Vertigo in the emergency department

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Introduction

- Vertigo/dizziness is a common complaint that accounts for 3.3 to 3.6% of emergency department visits.

Newman-Toker DE et al.
Spectrum of dizziness visits to US Emergency Departments: cross-sectional analysis from a nationally representative sample
Mayo Clin Proc 2008 July; 83(7):765-775

Cheung CS et al.
Predictors of important neurological causes of dizziness among patients presenting to the emergency department.
Emerg Med 2010 July;27(7):517-521

- Diagnosis of a patient suffering from vertigo is challenging as it may due to various disorders in the fields of Otology, Neurology, Psychiatry and Internal Medicine...

- However, in emergency, it is easier to make an accurate diagnosis as vertigo should be associated with objective signs, in particular oculomotor abnormalities.
It is essential to remind that vertigo due to a peripheral (ENT) disorder has mainly 2 different presentations:

- either a **dysfunction of a canal** as observed in BPPV: the patient complain of brief (less than 1 minute) positional vertigo and positional manoeuvres should trigger a typical positional nystagmus (according to the canal involved)

- or a **dysfunction of the inner ear and/or vestibular nerve**, with a spontaneous vertigo during a least 20 minutes as can be observed in a crisis of Meniere’s disease, labyrinthitis, vestibular neuritis… Then, the patient should have a typical peripheral vestibular deficit with a spontaneous horizontal-torsional nystagmus and a contralateral body deviation.
However, one of the most difficult diagnostic challenge is to differentiate a benign vestibular neuritis from a dangerous stroke in the posterior fossa that can present with isolated vertigo.

Peripheral vestibular disease

(vestibular neuritis +++)

Central vestibular or cerebellar disease
(cerebellar stroke +++)


The diagnosis relies on **history taking** (symptoms)

There is accumulating evidence that trying to clarify the type of vestibular symptoms (dizziness / vertigo / unsteadiness /lightheadedness…) is of limited clinical utility.

On the contrary, it is useful to fizational on :

**TIming** (onset, duration, evolution ) and

**TRiggers** (action, movements or situations that provoke the onset of dizziness in patient with intermittent symptoms)

For example :
- Vestibular symptoms only on arising is an argument for orthostatic hypotension, whereas symptoms both on arising and on lying back or when rolling in bed is typically observed in BPPV.
  - Head trauma induces BPPV, labyrinthine concussion and/or fracture.

(TITRATE is the acronym for TIming, TRiggers And Targeted Exams)

Newman-Toker DE, Edlow JA.

TITRATE: A Novel Approach to Diagnosing Acute Dizziness and Vertigo

A few simple questions should be systematically asked in order to search for a neurological disorder (clumsiness, paresthesia, dysarthria…)
**SYMPTOMS**

- **Isolated Vertigo**
  - Brief (< 1 mn) and Positional (bed +++)
  - Usually PERIPHERAL (BPPV)
  - Usually PERIPHERAL (vestibular neuritis ?)
  - Vestibular Migraine ?

- **Vertigo with hearing loss Fullness, tinnitus**
  - Unique episode (days)
  - Usually PERIPHERAL (vestibular neuritis ?)
  - Vestibular Migraine ?
  - Usually PERIPHERAL (labyrinthitis ?)
  - Usually PERIPHERAL (Meniere ?)
  - Usually PERIPHERAL (labyrinthine concussion and/or fracture)

- **Spontaneous Vertigo**
  - Recurrent episodes
  - Usually PERIPHERAL (BPPV)
  - Usually PERIPHERAL (labyrinthitis ?)
  - Usually PERIPHERAL (Meniere ?)

- **Post traumatic Vertigo**
  - Recurrent Episodes (> 20 mn)
  - Usually PERIPHERAL (labyrinthine concussion and/or fracture)

- **Vertigo with neurological symptoms**
  - double vision, paresthesia, clumsiness (hand)
  - dysarthria, dyshagia, dysphonia

**CENTRAL (stroke...)**
The diagnosis relies on **bedside examination** (signs)

At least 2 recent series show the importance and sensitivity of clinical examination compare to imaging tests in acute vertigo patients:

- **Series from a Neurological Department using a 3-step bedside oculomotor examination**
  
  No device
  
  Kattah JC et al. HINTS to diagnose stroke in the Acute Vestibular syndrome. Three-step bedside oculomotor examination more sensitive than early MRI diffusion-weighted Imaging.
  
  Stroke 2009;40:3504-3510

- **Series from an ENT Department using a 4-step bedside examination including oculomotor and body examination**
  
  Frenzel glasses are needed
  
  Vanni S et al. STANDING, a four-step bedside algorithm for differential diagnosis of acute vertigo in the emergency department
  
  Acta Otorhinolaryngologica italica 2014;34:419-426

Prospective study of 101 consecutive patients with an acute vestibular syndrome and at least 1 stroke risk factor underwent:

A 3-step bedside examination including:
- Observation of Nystagmus in different positions of gaze.
- Prism cross-cover test of ocular alignment (search for a skew deviation)
- Horizontal head impulse test (Halmagyi test)

Bedside examination was compared to Neuroimaging (MRI or CT)
Among the 101 consecutive patients:

- 25 patients had a peripheral lesion
- 76 had a central lesion (69 ischemic strokes)

The presence of normal horizontal head impulse test, direction changing nystagmus in eccentric gaze, or skew deviation was 100% sensitive and 96% specific for stroke.

Initial MRI diffusion-weighted imaging was falsely negative in 12% (all < 48 hours after symptoms onset)

A 3-step bedside oculomotor examination appears more sensitive for stroke than early MRI in Acute vestibular syndrome.
Vanni S et al. **STANDING**, a four-step bedside algorithm for differential diagnosis of acute vertigo in the emergency department

*Acta Otorhinolaryngologica italica* 2014;34:419-426

Prospective study of 292 consecutive patients with an acute vestibular syndrome randomized in a STANDING group and a CONTROL group

A 4-step bedside examination including:

- Observation of *Spontaneous nystagmus* (Frenzel glasses)
- Observation of *Positional nystagmus* (supine roll test, Dix Hallpike)
- *Horizontal head impulse test* (Halmagyi test)
- Analysis of *body stability* (the inability to stand alone with eyes opened is considered a central sign)

The STANDING algorithm shows good reliability and very high accuracy in excluding dangerous disease in the hands of emergency physicians.
Based on the 2 previous studies we regularly use a simple algorithm using a set of 5 basic bedside tests:

1. Analysis of eyes movements in different position of gaze as well as ocular pursuit

2. Analysis of nystagmus under videonystagmoscopy (portable device).

3. Head Impulse Test / Halmagyi test

4. Positional manoeuvres

5. Analysis of postural stability by Romberg and/or Fukuda testing.
Spontaneous Nystagmus is present

Nystagmus is obviously Central
(Gaze evoked Nystagmus, Nystagmus is purely vertical or purely torsional)

Spontaneous Nystagmus is absent

Cerebellar infarct in the territory of the medial branch of the posterior inferior cerebellar artery

CENTRAL
Spontaneous Nystagmus is present

CENTRAL

PERIPHERAL

Spontaneous Nystagmus is absent

Nystagmus is possibly Peripheral = horizontal-torsional

Head impulse test

Saccade -

Saccade +

Standing Position -

Standing Position +

Nystagmus (fixation, VNS)

Standing Position -

Nystagmus  (fixation, VNS)
Spontaneous Nystagmus is present

Dix Hallpike

Spontaneous Nystagmus is absent

Positional Manœuvres

Supine roll test

Dix Hallpike

Horizontal Nystagmus

Rotatory Upbeating Nystagmus

Hor BPPV

Post BPPV
Spontaneous Nystagmus is present

CENTRAL

Spontaneous Nystagmus is absent or atypical

Positional Manœuvres

Nystagmus is absent or atypical

Standing Position - or other neurological Signs +

Atypical positional vertigo revealing a cerebellar metastasis

Atypical positional nystagmus in Multiple Sclerosis

Nystagmus (fixation, VNS)
Spontaneous Nystagmus is absent

Positional Manœuvres

- Supine roll test
  - Horizontal Nystagmus
  - Dix Hallpike
    - Rotatory Nystagmus
      - Saccade -
        - Standing Position -
          - Hor BPPV
        - Standing Position +
          - Post BPPV
  - Saccade +
    - Standing Position +
      - CENTRAL
      - PERIPHERAL

Spontaneous Nystagmus is present

Nystagmus is obviously Central
(Gaze evoked Nystagmus, Nystagmus is purely vertical or purely torsional)

- Head impulse test
  - Saccade -
    - Standing Position -
      - CENTRAL
  - Saccade +
    - Standing Position +
      - PERIPHERAL
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 (cover test, head shaking, vibratory test, fistula test...search for cerebellar dysmetria...).

This clinical evaluation should be completed by audiological testing (which can be performed with a portable device) as audiological testing often immediately orientates the diagnosis.
Normal pure tone Audiometry

Normal Audiometry is compatible with BPPV, vestibular neuritis, vestibular migraine, cerebellar stroke (in the territory of the postero-inferior cerebellar artery), Wallenberg syndrome…
Audiometry showing a sensorineural hearing loss on the low-middle frequencies

This audiometry is typical of a Meniere’s disease (right Meniere’s disease at an early stage)
Audiometry showing a sensorineural hearing loss on the middle-high frequencies or total deafness

This audiometry is compatible with a vestibular schwannoma (A) (including an intralabyrinthine form), labyrinthitis (B), temporal bone fracture (C), intralabyrinthine haemorrhage (total deafness), cerebellar stroke (rare) in the territory of the antero-inferior cerebellar artery (which also supply the inner ear)

A  
Enhancement of the right ponto-cerebellar angle after gadolinium injection (vestibular schwannoma)

B  
Enhancement of the right labyrinth after gadolinium injection (labyrinthitis in the context of Relapsing Polychondritis)

C  
Translabyrinthine fracture with pneumolabyrinth (total deafness) on CT scan
Audiometry showing a mixed hearing loss

This audiometry in the context of vertigo is an argument for a third window mechanism as can be observed in dehiscence of the superior canal (A), enlarged vestibular aqueduct (B)…

Dehiscence of the right superior canal with dehiscence of the tegmen tympani

Enlarged vestibular aqueduct
CONCLUSION

Based on **history taking and a set of basic bedside tests** (together with pure tone audiometry), 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 guide for other appropriate audiovestibular (electrophysiological), imaging (brain MRI and/or inner CT) and/or laboratory testing.