

**IFOS  
Ho Chi Minh,  
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**Bedside neuro-otological examination  
and  
interpretation of commonly used tests**

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# Introduction

- The objective of this presentation is to demonstrate that **patient's neuro-otological 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 neuro-otological examination is required to determine if imaging studies and/or laboratory tests are needed.

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)**

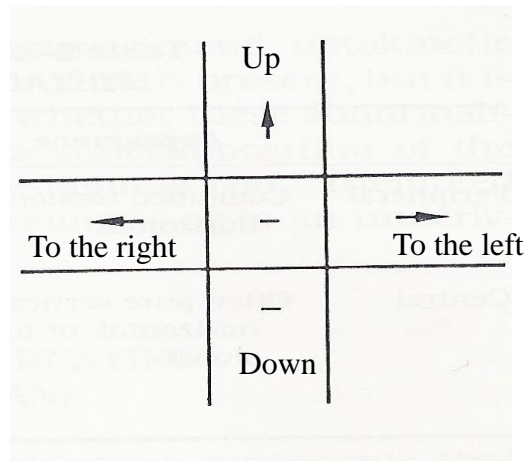
**The occurrence of abnormalities such as a gaze evoked nystagmus, a down beat nystagmus, an internuclear ophthalmoplegia ... immediately affirms a central neurological disorder and sometimes the exact localization of the lesion.**

**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.**

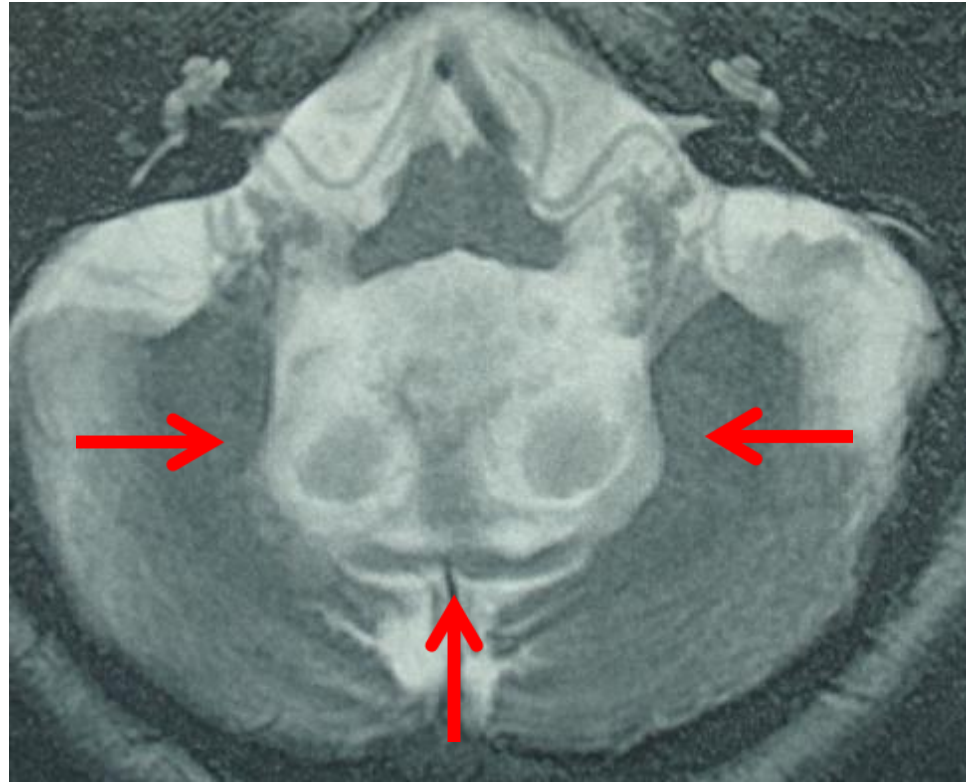


Gaze-evoked nystagmus on lateral gaze and upward gaze is common while gaze-evoked nystagmus on downward gaze is infrequent

- 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

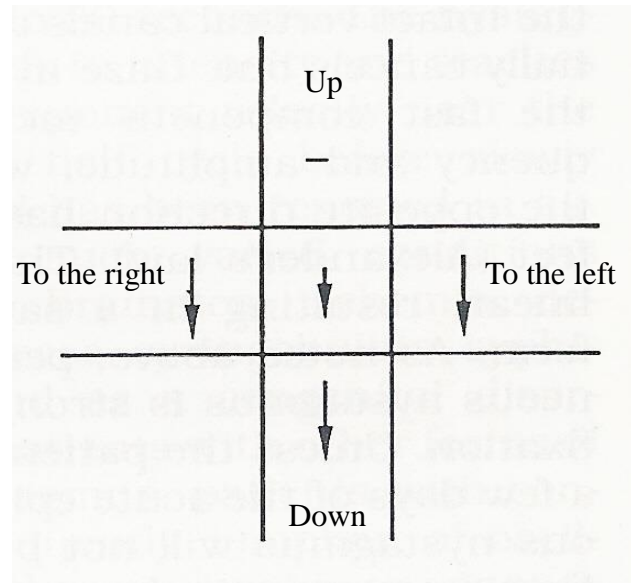
Patient with a long lasting history of dysequilibrium



Atypical malformation in the cerebellum

# 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

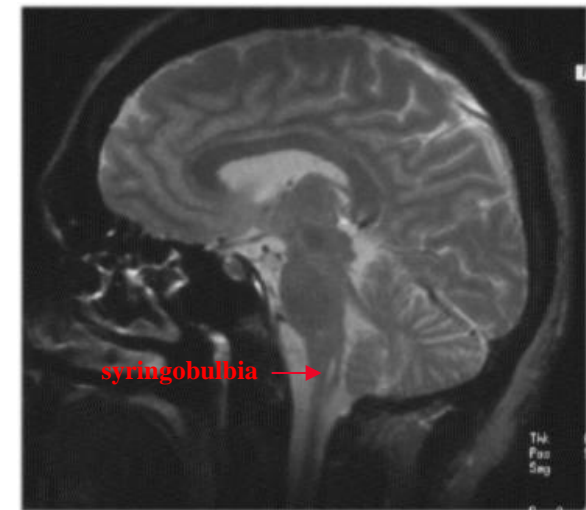
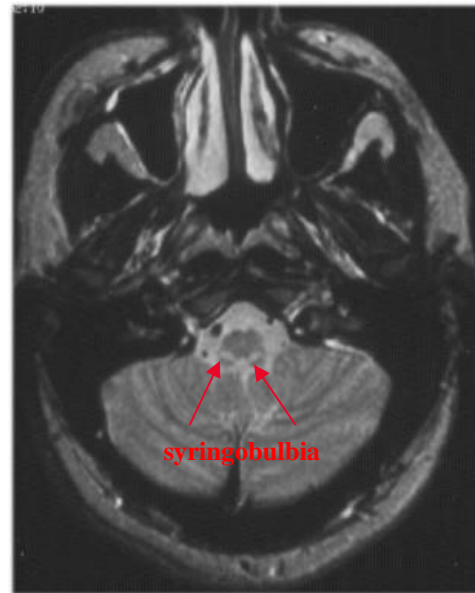
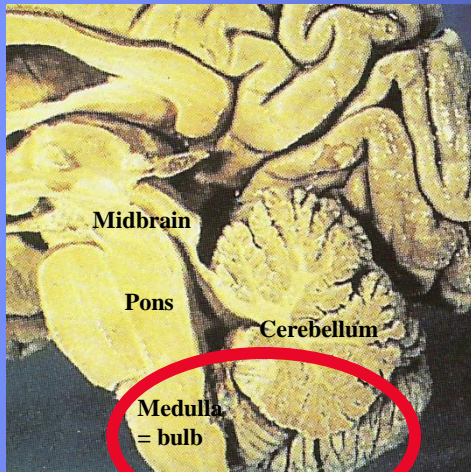
# Central down beating nystagmus

➤ 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



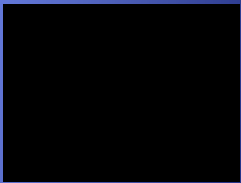
Chiari Malformation

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

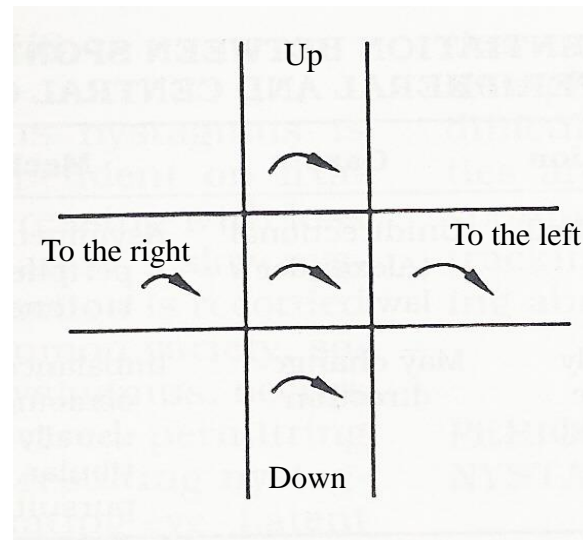
➤ As a peripheral nystagmus is increased or became apparent when fixation is eliminated, it is necessary to use either Frenzel lenses, ophthalmoscopy or **videonystagmoscopy** (++++)

➤ 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)**

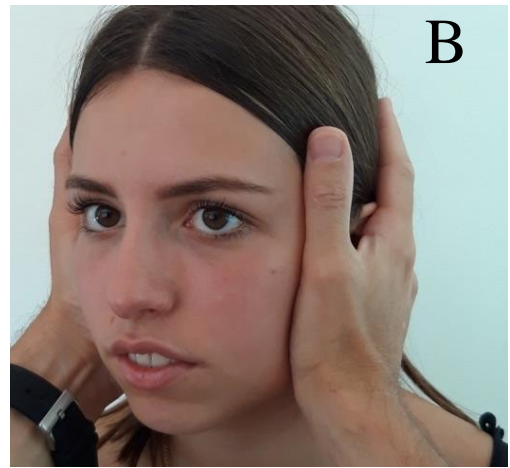
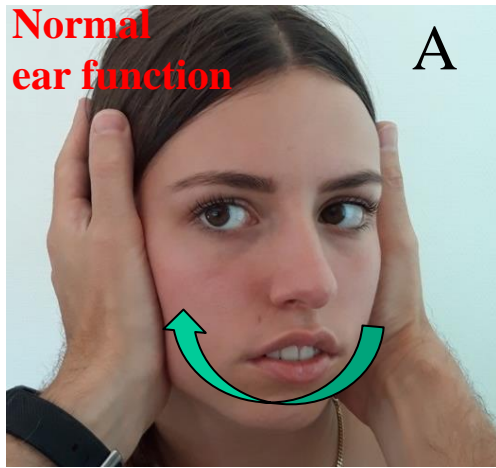
## **G...Armand. 42 years old.**

- **History = 0**
  - **Disabling vertigo and vomiting at midday**  
**No hearing or neurological disorder**
  - **Examination at 5 pm : Left horizontal-torsional nystagmus enhanced with Videonystagscopy**
  - **Pure tone audiogram : N**
  - **cVEMPs : N**
- Right vestibular neuritis (superior nerve)**

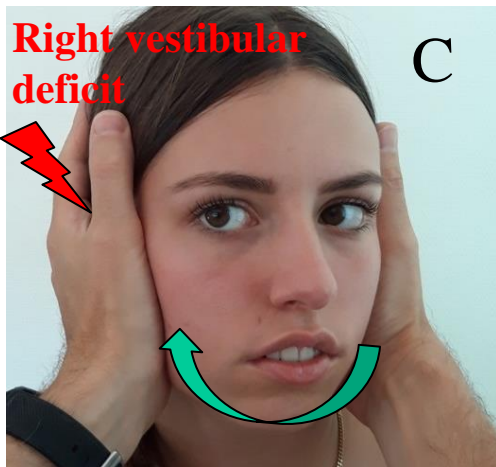
### 3. The Head Impulse Test (Halmagyi test)



- 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 (overt saccade).
- 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



During abrupt head thrust from left (A) to right (B), the vestibulo-ocular reflex will compensate for head turn and gaze will stay fixed on fixation target (nose of the examiner)



**In case of a right peripheral vestibular deficit,**  the eyes will move with the head (C-D) so that the patient has to make a corrective saccade  at the end of the head impulse (D-E) in order to return his gaze to the earth-fixed target (nose of the examiner). This **'overt' corrective saccade to the left is the clinical sign of a right vestibular deficit**

## **G...Armand. 42 years old.**

- **History = 0**
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**No hearing or neurological disorder**
- **Examination at 5 pm : Left horizontal-torsional nystagmus enhanced with Videonystagscopy**  
**Halmagyi test is positive for head thrust to the right**  
**= Left horizontal corrective saccade**
- **Pure tone audiogram : N**
- **cVEMPs : N**
- ➔ **Right vestibular neuritis (superior nerve)**

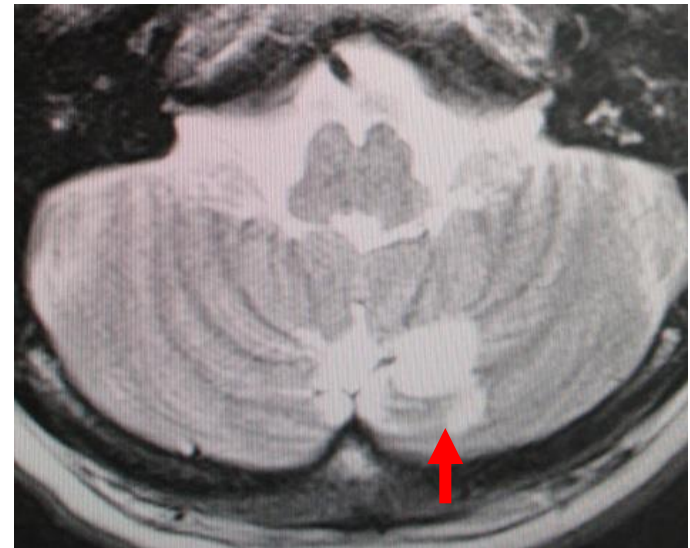
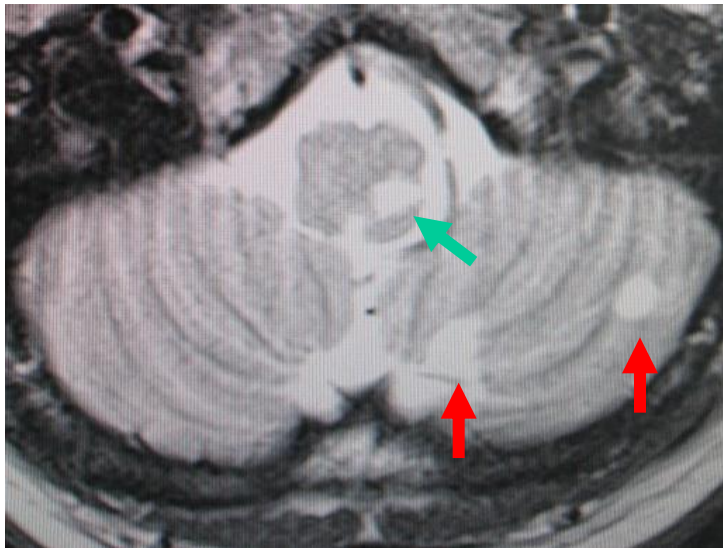
## B... Michel (55 years old).

➤ Previous history = 0

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

**Left body deviation** and intermittent and slight right nystagmus

➤ **Halmagyi test is normal.**



Left Wallenberg syndrome (  ) with cerebellar ischemia (  )



## 4. The positional manoeuvres

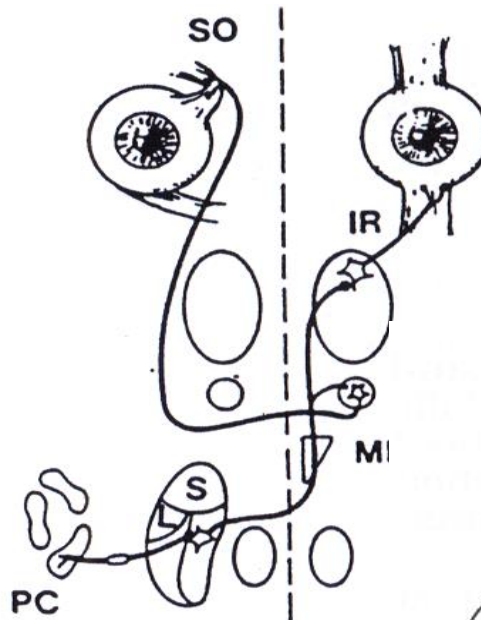
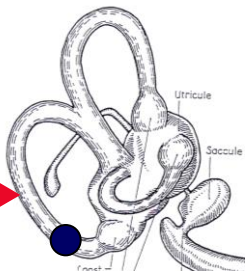
- There are essential to diagnose **Benign Paroxysmal Positional Vertigo (BPPV)** which is the first cause of vertigo and manifests by brief and positional vertigo.
- They should be performed in the plane of the posterior (and anterior) canal (Dix Hallpike Manœuvre) and horizontal canal (Head rotation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

**Benign paroxysmal positional vertigo : diagnostic criteria.**

**Consensus document** of the committee for the classification of vestibular disorders of the Barany society.

Von Brevern M, Bertholon P, Brandt T, Fife T, Imai T, Nuti D, Newman-Toker D.  
J Vest Res, **2015**;25:105-117.

**Posterior canal** →



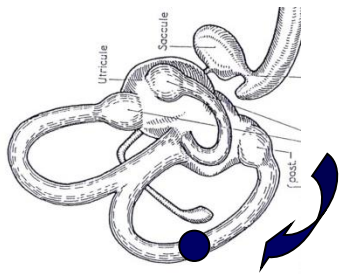
**Posterior Canal Connection with ocular eyes muscles**



**Dix Hallpike manoeuvre**



**Rotatory-upbeating nystagmus**

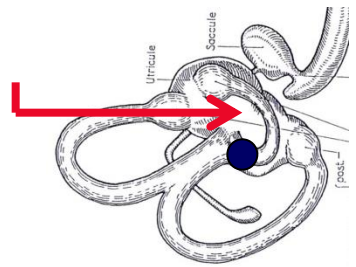


Dix MR, Hallpike CS.

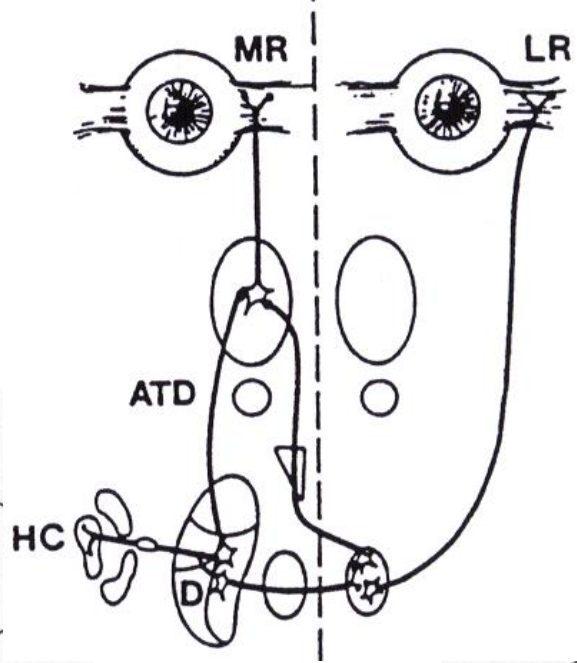
The pathology, symptomatology and diagnosis of certain common disorders of the vestibular system.

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

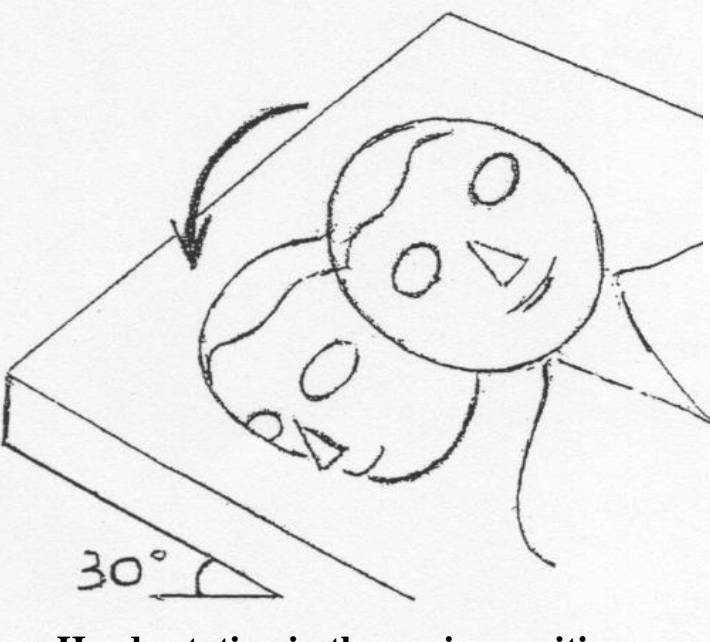
**Horizontal canal**



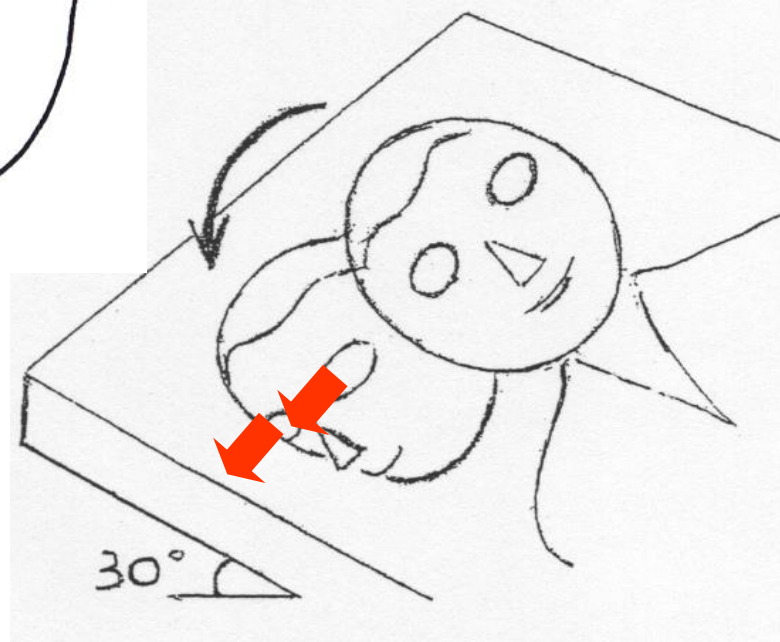
**Geotropic form**



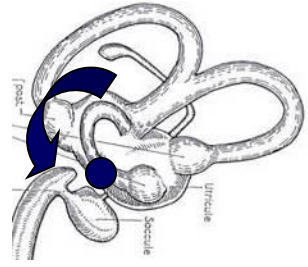
**Horizontal Canal Connection with ocular eyes muscles**



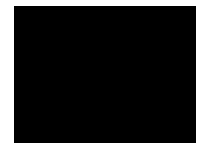
**Head rotation in the supine position**



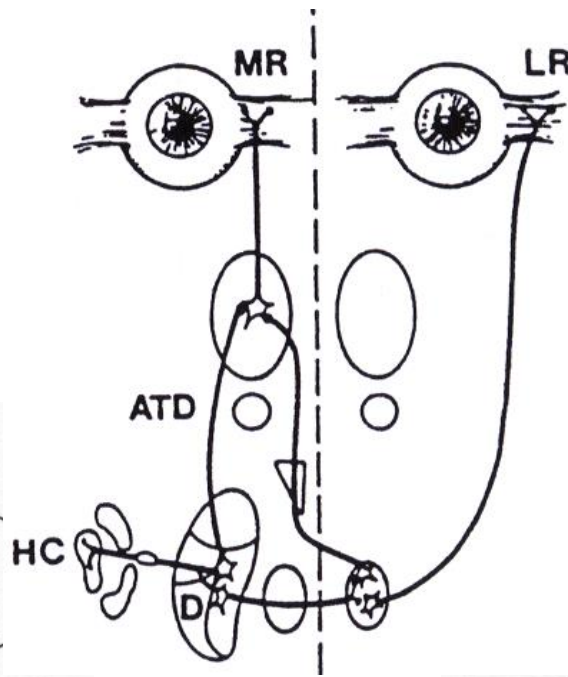
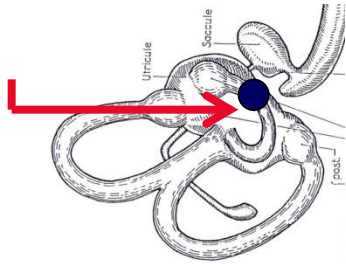
**Horizontal nystagmus (right beating for rotation of the head to the right)**



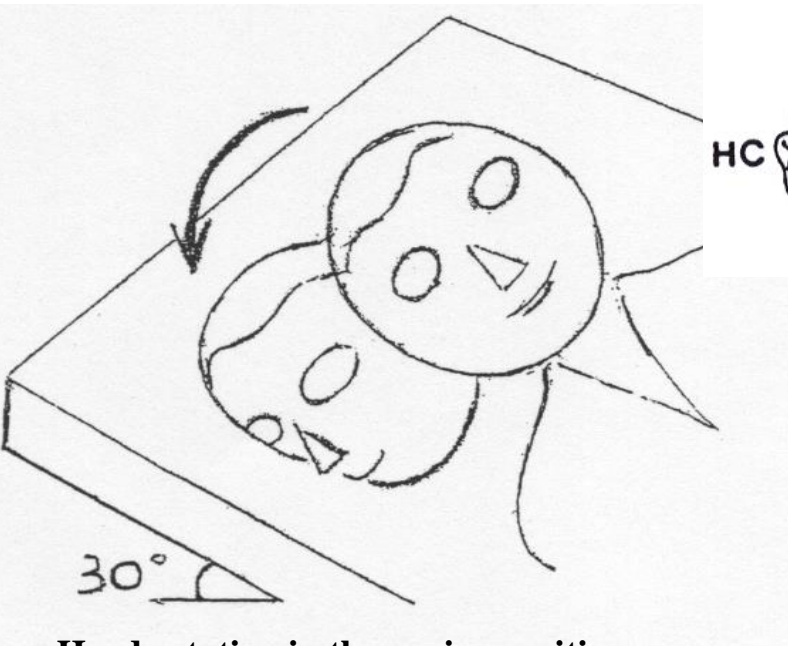
McClure JA.  
Horizontal canal BPV.  
J Otolaryngol 1985;14:30-5.



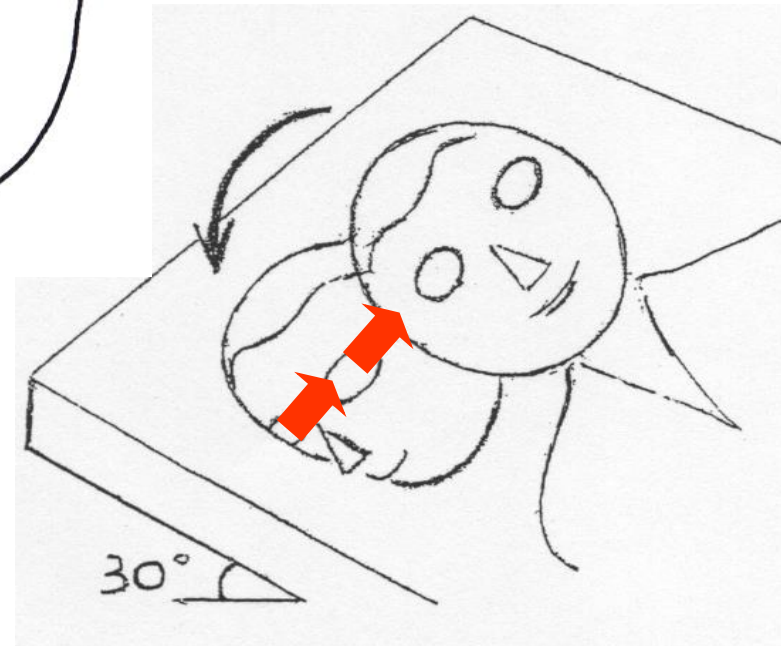
# Horizontal canal



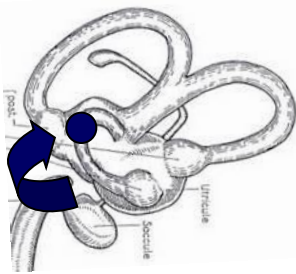
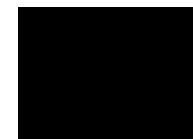
**Ageotropic form**



**Head rotation in the supine position**



**Horizontal nystagmus**  
(left beating for rotation of the head to the right)



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, the Halmagyi test.

## **5 a. Postural stability in Peripheral vestibular disease**

- 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 + (corrective saccade)



## **G...Armand. 42 years old.**

- **Disabling vertigo and vomiting at midday**  
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- **Examination at 5 pm : Left horizontal-torsional nystagmus enhanced with Videonystagscopy**  
**Halmagyi test is positive for head thrust to the right**  
**= Left horizontal corrective saccade**

**The patient is able to stand with eyes opened**  
**and deviate to the right with eyes closed**

- **Pure tone audiogram : N**
- **cVEMPs : N**



**Right vestibular neuritis (superior nerve)**

## **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.**

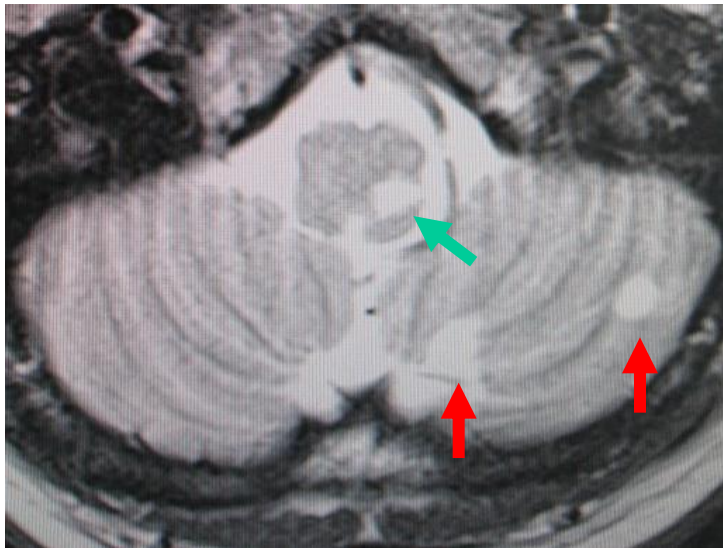
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intermittent and slight right nystagmus    Halmagyi test is normal.



Left Wallenberg syndrome (  ) with cerebellar ischemia (  )

## 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

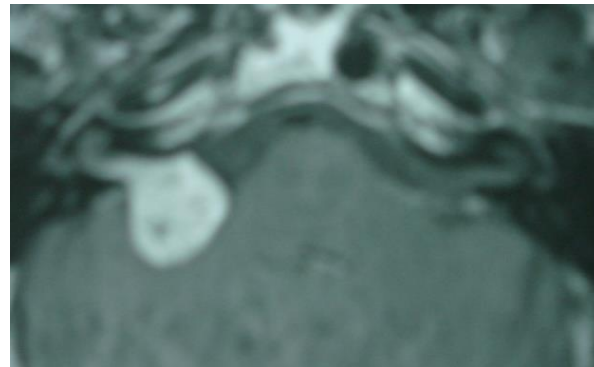
can happen in children (around puberty)

# Difficult if association of

a functional gait



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**