

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

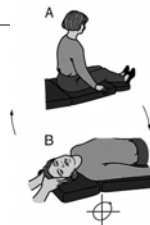
Head r.e. Gravity

Head:gravity
Head on trunk
Body:gravity

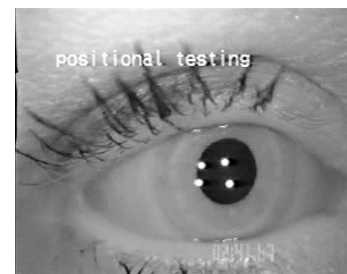
- Benign paroxysmal positional vertigo
- Peripheral otolithic disturbance
- Central otolithic disturbance

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



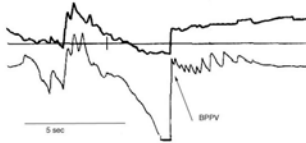
Dix Hallpike was positive



BPPV nystagmus



C. Nystagmus of BPPV



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

Video Frenzel Goggles make it easier



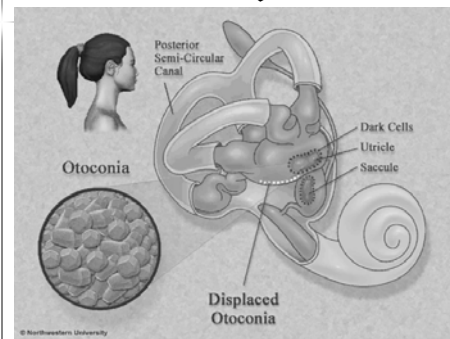
C/o Micromedical Technology, Chatham, IL



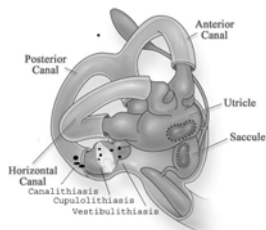
Prevalence of BPPV is high

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

BPPV Mechanism canalithiasis (loose rocks)

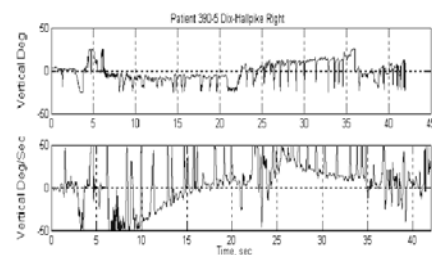


Cupulolithiasis and short arm alternatives to canalithiasis

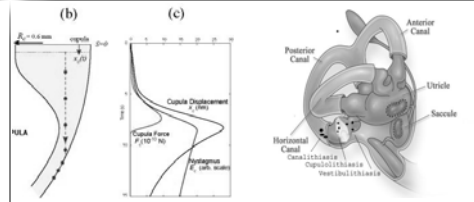


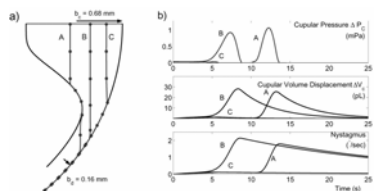
There is good pathological evidence for these alternatives too.

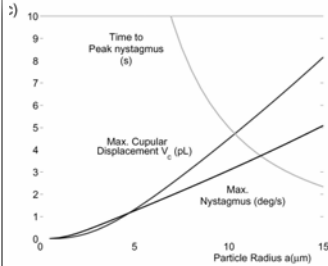
BPPV timing: Latency, burst, reversal, fatigue



	<h2>Mathematical Model of BPPV:</h2>
	<ul style="list-style-type: none"> ■ Squires T, Weidman M, Hain T, Stone H. A mathematical model for top-shelf vertigo: the role of sedimenting otoconia in BPPV. J. Biomech. vol. 37, issue 8, pp 1137-1146, 2004

	<h2>Mechanism of Latency and fatigue of BPPV</h2>
	<div>  </div> <ul style="list-style-type: none"> ○ Hydrodynamic advantage is less in ampulla ○ Margination -- fatigue <p><small>Squires T, Weidman M, Hain T, Stone H. A mathematical model for top-shelf vertigo: the role of sedimenting otoconia in BPPV. J. Biomech. vol. 37, issue 8, pp 1137-1146, 2004</small></p>

	<h2>Path also affects latency</h2>
	<div>  </div> <p>About 2 deg/sec/otoconium</p> <ul style="list-style-type: none"> ■ Long latency for eccentric particles due to wall effects and collisions. No nystagmus for case 'C' which hits wall before entering duct

	<h2>Bigger particles produce stronger nystagmus</h2>
	<div>  </div> <p>Larger particles produce stronger nystagmus that peaks later.</p> <p>It takes 20-7.5μm otoconia to produce about 45 deg/sec</p>

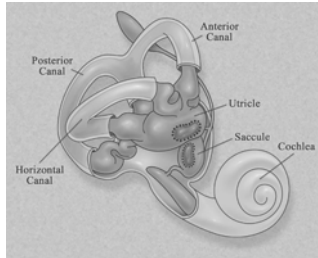
	<h2>Cupulolithiasis produces <u>less</u> nystagmus/otolith</h2>
	<ul style="list-style-type: none"> ■ Debris attached to cupula ■ No hydrodynamic amplification ■ Low level nystagmus (0.6 deg/sec per otoconium vs 2 overall for canalithiasis). ■ Should build up due to cupula dynamics and velocity storage. <p><small>Squires T, Weidman M, Hain T, Stone H. A mathematical model for top-shelf vertigo: the role of sedimenting otoconia in BPPV. J. Biomech. vol. 37, issue 8, pp 1137-1146, 2004</small></p>

	<h2>Inertia of otoconia is unimportant to diagnosis or treatment</h2>
	<ul style="list-style-type: none"> ■ PositionAL vs PositionING. Does this matter ? ■ In theory, not very much. <ul style="list-style-type: none"> – Stokes velocity for 1 g acceleration is 0.2 mm/sec – Large radius of canal is 3.2mm, so diameter is roughly 20mm. – Particle only moves 1% of diameter in 1 second.

BPPV Variants

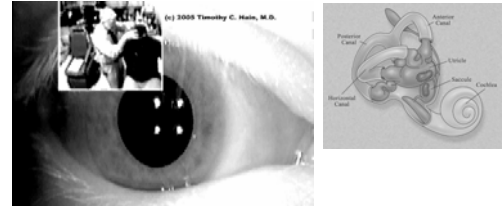
Ewald's first law: eye movements occur in the plane of the canal being stimulated. Three canals → three vectors.

- Posterior canal
- Lateral canal
- Anterior canal



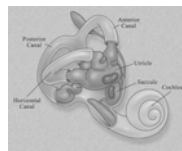
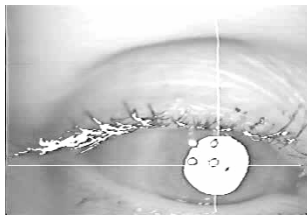
Vector of nystagmus tells you the variant of BPPV

Posterior Canal (94%) ■ Upbeating/Torsion



Vector of nystagmus tells you the variant of BPPV

Lateral Canal (5%) ■ Horizontal DCPN



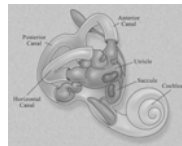
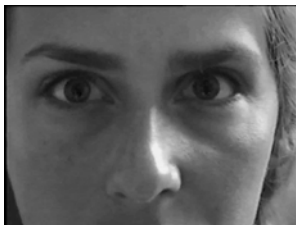
In theory, should rarely have latency

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)

Vector of nystagmus tells you the variant of BPPV

Anterior canal (1%) ■ Downbeating



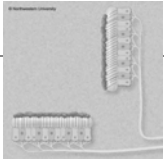
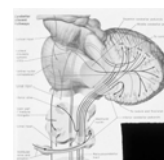
In theory, should always have latency


Mixed canal variant BPPV


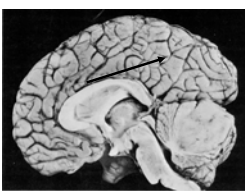
- Mixed canal
 - Debris in more than one canal
 - Signature – nystagmus reverts over time (i.e. starts posterior, changes to horizontal).

	BPPV Summary
	<ul style="list-style-type: none"> • BPPV is easily diagnosed (Hallpike maneuver) • Anatomic locations explain nystagmus patterns, and have specific maneuvers.

	Positional nystagmus -- Head r.e. Gravity
	<ul style="list-style-type: none"> ■ BPPV ■ Central otolith – AKA central positional nystagmus ■ Peripheral otolith

	Central Positional Nystagmus
BPPV Central Peripheral otolith	<ul style="list-style-type: none"> ■ Otoliths are the only sensor available to brain regarding orientation to gravity ■ Central otolith processing mainly occurs in midline cerebellum.  


	This child is holding onto the bed rail due to ataxia from a medulloblastoma
BPPV Central Peripheral otolith	 <p><small>M.S. Cerebellar medulloblastoma</small></p>

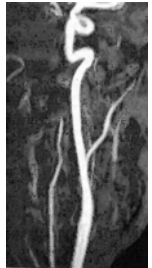
	Cerebellar Medulloblastoma
BPPV Central Peripheral otolith	<ul style="list-style-type: none"> ■ Mainly affects children ■ Begins in cerebellar nodulus -- vestibulocerebellum ■ Hydrocephalus (projectile vomiting) and cerebellar signs. ■ STRONG positional nystagmus   <p><small>MIDLINE CEREBELLAR MEDULLOBLASTOMA</small></p>

	Central positional general rules
BPPV Central Peripheral otolith	<ul style="list-style-type: none"> ■ Generally horizontal ■ Direction changing (like lateral canal) ■ Non-fatiguing ■ Does not revector with maneuvers ■ Accompanied by other central signs (e.g. ataxia)

	Head r.e. Trunk (e.g. Cervical Vertigo)
	<ul style="list-style-type: none"> ■ Circulatory disturbance ■ Pain/spasm in neck ■ Cervical disk disease


	Core symptom of cervical vertigo
	<ul style="list-style-type: none"> ■ Symptoms provoked by head-on-trunk movement, regardless of position r.e. gravity.

	Core bedside test for cervical vertigo: Vertebral Artery Test (VAT)
	<ul style="list-style-type: none"> ■ Using Frenzel goggles ■ Person sitting upright ■ Turn head to one side ■ Hold for 20 seconds ■ Watch for nystagmus. 

	Bow Hunter's Syndrome (very rare)
<p>Circulatory disturbance Pain/spasm in neck Cervical disk disease</p>	<ul style="list-style-type: none"> ■ 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, <u>chiropractic manipulation</u> are all possibilities. 

	Chiropractic manipulation
<p>Circulatory disturbance Pain/spasm in neck Cervical disk disease</p>	<ul style="list-style-type: none"> ■ 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"
<p>Circulatory disturbance Pain/spasm in neck Cervical disk disease</p>	<ul style="list-style-type: none"> ■ 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 <p>Brandt 1996 ; DeJong and DeJong (1977)</p>


	<h2>Cervical Spinal Stenosis</h2>
<p>Circulatory disturbance Pain/spasm in neck Cervical disk disease</p> <ul style="list-style-type: none"> ■ 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. 	

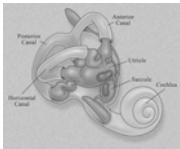
	<h2>Third type of positional vertigo: Body r.e. gravity</h2>
	<ul style="list-style-type: none"> ■ Orthostatic hypotension ■ CSF leak

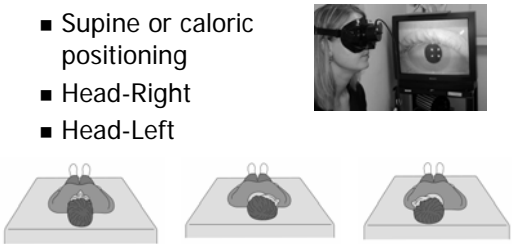
	<h2>General points</h2>
	<ul style="list-style-type: none"> ■ These people are dizzy upright, not supine ■ They complain of faintness rather than vertigo ■ They don't have any nystagmus

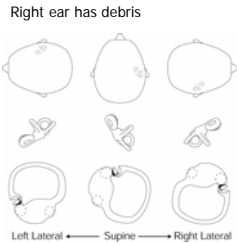
	<h2>BEDSIDE MANEUVERS</h2>
	<ul style="list-style-type: none"> ■ BPPV <ul style="list-style-type: none"> – Dix Hallpike test – Head on body (lateral canal) ■ Central Vertigo ■ Cervical Vertigo

	<h2>Diagnosis: Dix-Hallpike Maneuver</h2>
<p>Dix-H L-canal Central VAT</p>	


	<h1>Dix Hallpike Technique</h1>
<ul style="list-style-type: none">■ 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-H L-canal Central VAT	<ul style="list-style-type: none"> ■ Dix Hallpike used again ■ Vertical rather than upbeatting nystagmus ■ Bad ear is on OPPOSITE side as maneuver ■ May see no torsion 

	Lateral Canal BPPV
Dix-H L-canal Central VAT	<ul style="list-style-type: none"> ■ Use video Frenzels ■ Supine or caloric positioning ■ Head-Right ■ Head-Left 

	Logic of maneuver for Lateral Canal BPPV
	<ul style="list-style-type: none"> ■ Direction changing nystagmus ■ Geotropic or Ageotropic, depending on starting location of dirigible debris. ■ Cupulolithiasis always ageotropic. ■ Most commonly seen post Epley maneuver <p>Right ear has debris</p>  <p>Left Lateral ← Supine → Right Lateral</p>

	Central positional tests
Dix-H L-canal Central VAT	<ul style="list-style-type: none"> ■ Same as lateral canal ■ Be sure to check VAT or prone (next)

	“Vertebral artery” test
Dix-H L-canal Central VAT	<ul style="list-style-type: none"> ■ Use Frenzels ■ Turn head to side ■ Wait for nystagmus 

	Other ways to separate trunk from gravity
	<ul style="list-style-type: none"> ■ 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

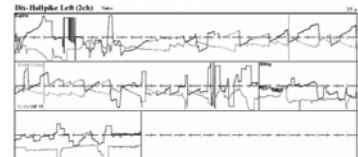
- Blood pressure upright and supine
- Pulse upright and supine
- Standing provoking increase of 20 in pulse drop in systolic BP suggestive
- Lots of confounding factors – anxiety for example.



ENG in Positional syndromes



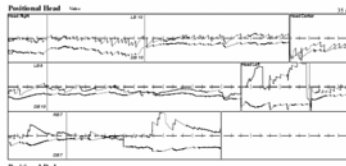
- Dix-Hallpike Test: **Posterior Canal BPPV**
 - Latency
 - Burst
 - Reversal
 - Fatigability



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:

<http://www.dizziness-and-balance.com/disorders/bppv/bppv.html>