Central Causes of vertigo

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Introduction

- Dizziness → 3–4% of all patients presenting to ED
- Front line physicians should always attempt to exclude dangerous diagnoses
- There is a "needle-in-the-haystack" problem:
- Only a very small minority of dizzy patients in an ED have cerebrovascular diagnoses (about 1% of those presented with isolated dizziness) , although a small proportion of a very large number of patients

Symptom Quality Approach

- Historically, taught for decades across all specialties, the diagnostic approach to dizziness was based on the "symptom quality" of the dizziness
- That is to say → work-up of patient endorses "vertigo" is different than "lightheadedness" or "unsteady gait"
- So the first question to ask a dizzy patient is, "What do you mean, 'dizzy'?"

Dizziness

Sensation of disturbed spatial orientation without a false or distorted sense of motion

Vertigo

- An illusion of movement. Sensation of self-motion / distorted self-motion.
- *Internal vertigo*
- *External vertigo*

Pre-syncope

A feeling of impending LOC usually due to reduction in cerebral blood flow

Unsteadiness

Feeling of being unstable while seated, standing, or walking

- Research in last 10 years → "symptom quality" approach is intrinsically flawed

- Implicit in this approach is that each word has diagnostic significance and also that patients reliably and consistently report only 1 type of dizziness, neither of which is true. In fact, basing the DDX simply on the word that the patient endorses is not helpful.

Time and Trigger Method

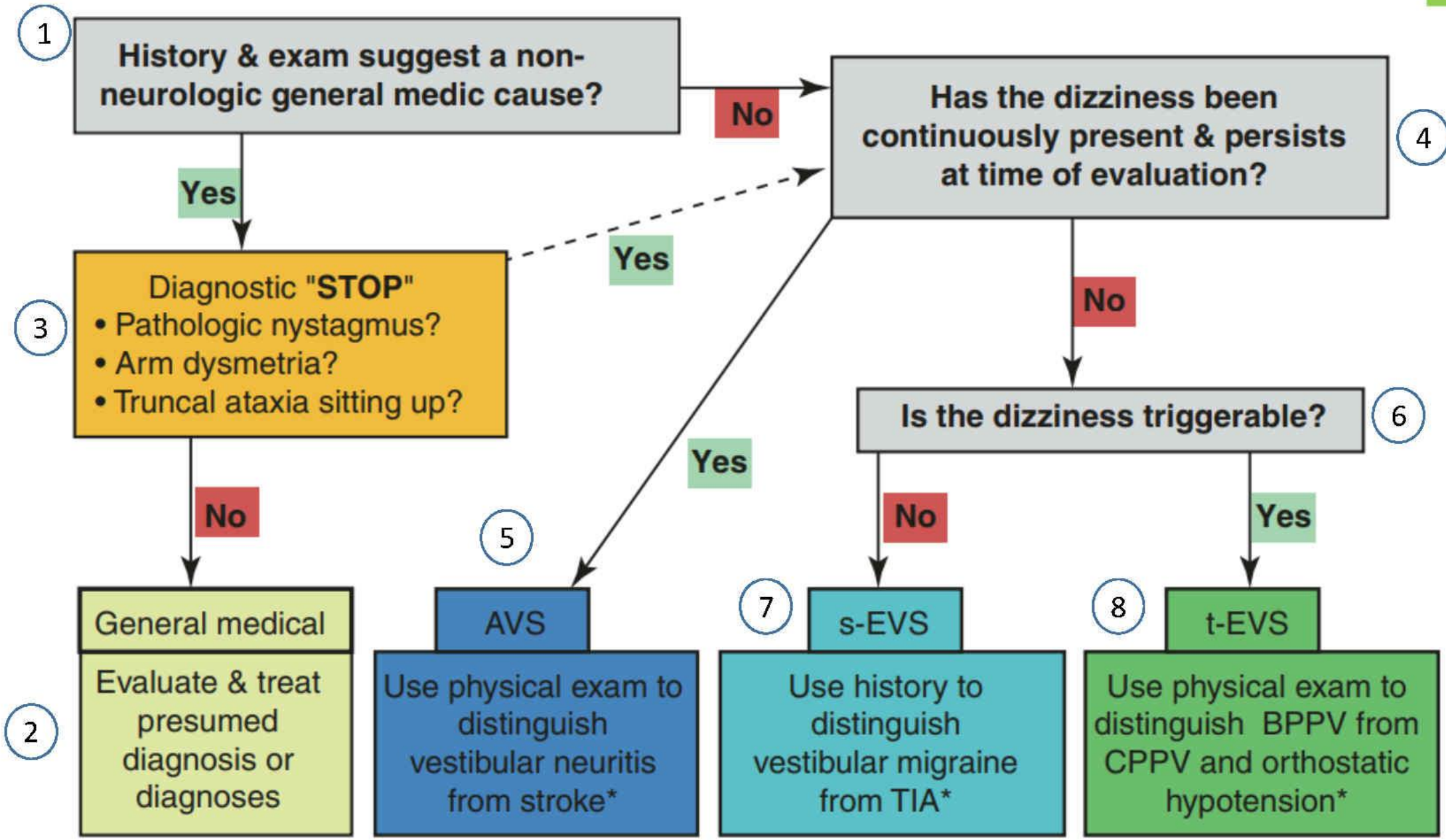
- BPPV patients often complain of “dizziness” or “lightheadedness” and not “vertigo” . This is especially true in older patients

- In one study, patients were asked a series of questions to determine their “type” and temporal aspects of dizziness. When re-surveyed within 10 min, using the same questions but in a different sequence, 50% changed their subtype . The responses to timing and triggers were much more consistent

ATTEST Method

- A : Associated symptoms
- TT: Timing and triggers
- ES: Exam signs
- T: Testing (additional testing, if needed)

ATTEST: Diagnostic Approach to the Acutely Dizzy Patient



Syndrome	Description	Common benign causes	Common serious causes	Important less common causes
AVS	Acute, continuous Dizziness lasting days, accompanied by nausea, vomiting, (often) nystagmus, head motion intolerance, and gait unsteadiness	• Vestibular Neuritis • Labyrinthitis	• Posterior circulation ischemic stroke	• MS • Wernicke's encephalopathy

Syndrome	Description	Common benign causes	Common serious causes	Important less common causes
s-EVS	Episodic dizziness that occurs spontaneously is not Triggered and usually lasts minutes to hours	• Vestibular migraine • Menière's • disease	• Posterior circulation TIA	• Arrhythmia • Panic Attacks • Transient low flow state • Pulmonary embolism • Aortic stenosis

Syndrome	Description	Common benign causes	Common serious causes	Important less common causes
t-EVS	Episodic dizziness brought on by a specific, obligate Trigger (typically a change in head position or standing up), and Usually lasting less than 1 min	• BPPV	• CPPV • Orthostatic hypotension due to serious medical illness	• SCDS • Vertebral artery compression

AVS-History

- Dizziness begins rapidly or abruptly and is continuously present. By definition, it is present at the time of evaluation.
- Nausea and vomiting are common in the AVS
- They are intolerant to head motion →

- A distinction must be made between
  - Who is completely asymptomatic at rest who then develops dizziness with motion (triggered dizziness)
  - Whose dizziness is present but mild at rest which gets worse with head motion (exacerbated dizziness)

AVS-History

- There are many causes, but three conditions account for 97%
- Most common, 75% of cases, is vestibular neuritis
- The second most common and the most serious, posterior circulation stroke, accounts for 20%
- Multiple sclerosis accounts for another 2–3%
- A large number of other condition account for remaining 2% or 3%
- One important diagnosis because it is treatable, is Wernicke's encephalopathy, which can present with an AVS

AVS-Physical Examination

- Not only is the physical examination useful, it is actually more useful than MRI scanning, at least within the first 48 h , nearly 100% sensitive in distinguishing peripheral from central causes
- HINTS is an acronym for a group of bedside ocular motor tests— the head impulse, nystagmus, and test of skew deviation
- Despite the order of letters, test for nystagmus first (It is easily tolerated ,first, not need to move head at all. Secondly if a patient does not have nystagmus in the first several days, vestibular neuritis is extremely unlikely, and, HIT has not validated in patients without nystagmus

Diagnosis of patients with the acute-onset persistent dizziness
Ask and answer 5 questions in the following sequence:

Is there a central pattern of nystagmus ?

↓

Is skew deviation present ?

↓

Is the head impulse test negative?
(only applies to patients with nystagmus*)

↓

Are there any CNS signs on focused neurological exam ?

↓

Is the patient unable to sit or walk unassisted?

"Yes" answer to ***any*** question:

Treat as stroke

- Consult a neurologist
- Perform brain and cerebrovascular imaging; specifically rule out vertebral dissection
- Admit for rest of stroke etiology work-up
- Begin secondary stroke prevention (if no thrombolysis)

"No" answer to ***all*** questions:

Treat as vestibular neuritis

- Give steroids
- Prescribe symptomatic medication such as antihistamines for no more than 3 days
- Arrange early follow-up with neurology or PCP

Test for Nystagmus

- By convention, nystagmus is named by direction of the fast component from the patient's perspective
- Starts by observing patient's eyes in primary gaze—looking straight ahead
- Have the patient look to both sides and up and down
- If the direction of fast component changes with gaze to the left and right (following the examiner's finger), they have "gaze-evoked nystagmus."
- In AVS, gaze-evoked, torsional, or vertical nystagmus are always central
- Some patients have physiological end-gaze nystagmus, the changes direction depening on direction of gaze. The nystagmus is very low amplitude and usually extinguishes rapidly. This is a normal finding

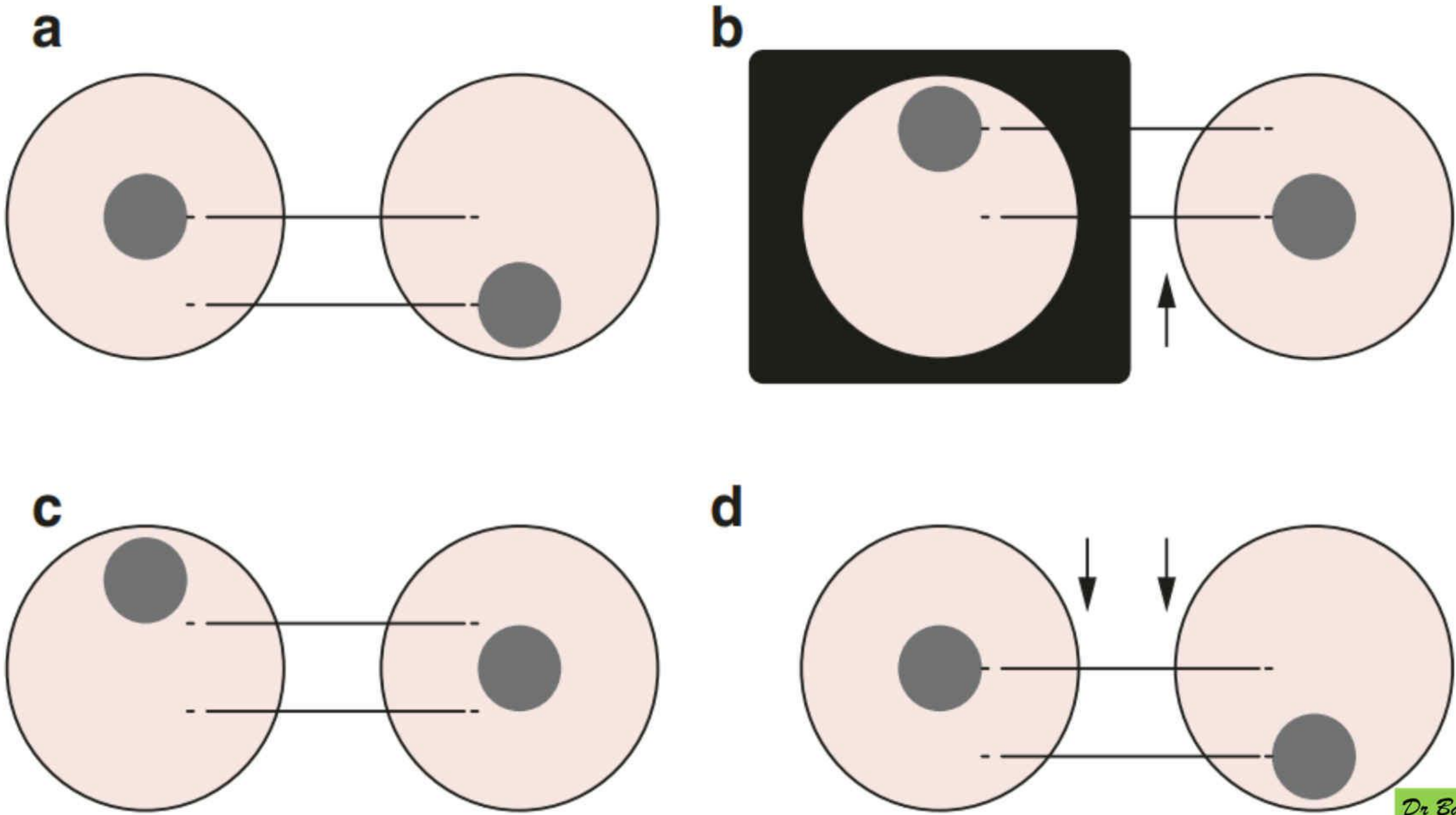
Finding	Significance	Comments
No nystagmus	Normal finding	• Essentially rules out vestibular neuritis but is consistent with a cerebellar stroke. • Some patients with BPPV will endorse continuous dizziness and not have nystagmus at rest

Finding	Significance	Comments
Spontaneous horizontal nystagmus in primary gaze	Does not distinguish between central and peripheral causes	Seen more commonly with peripheral causes of AVS but is not diagnostic. In neuritis, may have a slight torsional component
Gaze evoked horizontal nystagmus that beats in only one direction	Does not distinguish between central and peripheral causes	Suggests a peripheral cause of AVS but is not diagnostic. In neuritis, may have a slight torsional component
Direction-changing gaze evoked Horizontal nystagmus	central	Note: this is always central but can be a benign central cause (e.g., acute alcohol intoxication or anticonvulsant use). Some patients have physiologic end-gaze nystagmus that is a normal finding

Finding	Significance	Comments
Pure vertical nystagmus	Central	In the ED, this should always be considered a central finding *
Tortional nystagmus	Central	Note that torsional nystagmus is the expected finding in PC-BPPV, but these patients do not present with the AVS but rather t-EVS. There is often a slight torsional component in neuritis

Skew deviation

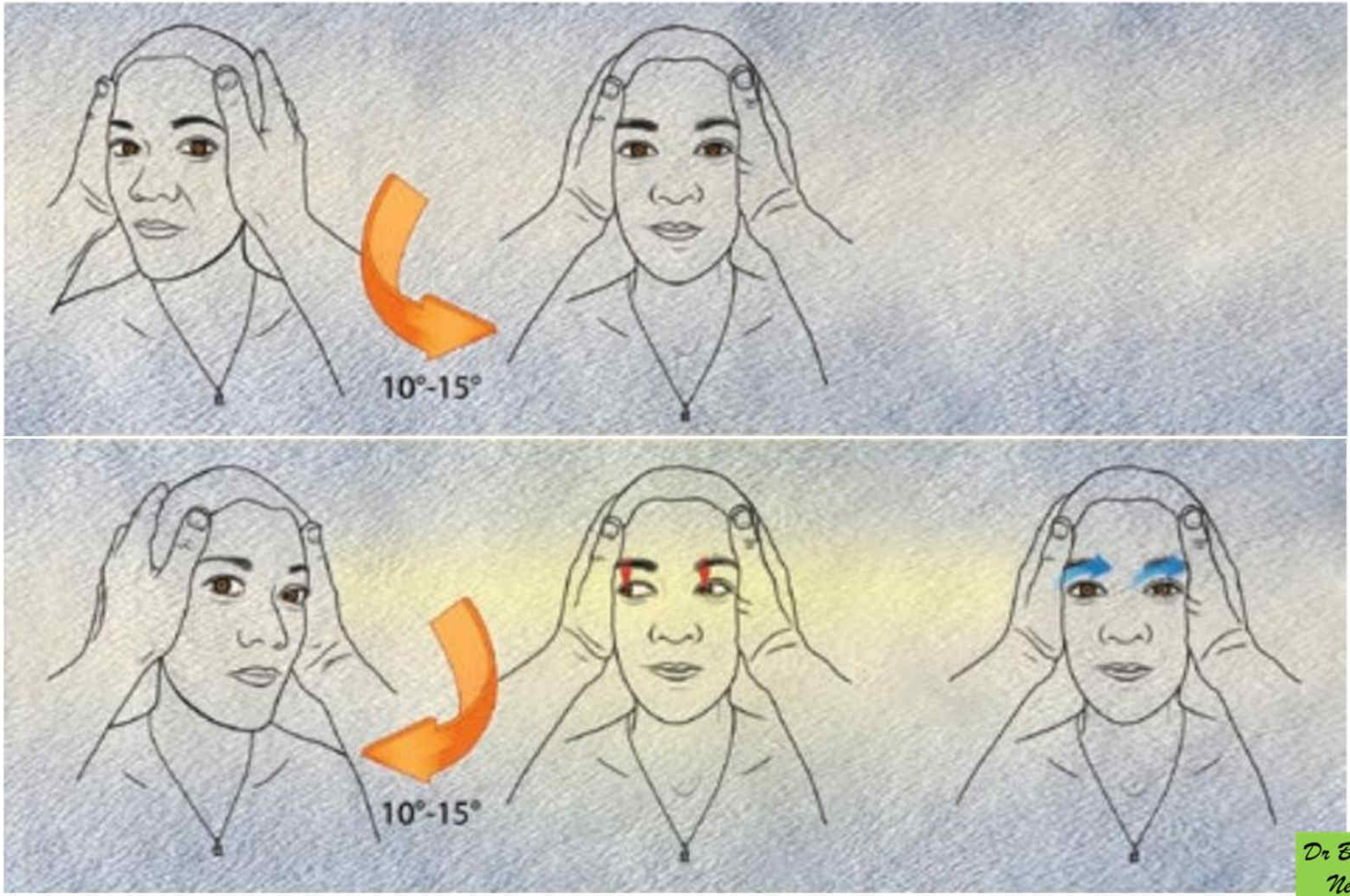
- Performs the alternate cover test to look for skew deviation.
- Instructing the patient to stare directly at the examiner's nose, the physician rapidly and alternately covers one eye then the other, going back and forth every second or so.
- Skew deviation is the presence of a small vertical correction, which is easier to see if the examiner focuses only on one eye or the other.
- It does not matter which eye one focuses on because as one side goes up, the other will go down. Normally, there is no vertical correction
- A horizontal correction is not skew deviation, only a vertical correction, which usually localizes to the brainstem



Finding	Significance	Comments
Skew deviation	Normally absent; its presence means a central cause	• Not very sensitive but very specific; if present, this should be considered to be a central cause of the AVS

Head Impulse Test (HIT)

- Next one performs the HIT
- For this test too, the patient fixes their gaze on the examiner's nose
- The patient's head should be "loose" and relaxed, and the active head movements done by the examiner should be very rapid but very small amplitude (~10–15°)
- Normally, the patient's eyes stay locked on target—the examiner's nose.
- The presence of a corrective saccade usually indicates a peripheral vestibular localization except in two circumstances—a stroke involving the vestibular nerve root entry zone (usually in AICA) or a labyrinthine infarct (i.e., a "stroke" of a peripheral structure but one fed by a branch of the AICA)



The final two steps

- A neurological examination targets the structures fed by the posterior circulation—brainstem, cerebellum and occipital lobes
- Cranial nerves, finger-to-nose or heel-to-shin testing, or a visual field abnormality indicate a central cause
- Last, one must test the gait. The inability to stand or sit up without assistance is more likely to be of a central cause and an unsafe discharge to home even if the cause is peripheral
- In one study, all the patients with an AICA stroke who had a falsely reassuring HIT were unable to walk, emphasizing the importance of testing the gait

Exam component	Significance	Comments
Hearing by finger rub in each ear	Can be central or peripheral	The classic teaching that dizziness plus decreased hearing is nearly always peripheral is wrong. Infarcts of the labyrinth or eighth nerve root entry one (AICA distribution) will also cause this combination of findings
Extraocular movements	If diplopia is present, this should be considered central	The nuclei of these three cranial nerves (3 and 4, midbrain, 4 and 6, upper pons) suggest a brainstem localization
Ptosis	Suggests a lateral medullary infarct	Part of Horner's syndrome

Anisocoria	Suggests a lateral medullary infarct	Seen best in a dark room to accentuate the difference in pupillary size. Part of Horner's syndrome
Facial weakness	Suggests a lesion in the internal auditory canal or brainstem	Standard seventh nerve testing
Decreased facial pain and temperature sensation	Suggests a lateral medullary infarct	Light touch is preserved, so one must test pain or temperature
Hoarseness (listening to the patient speak)	Suggests a lateral medullary infarct	Be careful about administering oral medications in this setting
Limb ataxia (finger-to-nose and heel-to-shin)	Cerebellar stroke	In the dizzy patient, these findings should be tested but may be absent in some patients with cerebellar strokes

Exam component	Significance	Comments
Truncal ataxia	Cerebellar or brainstem stroke	Test the ability of the patient to maintain in the seated position unassisted in the stretcher without holding on to the guard rails for support
Gait ataxia	Cerebellar or brainstem stroke	Test the ability of the patient to stand and walk unassisted. Patients with neuritis may have some unsteadiness but usually can stand and walk, whereas many patients with stroke cannot

Component of exam	Sensitivity for central causea (%)	Comments
Nystagmus	55	
Test for Skew Deviation	25	This finding is not very sensitive but specific for a central etiology, usually in brainstem
Head impulse test	85	Extremely important to only use this test in patients with the AVS with nystagmus. Other patients will have a “negative” test, which is “worrisome” for a stroke
Focused neurological exam	65	In addition to obvious neurological findings, it is important to look for subtle findings that can be easily missed
Gait and/or truncal ataxia	65	Some patients without the first four findings may unable to sit up or stand and walk unaided. Many of these will have a stroke.

s-EVS-History

- The dizziness occurs in discreet episodes between which is asymptomatic
- By definition asymptomatic when evaluated in ED. If still symptomatic→ Do as for patients with an AVS
- Because they are asymptomatic and the dizziness is not triggerable, evaluation is entirely based on history
- The most common cause is vestibular migraine
- The most serious but less common cause of the s-EVS is posterior circulation TIA. (rare, but precedes stroke in approximately 8%)
- Non-rotatory dizziness is the most common nonfocal symptoms in stroke patents (14%) (nonfocal symptoms occurred in nearly 20% of strokes)
- Third most common diagnosis is Ménière's disease, although uncommon

s-EVS

- One caveat is that there can be overlap
- Vestibular migraine → may or may not have a headache
- Even if they do, the headache → can precede, follow, or occur during the episode of dizziness
- Vestibular migraine represents a small proportion of patients with migraine, but migraine is so common → vestibular migraine is the most common cause of s-EVS
- A history of migraine, multiple previous episodes over a long period of time and younger age → favor Vestibular migraine

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Migraine with Brainstem Aura

A. Attacks fulfilling criteria for 1.2 *Migraine with aura* and criterion B below

B. Aura with both of the following:

1. At least two of the following fully reversible brainstem symptoms:
   - ☐ Dysarthria → **Not Aphasia**
   - ☐ Vertigo → **Not Dizziness**
   - ☐ Tinnitus
   - ☐ Hypacusis → **Not Ear fullness**
   - ☐ Diplopia
   - ☐ Ataxia not attributable to sensory deficit
   - ☐ Decreased level of consciousness (GCS ≤13) → **Can be GCS estimation**
2. No motor or retinal symptoms.

Many of these may occur with anxiety and HV and subject to misinterpretation

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Vestibular Migraine

- At least five episodes with vestibular symptoms of moderate or severe intensity lasting between 5 min and 72 h
- Present migraine or previous history of migraine with or without aura (according to the International Classification of Headache Disorders)
- One or more migraine features with at least 50% of the vestibular episodes
  - Headache with at least two of the following characteristics: unilateral location, pulsatile quality, moderate or severe pain, and aggravation by routine physical activity
  - Photophobia or phonophobia
  - Visual aura
- No other vestibular explanation

- One symptom is sufficient during a single episode. Different symptoms may occur during different episodes.
- Associated symptoms May occur before, during, or after the vestibular symptoms.

Vestibular Migraine – Vestibular symptoms

(a) Spontaneous vertigo:
- Internal vertigo (a false sensation of self-motion)
- External vertigo (a false sensation that the visual surround is spinning or flowing)

(b) Positional vertigo, occurring after a change of head position

(c) Visually induced vertigo, triggered by a complex or large moving visual stimulus

(d) Head motion-induced vertigo, occurring during head motion *

(e) Head motion-induced dizziness with nausea (dizziness is characterized by a sensation of disturbed spatial orientation; other forms of dizziness are currently not included in the classification of vestibular migraine).

TIA and Meniere's disease

- Posterior circulation **TIA** usually
  - Lasts less than an hour
  - Abrupt onset and offset
  - Older patients with vascular risk factors
  - A long history of multiple spells would make TIA less likely
  - Smaller number of spells (<5 per week)
  - Isolated dizziness
- brain imaging, even with MRI is often normal. One preliminary study → MRP might help to identify patients with a cerebrovascular cause of episodic dizziness with negative DWI-MRI
- Clues to the diagnosis of Meniere's disease are aural fullness and tinnitus during an episode and decreased hearing over time

t-EVS- History

- The most common cause is orthostatic hypotension. Symptoms triggered by standing up from seated or lying down position
- Another very common cause is BPPV. Dizziness occurs while is lying down, especially at nighttime, strongly suggests BPPV , very unusual with OH
- Because symptoms are triggerable, they can be reproduced at the bedside, and physical examination is very useful
- One rare cause is triggered by loud noises (the Tullio phenomenon) or Valsalva → superior canal dehiscence syndrome (SCDS) / PLF
- Another rare cause is positional vertebral artery compression lead to posterior fossa ischemia when a vertebral artery is compressed with turning of the head (bow hunter's syndrome), often by a bony spur
- Triggered dizziness can also occur with compression of the brainstem by an abnormal vertebral artery

t-EVS- Examination

- In patients whose symptoms suggest orthostatic hypotension, measuring the vital signs while lying in bed and standing, recording the PR, systolic, and diastolic BP but also any orthostatic symptoms

- In patients whose histories suggest BPPV, provocative maneuvers of semicircular canals will make this diagnosis ; the posterior canals are tested first because are more gravity dependent and more common to be the offending canal

BPPV versus CPPV

- Usually done with Dix-Hallpike
- → positive→ usually the Epley or Semont maneuver
- → negative → horizontal canal (supine head roll test)
- If positive, treating with a Lempert barbecue roll
- Superior canal is very rarely involved and diagnosed and treated similar to PC

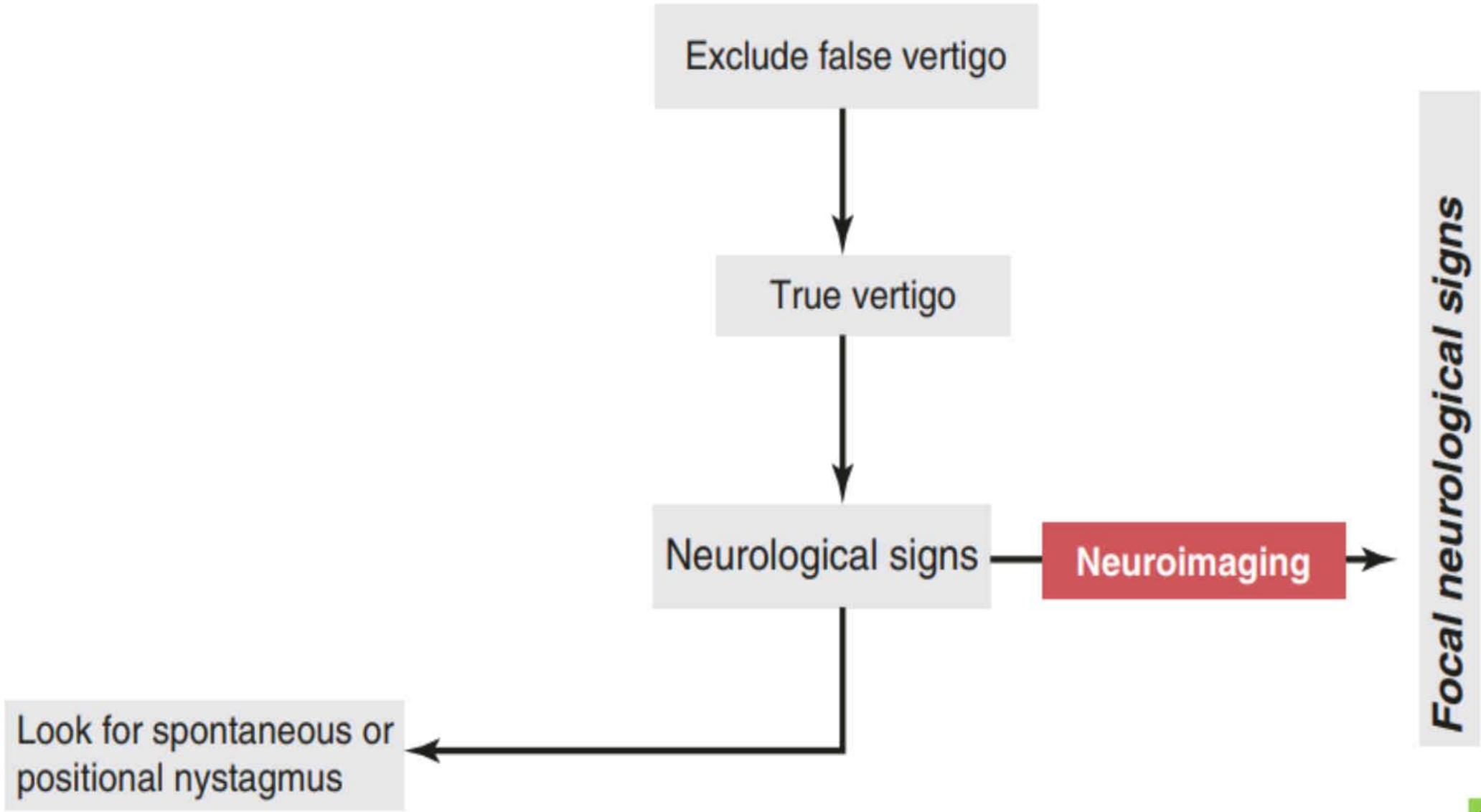
- If the history strongly suggests BPPV, but these maneuvers do not clarify the diagnosis, consider the very uncommon possibility of **CPPV**, in which a structural lesion such as stroke or tumor abuts the fourth ventricle

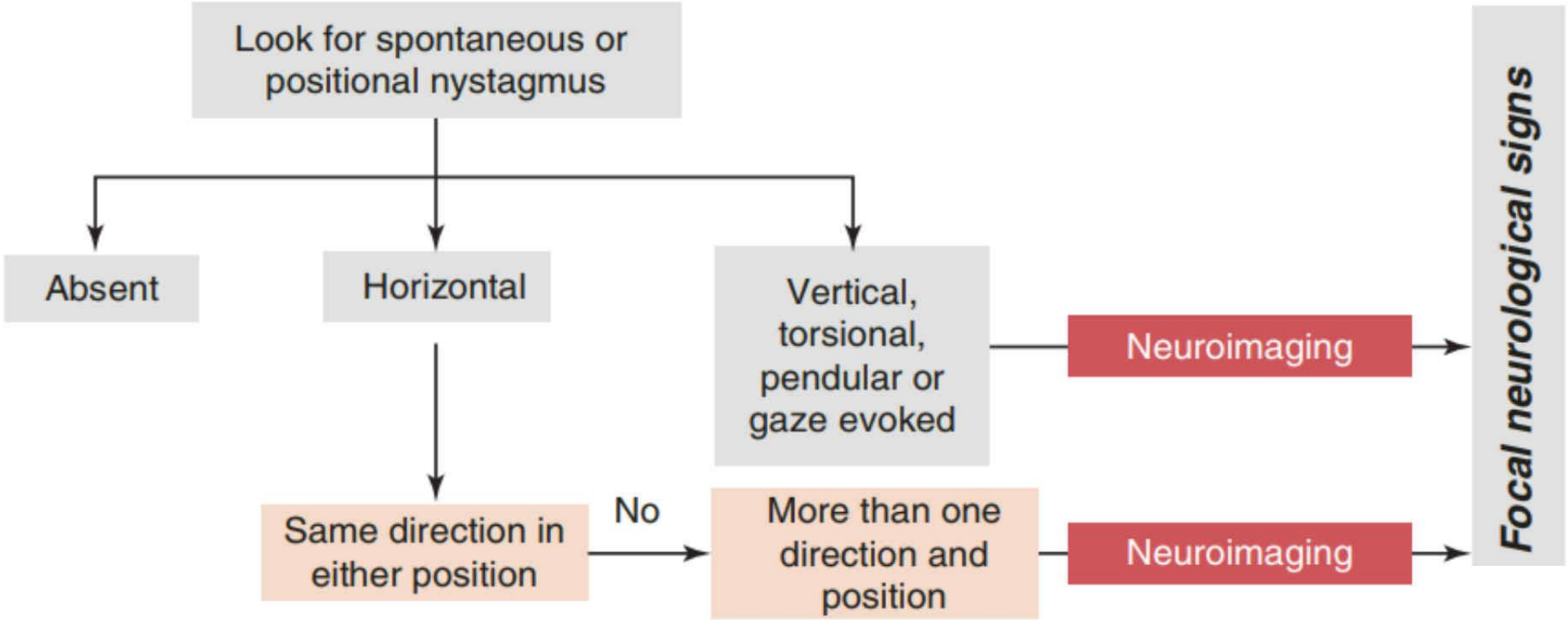
Canal involved, mechanism (proportion of BPPV cases)	Provocative diagnostic maneuver/ test	Expected type of nystagmus[a]	Therapeutic maneuver
pc-BPPV (80–85%)	Dix-Hallpike	Upbeating (from patient's perspective) and torsional[b]	Epley maneuver Alternative: Semont maneuver
sc-BPPV (~1–2%) (sometimes called anterior canal)	Dix-Hallpike	Downbeating vertical nystagmus[d]	Can use Epley, but this form of BPPV usually resolves spontaneously

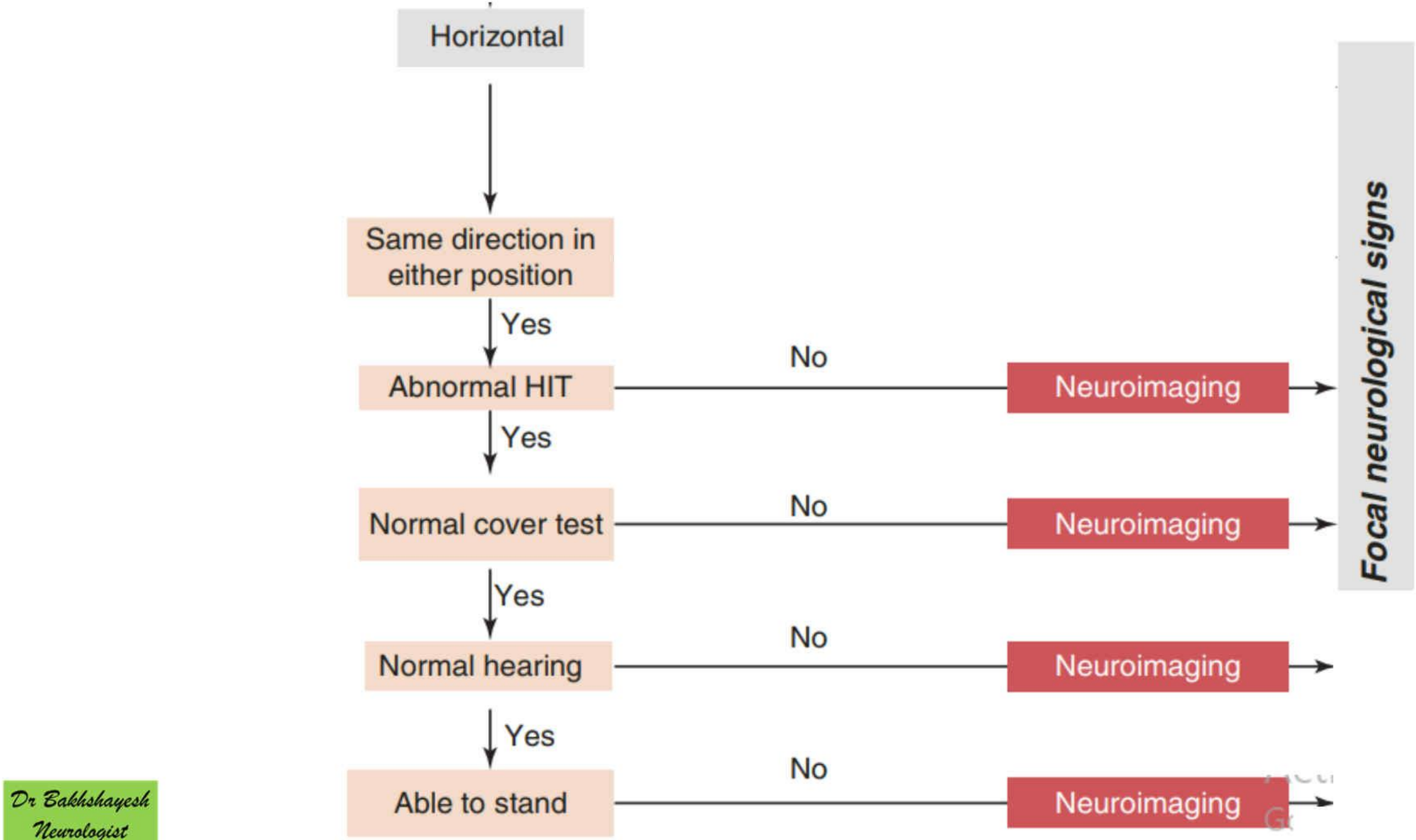
hc-BPPV (15–20%) (sometimes called lateral canal)			
– Canalolithiasis (majority of horizontal canal cases)	Supine head roll	Geotropic (beats towards the floor) horizontal that is transient[c] Occurs on both sides, but is more intense on the affected side	Lempert barbeque roll maneuver Alternative: Gufoni maneuver
– Cupulolithiasis (minority of horizontal canal cases)	Supine head roll	Apogeotropic (beats towards the ceiling) horizontal, that is, persistent Occurs on both sides but is more intense on the healthy unaffected side	Gufoni maneuver

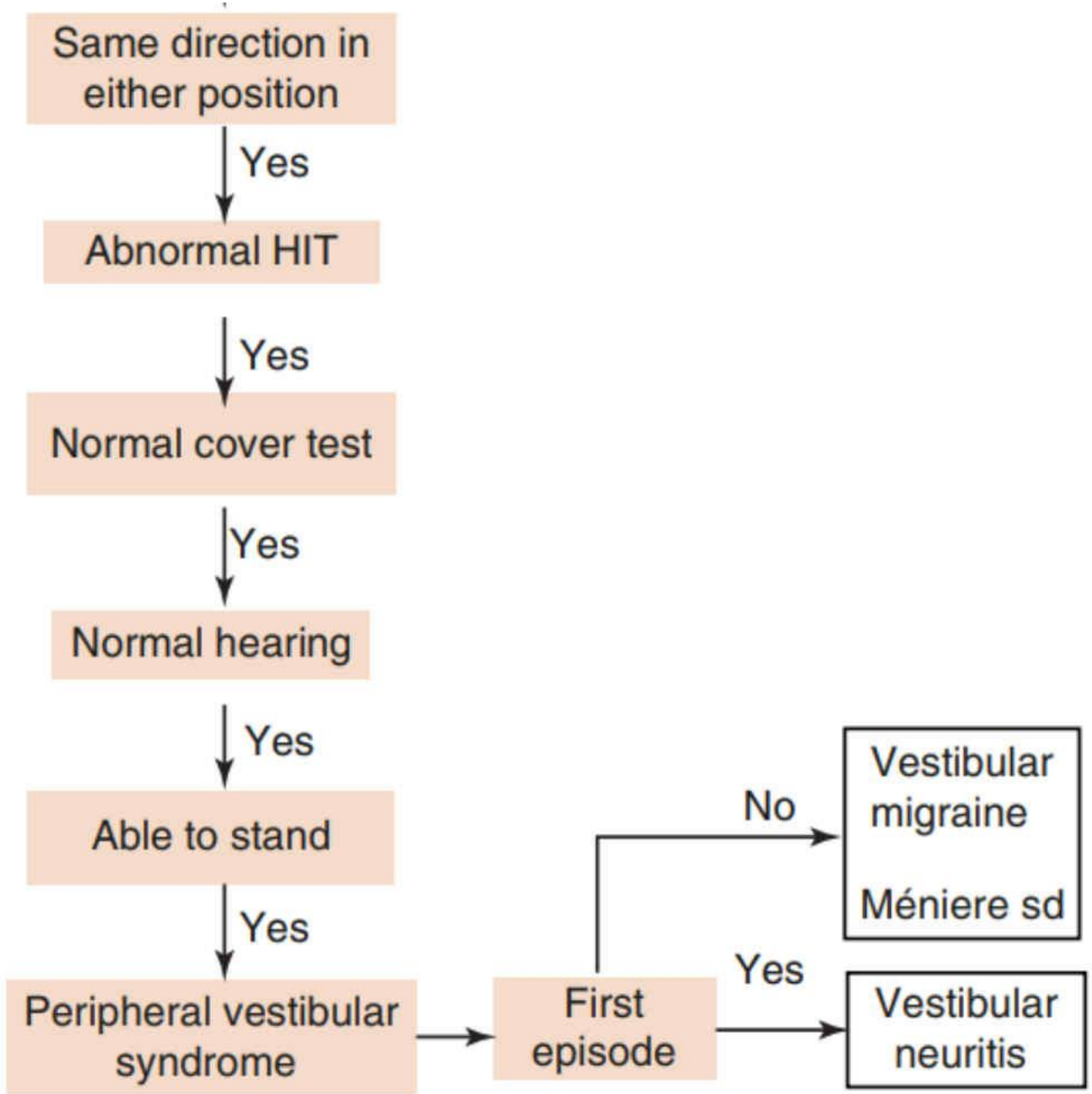
Characteristics that suggest CPPV

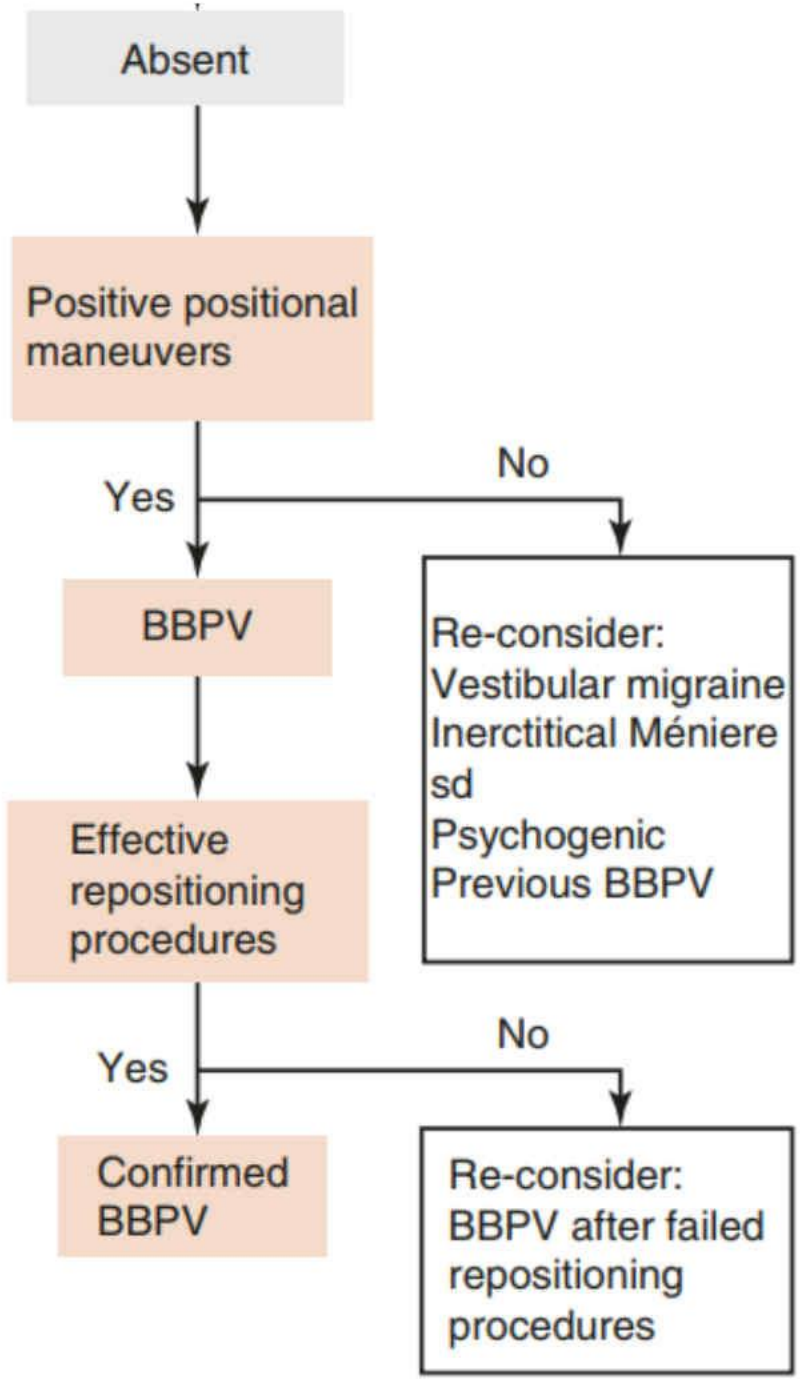
1. Presence of symptoms or signs that are NOT seen in BPPV
   (a) Headache
   (b) Diplopia
   (c) Abnormal cranial nerve or cerebellar function
2. Atypical nystagmus characteristics or symptoms during positional tests
   (a) Downbeating nystagmus
   (b) Nystagmus that starts instantaneously, persists for longer than 90 s, or lacks a crescendo-decrescendo pattern of intensity
   (c) Prominent nystagmus with mild or no associated dizziness or vertigo
3. Poor response to therapeutic maneuvers
   (a) Repetitive vomiting during positional maneuvers
   (b) Unable to cure patient with canal-specific canalith repositioning maneuver
   (c) Frequent recurrent symptoms











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