Central Vertigo

Timothy C. Hain, MD

Northwestern University Medical School
Chicago, IL

**Definition**

- Central vertigo is vertigo caused by a disturbance of brain
- Central vertigo is NOT vertigo where examiner doesn't recognize the ENG pattern. (This is undiagnosed vertigo)

**Central dizziness/ vertigo is rare**

- About 5% of all vertigo
- About 25% of vertigo seen by neurologists

**There are many localizations and causes for Central Dizziness**

- Migraine
- Vascular
- Degenerative
- Seizure
- Developmental
- Toxic
- Paraneoplastic
- Unclear

**Case (patient DA)**

- 43 y.o. F, episodes of dizziness for 5 years
- Attacks begin with headache, nausea, dizziness, and severe ear pain.
- About 3/month, lasting 2-3 days.
- Severe motion intolerance

Migraine causes most central vertigo!
**Case Study (patient DA)**
- Tinnitus in both ears
- Denies hearing loss
- Physical exam normal
- Audiogram, 3 caloric tests, MRI of brain normal

**Headaches are common**
- 90% lifetime prevalence
- 25% annually report recurrent episodes of severe headache
- 4% daily or near-daily headache
- Medications used by 9% of US adults each week to treat headaches

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**Migraine**
- Most common headache, about 10% of entire population (Stewart, 1992)
- 20-30% of women of childbearing age have migraine
- 90% of “sinus” headaches meet criteria for migraine diagnosis.

**Migraine Variants**
- Common migraine (just headache)
- Classic migraine (with aura)
Migraine Variants

- Acephalgic migraine: Aura without headache (a tough call).
- Usual story is transformation of headache with aura into aura alone.
- About 1% of migraine population*  
  
  *Krayen/Hood, 1984; Selby/Lance, 1960  

Migraine Variants

- Complicated migraine is accompanied by a neurological deficit.
  - About 1% of migraine patients
  - About 25% of patients with migraine have "small vessel disease" on MRI.
  - Prevention is important here

Prevalence of Migraine

(Stewart et al, 1994)
Migraine in Women
- 3:1 ratio of women:men.
- Peak age is 30-45.
- 10:1 increase in frequency of migraine around time of menses.
- Attributed to fluctuations in estrogen level. Can treat by eliminating fluctuations (often BC pills).
- Usually stops while pregnant
- Often flares for a few years near menopause

Migraine & Vertigo (MAV): Prevalence
- Migraine:
  - 10% of U.S. pop
  - 20-30% of women childbearing age
- Vertigo: 35% of migraine population.
- Migraine + vertigo:
  - ~ 3.5% of U.S. pop.
  - ~ 10% of women of childbearing age
- 1% of German population has MAV

1. Lipton and Stewart 1993; Stewart et al, 1994

There is 5 times more migrainous vertigo than there is Meniere's disease!

Headache (HA) and dizziness not have to occur at same time in MAV.

- Cutrer/Baloh (1992)
  - 5% (5/91): vertigo time-locked to HA
  - 25%: vertigo always independent of HA
- Johnson (1998): 91% (81/89) vertigo independent of HA

Migraine is often accompanied by strong motion sensitivity

<table>
<thead>
<tr>
<th>Percent of migraine patients with motion sickness</th>
<th>Authors</th>
</tr>
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<tbody>
<tr>
<td>Group</td>
<td></td>
</tr>
<tr>
<td>49% Children</td>
<td>Bille (1962)</td>
</tr>
<tr>
<td>45% Children (60)</td>
<td>Barabas et al (1983)</td>
</tr>
<tr>
<td>50.7% Unselected</td>
<td>Kayan and Hood (1984)</td>
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Even intermittent headache is not necessary to diagnose migraine

10% normals have motion sensitivity
MAV without headache is very rare

- Migraine aura without headache: 1% of migraine population*
- Migraine associated vertigo (1% in general **, about 2% women childbearing age)
- Migraine aura without headache + vertigo: 0.01% of population, 0.02% women childbearing age.


Migraine variants with vertigo but without headache

- Benign Positional Vertigo of Childhood (BPV)
- Cyclic vomiting syndrome – periodic vomiting for several days.
- “Vestibular” Menieres?

MAV symptoms may last for days (or even months)

- Cutrer and Baloh, 1992: Bimodal distribution
- 31% min-2 hrs
- 49% longer than 24 hours

Diagnosis of MAV is Based on Clinical judgment

- Headaches and dizziness
- Lack of alternative explanation (normal otological exam, neurological exam, CT)
- High index of suspicion in women of childbearing age. Perimenstrual pattern.
- Family history in 50%
- Response to prophylactic medication or a triptan

ENG findings in Migraine

- Should be normal
- Migraine is not a disease of the inner ear
- When you have a normal ENG, in woman of childbearing-age with headache --

Brainstem disorders

- Brainstem contains cranial nerves and connects the cortex and spinal cord
- Typified by a mixture of lower motor cranial nerve problems (e.g. diplopia), and vertigo
- Strokes, tumors and degenerative disorders are main causes
Common Strokes with Dizziness

- PICA (lateral medullary and cerebellum)
- AICA (pons and cerebellum)
- Basilar artery

Cerebellar Strokes

- Basilar artery
- AICA
- PICA

Posterior Inferior Cerebellar Artery (PICA)

Adolf Wallenberg

German internist, born November 10, 1862, Preuss.-Stargard. died 1949.

Posterior Inferior Cerebellar Artery (PICA)

- PICA territory (often from vertebral artery)
- Supplies lateral 50% of medulla and inferior 1/3 cerebellum

PI CA syndrome

Lateral Medullary Syndrome

- Ipsilateral cerebellar signs
- Vertigo (vestibular nucleus)
- Contralateral pain and temp (STT)
- Dysphagia/Dysphonia (Nucleus ambig)
- Ptosis/Miosis

Case (IC)

- Onset of dizziness 1 week ago
- Unable to walk
- Diabetes and new onset a-fib
- Exam:
  - Ataxic but intact VOR
  - No spontaneous nystagmus
  - Neuropathy
A 44-year-old woman was involved in a rear-end collision. She had a whiplash injury, and apparently the vertebral arteries in the neck were contused. Several days after the accident she became comatose, and studies suggested complete occlusion of the basilar artery.

**Basilar Artery syndrome (C.A.)**

**Basilar artery case findings (1991 vs. 2001)**

- Unsteady Gait  
- Finger to nose ataxia  
- Nystagmus (eyes moving involuntarily)

Basilar artery strokes are often fatal.

**Common features of cerebellar gait ataxia**

- Severe impairment of balance (worse than sensory balance disorders)  
- Wide based gait  
- Often refractory to treatment and time

**Anterior inferior cerebellar artery Case**

- Woman with diabetes, obesity, hypertension suddenly becomes dizzy, and develops facial weakness in swimming pool.  
- Brought into hospital and CT scan shows stroke in mid-pons.
**Anterior inferior cerebellar artery AICA syndrome**
- AICA supplies pons, cerebellum, 8th nerve
- Facial weakness
- Vertigo/hearing loss
- Incoordination

**Degenerative brainstem disorders**
- Tau-opathies
  - PSP – progressive supranuclear palsy
  - MSA – multisystem atrophy
- About 4/100K prevalence
- Present with falls
- Diagnosed with bedside exam or ENG

**PSP - case example**
- 55 year old AA man begins to fall
- Over several years frequency increases to daily
- On exam, he is ataxic and has slow saccades

**Slow saccades of PSP**

**Cerebellar disorders**
- Cerebellum is coordination center
- Typified by profound unsteadiness, uncoordinated limb movements, normal power.

**Bedside findings**
- Ataxia (Romberg)
- Dysmetria (limbs)
- Eye movement findings
  - Poor pursuit and fixation suppression
  - Spontaneous nystagmus, sometimes bizarre
  - Rebound nystagmus
  - Dysmetric saccades, Opsoclonus in some
  - Positional nystagmus (does not fatigue)
Pendular nystagmus

Something else was moving too

Rebound Nystagmus

Saccadic Dysmetria

Opsoclonus

Many kinds of cerebellar disorders

- Tumors
- Paraneoplastic (don't miss this one)
- Congenital (Chiari)
- Degenerations
- Stroke
- Post-infectious
Brain Tumors Causing Dizziness

- Acoustic Neuroma
- Meningioma
- Cerebellar astrocytoma
- Cerebellar hemangioblastoma
- Metastatic

Brain tumors causing dizziness

- Very rare
- Occasionally dangerous

Cerebellar Tumors of Adults

- Adults
  - Metastatic from breast, skin, lung or bowel
  - Prognosis is generally poor except for radiosensitive tumors (e.g. Lymphoma)

Rubinstein L, Tumors of the Central Nervous System

Cerebellar Astrocytoma Case

- Young woman in residency training
- Developed a headache and went to ER. In ER a CT scan was done.
- A large tumor was found occupying most of right side of cerebellum.
- Tumor was removed - after operation patient developed incoordination R side. Over 6 months, has improved so much can return to training program.

Cerebellar Medulloblastoma

- Mainly affects children
- Begins in cerebellar nodulus -- vestibulocerebellum
- Hydrocephalus (projectile vomiting) and cerebellar signs.
- Treat with resection, chemotherapy and radiation.
- 5 year survival – 80%
Paraneoplastic syndromes -- case

- 35 year old woman admitted to hospital because very unsteady - poor coordination
- Many tests were done without a diagnosis. Nobody did a breast exam.
- 1 year later noticed a large breast lump
- Breast cancer removed - but patient left with severe cerebellar syndrome

Paraneoplastic syndromes

- Remote effect of cancer
- Associated with lung and breast cancer
- Vestibulo-cerebellar syndrome - dominated by
  - Ataxia
  - Nystagmus (particularly downbeating)
- May be related to autoantibodies

Chiari Malformation: Case

- Dock worker in Baltimore came in because gets dizzy when lifts heavy boxes
- Examination: unsteady, downbeating nystagmus.
- MRI showed cerebellar tonsils lower than normal

Chiari Malformation

- Cerebellar tonsils herniate downward
- Adult onset
- Straining or coughing produces headache or fainting
- Unsteadiness
- Nystagmus
- Syring (hole in spinal cord) often associated

PAN – periodic alternating nystagmus

- Congenital form
- Acquired form (usually nodulus lesion)
- Often missed on ENG because 200 seconds to cycle

Post-infections cerebellar disease

- Rapidly developing gait ataxia
- Marked nystagmus/opsoclonus/nystagmus
- Recovery may take months, sometimes there is permanent residual
**Cortex**
- Little dizziness comes from cortex
- Seizures are often accompanied by dizziness

**Seizures causing Dizziness**
- Quick spins (1-10 seconds)
- Confusion and dizziness
- May be triggered by flashing lights
- Head injury is common

**Case**
- 8 Year old became dizzy playing video games
- Mother noted the eyes jumped
- Transient confusion

**In the clinic he had a spell of dizziness with clear nystagmus**

**EEG shows seizure**

**Congenital Nystagmus**
- Strong nystagmus
- Worse in light
- Usually is strongly modulated by gaze
- May be “reverse exponential” on ENG
CN - worse with fixation

CN - Latent nystagmus

Summary - this is a hard part to dizzy evals

- Central vertigo is uncommon but very complex, and often a dangerous problem.
- Nearly any neurological condition may cause central vertigo
- Proper examination can require a lot of neurology.