

A tall, modern skyscraper with a glass facade, the Burj Khalifa, is shown against a clear blue sky. The building has a distinctive tiered design with several setbacks. The text 'IFOS Dubai 29/03/2019' is overlaid on the top left of the image.

IFOS
Dubai
29/03/2019

**Bedside oto-neurological examination
and
interpretation of commonly used tests**

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Introduction

- The objective of this presentation is to demonstrate that patient's oto-neurological examination at bedside (together with the history) is extremely reliable to differentiate a peripheral vestibular disorder from a central lesion and often to approach the underlying etiology.
- Based on a set of **basic bedside tests**, clinician should be able to decide :
 - whether the patient is possibly suffering from a stroke
 - whether the patient is affected by a non-threatening disorder for which treatment can be started (Benign paroxysmal positional vertigo, vestibular neuritis, Meniere's disease, vestibular migraine...)
 - whether the diagnosis is still unclear and additional oto-neurological examination is required to determine if imaging studies and/or laboratory tests are needed.

It should be immediately emphasized that :

- **Imaging of the head of all patients with vertigo is neither practical nor useful.**

Due to the risk of a vertebrobasilar ischaemia, it is tempting to perform a CT brain scan which was positive in only 0,74 % of patients (6/810 patients) and/or a brain MRI positive in only 12.2 patients (11/90 patients).

Ahsan SF, Syamal MN, Yaremchuk K, Peterson E, Seidman M. The cost and utility of imaging in evaluating dizzy patients in the emergency room. *Laryngoscope* 2013 Sept 123(9):2250-3.

- **It is even worse for laboratory abnormalities which were able to explain vertigo in 0.6 % of patients (26/4538).**

Hoffman RM, Einstadter D, Kroenke K; Evaluating dizziness. *Am J Med* 1999 Nov,107(5):468-78.

→ Imaging (MRI and/or CT scan) and/or laboratory testing should be appropriately guided by the clinical evaluation

The set of **basic bedside tests** should at least include :

1. The simple analysis of eyes movements in different position of gaze as well as ocular pursuit
2. The analysis of nystagmus under videonystagmoscopy (portable device).
3. The Head Impulse Test / Halmagyi test
4. The positional manoeuvres
5. The analysis of postural stability by Romberg and/or Fukuda testing.

1. The simple analysis of eyes movements in different position of gaze as well as ocular pursuit

The patient is simply ask to fixate a target in the different position of gaze and then to follow a moving target (pursuit)

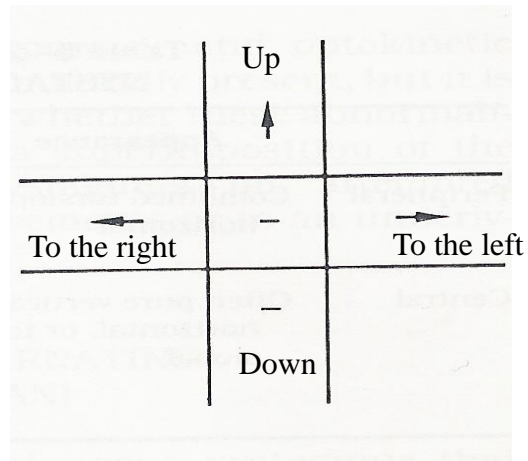
The occurrence of abnormalities such as a gaze evoked nystagmus, a down beat nystagmus, an internuclear ophthalmoplegia ... immediately affirms a central neurological disorder and sometimes the exact localization of the lesion.

Smooth pursuit is often affected by central neurological disorder (cerebellum lesion +++, brainstem +).

Central Nystagmus

= 'gaze evoked nystagmus'

- Gaze evoked nystagmus develops because of an **inability to maintain fixation in eccentric gaze**. The eyes drift back to the midline, and a corrective saccade is generated to reposition the eyes on the eccentric target
 - ➔ **the fast phase is always in the direction of the gaze.**

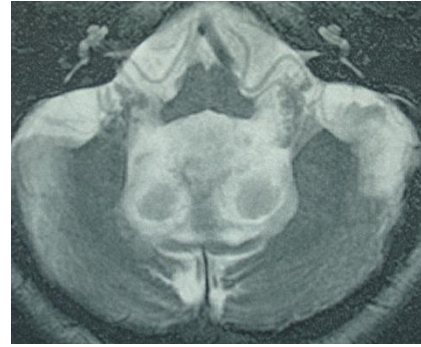


Gaze-evoked nystagmus on lateral gaze and upward gaze is common while gaze-evoked nystagmus on downward gaze is infrequent

- This nystagmus should be distinguished from a physiologic nystagmus in the eccentric gaze (which occurs on looking far laterally and is poorly sustained after a few beats)
- This nystagmus is **usually associated with a saccadic pursuit**
- It is the most frequent central nystagmus

Central gaze evoked nystagmus

video patient 1



Atypical malformation in the cerebellum

video patient 2

She started attacks of ataxia/dizziness at approximately 6 years old. During a typical attack, she felt dizzy, and very unsteady, sometimes with headache and photophobia

Interictal examination revealed an horizontal gaze-evoked nystagmus as well as an upbeat nystagmus on vertical gaze and a saccadic pursuit

MRI scan was normal

Acetazolamide had a dramatic positive effect

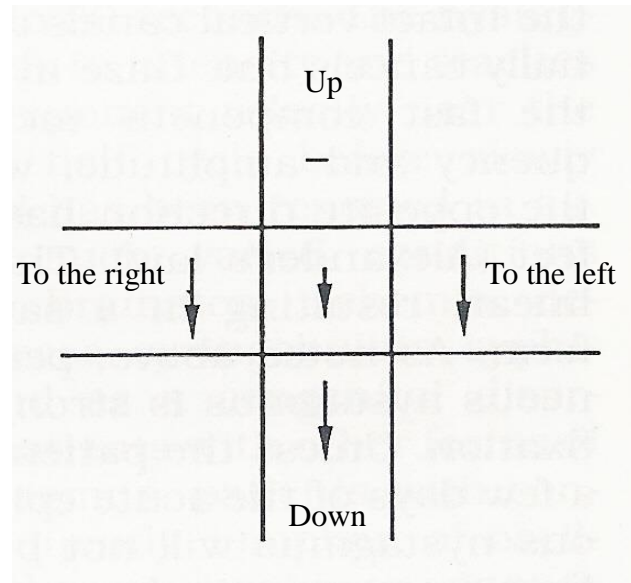
Bertholon P, Chabrier S, Riant F, Tournier-Lasserve E, Peyron R

Episodic ataxia type 2 : unusual aspects in clinical and genetic presentation. Special emphasis in childhood.

J Neurol Neurosurg Psychiatry 2009;80:1289-1292

Central Nystagmus = Down beating nystagmus

- This nystagmus is present at fixation and is **downbeating**. It increases in lateral gaze (and sometimes is only present in lateral gaze).



- It is associated with vertical oscillopsia (rather than vertigo) and dysequilibrium

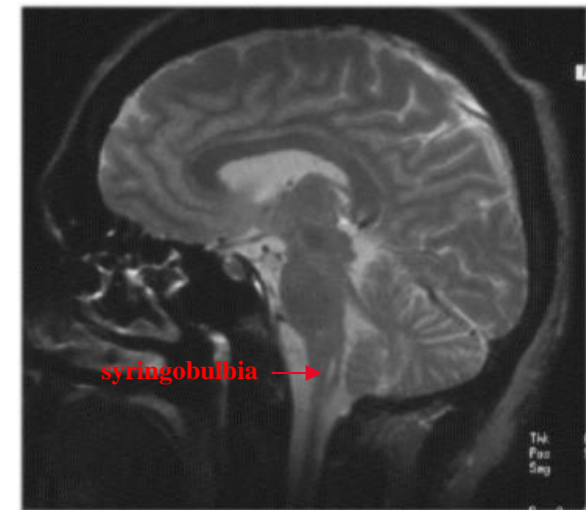
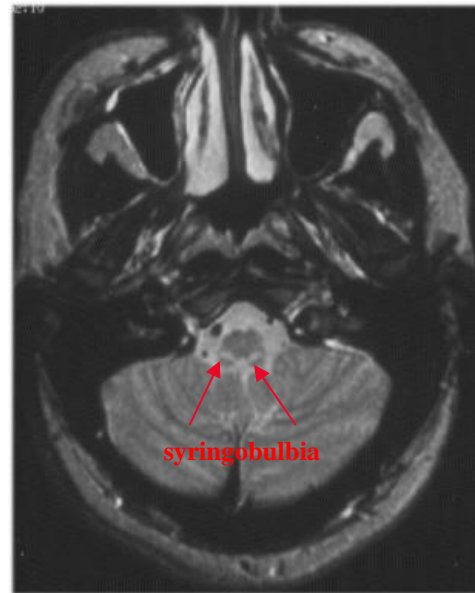
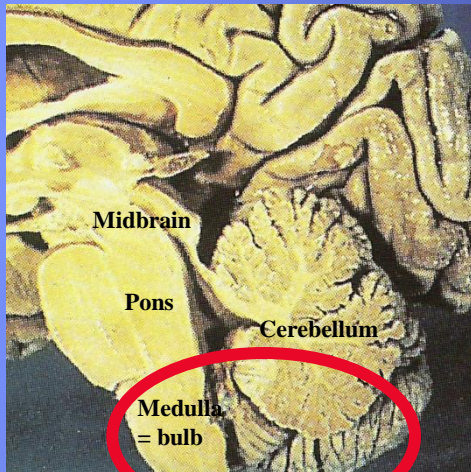
Central down beating nystagmus

➤ This nystagmus localizes the lesion to the inferior part of the posterior fossa (medulla or inferior part of the cerebellum) whatever the etiology (craniocervical malformations, cerebellar degeneration, vascular pathology, inflammatory disease, intoxication with lithium or antiepileptic drugs...)

Wagner JN, Glaser M, Brandt T, Strupp M.

Downbeat nystagmus ; aetiology and comorbidity in 117 patients.

J Neurol Neurosurg Psychiatry 2008;79:672-677.



Bertholon P et al.

Post-traumatic syringomyelobulbia and inferior vertical nystagmus.

Rev Neurol (Paris). 1993;149(5):355-8

Central down beating Nystagmus

video patient 3



Chiari Malformation

2. The analysis of nystagmus under videonystagmoscopy (static or portable device).

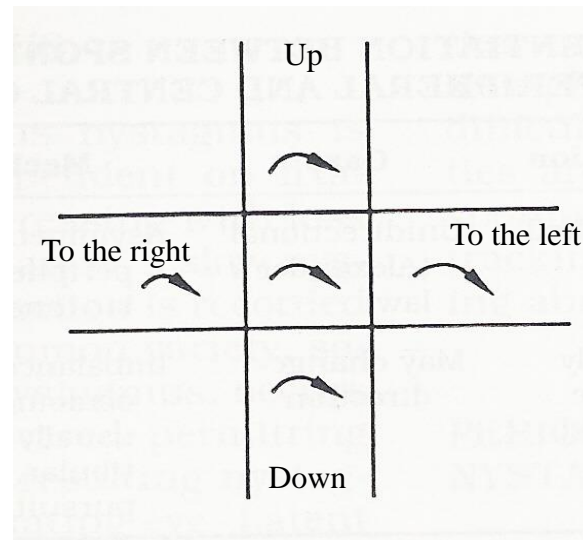
➤ As a peripheral nystagmus is increased or becomes apparent when fixation is eliminated, it is necessary to use either Frenzel lenses, ophthalmoscopy or **videonystagmoscopy** (++++)

➤ A peripheral vestibular nystagmus due to a lesion of the inner ear and/or vestibular nerve is usually **horizontal-torsional** (Jerk nystagmus with a slow and a fast phase; the direction of the nystagmus is described with reference to the fast phase).

➤ This nystagmus does not change direction with change in gaze position



- **The nystagmus is increased when the eyes are deviated in the direction of the fast phase (Alexander's law)**



- **This nystagmus is associated with a body deviation, when eyes closed, to the opposite side of the fast phase of the nystagmus (typical peripheral vestibular deficit)**

G...Armand. 42 years old.

- **History = 0**
 - **Disabling vertigo and vomiting at midday**
No hearing or neurological disorder
 - **Examination at 5 pm** (video patient 4 : nystagmus)
 - **Pure tone audiogram : N**
 - **cVEMPs : N**
- Right vestibular neuritis (superior nerve)**

3. The Head Impulse Test / Halmagyi test

- It needs to observe the **effect of head rotation on the eye movements** = the patient is instructed to fixate the examiner's nose and is applied high acceleration head thrusts.
- Any corrective saccade shortly after the end of the head thrust is a sign of an inappropriate compensatory eye movement.
- By using head thrusts in the various canal planes each individual canal can be tested, but when **performed clinically the test is essentially reliable in the horizontal canal.**

Halmagyi GM et al.
The Video Head Impulse Test.
Front Neurol 2017 Jun;9;8:258

Normal ear function



Video

Patient 4

(Halmagyi)

Right vestibular deficit

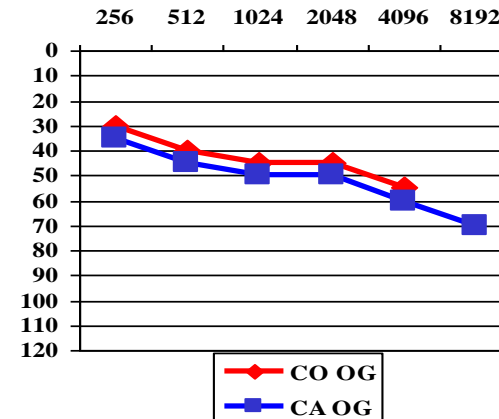
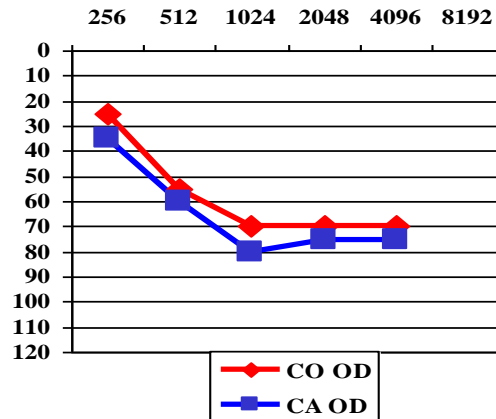


**Corrective saccade
to maintain fixation
(on examiner's nose)**



C...Gregory. 29 years old.

- since childhood, right hearing loss.
 - January 2009, left sudden hearing loss + vertigo.
- Halmagyi testing is bilaterally positive**
- VNG = No response on caloric and rotatory testing**
- cVEMP = No response**
- MRI : hypersignals (Normal neurological examination)**



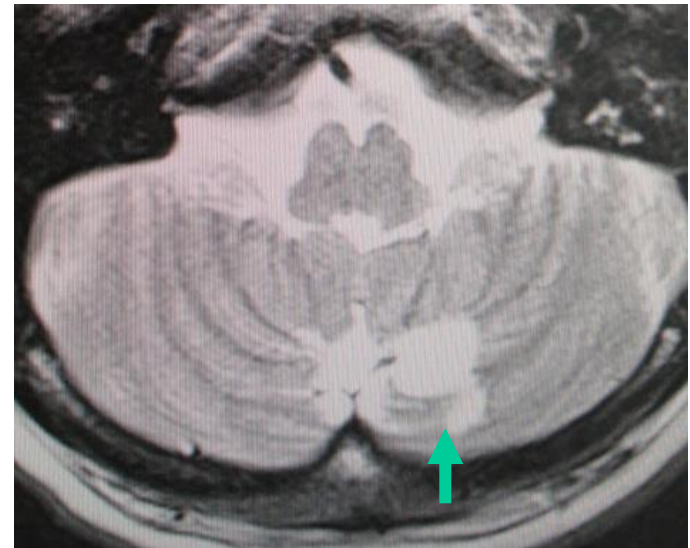
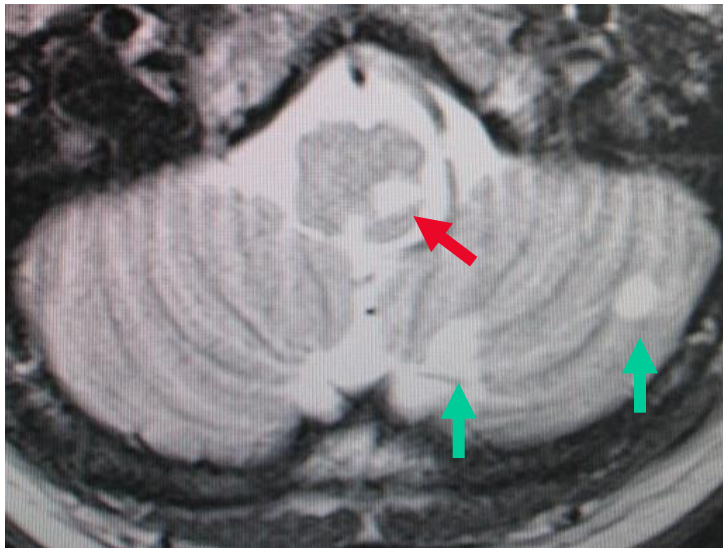
➔ Bilateral vestibular areflexia
associated with bilateral sensorineural hearing loss (unknown etiology)

B... Michel (55 years old).

➤ Previous history = 0

➤ 28/09/2013 : **Vertigo + Vomiting and left instability**

Left body deviation and intermittent and slight right nystagmus

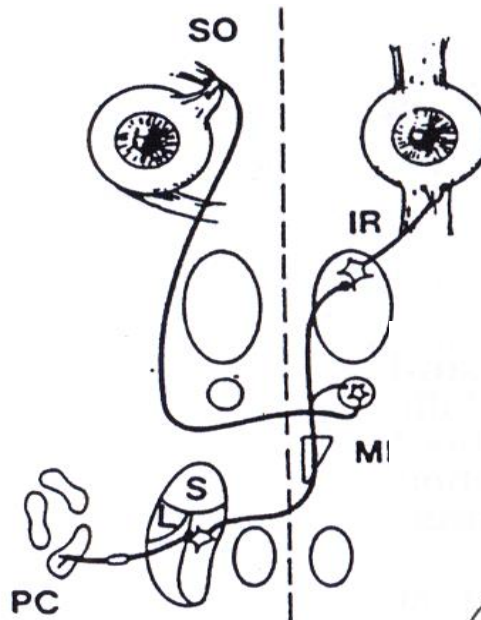
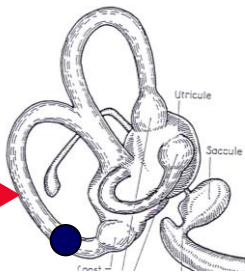


Left Wallenberg syndrome () and cerebellar ischemia ()

4. The positional manoeuvres

- **There are essential to diagnose Benign Paroxysmal Positional Vertigo (BPPV) which is the first cause of vertigo and manifests by brief and positional vertigo.**
- **They should be performed in the plane of the posterior (and anterior) canal (Dix Hallpike Manoeuvre) and horizontal canal (Head rotation in the supine position)**
- **The direction of the nystagmus is essential to diagnose the canal involved**

Posterior canal →



Posterior Canal Connection with ocular eyes muscles

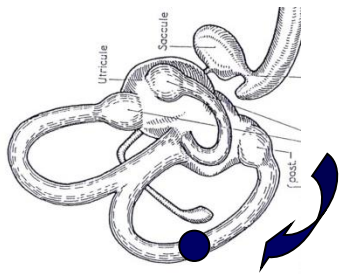


Dix Hallpike manoeuvre



Rotatory-upbeating nystagmus

Video Patient 7

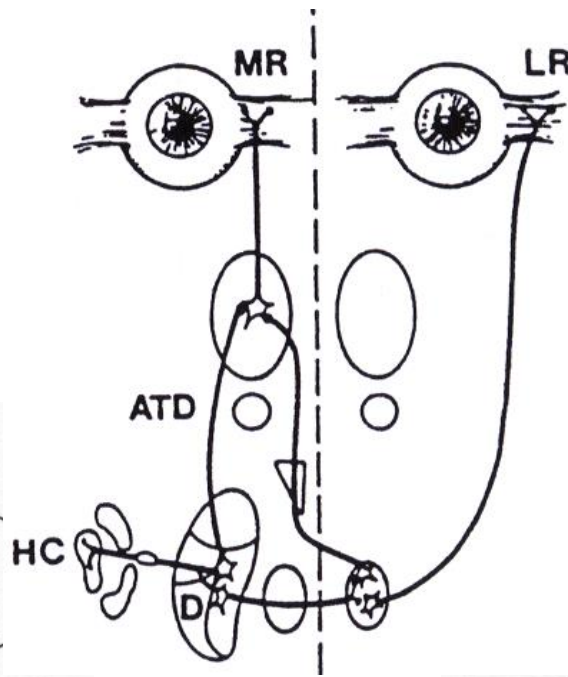
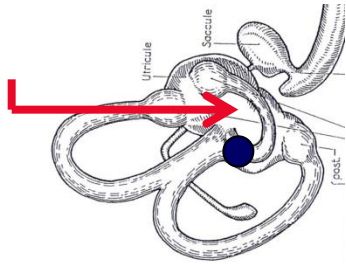


Dix MR, Hallpike CS.

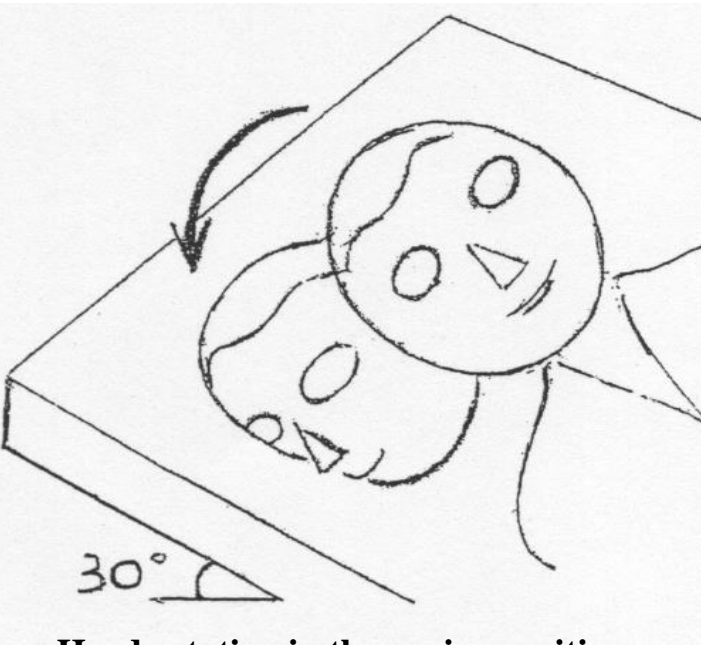
The pathology, symptomatology and diagnosis of certain common disorders of the vestibular system.

Ann Otol Rhinol Laryngol 1952;61:987-1016.

Horizontal canal

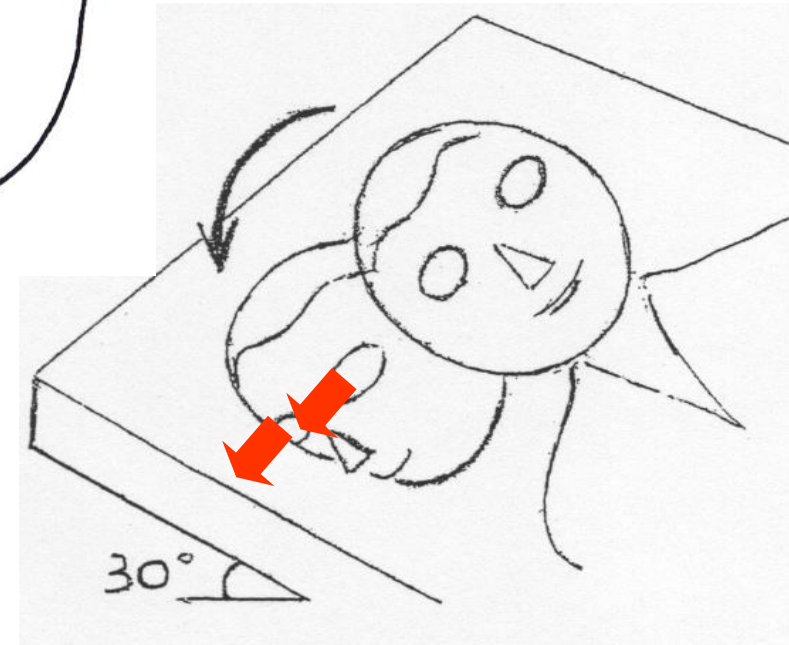


Geotropic form



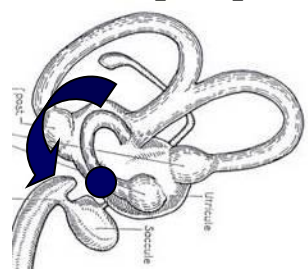
Head rotation in the supine position

Horizontal Canal Connection with ocular eyes muscles



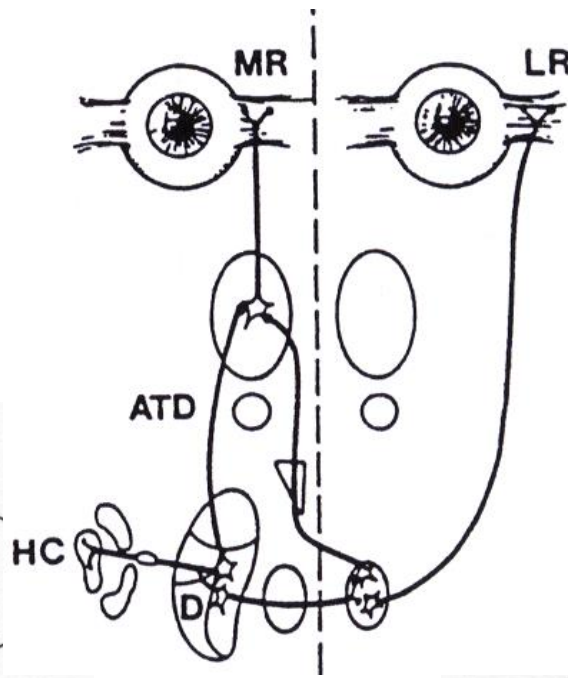
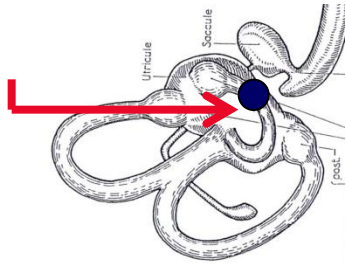
Horizontal nystagmus (right beating to the right)

Video Patient 8

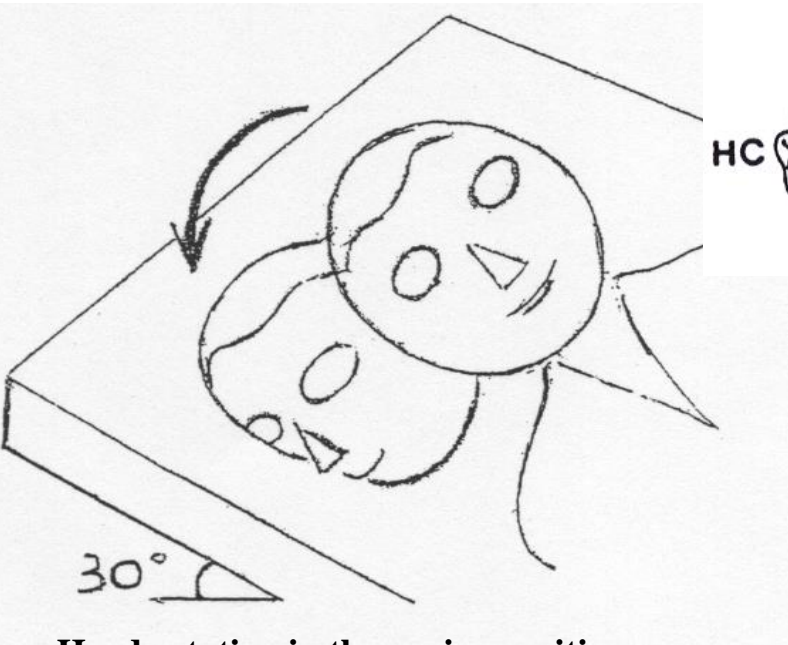


McClure JA.
Horizontal canal BPV.
J Otolaryngol 1985;14:30-5.

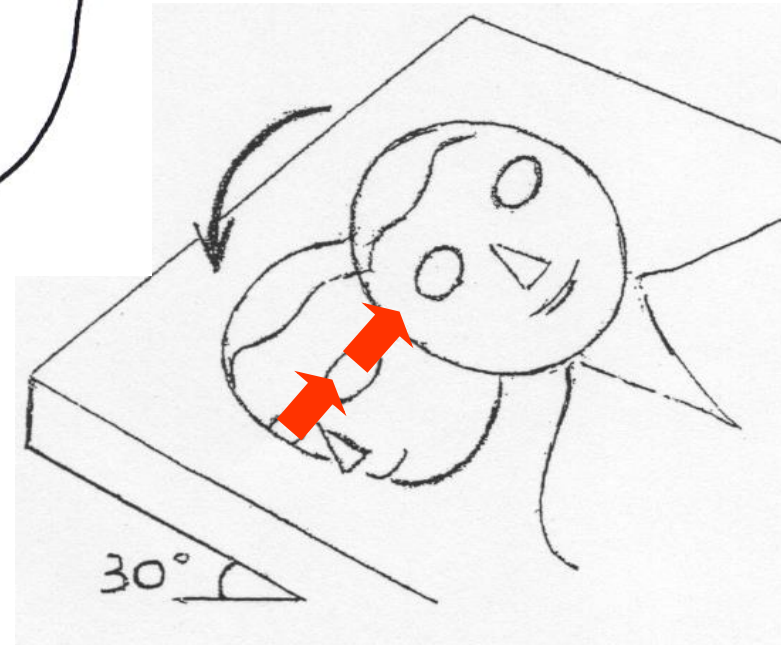
Horizontal canal



Ageotropic form

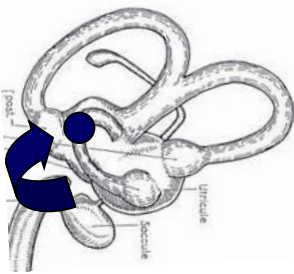


Head rotation in the supine position



Horizontal nystagmus
(left beating to the right)

Video
Patient 9



Baloh RW, Yue Q, Jacobson KM, Honrubia V.

Persistent direction-changing positional nystagmus : another variant of benign positional nystagmus ?
Neurology 1995;45:1297-1301.



5. The analysis of postural stability by Romberg and/or Fukuda testing.

- The diagnosis of a patient with posture and gait disorders is a difficult **challenge** for the clinician as what is wrong can be due to impairments ranging **from the top of the head to the tip of the toes** (vision deficiency, inner ear disease, polyneuropathy, brainstem and/or cerebellar disorders, hydrocephalus or parkinsonian disorder, spinal cord lesion, musculoskeletal dysfunction...) !
- However, a gait disorder is unlikely to be due to vestibular disease (peripheral or central) if it has never been associated with vertigo, dizziness, oscillopsia or hearing disorder.

- **Examination of posture and gait (vestibulo-spinal reflex) can shed useful light in the diagnosis of the dizzy patients but is less important than eye movements (vestibulo-ocular reflex) or positional manoeuvres**
- **Examination of posture and gait sometimes can immediately differentiate a peripheral (5 a) from a central vestibular disorder (5 b)**
- **Examination of posture and gait is more important than eye movements to diagnose a psychological disorder (5 c)**

Examination of posture/gait disorder

- **Romberg test** = patient stands with feet together, hands by the sides, eyes opened and then eyes closed.



- **The Fukuda (or Unterberger) stepping test** = patient walks on the spot with feet together, eyes opened and then eyes closed.

- **Gait analysis**

50 steps in 30 s.
(N < 30°)

These tests can not be taken in isolation but should be performed in conjunction with appropriate additional tests in particular the search for a nystagmus / Halmagyi test

5 a. Postural stability in Peripheral vestibular disease

Video
Patient 4
(body
deviation)

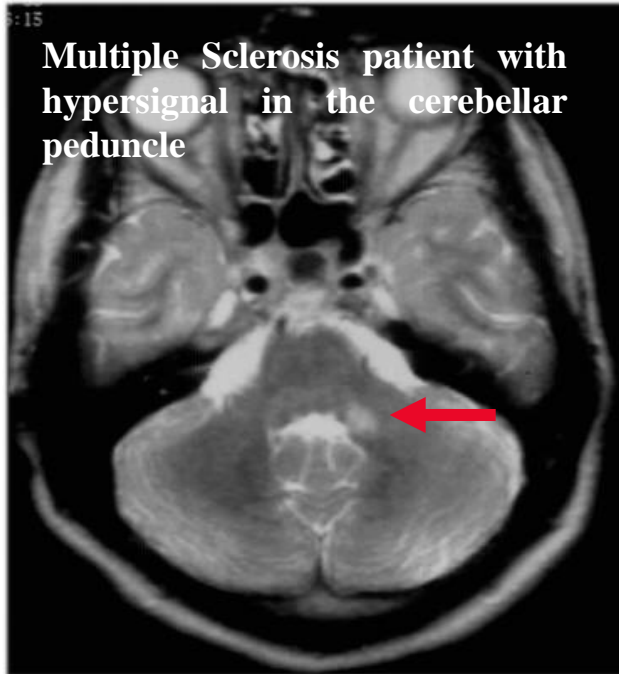
- **Patient is able to stand with eyes opened (when reassured) and turns towards one side with eyes closed.**
- **Horizontal or horizontal-torsional nystagmus towards the other side without fixation (Videonystagmoscopy).**
- **Additional test = Halmagyi test should be +
(saccade)**

5 b. Postural stability in central vestibular disorder

- **Usually no correlation between the body deviation and the nystagmus.**
- **Intensity of the body deviation (inability to stand alone with eyes opened).**
- **Central or no nystagmus (isolated body lateropulsion).**
- **Additional test = Halmagyi test (usually N).**
- **Often associated with central neurological symptom or sign.**

Video
Patient 6
(body deviation)

Isolated body lateropulsion



Bertholon P et al.
Isolated body lateropulsion caused by a lesion the cerebellar peduncles.
J Neurol Neurosurg Psychiatry 1996, 60,3 , 356-357

- patient unable to stand without other symptoms
- body lateropulsion without nystagmus

Various localization :

- Inferior and/or cerebellar peduncles
- Cerebellum (flocculo-nodular lobe)
- Brainstem (red nucleus, medulla oblongata)

5 c. Psychological gait disorder

- Posture and gait is more important than eye movements to depict psychological disorder.
- Diagnosis **at glance**

be aware of discrepancy : **Sitting/Standing**

Romberg/Fukuda

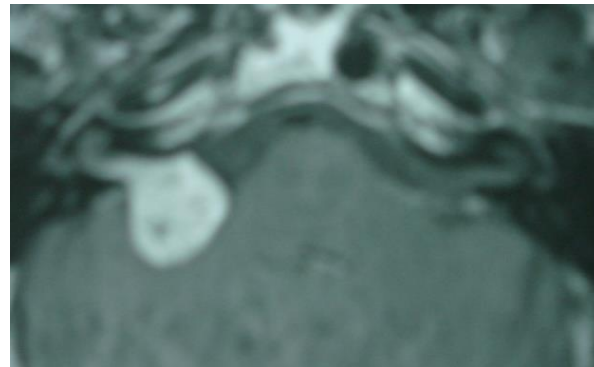
can happen in children

Difficult if association of

a functional gait

Patient
Video

favoured by peripheral / central lesion



Right vestibular schwannoma

CONCLUSION

- This set of **5 basic bedside tests** is usually able to differentiate a peripheral vestibular disorder from a central lesion and often to approach the underlying etiology.
- This set of **5 basic bedside tests can be completed by many others clinical tests** (head shaking, vibratory test, fistula test...search for dysmetria...) **and of course audiological testing.**
- **This clinical evaluation will guide for other appropriate audiovestibular electrophysiological, imaging (brain MRI and/or inner CT) and/or laboratory testing**