Dizziness in the Elderly Diagnosis and Treatment

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Dizziness in the elderly

- Prevalence of dizziness
  - All age: 17%
  - Age > 65: 30%
  - Age > 85: 50%

- *老人頭暈找得到原因嗎？*

Jonsson et al. J Vestib Res 2004

老人頭暈找得到原因嗎？

- 神經科/耳鼻喉科觀點:
- *可以！而且大部分是**vestibular disorders!***
- FIND THE DIAGNOSIS AND TREAT IT!

- 家醫科觀點：
- *大部分老人頭暈找不到明確的診斷，只找得到**risk factors***
- ***Multi-factor, geriatric syndrome***
- TREAT THE RISK FACTORS!

Newman-Toker et al. Neurol Clin 2015
Tinetti et al. Ann Intern Med 2000
Kao et al. J Am Geriatr Soc 2001

神經科醫師觀點

Etiologies of dizziness (Elderly)

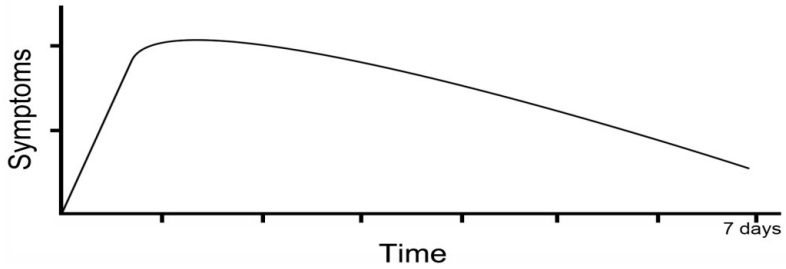
• Benign paroxysmal positional vertigo	18.3%
• Phobic postural vertigo (PPPD)	15.9%
• Central vestibular vertigo	13.5%
• Vestibular migraine	9.6%
• Vestibular neuritis	7.9%
• Meniere's disease	7.8%
• Bilateral vestibulopathy	3.6%
• Vestibular paroxysmia	2.9%
• Perilymphatic fistula	0.4%
• Various other disorders	12.3%
• Unknown etiology	4.2%

Aging +
Multi-sensory dizziness
Orthostatic hypotension
Cardiac arrhythmia
Drug-induced dizziness

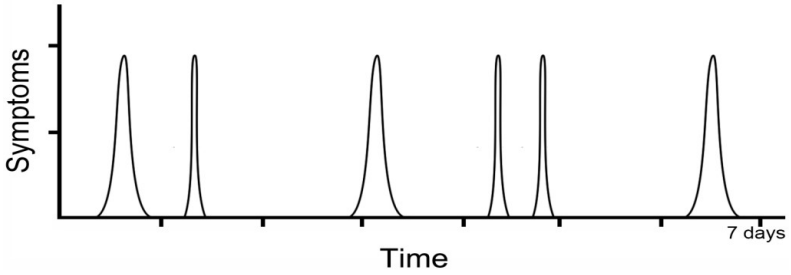
Brandt. Vertigo: Its Multisensory Syndromes. 1999

Classification by Timing: Vestibular syndromes

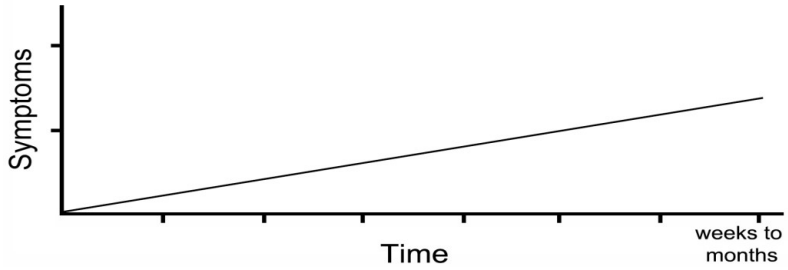
- Acute vestibular syndrome (AVS)



- Episodic vestibular syndrome (EVS): spontaneous (sEVS) and triggered (tEVS)



- Chronic vestibular syndrome (CVS)



Courtesy of David Newman-Toker

Acute vestibular syndrome

- Acute and prolonged vertigo over 24 hours
- Often monophasic (recurrence rate <5%)
- **75% Peripheral - vestibular neuritis** (no auditory symptoms), labyrinthitis (with auditory symptoms), Ramsay Hunt syndrome
  25% Central – stroke (more common in the elderly)

當被急診醫師照會眩暈時，你會怎麼做？

	Sensitivity for central lesion
1. 做NE, 看有沒有其他neurological signs	50%
2. 問stroke risk factors	60%
3. 做CT	30%

Kattah et al. Stroke 2009
Newman-Toker et al. Acad Emerg Med 2013

Central-type Nystagmus

- Pure vertical nystagmus or pure torsional nystagmus
- Direction-changing nystagmus in the gaze

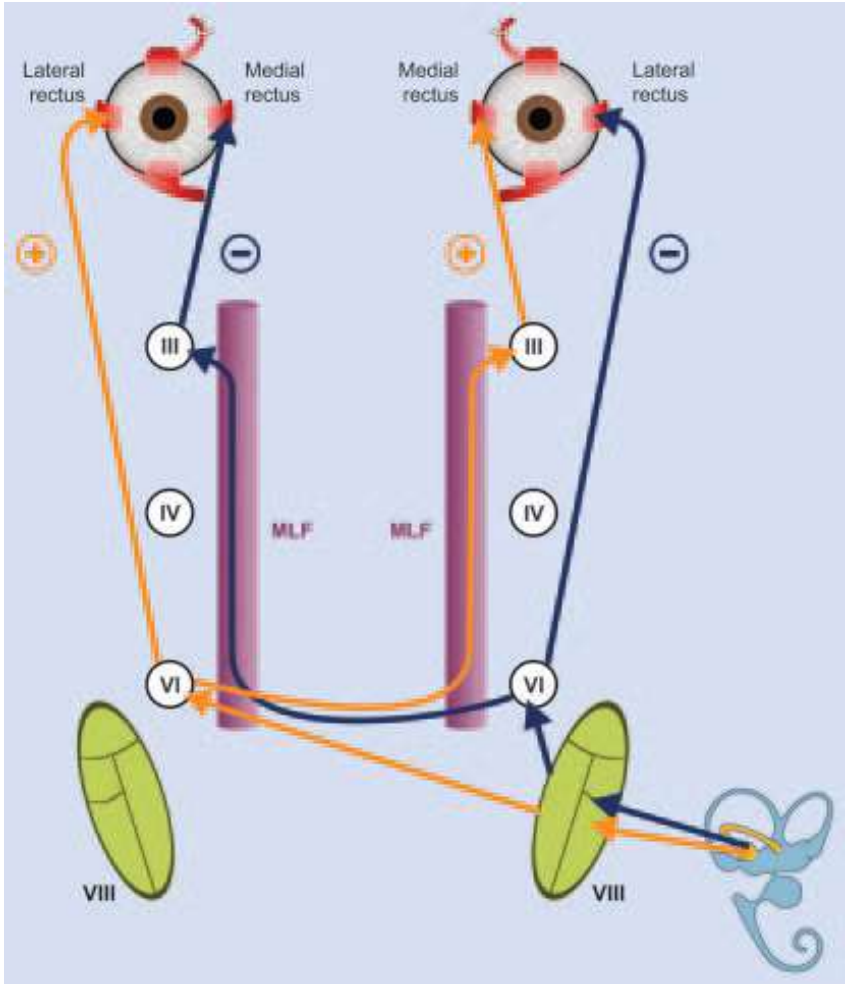
	Peripheral	Central	
Obvious oculomotor signs	0%	32%	0.68 (0.59–0.80)*
Dominantly vertical or torsional nystagmus	0%	12%	0.88 (0.81–0.96)
Oculomotor paralysis (3-4-6, INO, gaze palsy)	0%	21%	0.79 (0.70–0.89)*
Subtle oculomotor signs	4%	100%	0.00 (0.00–0.11)*
Direction-changing horizontal nystagmus	0%	20%	0.80 (0.72–0.90)*

60-70% of central-type vertigo presents with "peripheral-type" nystagmus (uni-directional, horizontal)!

Kattah et al. Stroke 2009
Tarnutzer et al. CMAJ 2011

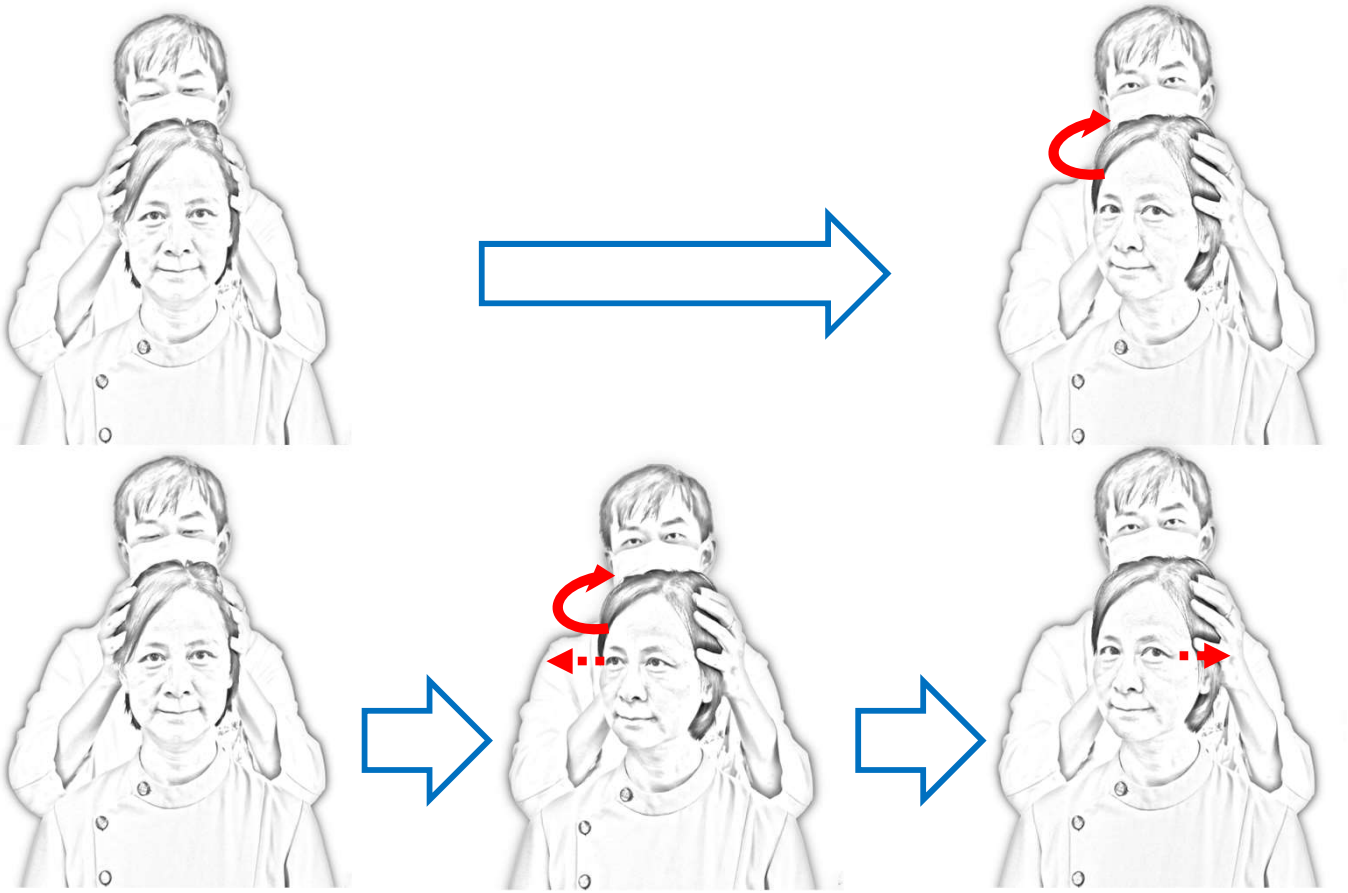
Head impulse test

- The most important function of vestibular system in human is to stabilize vision during head-body movement.
- This purpose is achieved via **vestibulo-ocular reflex (VOR)**.



Frohman et al. Neurology 2008

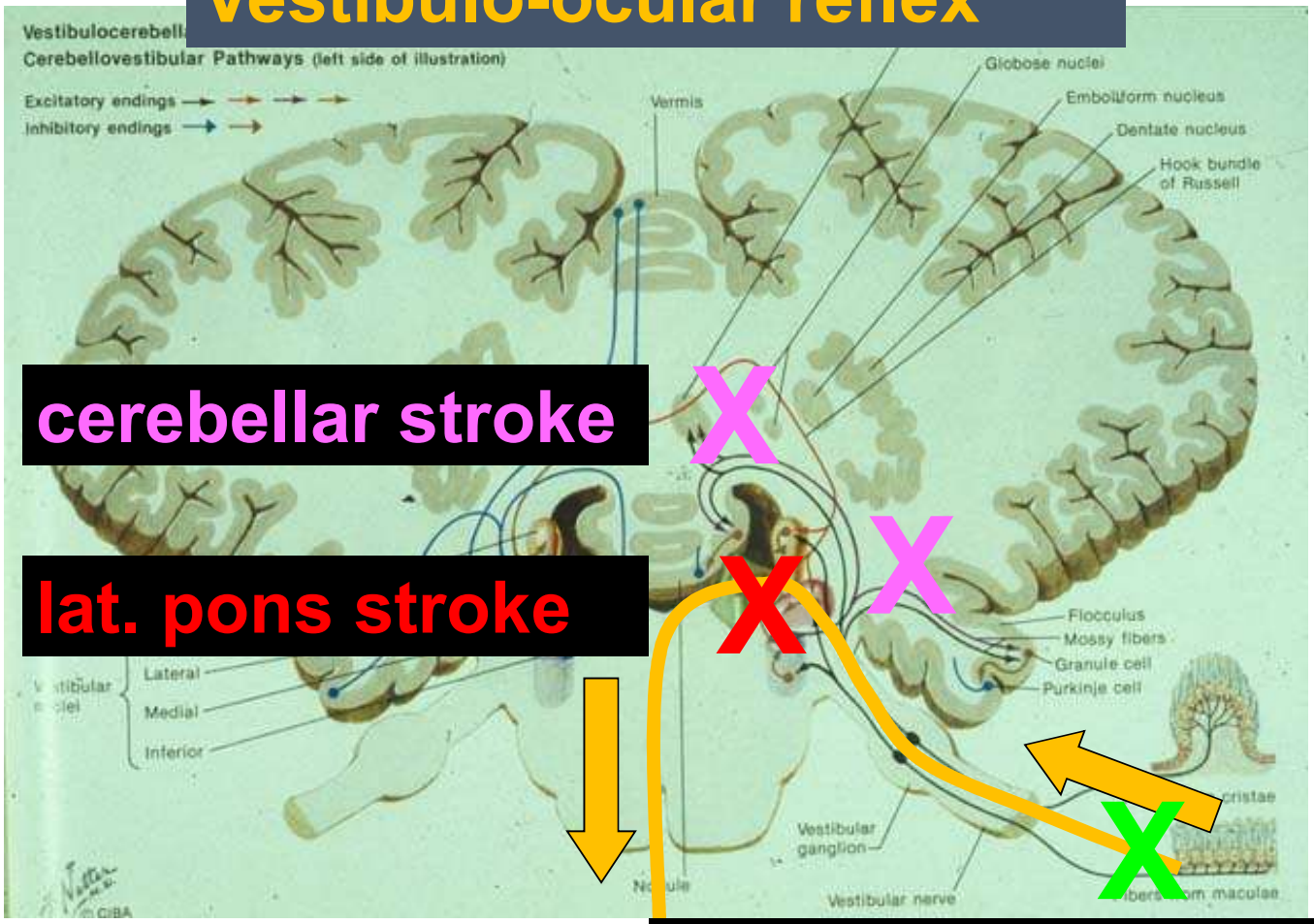
VOR test in clear patients: Head Impulse Test (HIT)



- Vestibular neuritis; labyrinthitis
  - **Abnormal** HIT: > 95%
- Vertigo caused by stroke
  - Abnormal HIT: 15%
  - **Normal** HIT: 85%

Halmagyi et al. Arch Neurol 1988

Vestibulo-ocular reflex



cerebellar stroke

X

X

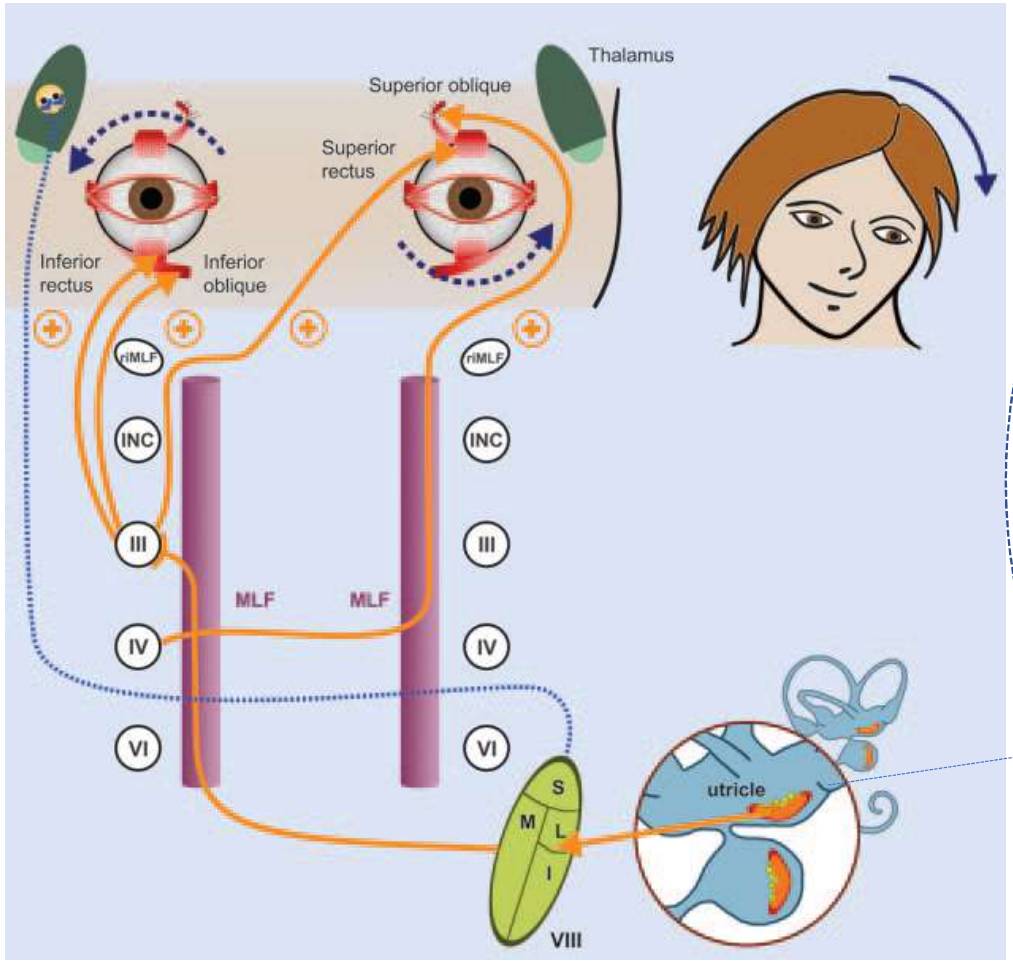
lat. pons stroke

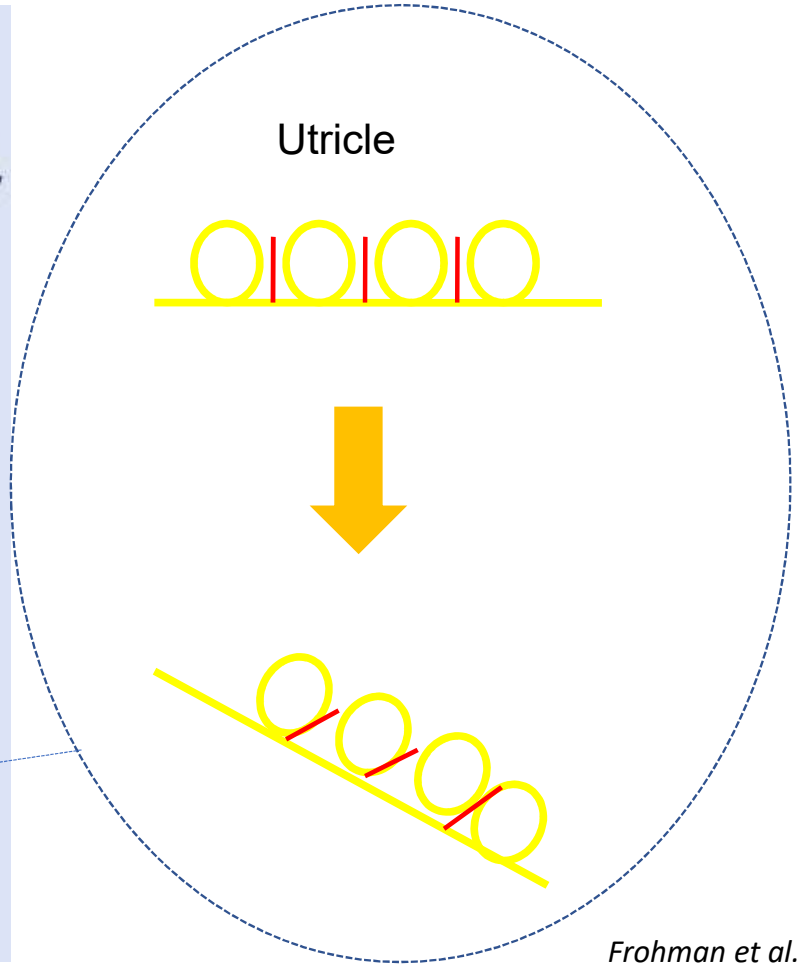
X

vestibular neuritis

Courtesy of David Newman-Toker

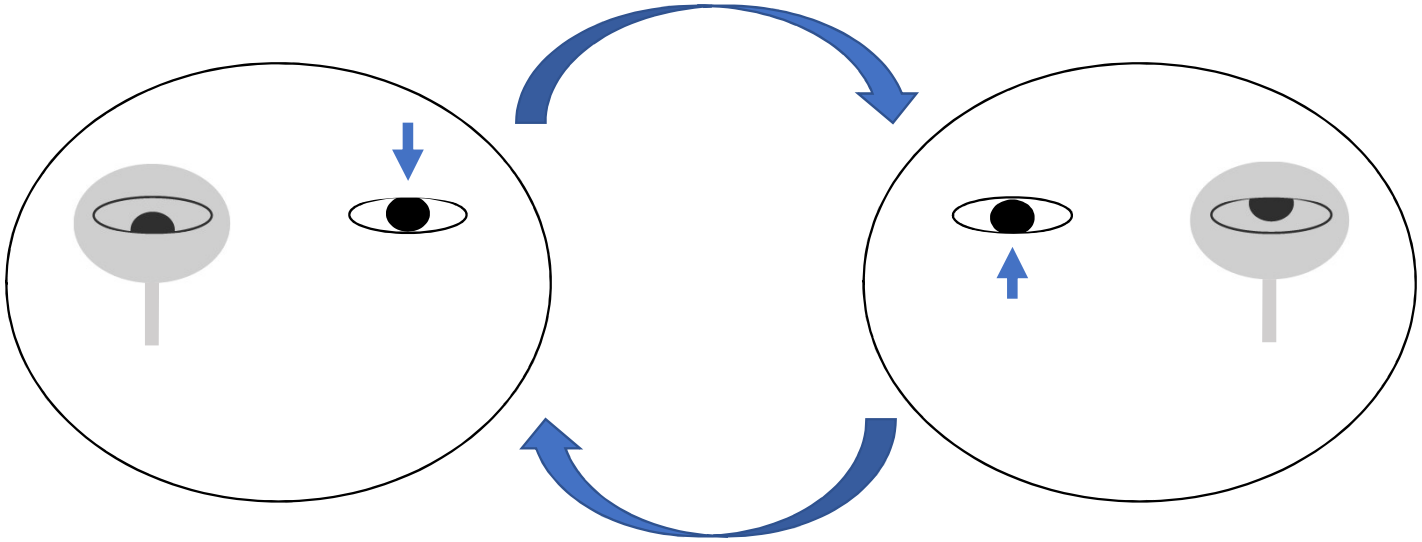
Skew Deviation – Otolith-Ocular reflex





Frohman et al. Neurology 2008

Test of skew deviation – alternate cover test



Note the vertical re-fixation of the uncovered eye

- Skew deviation can be a peripheral sign in the laboratory, but duration is usually brief.
- In clinical practice, skew deviation is a central sign.

Tarnutzer et al. CMAJ 2011

HINTS

- HINTS= Head Impulse test, Nystagmus, Test of Skew
- Normal HIT, direction-changing nystagmus, or skew deviation imply stroke.

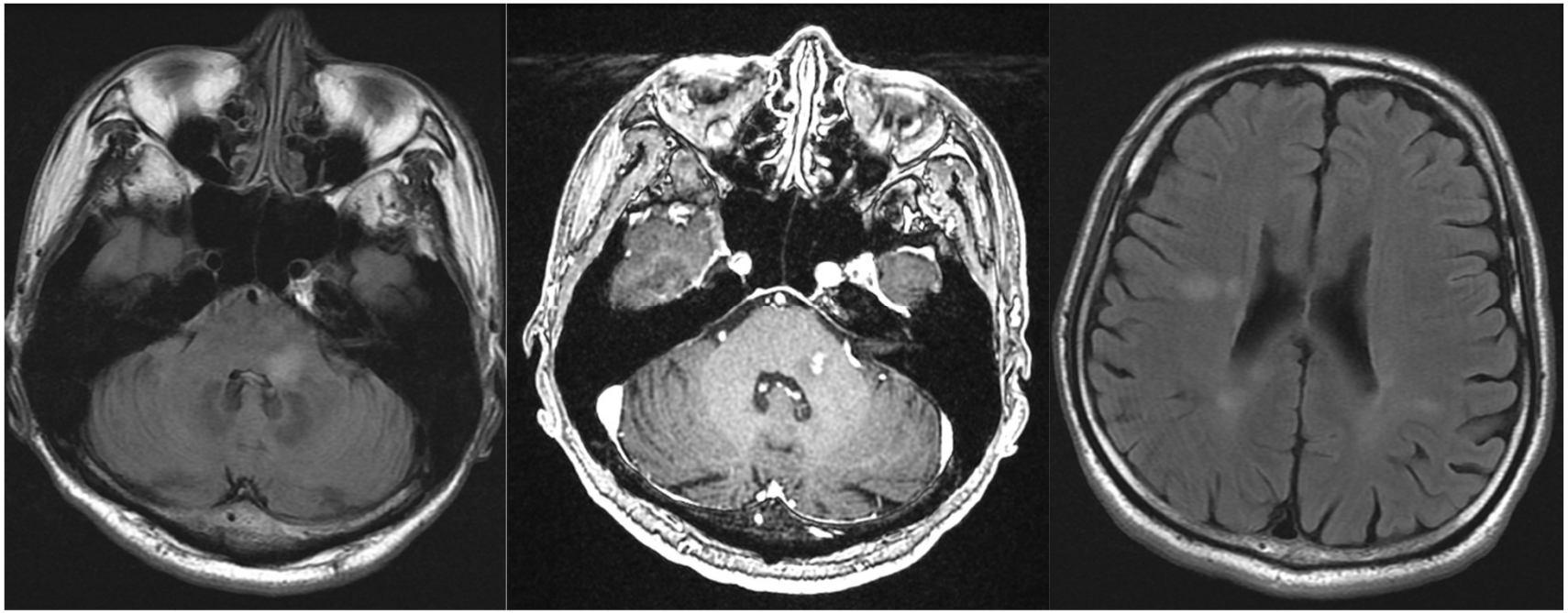
Test Properties	ABCD2 ≥ 4 (Five-item Rule*)	HIT (One-step Rule*)	HINTS (Three-step Rule*)	HINTS "Plus" (Four-step Rule*)
Stroke only (*n* = 113 stroke, *n* = 77 nonstroke)				
Sensitivity for stroke	61.1 (51.8–69.7)	90.3 (83.7–94.8)	96.5 (91.7–98.9)	99.1 (95.7–100.0)
Specificity for stroke	62.3 (51.2–72.6)	87.0 (78.1–93.2)	84.4 (75.0–91.3)	83.1 (73.5–90.3)
LR+ stroke	1.62 (1.17–2.24)	6.95 (3.89–12.43)	6.19 (3.68–10.42)	5.87 (3.58–9.64)
LR– stroke	0.62 (0.47–0.83)	0.11 (0.06–0.20)	0.04 (0.02–0.11)	0.01 (0.00–0.08)
Reduction missed stroke†	Reference case	75.0	90.9	97.7
Any central cause (*n* = 124 central, *n* = 66 peripheral)				
Sensitivity for central	58.1 (49.2–66.5)	91.1 (85.1–95.3)	96.8 (92.4–99.0)	99.2 (96.1–100.0)
Specificity for central	60.6 (48.5–71.8)	100.0 (95.6–100.0)	98.5 (92.8–99.9)	97.0 (90.4–99.5)
LR+ any central cause	1.47 (1.05–2.06)	>91.1‡ (NC)	63.9 (9.13–446.85)	32.7 (8.36–128.16)
LR– any central cause	0.69 (0.52–0.92)	0.09 (0.05–0.16)	0.03 (0.01–0.09)	0.01 (0.00–0.06)
Reduction missed central†	Reference Case	78.8	92.3	98.1

Newman-Toker et al. Acad Emerg Med 2013

Case

- 30-year-old man
- He experienced **vertigo and left hearing loss** one week ago, and was diagnosed as "PERIPHERAL VERTIGO" in a Neurology clinic
- Vertigo improved after medical treatment, but recurred one week later.
  - **Head impulse test:** left side impaired
  - **Nystagmus:** right-beating nystagmus, unidirectional
  - …looks like peripheral…
  - Skew deviation: video

Case - HINTS

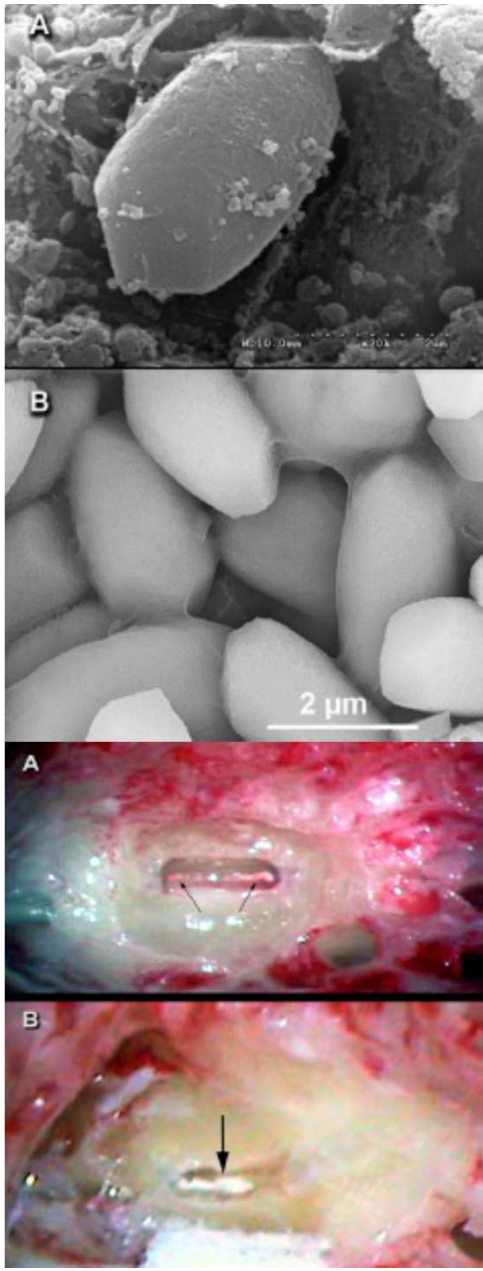


Episodic vestibular syndrome – triggered

- **D/D**
  - **BPPV vs Orthostatic Hypotension vs CPPV**

Benign Paroxysmal Positional Vertigo (BPPV)

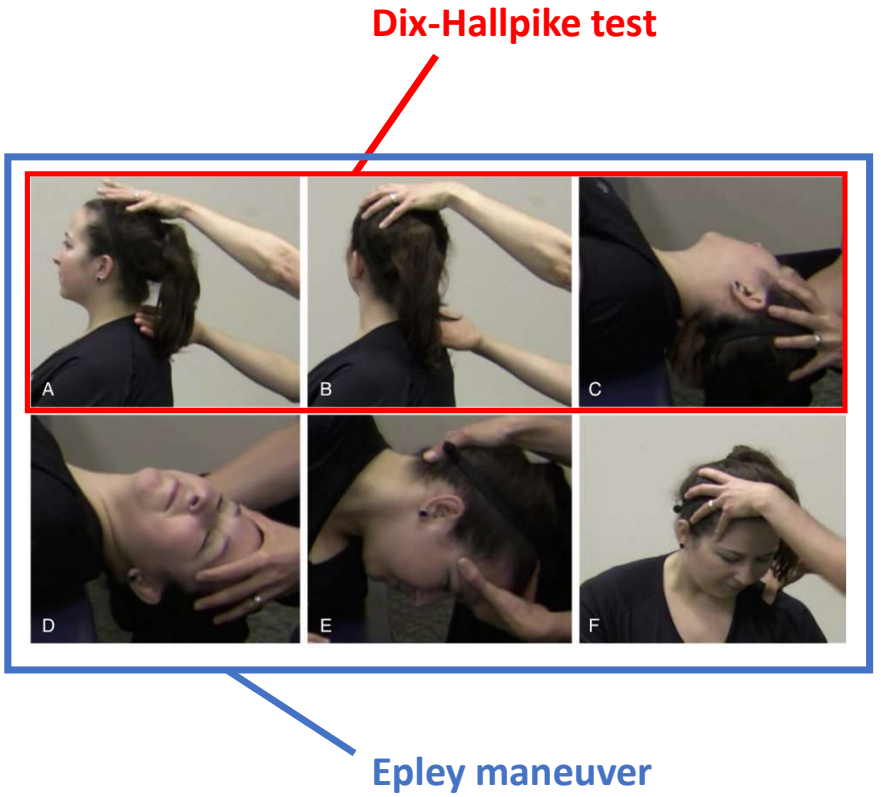
- **The most common vertigo (prevalence: 3%), and more common in the elderly**
- **Otoconia drop into semicircular canals**
- **Vertigo during position change**
  - Lying down or sitting up from bed
  - Rolling over in bed
- **Duration:** secs – 1 min
- ***Always positional vertigo?***



Courtesy of David Zee (Kao 2017)

BPPV in the elderly

- **Atypical presentation in the elderly**
  - **Chronic dizziness & unsteadiness rather than positional vertigo**
- **Gold standard for diagnosis (even in chronic dizziness)**
  - **Dix-Hallpike test** for posterior canal BPPV
  - **Supine-roll test** for horizontal canal BPPV
- **Treatment: Canalith repositioning maneuver**



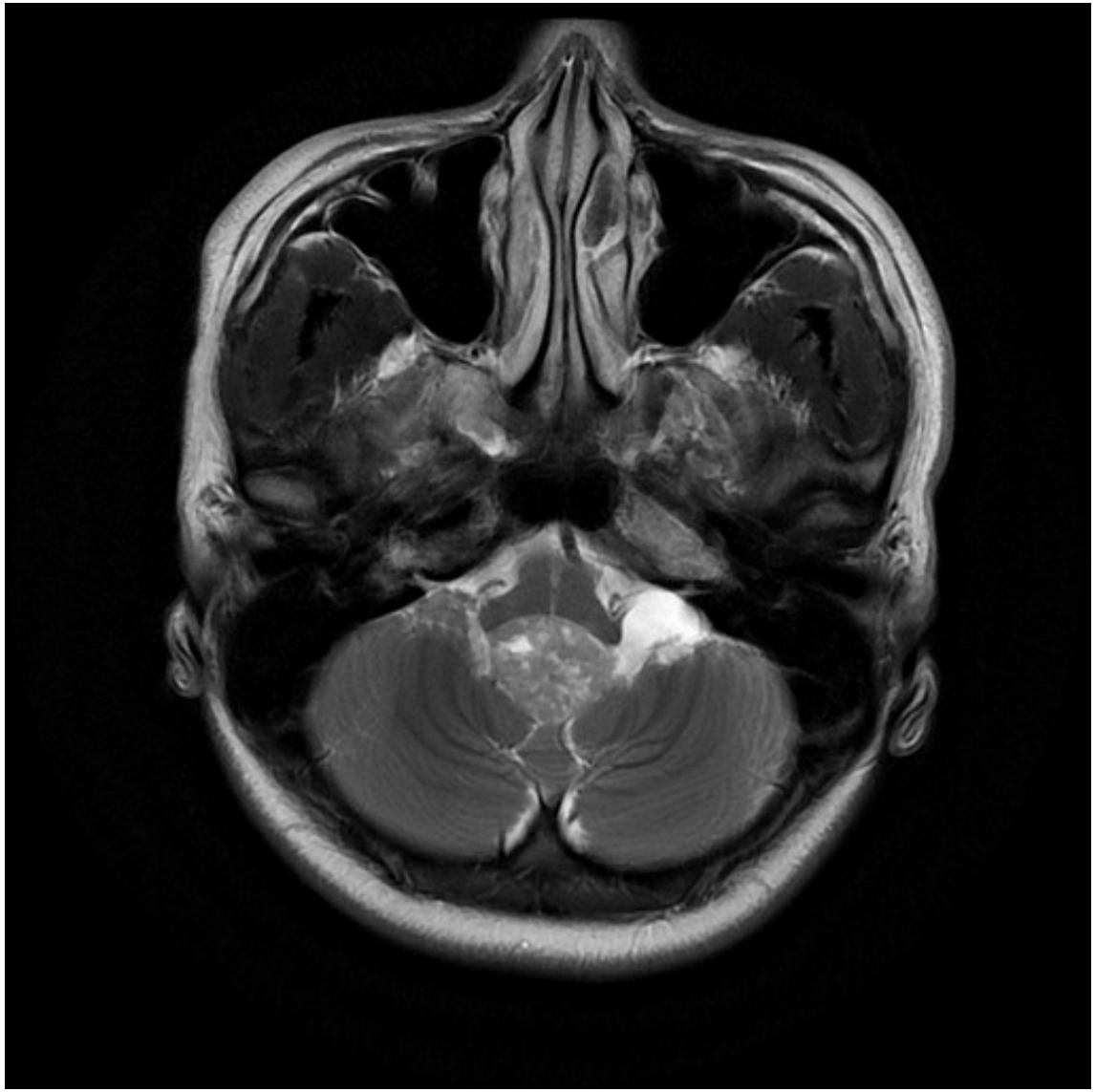
Chang et al. Dizziness and vertigo across the life span 2018

Orthostatic Hypotension (OH)

- Dizziness when standing up from lying, sitting or from squatting
- No dizziness when lying down or rolling over
- *用會不會『眩』區別**BPPV**和**OH?***
- **BPPV**在老人身上經常不會『眩』，只會『暈』
- **OH**病人中，約**30%**曾感覺到『眩』
- **Gold Standard**
  - Orthostatic BP
  - Tilt table test

Central Paroxysmal Positional Vertigo (CPPV)

De Schutter et al. Prog Brain Res 2019

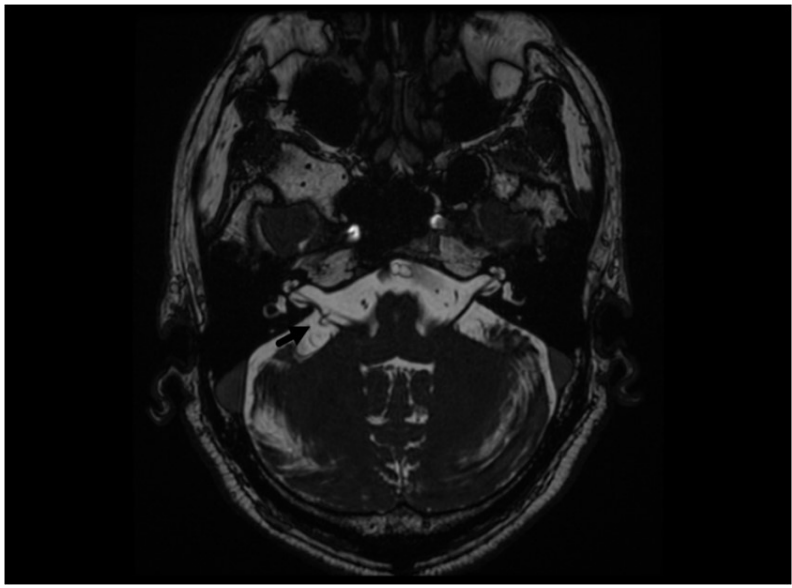


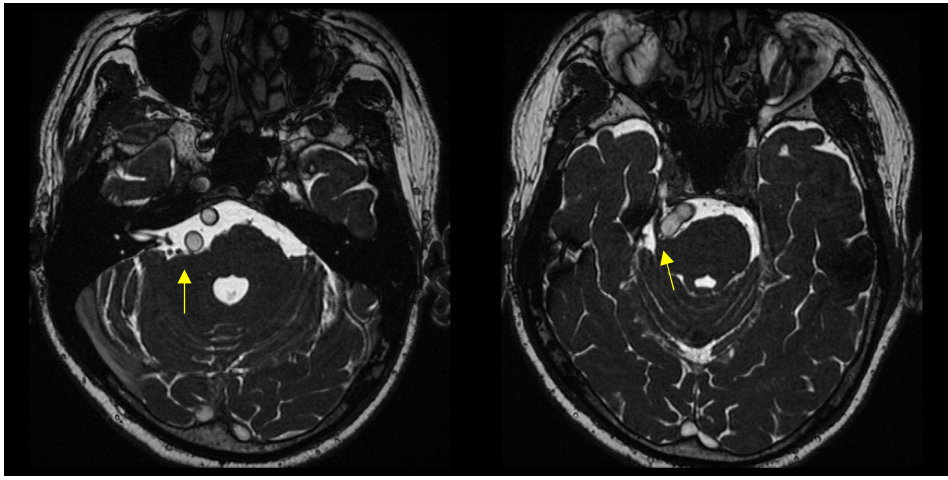
Episodic vestibular syndrome – Spontaneous

- Classification by time:
  - **Secs: VP vs arrhythmia**
  - **Mins-Hrs: MD vs VM vs VBI**

Vestibular Paroxysmia (VP)

- 2.9-4% in Neurology Dizziness Clinic
- Paroxysmal brief and frequent vertigo/dizziness
  - **Duration:** seconds to one minute
  - **Frequency:** often 5-100/day
  - **Tinnitus:** sometimes (25%) accompanied by paroxysmal typewriter tinnitus
  - **Attack:** at rest, during position change, or both
- **Treatment (very effective):** carbamazepine, oxcarbazepine
- **Theory:** neurovascular compression of CN VIII
- More at old age because of **dolicoectasia**

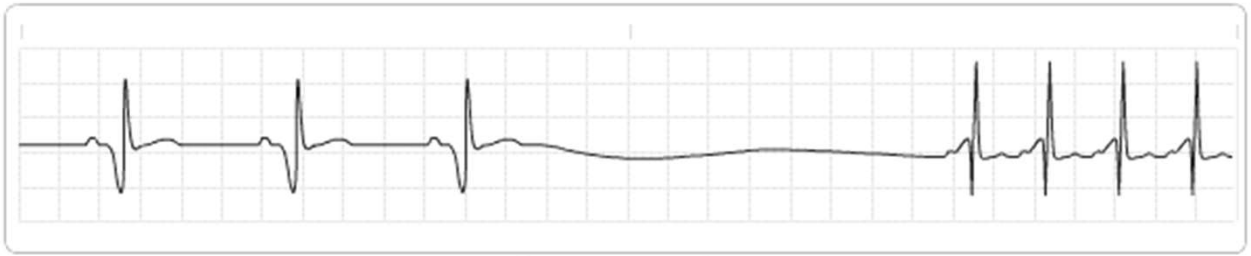




Jannetta et al. N Engl J Med 1984
Brandt et al. Lancet 1994
Hufner et al. Neurology 2008

Arrhythmia-induced brief dizziness – Not Rare!

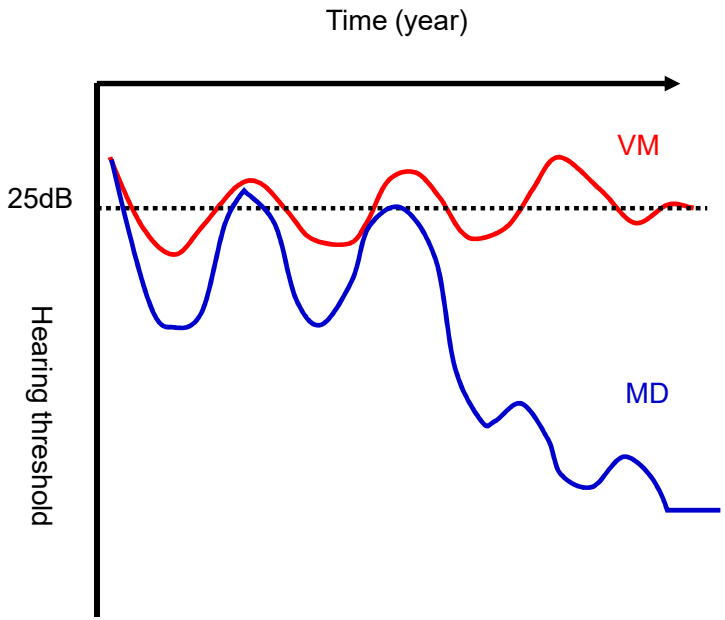
- **Etiology:** cardiac long pause by sick sinus syndrome (SSS), high-degree AV block
- Spontaneous attacks, not posture-related
- Not spinning, but may be hard to identify in so brief episodes
- ***Always with syncope?***
- **Diagnosis:** R-R interval in Holter ECG
  - > 3 secs: black-out sensation or syncope
  - **2-3 secs: only dizziness**



Sick Sinus Syndrome

Meniere's Disease (MD) and Vestibular Migraine (VM)

- ***Meniere's disease: always with hearing loss?***
  - **Recurrent vertigo (20mins – 12hrs)**
  - **Tinnitus**
  - **Low-frequency sensorineural hearing loss**
  - Can be isolated vertigo in the initial episodes
  - 2 years after onset: **progressive hearing loss**
- ***Vestibular migraine: always with headache?***
  - **Temporal dissociation between dizziness and headache (50%),** more dissociation at old age
- **Onset at old age: always consider other diagnoses**

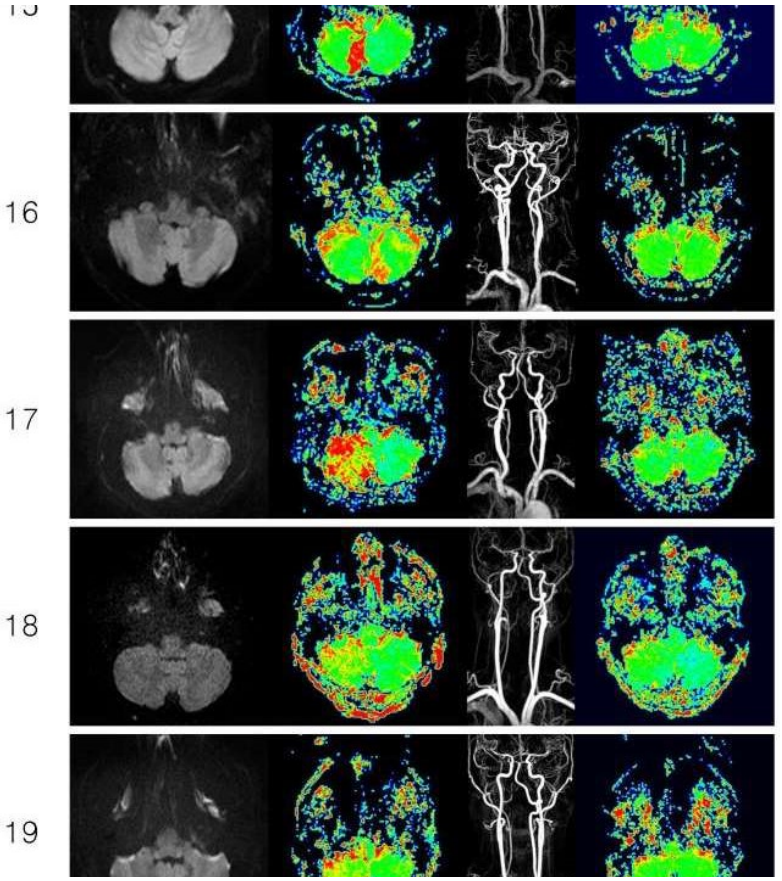


Lopez-Escamez et al. J Vestib Res 2015
Lempert et al. J Vestib Res 2012
Pagnini et al. Acta Otorhinolaryngol Ital. 2014

Vertebrobasilar Insufficiency (VBI)

- ***VBI always with other neurological symptoms?***
- **62% VBI:** At least one episode is isolated vertigo
- **21% VBI:** All episodes are isolated vertigo

- Recurrent vertigo over 2 years usually indicates benign origin.
- First episode (acute transient vestibular syndrome): **27%** are VBI or stroke



Choi et al. Stroke 2017
Grad et al. Arch Neurol 1989

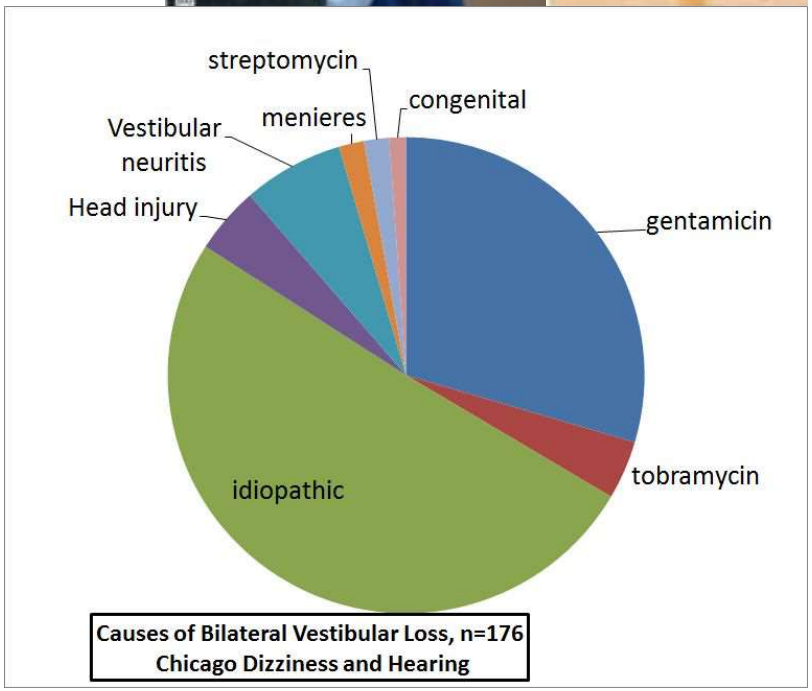
Chronic vestibular syndrome

CVS in the elderly: often non-specific; without abnormal signs

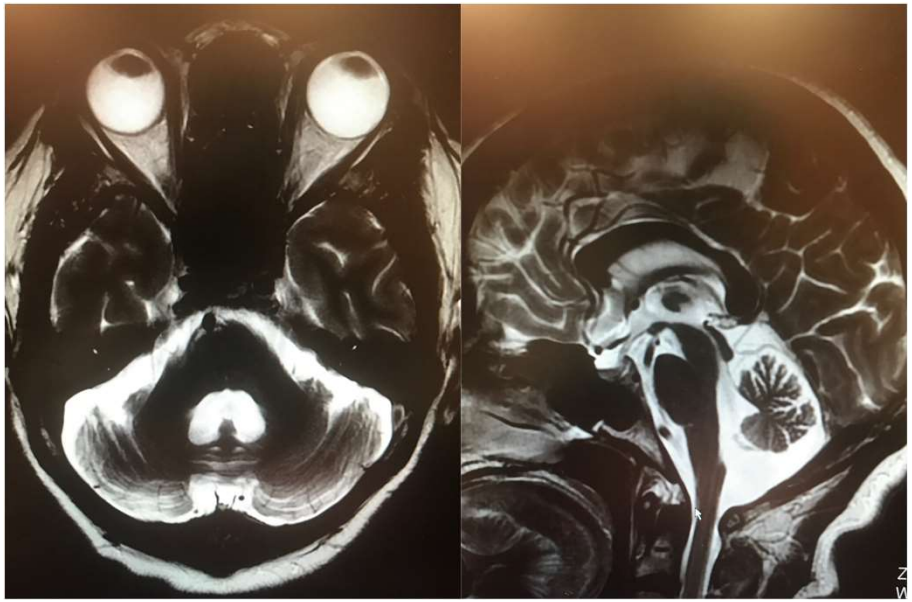
“Inner ear degeneration?”

Bilateral Vestibulopathy

- **Not only chronic dizziness**
- Oscillopsia during head motion or walking
  - ***Head impulse test:*** *Positive at bilateral sides*
  - ***Dynamic visual acuity:*** *Decreased*
- Postural imbalance (worse in darkness)
  - ***Romberg test:*** *abnormal (acute stage)*
  - ***Sharpened Romberg test:*** *abnormal (chronic stage)*
- Etiology:
  - Gentamicin ototoxicity, bilateral Meniere's disease, etc.
  - ***> 50% are "idiopathic"…Inner ear degeneration?***
  - **In a recent study, 76% combined with central pathology (e.g. cerebellar degeneration)**



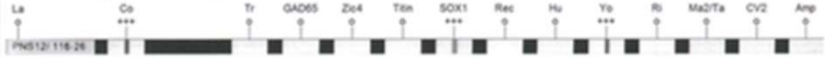
Kattah et al. Front Neurol 2018



檢驗代號	檢驗項目	檢驗結果	單位	參考值
Blot-03	Paraneoplastic Neurologic Syndrome			
	Amphiphsyin	–		–
	CV2	–		–
	PNMA2(Ma2/Ta)	–		–
	Ri	–		–
	Yo	+++		–
	Hu	–		–
	Recoverin	–		–
	SOX1	+++		–
	Titin	–		–
	Zic4	–		–
	GAD65	–		–
	Tr(DNER)	–		–

備註：

1. Paraneoplastic Neurologic Syndrome



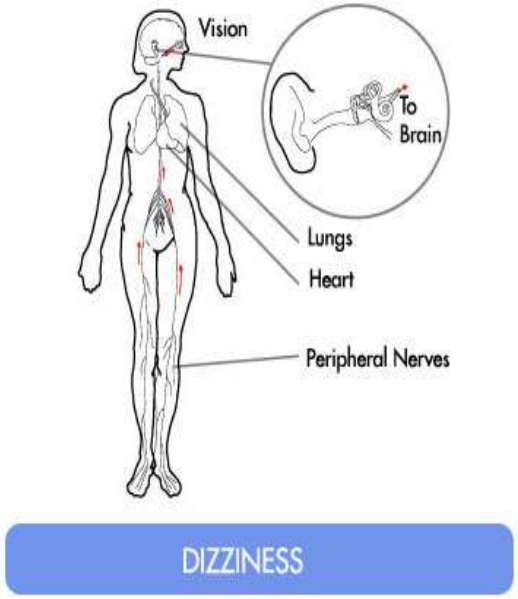
2. －：Negative / ±：Trace / +：Positive

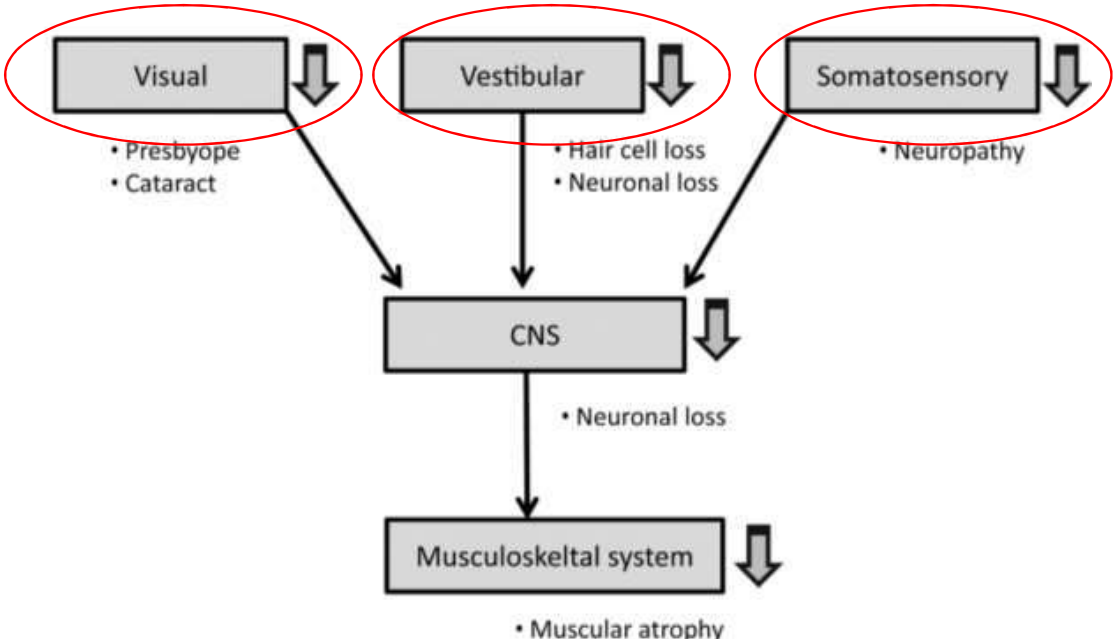
Presbyvestibulopathy

- **Many older people with dizziness: low-normal or borderline vestibular function.**
- **Presbyvestibulopathy - ICVD criteria *(International Classification of Vestibular disorders)***
- A. Chronic vestibular syndrome (at least 3 months duration) with at least 2 of the following symptoms:
  - Postural imbalance or unsteadiness
  - Gait disturbance
  - Chronic dizziness
  - Recurrent falls
- B. Mild bilateral peripheral vestibular hypofunction documented by at least 1 of the following:
  - VOR gain measured by video-HIT between 0.6 and 0.83 bilaterally
  - VOR gain between 0.1 and 0.3 upon sinusoidal stimulation on a rotatory chair (0.1 Hz, Vmax = 50-60°/sec)
  - Reduced caloric response (sum of bithermal maximum peak SPV on each side between 6 and 25°/sec)
- C. Age ≥ 60 years
- D. Not better accounted for by another disease or disorder
- ***Does borderline vestibular function cause dizziness?***

Multi-sensory dizziness

- Multi-sensory dizziness may be the most common cause of chronic dizziness in the elderly.

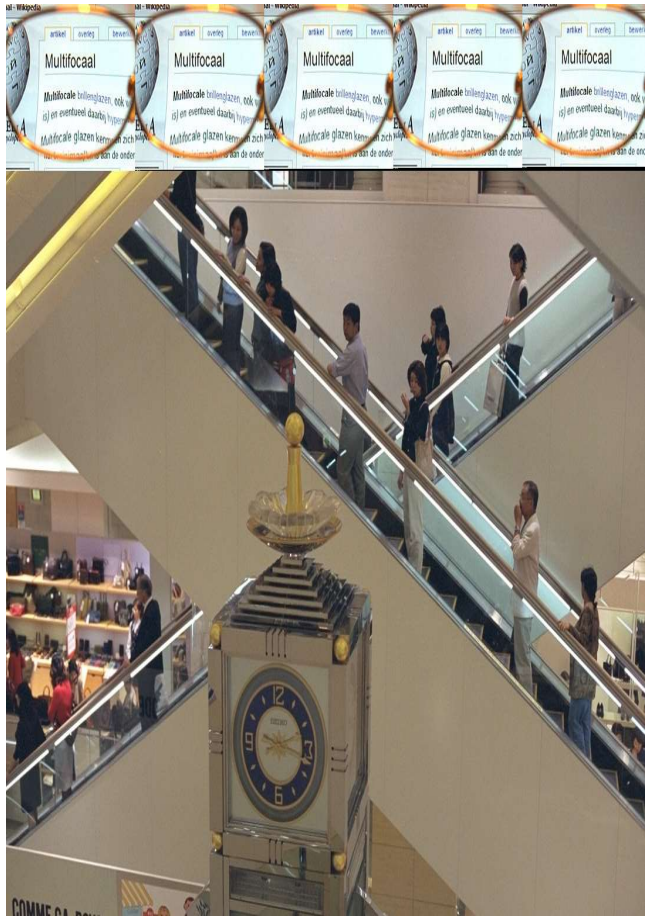




Multi-sensory dizziness - Vision

- **Visual disturbance**
  - Presbyopia → **Multifocal lens**
  - Cataract → **Cataract surgery** (unilateral > bilateral)

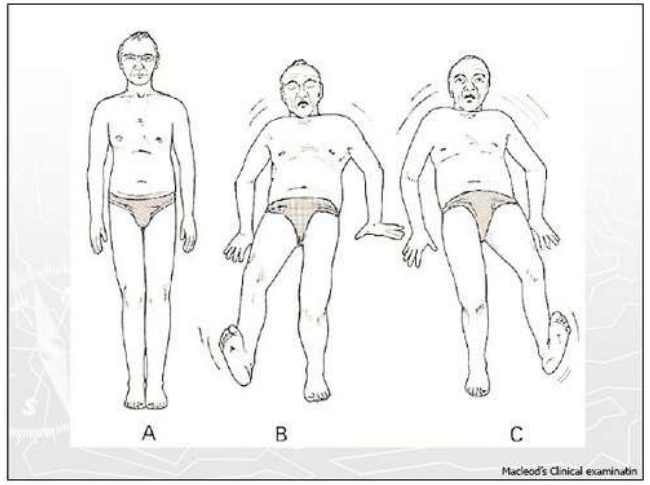
- **Visual dependence**
  - Inappropriate sensory re-weighting
  - Supermarket syndrome
  - **Primary:** aging, anxiety, and migraine history
  - **Secondary:** inadequate substitution after vestibular loss

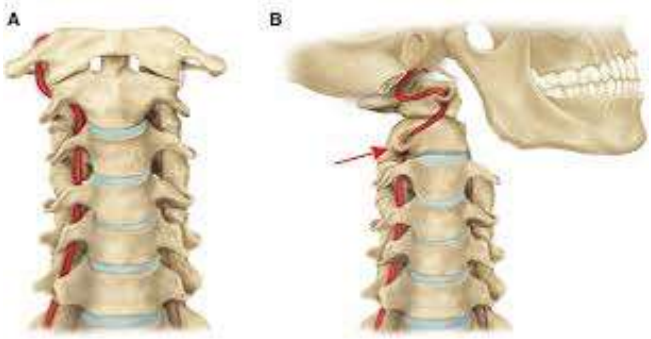


Poulain et al. Gait Posture 2008
Haran et al. BMJ 2010

Multi-sensory dizziness – Somatic sensation

- Polyneuropathy (e.g. DM)
- Osteoarthrosis (e.g. knee/hip OA)
- Cervicogenic dizziness
  - Vestibular cortex receives many proprioceptive fibers from neck
  - Cervical whiplash injury is proven to induce dizziness
  - *C-spine degeneration cause dizziness?*
  - *....controversial…may be an exacerbating factor*
  - D/D: rotational vertebral artery syndrome (bow hunter syndrome)

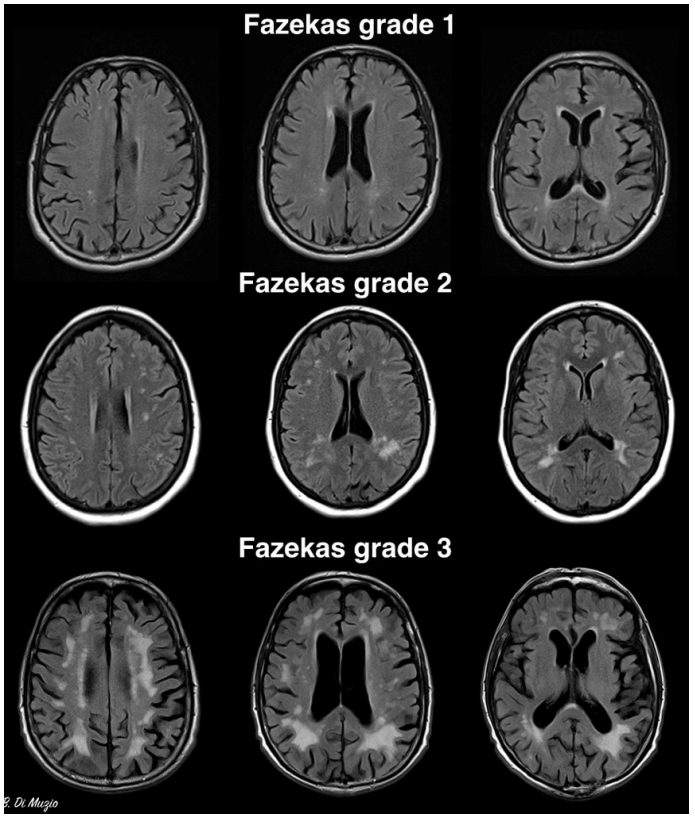




Brandt et al. J Neurol Neurosurg Psychiatry 2001

Cerebral small vessel disease

- Dizziness in the elderly seems to be related to severity of SVD
- **Two theories:**
  - **SVD → imbalance → sense of disequilibrium → dizziness**
  - **SVD → disconnection between multi-sensory and motor fibers → dizziness**
- *Many SVD patients do not complain of dizziness!!....may be an exacerbating factor*



Baloh et al. Arch Neurol 1995
Cerchiai et al. Front Neurol 2018

家醫科醫師觀點

Dizziness: a Geriatric Syndrome

- **Multiple risk factors in most older patients with dizziness**
  - A: **A**nxiety or depression
  - B: **B**lood pressure (e.g. orthostatic hypotension)
  - C: **C**ardiovascular or cerebrovascular diseases
  - D: multiple **D**rugs
  - E: **E**ar degeneration
  - V: **V**isual disturbance
  - G: **G**ait disturbance
- **Suggestion for a favorable outcome**
  - 1. Treat A: low-dose medication or cognitive behavioral therapy
  - 2. Treat D: medication reduction
  - 3. Treat G: rehabilitation for balance

Tinetti et al. Ann Intern Med 2000
Kao et al. J Am Geriatr Soc 2001
Maarsingh et al. Front Med 2014