DIAGNOSING DIZZINESS

DR AARON GUINN
DECEMBER 5, 2017

DISCLOSURE

- Dr. Aaron Guinn
- I have no relationships with commercial interests
- I have no disclosures

LEARNING OBJECTIVE

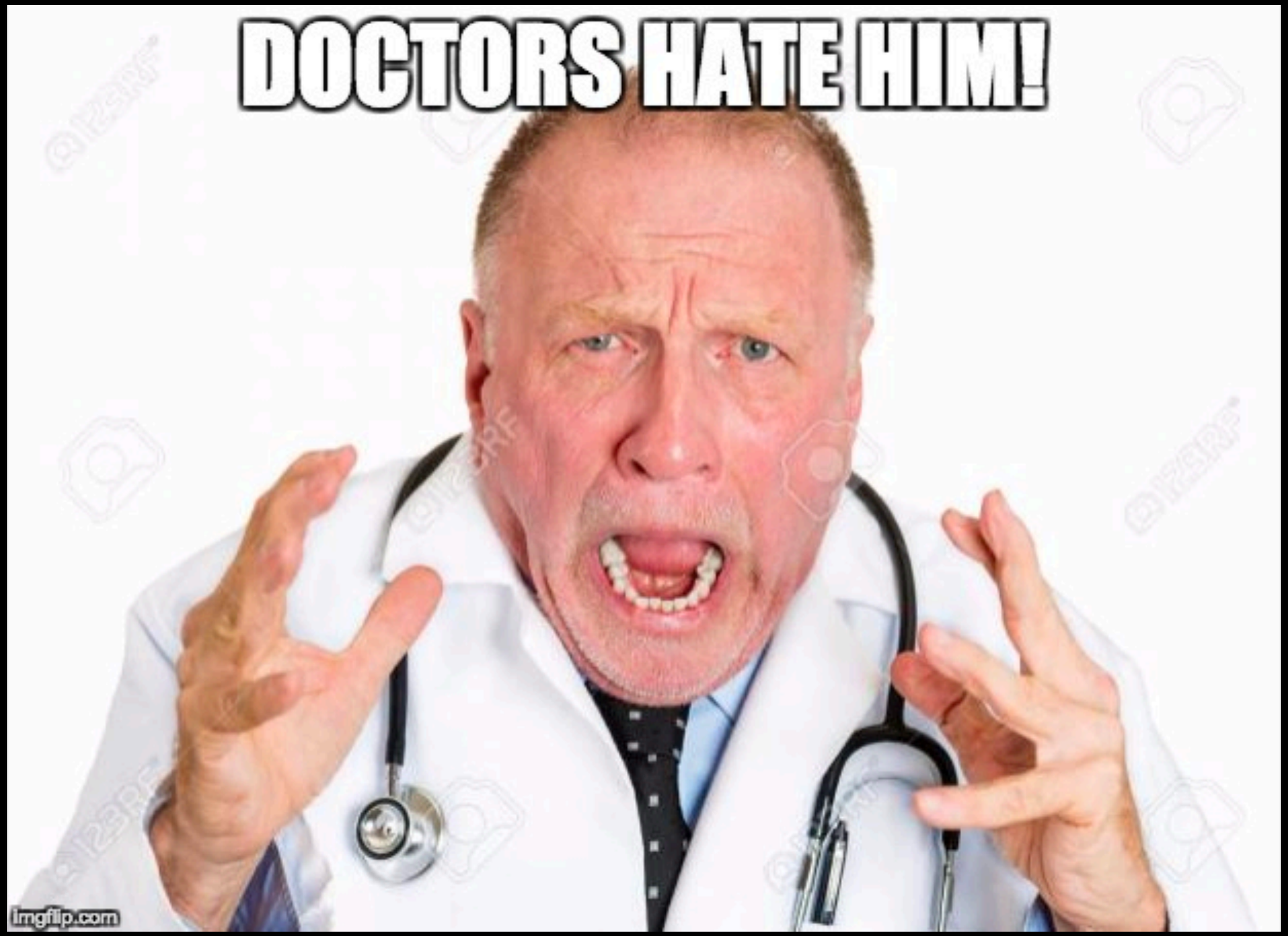
1. Become confident enough with dizziness that you are excited when you pick up the chart with the entrance complaint of “dizziness.”

OUTLINE

1. Review the traditional diagnostic approach to dizziness
2. Discuss why this approach is completely useless
3. Suggest an alternate diagnostic framework
4. Review common and can't-miss causes of dizziness in the ED
5. Place these illnesses into a new diagnostic framework

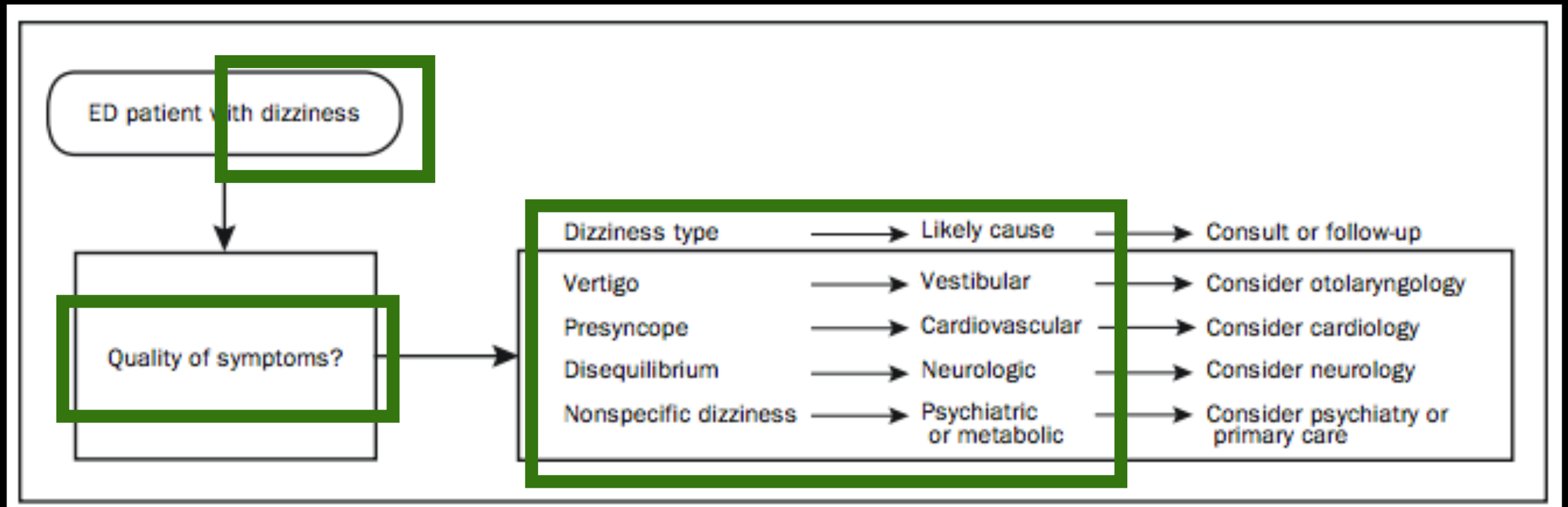
DIAGNOSING DIZZINESS: WE'RE DOING IT WRONG

DIAGNOSING DIZZINESS



OUR CURRENT APPROACH

1. What is the quality of the dizziness?



Mayo Clin Proc 2007 - Stanton et al.

OUR CURRENT APPROACH

2. If vertigo, is it peripheral or central?

Table 19-1 Characteristics of Peripheral and Central Vertigo

CHARACTERISTIC	PERIPHERAL	CENTRAL
Onset	Sudden	Gradual or sudden
Intensity	Severe	Mild
Duration	Usually seconds or minutes; occasionally hours, days (intermittent)	Usually weeks, months (continuous) but can be seconds or minutes with vascular causes
Direction of nystagmus	One direction (usually horizontorotary)	Vertical, downbeating
Effect of head position	Worsened by position, often single critical position	Little change, associated with more than one position
Associated neurologic findings	None	Usually present
Associated auditory findings	May be present, including tinnitus	None

OUR CURRENT APPROACH

3. Investigate and treat based on that

CT brain (it's always normal)

Betahistine/Gravol/Ondansetron

PT/OT Hold


EVERYTHING
YOU KNOW
IS WRONG
(ABOUT DIZZINESS)

WHERE DOES THIS COME FROM?

WHY OUR CURRENT APPROACH IS USELESS

Mayo Clin Proc 2007 - Newman-Toker et al.

WHY OUR CURRENT APPROACH IS USELESS

Acad Emerg Med 2011 - Kerber et al.
Eur Neurol 2011 - Royl et al.
Stroke 2006 - Kerber et al.

WHY OUR CURRENT APPROACH IS USELESS

WHY OUR CURRENT APPROACH IS ~~USELESS~~ DANGEROUS

Eur Neurol 2011 - Royl et al.
Stroke 2006 - Kerber et al.

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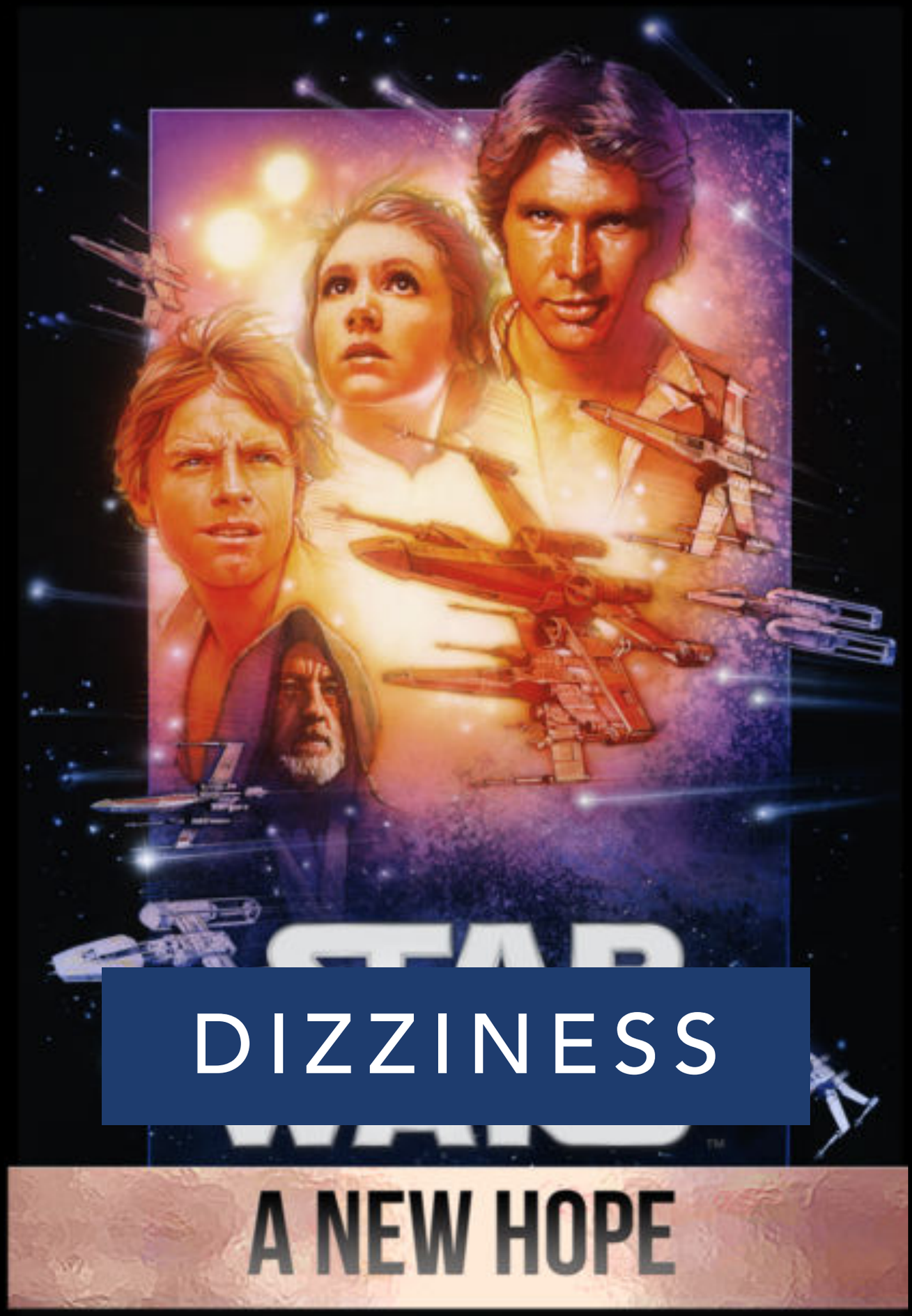
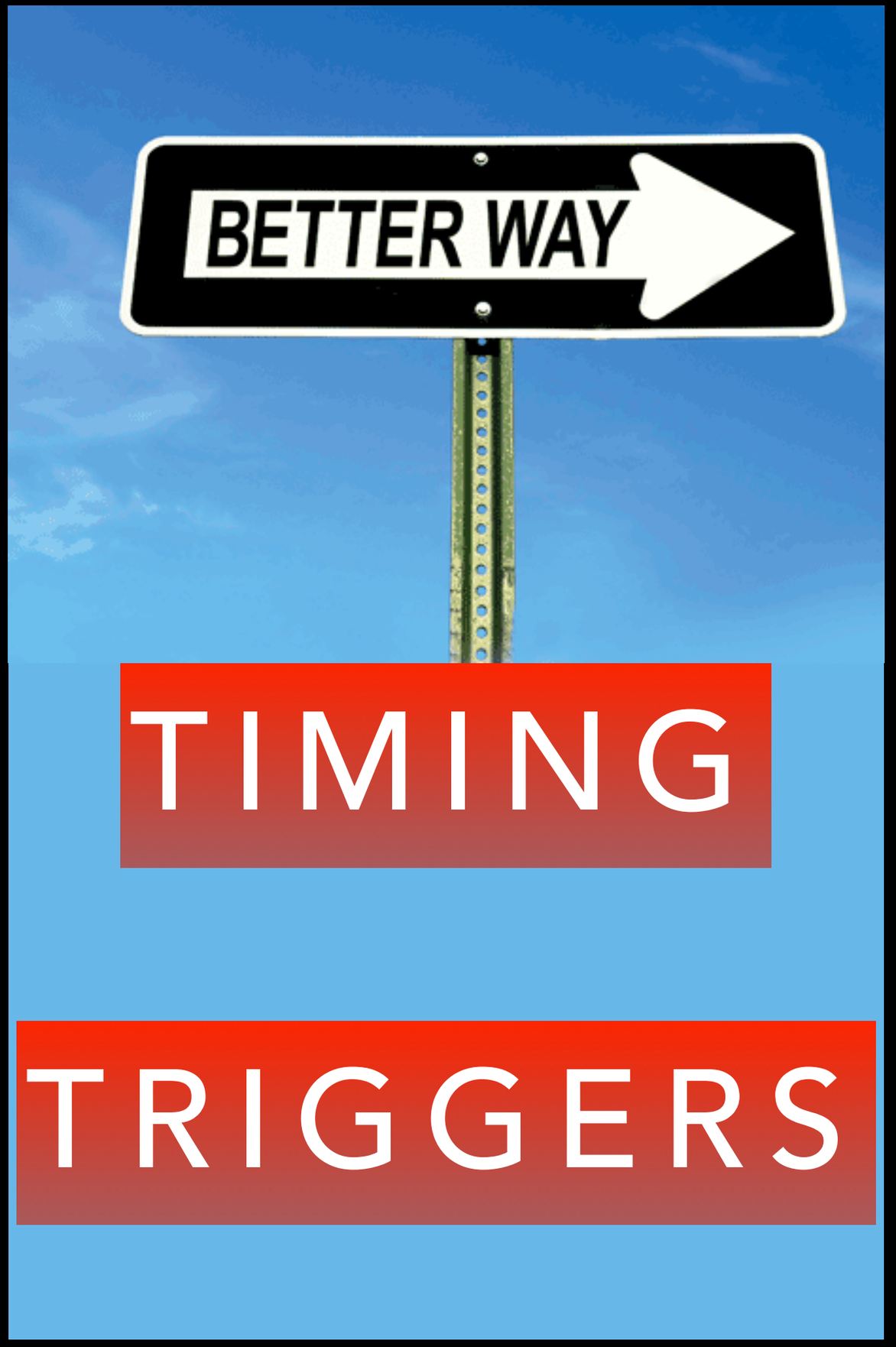
among
That



DIZZINESS



TIMING

TRIGGERS

A BETTER APPROACH

Timing and Triggers

	Quality Of Dizzyness	Timing And Triggers
Patients Choosing More Than One Answer	83%	16%
Patients Who Selected A New Answer When Asked Again	76%	9%

Mayo Clin Proc 2007 - Newman-Toker et al.

Dizzy Patient

- Dizziness Never Goes Away **(Constant Dizziness)**
  - >24 hours to Weeks → **Acute Vestibular Syndrome**
    1. Cerebellar Stroke
    2. Vestibular Neuritis
    3. Multiple Sclerosis
    4. Tox
    5. Wernicke's
    6. Metabolic
  - Weeks to Months → **Chronic Vestibular Syndrome**
    1. Psychiatric
    2. Ototoxic Med
    3. CNS mass
    4. Late stroke
- Dizziness Goes Away at Times **(Intermittent Dizzines)**
  - Trigger → **Triggered Vestibular Syndrome**
    1. BPPV
    2. Orthostatic Hypotension
  - No Trigger → **Episodic Vestibular Syndrome**
    1. Vestibular Migraine
    2. TIAs
    3. Meniere's
    4. Dysrhythnia
    5. Vasovagal

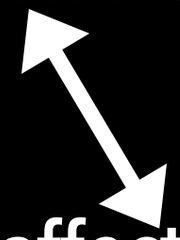
Acad Emerg Med 2013 - Edlow

CONSTANT DIZZINESS

DIZZINESS THAT NEVER GOES AWAY COMPLETELY

1. VESTIBULAR NEURITIS

- Onset of constant dizziness **over hours** that lasts days +/- hearing symptoms
  - Nystagmus (unidirectional, horizontal, **away from affected side**) is **essentially always present**
    - Abnormal vestibulo-ocular reflex is usually present **on affected side**
  - Is eventually self-limited in most patients
  - Consider treatment with steroids; may hasten symptom resolution (10-15d course)
  - No evidence of benefit for antivirals or betahistine



NEJM 2004 - Strupp et al.
Otol Neurotol 2008 - Shupak et al.

2. CEREBELLAR STROKE

- Onset of constant dizziness **over seconds to minutes,** +/- hearing symptoms
- No single or combination of historical features allows you to rule it out
- Sensitivity of non-HINTS+ neuro exam is only 50%
    - Single most sensitive non-HINTS+ test is truncal ataxia - 34% Sn
    - **Nystagmus is absent in 50%**
- Sensitivity of early CT is only 33% - you will miss 2/3 of strokes
- Sensitivity of early MRI is only 86% - you will miss 14% of strokes

JEM 2012 - Hwang et al.
CMAJ 2011 - Tarnutzer et al.
Acad Emerg Med 2013 - Newman-Toker et al.
Ann Emerge Med 2017 - Edlow et al.

ACUTE VESTIBULAR SYNDROME

- A subtype of constant dizziness:

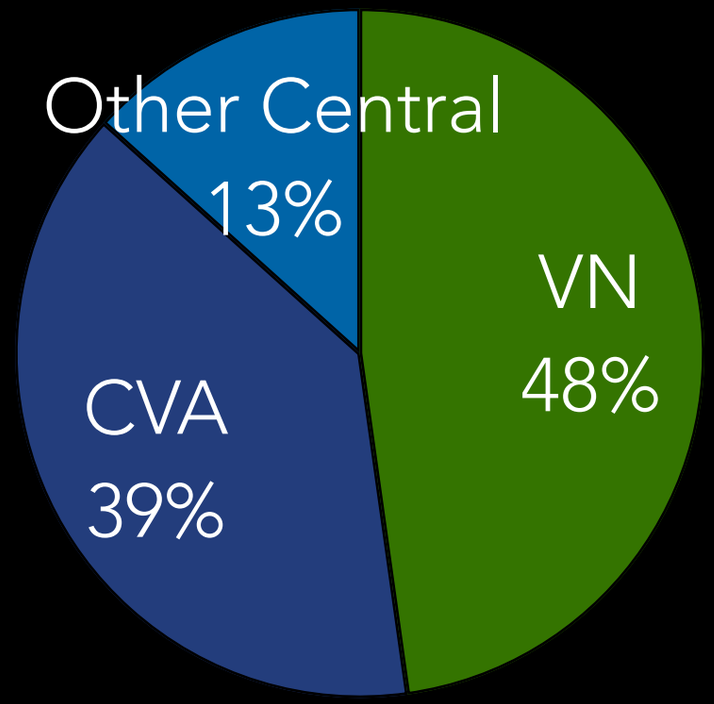
1. Lasts for at least 24 hours

2. Has spontaneous nystagmus

- Does not matter if symptoms are worse with movement

- Key point is the **dizziness never goes away**

- **Strokes unless proven otherwise**



Acta Otorhinolaryngol Ital 2014 - Vanni et al.

ACUTE VESTIBULAR SYNDROME

Box 1: Differential diagnosis of acute vestibular syndrome based on expert opinion

Less urgent causes

Common

- Vestibular neuritis or labyrinthitis
- Multiple sclerosis

Uncommon (< 1%) or unknown frequency

- CNS adverse effects (e.g., antiepileptics)
- Medication ototoxicity (e.g., post-aminoglycoside)
- Other CNS inflammation (e.g., sarcoidosis)
- Prolonged attack of episodic ataxia syndrome
- Prolonged attack of Menière disease
- Prolonged attack of vestibular migraine
- Traumatic vestibulopathy (including surgical)

*Presumed possible**

- Atypical infection (otosyphilis, Lyme disease)
- Celiac disease
- Cerebello-pontine angle neoplasm
- Degenerative cerebellar ataxia
- Drug intoxication (e.g., alcohol, illicit drugs)

More urgent causes

Common

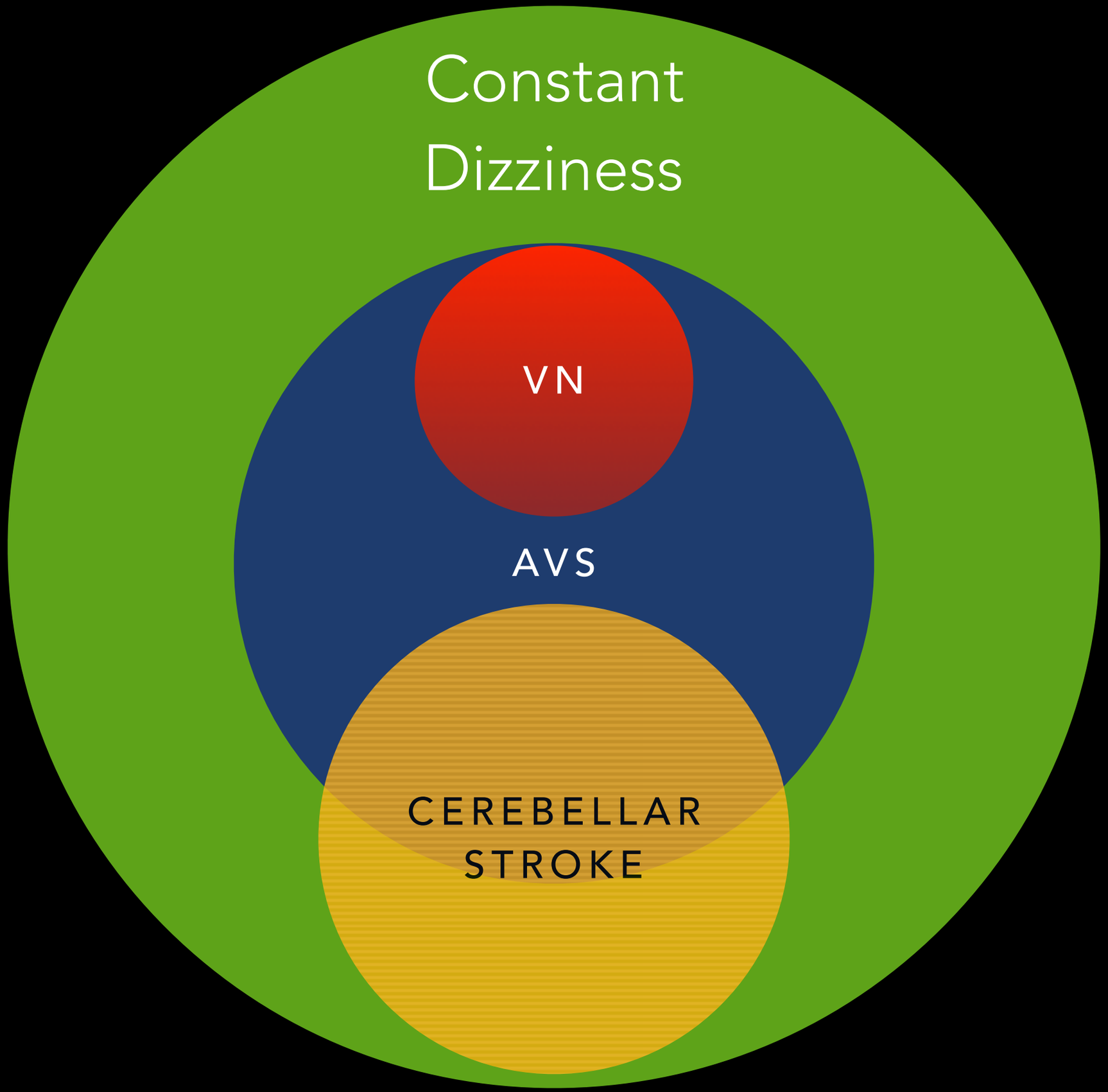
- Brainstem or cerebellar infarction
- Brainstem or cerebellar hemorrhage

Uncommon (< 1%) or unknown frequency

- Bacterial labyrinthitis/mastoiditis
- Brainstem encephalitis (e.g., listeria, paraneoplastic)
- Brainstem hypertensive encephalopathy
- Herpes zoster oticus (Ramsay Hunt syndrome)†
- Labyrinthine stroke‡
- Wernicke syndrome (vitamin B_1 deficiency)
- Miller Fisher syndrome

*Presumed possible**

- Altitude sickness or hypoxia
- Basilar meningitis (e.g., tuberculosis)
- Cerebral infarction or hemorrhage§
- CNS medication toxicity (e.g., lithium)
- Decompression sickness
- Electrolyte imbalance (e.g., hyponatremia)
- Endocrine disorders (e.g., acute adrenal insufficiency)
- Environmental toxins (e.g., carbon monoxide)
- Subarachnoid hemorrhage/aneurysm


Constant
Dizziness
VN
AVS
CEREBELLAR
STROKE

HINTS+ EXAM

- A combination of 4 bedside tests:

1. **H**ead **I**mpulse testing
2. **N**ystagmus type
3. **T**est of **S**kew
4. Hearing (**+**)

- **In px with AVS**, distinguishes CN8 (VN) from central causes

IF 1 OUT OF 4 THAT DOESN'T FIT WITH VN = CENTRAL CAUSE

- Works by assuming that unless you have a perfect exam for VN, that you have a central cause

1. (HORIZONTAL) HEAD IMPULSE TESTING

- Aka head thrust test

- Is a test invented specifically to diagnose vestibular neuritis in AVS patients

    - Tests the vestibulo-ocular reflex

        - In VN, rapid head movement **towards** affected side will have abnormal result

    - Use is in patients with a formal definition of an AVS

    - Sn 85% Sp 95% to differentiate VN from central cause

Arch Neurol 1988 - Halmagyi et al.
CMAJ 2011 - Tarnutzer et al.

Fig 3.—Clinical sign of right canal paresis: abnormal gaze fixation during rapid head turn toward lesioned side. A, With her face turned a little to left and with her eyes fixed on a distant target, patient (professional model) waits for her head to be moved rapidly to the right. B, Following rightward head turn, it becomes evident that gaze has shifted during head turn with head to right. C, Leftward or compensatory saccade is now required to refix gaze.

How can we improve the sensitivity of our physical exam from 85% to 100%?

By adding a few other physical exam findings

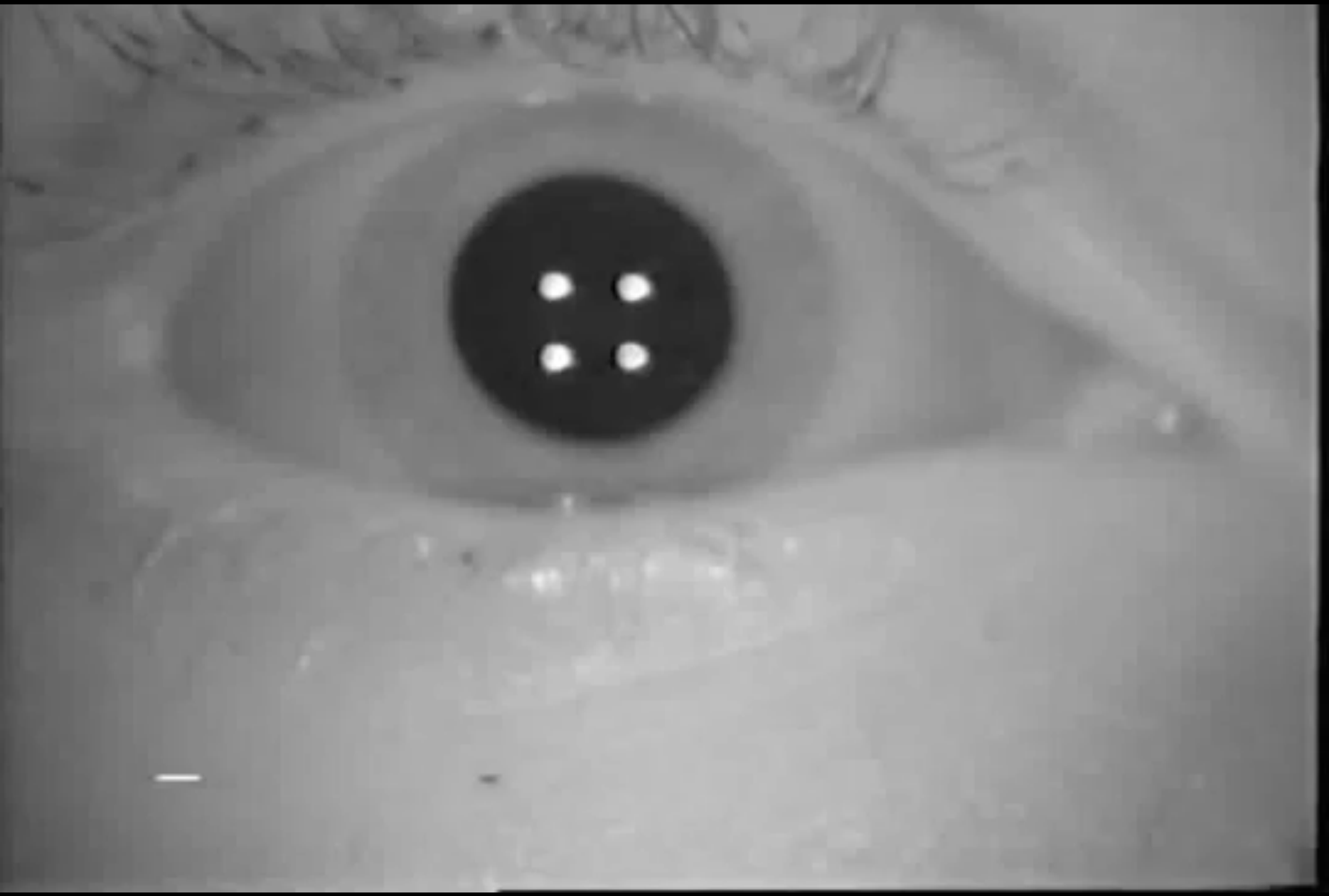
A FEW OTHER PHYSICAL EXAM FINDINGS

2. Nystagmus

   - In VN, you expect **unidirectional**, **horizontal** nystagmus
   - Fast-phase **away** from the affected ear
   - **Any other type of nystagmus = central cause**

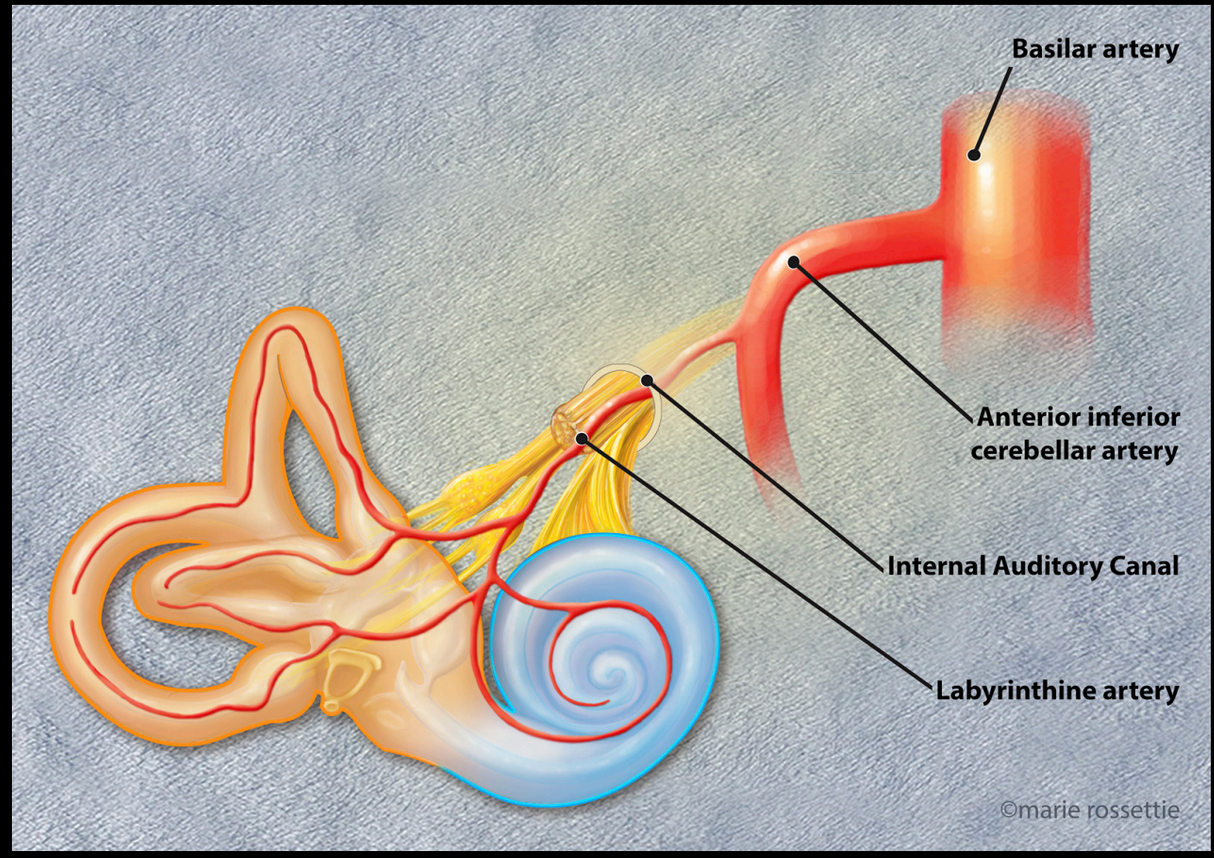
3. Test of Skew

   - In VN, you should have **no vertical skew deviation**
   - If you do = central cause



4. HEARING

- The HINTS exam can miss infarcts in the AICA distribution
  - <1% of ischemic cerebellar infarcts (they are Zebras)
  - AICA provides blood to CN8 and the inner ear
  - HINTS+ adds on a screen for hearing loss
  - **Rub your fingers next to their ears and see if the patient notices a difference between sides**
  - Sn 99.2%, Sp 84%



Acad Emer Med 2013 - Newman-Toker et al

HINTS+ SUMMARY

- **Head Impulse**: normal VOR = central (stroke)
- **Nystagmus**: anything other than unidirectional horizontal nystagmus = central (stroke)
- **Test of Skew**: vertical skew deviation = central (stroke)
- **Hearing**: decreased hearing = central (stroke)
- **If any 1 of these 4 tests suggests a central cause, you have diagnosed a central cause.**

HINTS+ EXAM

- HINTS 2009: Validated = 100% Sn, 96% Sp (n=101)
- HINTS 2013: Validated in another cohort = 97% Sn, 84% Sp (n=190)
- HINTS 2016: Validated in another cohort = 100% Sn, 94% Sp (n=114)
- HINTS+ 2013: Validated = 99% Sn, 83% Sp (n=190)
    - HINTS+ 2014: Validated in another cohort = 100% Sn (n=15)
- This beats the performance of early MRI
    - MRI within 48hr of symptom onset is 86% Sn
    - Is only 47% Sn for stroke < 10mm (HINTS+ is ~100% Sn in these)
- Late MRI is essentially 100% Sn

Stroke 2009 - Kattah et al.
Acad Emer Med 2013 - Newman-Toker et al
Front Neur 2016 - Carmona et al.
Neurology 2014 - Tehrani et al.

HINTS+ EXAM

- In the first 48 hours, physical examination outperforms MRI. If the physical examination suggests stroke, do not use a negative MRI result to exclude stroke.

- Ann Emerg Med 2017, Edlow

➡ In patients with AVS, cerebellar stroke is a clinical diagnosis

➡ The HINTS+ exam is the gold-standard for diagnosing a central cause of AVS within 48hr of symptom onset.

HINTS+ CRITICISMS

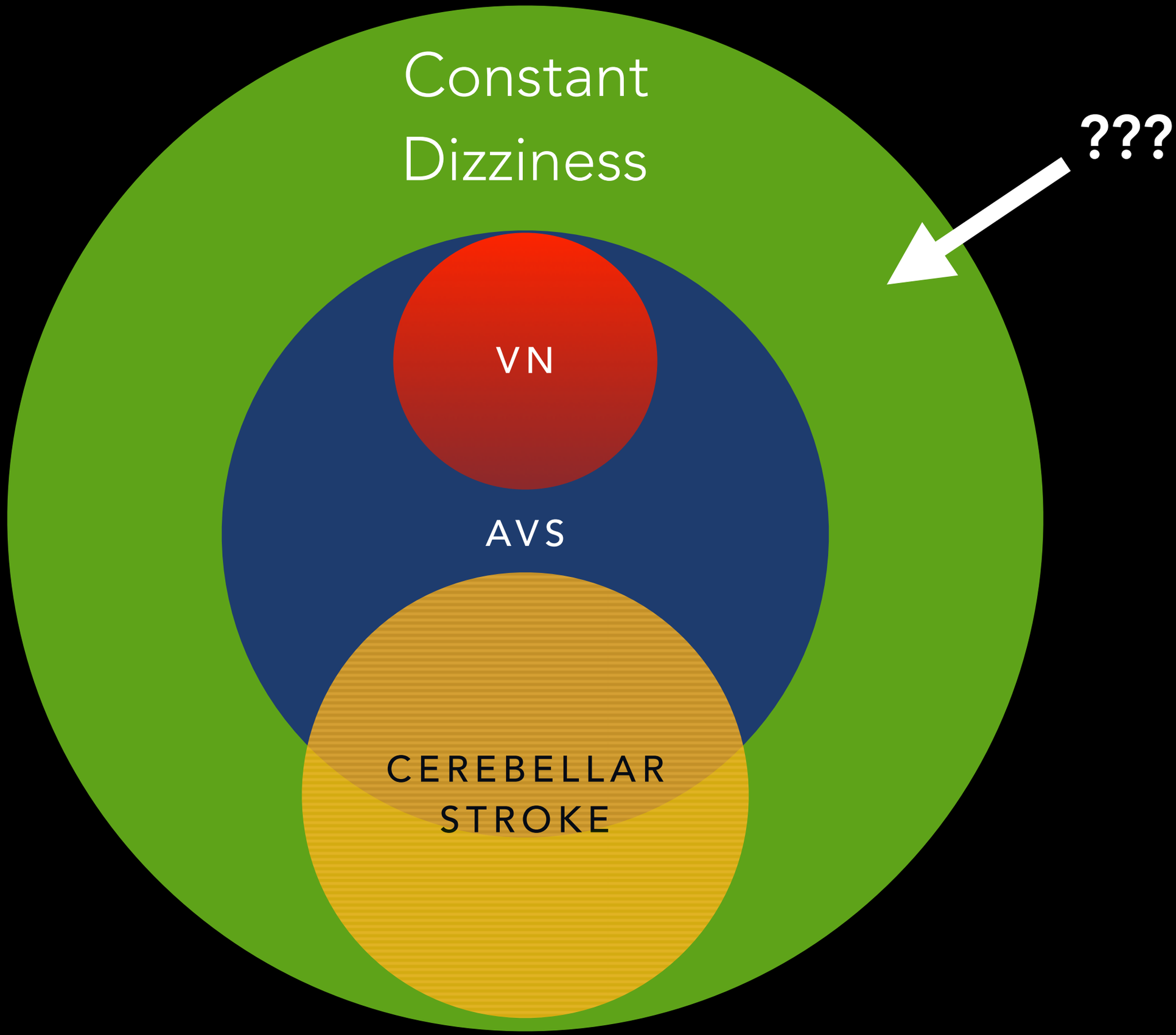
1. Will it still be accurate if emergency physicians are the ones doing it?

2. How does it perform in patients with constant dizziness for <24h?

    - Will still distinguish central versus CN8 causes
    - There are just more central causes: TIA, Meniere's, vestibular migraine, etc.

3. How does it peform in patients with constant dizziness but no nystagmus?

    - We have no idea; safest thing is to avoid in these people


Constant
Dizziness
???
VN
AVS
CEREBELLAR
STROKE

CONSTANT DIZZINESS WITH NO SPONTANEOUS NYSTAGMUS

- Around 1/3 of patients with constant dizziness will have no spontaneous nystagmus
  - Don’t meet formal definition of AVS
    - HINTS+ is not validated in this population
  - 50% of cerebellar strokes have constant dizziness with no nystagmus
  - Prevalence of stroke/central causes is not clear

Ann Emerg Med 2017 - Edlow
Acta Otorhinolaryngol Ital 2014 - Vanni et al.

CONSTANT DIZZINESS WITH NO SPONTANEOUS NYSTAGMUS

- Expert opinion:

Walk: truncal ataxia
Talk: phonation
Move: finger-nose and heel-shin

Look: test of skew
Listen: hearing
Feel: facial temperature sensation

Ann Emerg Med 2017 - Edlow
Acta Otorhinolaryngol Ital 2014 - Vanni et al.

INTERMITTENT DIZZINESS

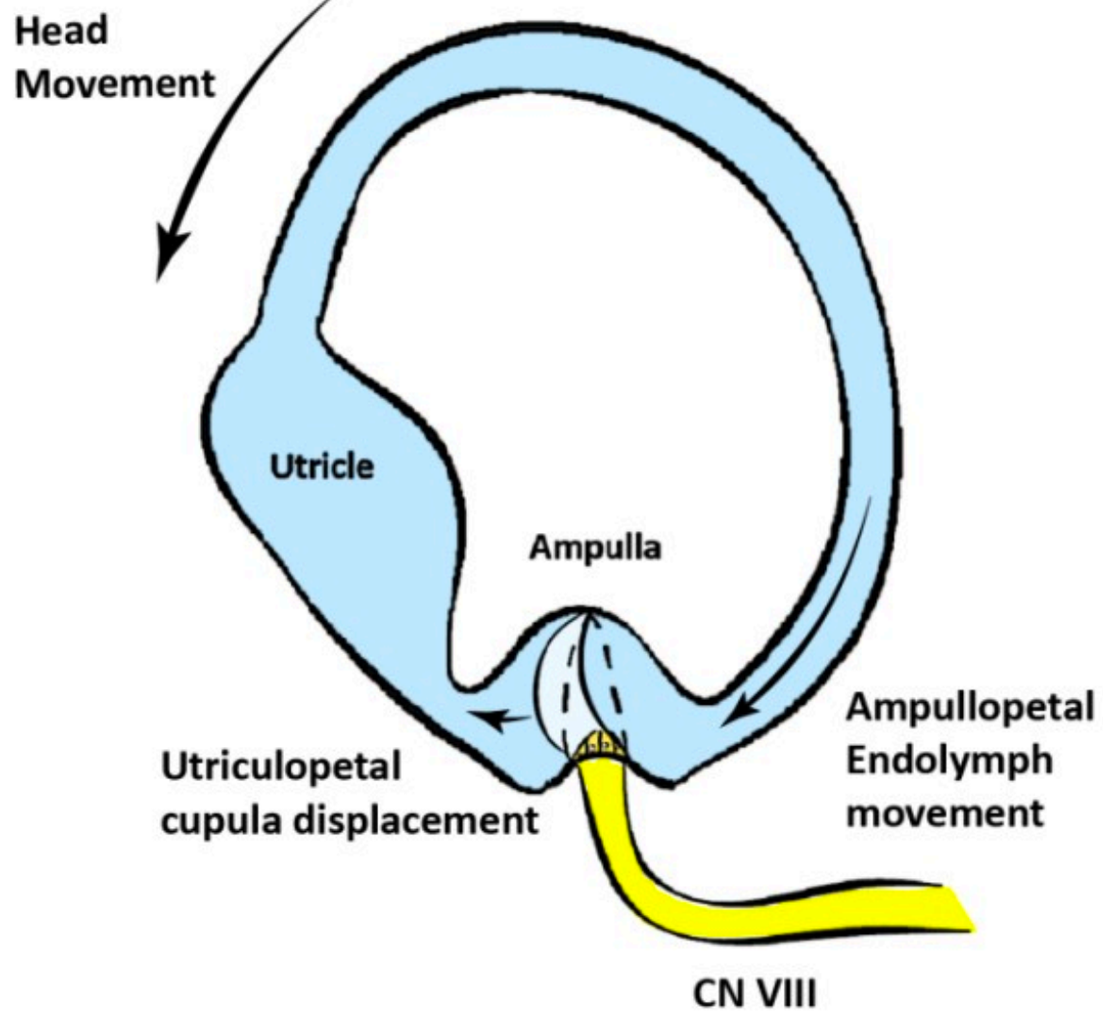
DIZZINESS THAT GOES AWAY COMPLETELY AT TIMES

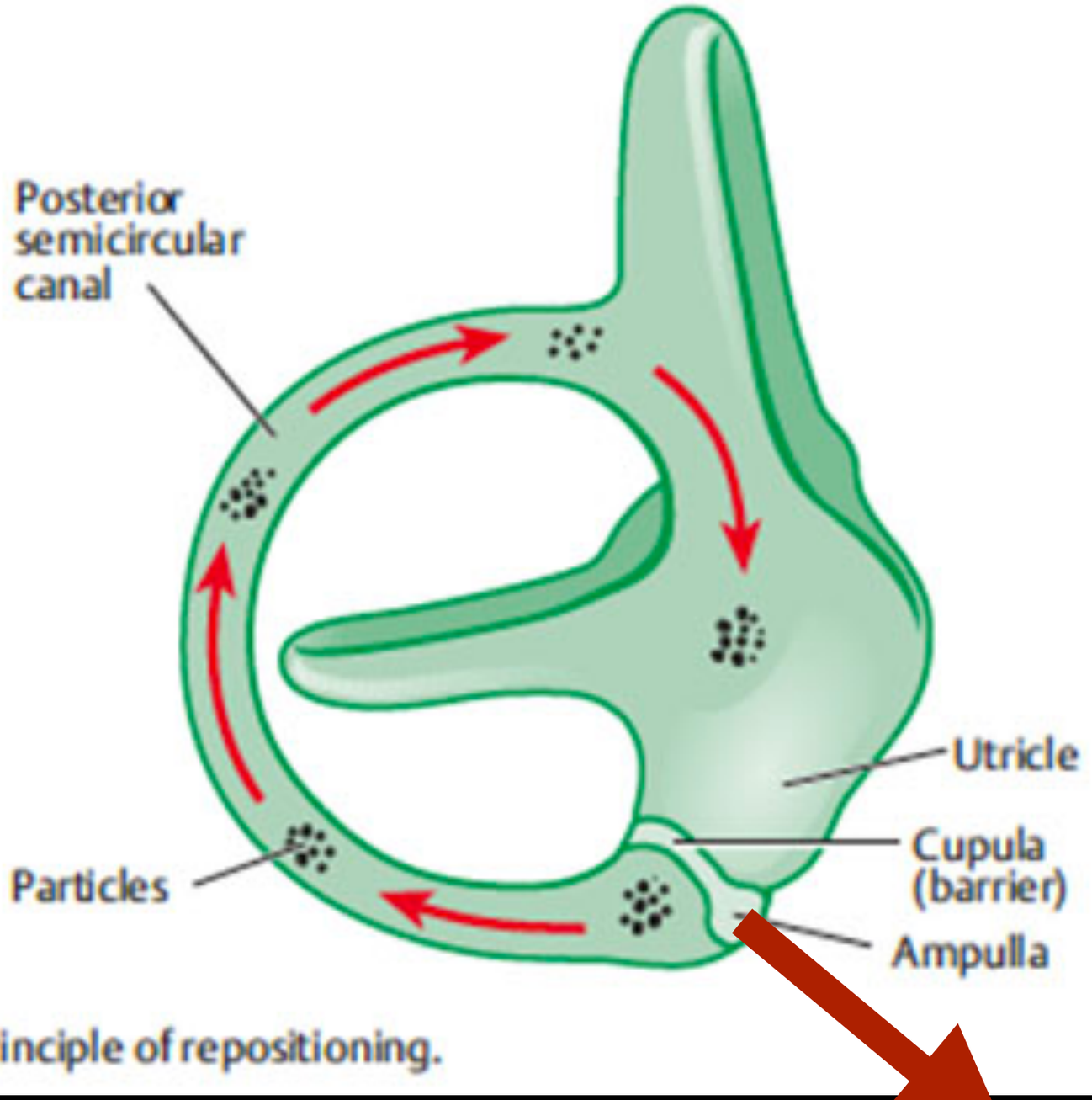
INTERMITTENT DIZZINESS

- Most frequent etiologies seem to be:
  1. Benign paroxysmal positional vertigo
  2. Orthostatic dizziness
  3. Vestibular Migraine
- These are generally the most common 3 causes of dizziness in ED patients

1. BPPV

- For some reason there are little bits of calcium carbonate (otoconia) in a semicircular canal (canalolithiasis)
    - Idiopathic, minor trauma, ischemia, etc.





C. Principle of repositioning.

CN8

1. BPPV

- Severe dizziness **triggered** by changes in head movement
  - Delay of a few seconds until symptoms start
  - Symptoms resolve completely within seconds to minutes
- 3 types
  - Posterior canal (PC-BPPV) - 80-90%
  - Lateral (horizontal) canal (LC-BPPV) - 10-40%
  - Superior canal (SC-BPPV) - ~2%

1. BPPV

- **No nystagmus or dizziness when sitting still, no prolonged symptoms**
- Triggered dizziness that lasts seconds to minutes **PLUS** a positive provocative test
    - PC-BPPV - Dix-Hallpike - vertical upwards, downwards torsional nystagmus when affected ear is down
    - LC-BPPV - Supine Roll Test - horizontal nystagmus that is worse when affected ear is down
    - SC-BPPV - Dix-Hallpike - vertical downwards, upwards torsional nystagmus when affected ear is down
- **No role for CNS imaging**

1. BPPV

- Reposition them ASAP (can pretreat with benzo 1hr before)
  - Epley is superior to Semont
  - NNT 1.1 for symptom improvement
    - NNT of 2 for immediate, complete symptom resolution
    - Early repositioning is important
      - Delay > 24h = NNH of 4 for sx recurrence, 6.5x increased risk of falling
- Teach them repositioning - improves symptoms NNT of 3 at 1 week
- Betahistine and benzos are no better than placebo

Cochrane 2014 - Hilton
Clin Exp Otorhinolaryngol 2011 - Do et al.
Cochrane 2016 - Murdin et al.
Neurology 2008 - Fife et al.

2. ORTHOSTATIC DIZZINESS

- What is this?
  - A term I made up.
- Orthostatic hypotension
  - Defined as a change in sbp of 20, or dbp of 10
    - Not based on presence or absence of symptoms
- Orthostatic dizziness (or orthostatic CNS hypoperfusion)
  - Dizziness **triggered** by standing up
  - Symptoms are recommended as a more useful definition of orthostatic "hypotension" by many sources

NEJM 1989 - Desforges
Postgrad Med J 2007 - Naschitz

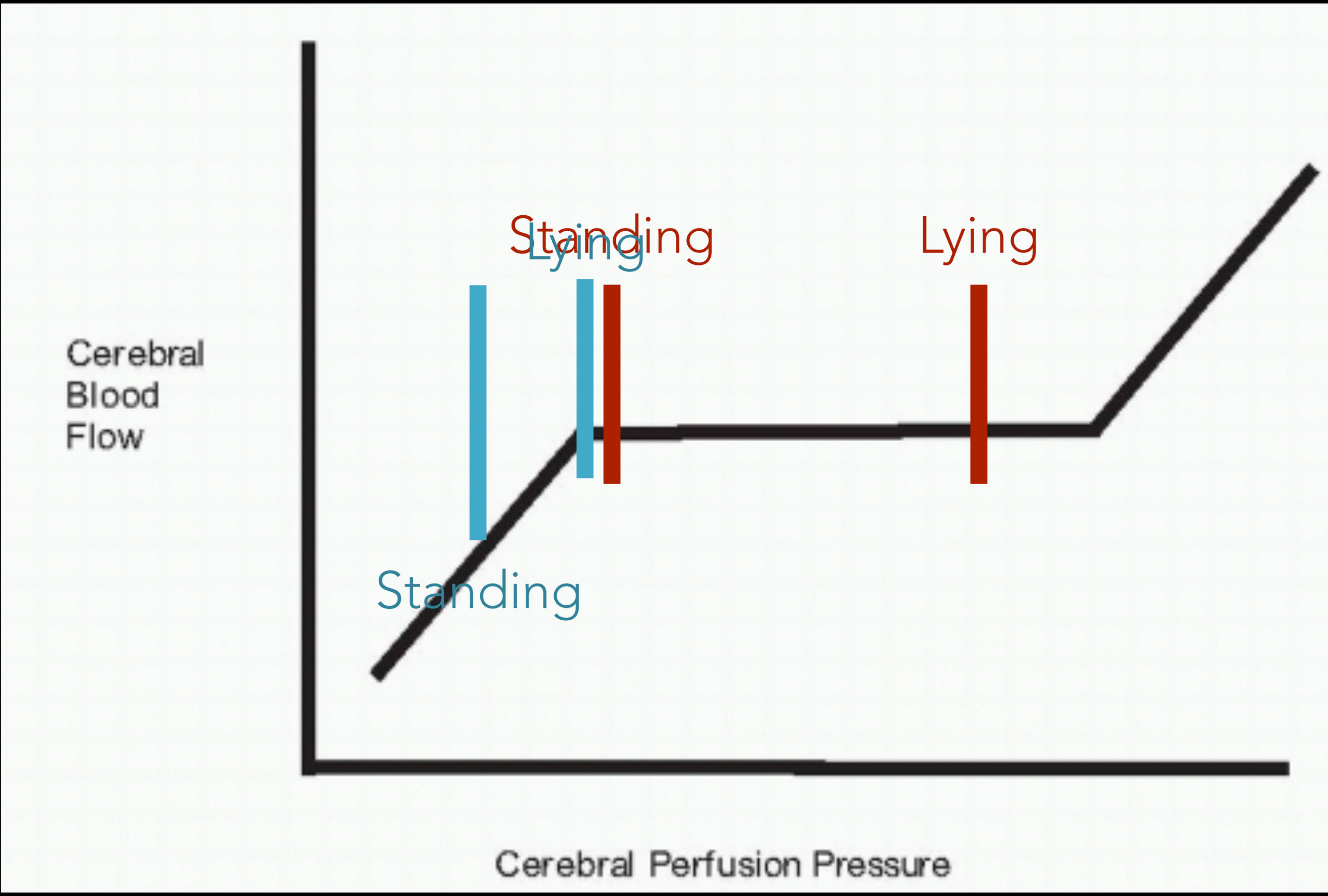
2. ORTHOSTATIC DIZZINESS

- Orthostatic bp measurements don't correlate with symptoms of dizziness
  - **LR+ = 1.36; LR - = 0.9** ← USELESS!!!
- Why are orthostatic vitals such a bad test at predicting symptoms?
  - Symptoms are based on CNS perfusion

1. Orthostatic changes in carotid bp do not correlate with brachial/ peripheral bp

2. Cerebral autoregulation curve is not flat, and everyone's curve is different

Ann Emerg Med 1991 - Koziol-McLain et al. Ochsner J 2012 - Aung et al.
Hypertens Res 2005 - Tabara et al.


Cerebral
Blood
Flow
Standing
Lying
Lying
Standing
Cerebral Perfusion Pressure

2. ORTHOSTATIC DIZZINESS

- Stand them up (for 3 minutes) and see if they feel dizzy *(get someone to walk test them)*

- No role for orthostatic vital signs due to abysmal performance as a diagnostic test

- No role for CNS imaging

Blood Press 2006 - Cohen et al.

2. ORTHOSTATIC DIZZINESS

- Causes (no useful epidemiological data)
  1. Medications
  2. Volume depletion
  3. Autonomic dysfunction (DM)
  4. Idiopathic
- Management
  - Identify most likely cause if possible and treat that
  - Fluid bolus often helps

3. VESTIBULAR MIGRAINE

- Diagnosis = clinical
  - Ask about other typical migraine symptoms (often not present)
  - 50% of episodes have no headache; dizziness may be only symptom
    - Generally, **no obvious trigger** of episode
    - When you see someone within an episode, the dizziness will be constant
- Treatment
  - Maxuran seems to work just as well as in normal migraine
  - Tryptans/ergots are controversial

J Neurol 2016 - Dieterich et al.

PUTTING IT ALL TOGETHER

History

Dizzy Patient (without obvious neurologic deficits or siginifcant head or neck pain)

- Dizziness Never Goes Away (**constant dizziness**)
  - Weeks to Months
  - Hours to Days
- Dizziness Goes Away at Times (**intermittent dizziness**)
  - No Trigger
  - Trigger

Syndrome

- **Chronic Vestibular Syndrome**
- **Acute Vestibular Syndrome**
- **Episodic Vestibular Syndrome**
- **Triggered Vestibular Syndrome**

Special Physical Exam

- Nystagmus → HINTS+
  - CN 8 problem
  - Brain Problem
- No Nystagmus → Walk, Talk, Move Look, Listen, Feel
  - Abnormal
  - Normal
- Dix-Hallpike Supine Roll Stand them Up

Possible Diagnoses

- **Chronic Vestibular Syndrome**
  1. **Psychiatric**
  2. Ototoxic Med
  3. CNS mass
  4. Late stroke
- **Acute Vestibular Syndrome**
  - Nystagmus
    1. **Vestibular Neuritis**

    If < 24hr also consider:

    2. Meniere's***
  - No Nystagmus
    1. **Cerebellar Stroke**
    2. Multiple Sclerosis
    3. Tox
    4. Wernicke's
    5. Metabolic***

    If <24hr also consider:

    6. Vestibular Migraine***
    7. TIA***
    8. Meniere's***
    - Abnormal
      1. **Cerebellar Stroke**
      2. Multiple Sclerosis***
      3. Tox***
      4. Wernicke's***

      If <24h also consider:

      5. TIA***
    - Normal
      1. **Vestibular Migraine*****
      2. Meniere's***
      3. Metabolic***
- **Episodic Vestibular Syndrome**
  1. **Vestibular Migraine**
  2. **TIA**
  3. Meniere's
  4. Dysrhythmia
- **Triggered Vestibular Syndrome**
  1. **BPPV**
  2. **Orthostatic Dizziness**

*** = theoretical

VESTIBOLOGY

STANDING, a four-step bedside algorithm for differential diagnosis of acute vertigo in the Emergency Department

Lo STANDING, un algoritmo bedside a quattro step per la diagnosi differenziale delle vertigini acute nel Dipartimento di Emergenza

S. VANNI[1], R. PECCI[2], C. CASATI[1], F. MORONI[1], M. RISSO[1], M. OTTAVIANI[1], P. NAZERIAN[1], S. GRIFONI[1], P. VANNUCCHI[2]

[1] Department of Emergency Medicine, Careggi Hospital, University of Firenze, Italy; [2] Department of Surgical Sciences and Translational Medicine, Unit of Audiology, Careggi Hospital, University of Firenze, Italy

- This is essentially the HINTS exam
  - Without test of skew
  - Adding on assessment of truncal ataxia
- Performed by ERPs after a 5 hour didactic workshop

- Rate of neuroimaging 28% vs. 51% in control
- Rate of hospital admission 32% vs 71% in control

ACKNOWLEDGEMENTS

- Dr. Peter Johns, MD, FRCPC-EM, University of Ottawa
- Every resident and student that's listened to me rant about this over the past 2-3 years

QUESTIONS?

GENERAL TREATMENT OF DIZZINESS

VESTIBULAR REHAB

- Performed by a number of private physiotherapists in the city
  - OR 2.67 for symptom improvement
- Better evidence for peripheral causes of dizziness

Cochrane 2015 - McDonnell et al.

MEDICATIONS

- **Benzodiazepines**: suppress GABA-mediated vestibular signalling in cerebellum
- **Antihistamines**: suppresses vestibular signalling by unclear mechanism
- Anticholinergics
- Betahistine: little evidence for benefit outside of Meniere's

Cochrane 2016 - Murdin et al.