Positional Vertigo

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Definition of Positional Vertigo

- Sensation of motion
- Elicited by changing of position of head or body
- With respect to one another or gravity

Frames of reference

Head r.e. gravity
  - otologic and central positional vertigo
Head r.e. body (trunk)
  - cervical vertigo
Body r.e. gravity
  - orthostasis

Head r.e. Gravity

- Benign paroxysmal positional vertigo
- Peripheral otolithic disturbance
- Central otolithic disturbance

Case SH

- 61 y/o slipped and fell, hitting back of head
- LOC for 20 min
- In ER, unable to sit up
- Hallpike maneuver - positive on left

Dix Hallpike was positive
BPPV nystagmus

- Latency (0-20 sec)
- Burst (< 60 sec)
- Upbeating/Torsion vector
- Reversal on sitting
- Fatigue with repetition

Video Frenzel Goggles make it easier

Prevalence of BPPV is high

- 20% of all vertigo
- 50% of vertigo in older persons.
- Linear increase with age!
- 85% of all positional vertigo

BPPV Mechanism
canalithiasis (loose rocks)

There is good pathological evidence for these alternatives too.

Cupulolithiasis and short arm alternatives to canalithiasis

BPPV timing: Latency, burst, reversal, fatigue
Mathematical Model of BPPV:


Path also affects latency

- Long latency for eccentric particles due to wall effects and collisions. No nystagmus for case ‘C’ which hits wall before entering duct

Cupulolithiasis produces less nystagmus/otolith

- Debris attached to cupula
- No hydrodynamic amplification
- Low level nystagmus (0.6 deg/sec per otoconium vs 2 overall for canalithiasis).
- Should build up due to cupula dynamics and velocity storage.

Mechanism of Latency and fatigue of BPPV

- Hydrodynamic advantage is less in ampulla
- Margination -- fatigue

Bigger particles produce stronger nystagmus

- Larger particles produce stronger nystagmus that peaks later.
- It takes 20 7.5 um otoconia to produce about 45 deg/sec

Inertia of otoconia is unimportant to diagnosis or treatment

- PositionAL vs PositionING. Does this matter?
- In theory, not very much.
  - Stokes velocity for 1 g acceleration is 0.2 mm/sec
  - Large radius of canal is 3.2 mm, so diameter is roughly 20 mm.
  - Particle only moves 1% of diameter in 1 second.

### BPPV Variants

Ewald’s first law: eye movements occur in the plane of the canal being stimulated. Three canals → three vectors.

- Posterior canal
- Lateral canal
- Anterior canal

### Vector of nystagmus tells you the variant of BPPV

<table>
<thead>
<tr>
<th>Variant</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior Canal (94%)</td>
<td>Upbeating/Torsion</td>
</tr>
<tr>
<td>Lateral Canal (5%)</td>
<td>Horizontal DCPN</td>
</tr>
<tr>
<td>Anterior canal (1%)</td>
<td>Downbeating</td>
</tr>
</tbody>
</table>

### Diagnosis of Lateral Canal

- **Best position is not head-hanging** but head up 30 degrees (to make lateral canal perpendicular)
- Can be either geotropic or ageotropic
- Should reverse direction r.e trunk with head forward (if doesn’t, is cervical)

### Mixed canal variant BPPV

- **Mixed canal**
  - Debris in more than one canal
  - Signature - nystagmus revectors over time (i.e. starts posterior, changes to horizontal).
BPPV Summary

- BPPV is easily diagnosed (Hallpike maneuver)
- Anatomic locations explain nystagmus patterns, and have specific maneuvers.

Positional nystagmus -- Head r.e. Gravity

- BPPV
- Central otolith - AKA central positional nystagmus
- Peripheral otolith

Central Positional Nystagmus

- Otoliths are the only sensor available to brain regarding orientation to gravity
- Central otolith processing mainly occurs in midline cerebellum.

Cerebellar Medulloblastoma

- Mainly affects children
- Begins in cerebellar nodulus -- vestibulocerebellum
- Hydrocephalus (projectile vomiting) and cerebellar signs.
- STRONG positional nystagmus

Central positional general rules

- Generally horizontal
- Direction changing (like lateral canal)
- Non-fatiguing
- Does not revector with maneuvers
- Accompanied by other central signs (e.g. ataxia)

This child is holding onto the bed rail due to ataxia from a medulloblastoma
Head r.e. Trunk (e.g. Cervical Vertigo)

- Circulatory disturbance
- Pain/spasm in neck
- Cervical disk disease

Core symptom of cervical vertigo

- Symptoms provoked by head-on-trunk movement, regardless of position r.e. gravity.

Core bedside test for cervical vertigo: Vertebral Artery Test (VAT)

- Using Frenzel goggles
- Person sitting upright
- Turn head to one side
- Hold for 20 seconds
- Watch for nystagmus

Bow Hunter’s Syndrome (very rare)

- Vascular compression. The vertebral arteries in the neck can be compressed by the vertebrae (which they traverse), or other structures (Kamouchi, Kishikawa et al. 2003; Sakaguchi, Kitagawa et al. 2003). Arthritis, surgery, chiropractic manipulation are all possibilities.

Chiropractic manipulation

- The most common cause of vertebral dissection is chiropractic manipulation (Vibert et al. ORL, 1993).
- We recommend against chiropractic treatment of vertigo that includes “snapping” or forceful manipulation of the vertebrae in persons with dizziness or unstable necks.

Pain/ stiffness in neck as cause of cervical “vertigo”

- Dejong and Dejong - classic paper (1977)
- Vestibular system needs to know where head is to do VSR
- Neck muscle spasm/pain may create false perception of neck position
- No simple mechanism to cause nystagmus

Brandt 1996 ; Dejong and Dejong (1977)
Cervical Spinal Stenosis

Circulatory disturbance
Pain/spasm in neck
Cervical disk disease

- Cervical cord compression (Benito-Leon, Diaz-Guzman et al. 1996; Brandt 1996). In this case, ascending or descending tracts in the spinal cord that interact with the cerebellum, vestibular nucleus or vestibulospinal projections are the culprit. This may be painless.
- In our opinion, based on clinical observations during videonystagmography, this is the most common mechanism of cervical vertigo.

Third type of positional vertigo: Body r.e. gravity

- Orthostatic hypotension
- CSF leak

General points

- These people are dizzy upright, not supine
- They complain of faintness rather than vertigo
- They don't have any nystagmus

BEDSI DE MANEUVERS

- BPPV
  - Dix Hallpike test
  - Head on body (lateral canal)
- Central Vertigo
- Cervical Vertigo

Diagnosis: Dix-Hallpike Maneuver

Dix-H
L-canal
Central
VAT

Dix Hallpike Technique

- Use Frenzel goggles
- Turn head first
- Bring back briskly
- Attempt to get head 20 deg dependent
- Wait for 20 seconds
- Look what happens when sits up
Anterior canal BPPV

- Dix Hallpike used again
- Vertical rather than upbeatning nystagmus
- Bad ear is on OPPOSITE side as maneuver
- May see no torsion

Lateral Canal BPPV

- Use video Frenzels
- Supine or caloric positioning
- Head-Right
- Head-Left

Logic of maneuver for Lateral Canal BPPV

- Direction changing nystagmus
- Geotropic or Ageotropic, depending on starting location of dirigible debris.
- Cupulolithiasis always ageotropic.
- Most commonly seen post Epley maneuver

Central positional tests

- Same as lateral canal
- Be sure to check VAT or prone (next)

“Vertebral artery” test

- Use Frenzels
- Turn head to side
- Wait for nystagmus

Other ways to separate trunk from gravity

- Head prone vs. Head supine (gravity reverses, trunk doesn't).
- Head on body vs. head on trunk (better for optical frenzels)
Bedside tests for Cardiovascular Orthostasis

- Blood pressure upright and supine
- Pulse upright and supine
- Standing provoking increase of 20 in pulse drop in systolic BP suggestive
- Lots of confounding factors - anxiety for example.

ENG in Positional syndromes

- Dix-Hallpike Test: Posterior Canal BPPV
  - Latency
  - Burst
  - Reversal
  - Fatigability

ENG in Positional syndromes

- Positional test: Lateral Canal BPPV
  - Latency (none)
  - Burst
  - Direction changing required
  - Be sure not cervical

ENG in Positional syndromes

- Positional test: Anterior Canal BPPV
  - Dix-Hallpike maneuver
  - Latency is expected
  - Burst of DBN

Mixed canal BPPV

- Dix-Hallpike provokes a nystagmus that starts in one canal, persists in another canal.
- Common mix is horizontal and posterior.

For more see: