Dizziness
A NEW APPROACH
May 2015 Massachusetts ACEP

Jonathan A. Edlow, MD
Department of Emergency Medicine
Beth Israel Deaconess Medical Center
Professor Harvard Medical School
Boston MA

Note: many slides had video clips that are not included in this hand-out

“What do you mean, ‘dizzy’?”

True vertigo
Near syncope
Dysequilibrium
“Other”

1. Few subjects
125 patients enrolled over a 2-year period (21 rejected due to inadequate data) = 104 (9 rejected for lack of diagnosis) = 95 patients.

2. Highly selected population
Mono-symptomatic dizzy patients (who had to be fluent in English, and available to return for 4 half days) referred to a dizziness clinic.

1972

An approach to the dizzy patient
David A. Katchen, M.D., and Carl R. Halm, M.D.

Note verification of diagnosis assigned by lead investigator
Follow-up
Patients do not reliably select a single dizziness subtype:

- Sensory symptoms are hard to describe
- Patients change dizzy category 50% of the time < 10 minutes
- Frequently select 2 or 3 categories simultaneously

There is no tight link between type & differential diagnosis:

- “Vertigo” (in dizzy patients) does not predict stroke diagnosis
- Dizzy patients w/ cardiac causes endorse “vertigo” in 37% of cases
- Patients w/ vestibular/CNS issues c/o “dizzy, “near faint”, “lightheaded”

What’s the Diagnosis?

NEW APPROACH: “ATTEST”

- Associated symptoms
- Timing
- Triggers
- Exam signs
- Testing to confirm diagnosis

A dizzy patient in the Emergency Department

“The whole world was spinning around; I felt like I was on a little kid’s Ferris wheel. Then it comes back, you start getting flushed feeling all over.”

“I bent over to pick up my grandson. I started getting dizzy, literally things started spinning...and then you get nauseous.”
Identify obvious, worrisome associated symptoms, signs and basic ancillary tests that suggest a particular diagnosis or group of diagnoses.

Timing of the dizziness. Ask about the onset and duration of attacks? Is the dizziness episodic or persistent? Is the dizziness triggered by specific head movements, or change in body position? Was there preceding trauma? A new medication?

Narrow the differential by defining a Timing & Triggers category.

Within each timing & trigger category, distinguish benign from dangerous causes by carefully looking for exam signs using a targeted bedside physical examination

If clinically important diagnostic ambiguity remains, exclude dangerous causes by appropriate testing; CT is rarely the best test!

Associated symptoms:
Are there obvious, worrisome symptoms, signs and basic ancillary tests that suggest a particular diagnosis or group of diagnoses?

HA stroke, vascular dissection
Neck pain vascular dissection
Chest pain PE, ACS
SOB PE, pneumonia, anemia
Pulsitations arrhythmia
Blushing, fluid losses hypovolemia
Fever systemic infection
Vital sign abnormalities explain them
Positive pregnancy test ectopic pregnancy

TT (timing & triggers) Patterns
1. Acute vestibular syndrome
   Rapid onset, prolonged course, improves with time

2. Chronic vestibular syndrome
   Gradual onset, prolonged course, worsens or plateaus with time

3. Spontaneous episodic vestibular syndrome
   Spontaneous episodes that are not positional

4. Triggered episodic vestibular syndrome
   (brief) episodes that are triggered by a change in body/hand positional

ACUTE VESTIBULAR SYNDROME

Vestibular neuritis/labyrinthitis
Cerebellar stroke
Brainstem stroke

There can also be a contextual or "exposure"-related AVS
Multiple sclerosis
Bacterial meningitis
Labyrinthine concussion or infarct
Hypothyroid or autoimmune (labyrinthitis)
Others

Wernike’s
41: ACUTE VESTIBULAR SYNDROME

Vestibular neuritis . . .
or . . . Posterior circulation stroke ??

1. How often do small strokes mimic a peripheral vestibular syndrome?
2. Are we missing them clinically?
3. If we are missing them, does it matter?
4. Can we distinguish between central and peripheral causes at the bedside?

~ 10% of cases

Yes, ~ 1/500 dizzy patients

Yes, brainstem compression & a 2nd stroke

Yes . . .

Cerebellar infarct
70 year old man with abrupt onset of vomiting

How BAD is CT?

CT is NOT sensitive for early ischemic stroke

• It’s worse for posterior circulation stroke (~ 20% sensitive)
• The vast majority of CT scans done for dizziness do not supply useful information
• “But it’s to r/o hemorrhage” is a poor excuse; ICH presenting as isolated dizziness in the absence of other worrisome findings (lethary, hard neurologic findings) is very rare
Delusions of CT accuracy
(Grewal Stroke 2015)

- Retrospective cohort study of patients discharged from Canadian EDs with a peripheral dizziness diagnosis
- Primary outcome: stroke outcome at 30 days
- Compared patients who HAD a CT scan vs those who had no CT
- Those who had a CT were 2.27x more likely to have a stroke than those without CT

What about MRI?

“We now have neuroimaging tests that renders your old-fashioned clinical paradigm useless; I suggest we order them”

“Don’t be too proud of this technological terror you’ve constructed; the ability to image the brain and its blood vessels is insignificant next to the power of a careful history & targeted physical exam”

REMEMBER: MRI misses up to 15% of posterior circulation strokes in the first 48 hours

ACUTE VESTIBULAR SYNDROME

<table>
<thead>
<tr>
<th>Unable to stand or sit?</th>
<th>“Yes” to any</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obvious CNS signs on exam?</td>
<td>“Yes” to any</td>
</tr>
<tr>
<td>Negative head impulse test?</td>
<td>“No” to all</td>
</tr>
<tr>
<td>Worrisome nystagmus?</td>
<td>Preferably with MRI</td>
</tr>
<tr>
<td>Skew deviation?</td>
<td></td>
</tr>
</tbody>
</table>

Evaluate for posterior circulation stroke – preferably with MRI

Try to diagnose & treat a specific peripheral cause; Know the common ones well.

Can we clinically distinguish central & peripheral?

**Exam Signs**

<table>
<thead>
<tr>
<th>Ability to walk</th>
<th>Peripheral</th>
<th>or</th>
<th>Central</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usually can</td>
<td>30-60%</td>
<td></td>
<td>Often unable</td>
</tr>
<tr>
<td>Other CNS findings</td>
<td>Absent</td>
<td>Present 60%</td>
<td></td>
</tr>
<tr>
<td>Head impulse test</td>
<td>Positive (corrective saccade)</td>
<td>Normal (no saccade)</td>
<td></td>
</tr>
<tr>
<td>Nystagmus type</td>
<td>Horizontal (unidirectional)</td>
<td>Direction-changing 20-50%</td>
<td></td>
</tr>
<tr>
<td>Skew deviation</td>
<td>Absent</td>
<td>May be present</td>
<td></td>
</tr>
</tbody>
</table>
Can the patient walk?
70 year-old woman with abrupt onset of “dizziness” and difficulty walking

- Normal mental status
- No dysmetria; no nystagmus
- No motor findings

CT at presentation to ED

DWI-MRI several hours later

Can the patient walk?
TEST THE GAIT !!

Does the patient have obvious CNS signs?

Logic dictates that if other (new) CNS findings are present in a dizzy patient, then the causative lesion is likely in the CNS

Subtle findings include:
- anisocoria (increased in the dark)
- dysarthria
- dysmetria
- facial hypesthesia (pain and temperature, not light touch)
- hoarseness
Head Impulse Test

*positive in vestibular neuritis
*negative in cerebellar stroke

Head impulse test
sensitivity & specificity

<table>
<thead>
<tr>
<th></th>
<th>Imaging negative (no stroke, N=8)</th>
<th>Imaging positive (stroke, N=34)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative test</td>
<td>0% (N=0)</td>
<td>91% (N=31)</td>
</tr>
<tr>
<td>Positive test</td>
<td>100% (N=8)</td>
<td>9% (N=3)</td>
</tr>
</tbody>
</table>

The occasional false + HIT in central lesions (at the entry site of the nerve root into the brainstem or labyrinthine infarction) almost always shows other features suggestive of a central lesion.

In the Lee study, all 25 cerebellar strokes (that clinically mimicked vestibular neuritis) had a negative head thrust test.

Quality of nystagmus in AVS

<table>
<thead>
<tr>
<th></th>
<th>Peripheral</th>
<th>Central</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Usually pure horizontal</td>
<td>Any direction, <strong>can be pure vertical or torsional</strong></td>
</tr>
<tr>
<td>Gaze-evoked</td>
<td>Unidirectional</td>
<td>May change direction</td>
</tr>
</tbody>
</table>

* Many people have some physiologic nystagmus on extreme end-gaze *

Direction-changing nystagmus
+ HIT (AICA stroke)

Gaze-evoked direction changing nystagmus is present in ~ 20-56% of patients with posterior circulation strokes presenting as acute dizziness.
Direction-changing nystagmus . . . in a patient on phenytoin

Torsional nystagmus (+ INO)

Uni-directional Nystagmus
Also had spontaneous nystagmus
Vertical Nystagmus
Also had direction-changing nystagmus

CHRONIC VESTIBULAR SYNDROME

Medication-related dizziness
Psychiatric (“type-4”) dizziness (anxiety/depression)
Mass (tumor, abscess) in posterior fossa

CVS: This patient had a benign hemangioblastoma that was resected; he recovered and was neurologically normal.

Skew Deviation

Perform the alternate cover test. Skew deviation is not very sensitive (~ 25%) but is very specific for brainstem lesions.
Newer data (March 2013): same authors published a preliminary study of “goggles” that measure & record these eye movements.

### Table 4. Bedside Signs and Initial MRI With DWI Test Properties for Ischemic Stroke in AVS

<table>
<thead>
<tr>
<th></th>
<th>Peripheral</th>
<th>Central</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtle ocular motor signs</td>
<td>4%</td>
<td>100%</td>
</tr>
<tr>
<td>Direction-changing horizontal nystagmus</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Skew deviation constant or unsteadiness</td>
<td>4%</td>
<td>25%</td>
</tr>
</tbody>
</table>

**Physical exam outperforms MRI !!!**

**ACUTE VESTIBULAR SYNDROME**

- Unable to stand or sit?
- Obvious CNS signs on exam?
- Negative head impulse test?
- Worrisome nystagmus?
- Skew deviation?

Evaluate for posterior circulation stroke – preferably with MRI

Try to diagnose & treat a specific peripheral cause.

Know the common ones well.

### SPONTANEOUS EPISODIC VESTIBULAR SYNDROME

**Vestibular migraine**
- TIA
- Arrhythmia
- PE or ACS
- Menière’s
- Rare

**Vertigo**
- Motion sickness
- Vestibular migraine

Migraine
Conventional wisdom: **Isolated** dizziness is rarely if ever TIA (dates back to a 1975 NIH consensus conference); other brainstem symptoms are usually present

**Oxfordshire Stroke study** 1141 ischemic stroke

Recorded isolated brainstem "TNA" (isolated vertigo or vertigo with non-focal symptoms, diplopia, generalized weakness, binocular visual symptoms) < 90d of the strokes (275 vertebrobasilar v 759 carotid territory events)

**Isolated vertigo** was seen in

- 23/45 vertebrobasilar TNAs
- 2% of all 1141 strokes
- 8.4% of the 275 VB strokes
- (10 others had vertigo + one other non-NINDS symptom)

Positive O.R. of 15

---

**SPONTANEOUS EPISODIC VESTIBULAR SYNDROME**

Which s-EVS patients have TIA?

<table>
<thead>
<tr>
<th>Migraine</th>
<th>TIA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>Younger</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Usually longer (&gt; 1 hour)</td>
</tr>
<tr>
<td><strong>Prior migraine</strong></td>
<td>More likely</td>
</tr>
<tr>
<td><strong>Symptom quality</strong></td>
<td>“positive”</td>
</tr>
<tr>
<td><strong>Multiple attacks</strong></td>
<td>More likely (over longer time)</td>
</tr>
</tbody>
</table>

---

**TRIGGERED EPISODIC VESTIBULAR SYNDROME**

Sometimes because there is concomitant nausea and vomiting (which outlasts the dizziness, or because it’s middle of the night (dark, lose sense of time), patients over-estimate the length of these episodes of dizziness.

**Triggered Episodic Vestibular Syndrome**

Other times, patients will report that their dizziness is continuous, lasts for days (due to very frequent episodes or due to low grade head motion or anticipation of dizziness with motion)
TRIGGERED
EPISODIC VESTIBULAR SYNDROME

BPPV
Orthostatic hypotension
Rare
Vertebral artery rotation
Brain mass - CPPV
Cerebellar atrophy

Dix-Hallpike maneuver

Have patient keep eyes open & look into the distance (not fixate on a near point)

Diagnostic Criteria for BPPV

- Brief episodes of dizziness lasting ~30 seconds that resolves without further motion
- + Dix-Hallpike test typically with mixed torsional nystagmus
- Latency (several seconds) after D-H before the vertigo/nystagmus begins
- Fatigability with multiple D-H maneuvers
Epley Maneuver

After dizziness & nystagmus resolve (~ 30-45 seconds) turn head 90°

After dizziness & nystagmus resolve (~ 30-45 seconds) help patient up
FAQ about the Epley

- Which side do I start with?
- How fast do I do it?
- Pre-treat with anti-emetics?
- How many repetitions?
- Post-Epley restrictions?
- How often is it successful?
- Why should I bother?
- Are there contraindications?

- The one with + Dix-Hallpike
- Moderate to rapid speed
- Not required; some do
- Till Dix-Hallpike is normal (1-4x)
- Not necessary
- ~ 80-85% (see next slide)
- Natural history weeks - months
- Severe carotid stenosis, cervical DJD, active brain or heart ischemia

Sounds like BPPV but Epley doesn’t work: differential diagnosis

1: Wrong technique

2: Wrong diagnosis
   - Distinguish dizziness that is *provoked or triggered by* versus *exacerbated by* head or body position changes. Is patient normal at rest and becomes dizzy on motion OR has fixed pathology (tumor, MS, labyrinthitis) & are dizzy at baseline but are more dizzy with movement.

3: Wrong canal
   - ~ 10-15% of BPPV is of the horizontal (lateral) canal

4: Wrong "PPV" - C(entral)PPV instead of B(benign)PPV - atypical features - longer duration episodes or D-H components do not fit (no latency, no fatigue of symptoms or persistent nystagmus)
   - Direction of nystagmus D-H remains positive
Timing & Triggers informs . . .

Differential diagnosis
- Head impulse
- Dix-Hallpike

Appropriate testing
- Torsional nystagmus
  - Indicates a CNS cause in AVS
  - Is the expected finding in t-EVS (pc-BPPV)
- Direction-changing nystagmus
  - Indicates a CNS cause in AVS
  - Is the expected finding in t-EVS (hc-BPPV)

Interpretation of those tests
- BPPV (vertigo) ≠ meclizine

Treatment

Associated symptoms
- Identify obvious, worrisome associated symptoms, signs and basic ancillary tests that suggest a particular diagnosis or group of diagnoses

Timing
- Define the timing of the dizziness. Ask about the onset and duration of attacks? Is the dizziness episodic or persistent?
- Is the dizziness triggered by specific head movements, or change in body position? Was there preceding trauma? A new medication?

Triggers
- Narrow the differential by defining a Timing & Triggers category.

Exam Signs
- Within each timing & trigger category, distinguish benign from dangerous causes by carefully looking for exam signs using a targeted bedside physical examination

Testing
- If clinically important diagnostic ambiguity remains, exclude dangerous causes by appropriate testing; CT is rarely the best test!

“Use the history and physical exam, Luke”
“Forget the CT”
Luke tears up the CT requisition

“I’m alright; I’m using the ATTEST method”
“Why did you cancel the CT?”
Remember: history and physical exam will be a potentially disastrous misdiagnosis

Luke nails the diagnosis using clinical skills . . .

THE END

Thanks to . . .
Our patients
Dr. Richard Baloh
Neurology (on-line) Drs. David Newman-Toker, Jorge Kattah
Drs. Louis Caplan & Sean Savitz
Dr. Michael Halmagyi, Australia
Dr. Terry Fife, Barrows Institute, Phoenix
AAN BPPV practice parameter
George Lucas