fistula. Blah, blah, blah, blah, blah, blah, blah. If you can read this, you have pretty good eyes, If you can read this, you must be in the front row. If you are reading this, try harder to listen to the lecture.
Distinguish between vertigo, oscillopsia, dysequilibrium, presyncope, brain fog.

Temporal pattern: affected by head movement, affected by surroundings, chronic or episodic.

Auditory symptoms: decrease or increase of hearing, ear fullness or pain, tinnitus or noise.

Associated symptoms: vision change, diplopia, numbness of face or limb, change of limb dexterity, alteration of speech or swallowing, balance change.

Ototoxic medications or polypharmacy.
Labyrinthine Disease

- Vestibular neuronitis/labyrinthitis/ischemic labyrinthine injury/otolithic avalanche
- Benign paroxysmal positional vertigo (BPPV)
- Disorders of endolymphatic pressure regulation (Meniere’s disease, superior canal dehiscence, perilymphatic fistula)
- Trauma/surgery
- Otitis media/cholesteatoma/meningitis etc.
- Medication
Benign Paroxysmal Positional Vertigo (BPPV)
Acoustic Neuroma
Superior Canal Dehiscence

Diagram showing the anatomy of the superior canal with dehiscence.

Images labeled A and B with annotations:
- Image A: Mastoid and Facial nerve.
- Image B: Temporal lobe (brain).
Perilymphatic Fistula
Neurological Causes due to Dysfunction of Central Integration

- Medullary or Cerebellar infarct due to PICA occlusion (Wallenberg syndrome)
- Cerebellar infarct due to AICA occlusion
- Vertebrobasilar insufficiency
- Migraine (vestibular migraine, basilar artery migraine)
- Multiple sclerosis
- Seizures
- Chiari malformation
- Cerebellar tumor or hemorrhage
- Cerebellopontine angle tumor (acoustic neuroma, meningioma)
- Infection (Lyme, syphilis)
Lateral Medullary Infarct/Wallenberg Syndrome

Vertigo, Horner Syndrome, INO, Loss of Pain and Temperature (may be crossed)
Benign Paroxysmal Torticollis/Vertigo
Neurological Causes of Dysequilibrium due to Disruption of Sensory Input

- Labyrinthine disease
- Visual impairment (new glasses, retinal disease etc.)
- Cervical myelopathy with posterior column involvement (cervical spondylosis, B12 deficiency).
- Polyneuropathy (diabetes, chemotherapy etc.)
- Trauma/cervical vertigo
Neuro-otological exam Part 1

- BP and pulse
- Head and neck exam
- Hearing (rubbing fingers, phone, 256 Hz tuning fork, Rinne and Weber)
- Cranial nerve exam (especially V, VII, IX, X)
- Internuclear ophthalmoplegia (INO), pain and temp loss, limb ataxia.
- Dysarthria, swallowing deficit
- Balance assessment (gait, tandem walk, Romberg, single leg stance etc.)
Neuro-otological exam Part 2

- Extraocular movements (saccades and smooth pursuit)
- Oculovestibular Reflex
- Spontaneous and gaze evoked nystagmus
- Head thrust test
- Head shaking nystagmus test
- Visual acuity during head movement
- Dix Hallpike manuever (For BPPV)
- Valsalva and sound stress tests (for SSCD)
- Voluntary hyperventilation
Head Thrust Test
Head Thrust Test
Positive Head Thrust Test Slow Motion
Head Thrust Test

Patient admitted for stroke
Head Shaking Test
Benign Paroxysmal Positional Vertigo (BPPV)
Benign Paroxysmal Positional Vertigo (BPPV)
**Dix Hallpike Manuever**

*Dix Hallpike is more sensitive if done in the morning due to fatigability feature.*

*Fixation suppression increases sensitivity.*

<table>
<thead>
<tr>
<th>Feature</th>
<th>Peripheral</th>
<th>Central</th>
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</thead>
<tbody>
<tr>
<td>Latency</td>
<td>3-5 seconds</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>Shorter (5-60 seconds)</td>
<td>Longer</td>
</tr>
<tr>
<td>Fatigability</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Reversal upon sitting up</td>
<td>Maybe</td>
<td>No</td>
</tr>
<tr>
<td>Vertigo/nausea</td>
<td>Common</td>
<td>Uncommon</td>
</tr>
</tbody>
</table>
Dix Hallpike Maneuver
Epley Maneuver (courtesy of Wikipedia and Dr. John Epley)

- The patient begins in an upright sitting posture, with the legs fully extended and the head rotated 45 degrees towards the affected side.
- The patient is then quickly and passively forced down backwards by the clinician performing the treatment into a supine position with the head held approximately in a 30 degree neck extension (Dix-Hallpike position) where the affected ear faces the ground.
- The clinician observes the patient's eyes for “primary stage” nystagmus.
- The patient remains in this position for approximately 1–2 minutes.
- The patient's head is then turned 90 degrees to the opposite direction so that the unaffected ear faces the ground, all while maintaining the 30 degree neck extension.
- The patient remains in this position for approximately 1–2 minutes.
- Keeping the head and neck in a fixed position relative to the body, the individual rolls onto their shoulder, rotating the head another 90 degrees in the direction that they are facing. The patient is now looking downwards at a 45 degree angle.
- The eyes should be immediately observed by the clinician for “secondary stage” nystagmus and this secondary stage nystagmus should beat in the same direction as the primary stage nystagmus. The patient remains in this position for approximately 1–2 minutes.
- Finally, the patient is slowly brought up to an upright sitting posture, while maintaining the 45 degree rotation of the head.
- The patient holds sitting position for up to 30 seconds.
Epley Maneuver
Treatment (briefly)

• Most peripheral vestibulopathies are self limited due to CNS adaption processes. Recurrent vertigo may warrant specific therapies.

• Vestibular suppressant medicines (meclizine, scopolomine, phenothiazines etc.) may provide symptomatic relief for sustained peripheral vestibulopathies and expense of slowing down CNS adaption and recovery. Medication is unhelpful for BPPV.

• Brandt Daroff exercises may speed up central adaption but can aggravate certain forms of BPPV.

• Physical therapy evaluation can help with assessment and with treatment of certain types of vertigo, especially BPPV.

• DizzyFix for BPPV  http://www.clearwaterclinical.com/dizzyfix

• ENT and Neurology referrals may be needed for protracted or unusual cases.

• OHSU Vestibular (Balance) Program

• VEDA (Vestibular Disorders Association)  http://vestibular.org/
VERTIGO: ver'-ti-go—
a feeling of dizziness . . .
a swimming in the head . . .
figuratively a state in which
all things seem to be engulfed
in a whirlpool of terror.