

First, some background... Coordinating a human's movements and recognition of your position in space makes use of three sensory modalities of the body.

Visual senses provide a spatial orientation.

Vestibular system of your inner ear gives you your orientation in relation to gravity.

And proprioception relates the movements of your body parts and gives the body's position relative to the head.

If one of these has a mismatch with the others, you can perceive movement when none actually exists. This, is vertigo.

This helps understand the actual definition of vertigo which is "a sensation of movement when none exists" which allows for a wider recognition than we sometimes think. This means something like the spinning of the room around you isn't necessary, if there is any sensation of movement when they aren't moving, then this is likely vertigo.

Objective One:

In patients complaining of dizziness, rule out serious cardiovascular, cerebrovascular, and other neurologic disease (e.g., arrhythmia, myocardial infarction [MI], stroke, multiple sclerosis).

Cardiovascular

- Arrhythmias
 - Of course get an ECG to sort this out
 - If they're asymptomatic when they see you which is too often the case, and these events are occurring on a daily basis, you might have a good chance of seeing them with a 24-48 hour holter monitor
 - If you want to review arrhythmias and their associated ECG features, pop back to [our early episodes on ACLS](#)
- Myocardial infarction
 - ECG and troponins
 - Ensure you are checking a delta if the history is convincing and ensuring you are sufficiently after onset of symptoms to avoid missing the initial troponin elevation
 - This isn't an MI episode, but most shops will have a rule out criteria with suggested time for delta measures to reduce the false negative rate.
- Aortic Stenosis - referring again to the greatest medical text around by Steven McGee
 - All of the likelihood ratios for physical exam findings are pretty weak, so the recommendation is to use combined findings:
 - A sustained apical impulse = LR 4.1
 - An absent or diminished S2 = LR 3.8, this is because the stiff aortic leaflets close with less vigor
 - A late peaking systolic murmur = LR 3.7

- A delayed carotid artery upstroke = LR 3.5
- He relates that the classic murmur of aortic stenosis radiated broadly from the cardiac apex to the right clavicle

Cerebrovascular

The big one to rule out here of course is

stroke, whether ischemic or haemorrhagic.

With vertigo as a component, this is most likely affecting cerebellum or brainstem, which might come with other symptoms such as [evidence based physical exam - 5th edition

Steven McGee]:

- Ophthalmoparesis - LR 70 - this can of course look like diplopia
- Visual field cut - LR 17.5 aka 'hemianopsia'
- Unilateral limb weakness - LR 8.6
- Sudden Onset vertigo, nausea and vomiting -- *this might fool us into jumping to vestibular neuritis if not for other neurological symptoms*
- Headache

Those are the symptoms of a posterior circulation stroke to ask about, what about the signs that might be helpful?

- Limb ataxia - LR 23.9
- Dysarthria - LR 20.6
- Facial droop - LR 18.8
- Severe truncal ataxia - LR 17.9
- NORMAL head impulse - LR 10.8
- Unilateral limb weakness - LR 8.6
- Skew deviation - LR 7.1
- Focal sensory disturbance - LR 7
- Gait ataxia - LR 4.5
- Nystagmus
- Horner's syndrome
- Additionally, they often wont be able to stand without help in the case of stroke -- this can be helpful to differentiate from vestibular neuritis, as those folks can usually stand on their own

According to Steven McGee the most useful exam findings to rule OUT stroke as the cause of the patients vertigo are:

1. An ABnormal head impulse test (corrective saccades present) - because this suggests a peripheral cause of the vertigo
2. No direction-changing nystagmus - we'll discuss what this looks like in a second
3. No skew deviation - again, listen in for the explanation of what this looks like

These tests are incorporated into what is known as the HINTS Exam. This stands for **H**ead Impulse, **N**ystagmus, **T**est of **S**kew.

Not an easy exam to carry out, but knowing that a well executed negative HINTS carries greater ability to rule out a stroke than an MR brain. And with some practice you'll get it down no problem.

****Note: do NOT perform HINTS for brief periodic vertigo, it is ONLY for prolonged vertigo and nystagmus at rest, ** It is important to note that the HINTS exam should only be used in patients who are symptomatic in regards to their dizziness at the time of assessment.****

****another tip is to state 'peripheral or central' regarding findings rather than 'normal or abnormal' to avoid confusion****

So, how do we do the HINTS exam?

1. Place hands on either side of the patient's head and ask them to focus on your nose the entire time. Then, slowly turn their head left and right to ensure they're loose, then quickly turn to one side about 20 degrees and watch their eye.
 - a. A slight pause with corrective saccade to get back to your nose suggests 'peripheral' cause
 - b. No corrective saccade required suggests 'central' causes

2. Nystagmus

Observe their eyes for a period of time for the nystagmus. Looking for which direction is the quick component. Usually a jerk one way, then slightly slower the other way.

For all patients, having them look TOWARDS the fast component will worsen it.

However, have them look away from the fast component:

- i. If it gets better or disappears, suggests 'peripheral'
 - ii. If instead the fast component just reverses to the other direction, that suggests 'central' cause for their vertigo.
- b. Unidirectional horizontal nystagmus suggests 'peripheral cause
 - c. Suppression of the nystagmus when fixed on an object also suggests 'peripheral' causes
 - d. Vertical nystagmus, or direction-changing horizontal nystagmus, or rotatory nystagmus all suggest 'central' cause for their vertigo
3. Test of Skew
- Again ask the patient to look straight ahead at your nose. Then cover one of their eyes with your hand. Then, quickly move your hand to cover the opposite eye. And back again.
- a. Any correction of the uncovered eye in a vertical or up/down diagonal direction is suggestive of a central cause.

	Peripheral	Central
Head impulse test	Abnormal	Normal
Nystagmus	None or unidirectional	Bidirectional or vertical
Test of skew	No vertical skew	Vertical skew

Dr Peter Johns of UOttawa EM has a great video demonstrating this exam which we will link to in the shownotes. <https://www.youtube.com/watch?v=1q-VTKPweuk>

Of course consider the likelihood in the context of your patient's vascular risk factors: age over 60, hypertension, diabetes, smoking and obesity.

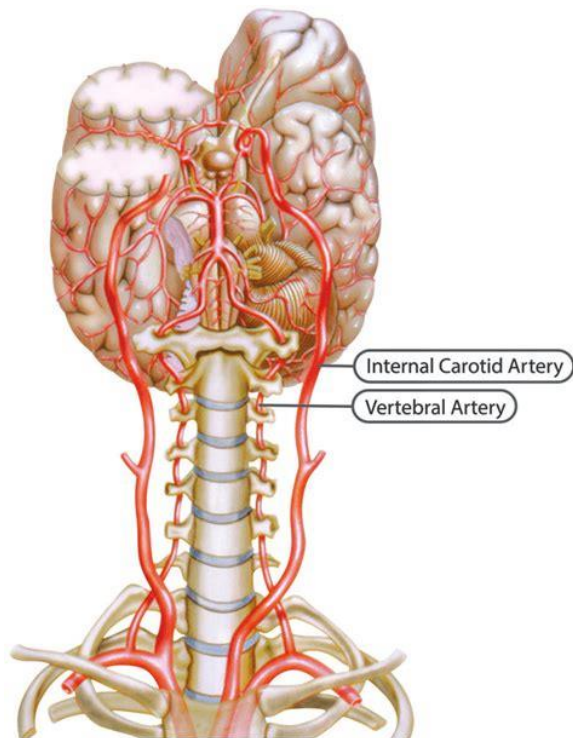
Another cerebrovascular cause of 'dizziness' to not miss is:

Vertebral Artery Dissection

This one can cause stroke in kids and young adults, think of it particularly following trauma.

Symptoms are:

- Sudden onset vertigo
- Headache that is often unilateral
- Neck pain - but note acute vertigo following trauma can be dissection even in the absence of pain
- If there are neurologic signs, they can be:
 - Ataxia
 - Dysarthria



Serious Neurologic Disease

The biggie here is Multiple Sclerosis.

This can be tricky, but you should be suspecting it when a younger person presents multiple times with neurological symptoms suggesting different areas of pathology, often with the previous complaints having resolved.

Physical exam might show:

- Decreased strength
- Increased tone or hyperreflexia
- Clonus
- Positive babinski reflex
- Decreased vibration sense and joint proprioception

In up to 30% of patients with MS, the initial presenting symptom is acute or subacute central vision loss, due to an Optic Neuritis.

This needs an MR brain if suspecting it.

Objective Two:

In patients complaining of dizziness, take a careful history to distinguish vertigo, presyncope, and syncope.

[Tintinalli's xth edition ch xx]

Vertigo is "the perception of movement (rotational or otherwise) where no movement is occurring"

Presyncope or near-syncope is 'light-headedness with concern for an impending loss of consciousness.

Syncope is "transient loss of conscious due to insufficient perfusion to the parenchyma of the brain, with quick resolution upon going horizontal.

Dysequilibrium is "a feeling of unsteadiness, imbalance, or a sensation of floating while walking.

Acute Vestibular Syndrome is a syndrome consisting of vertigo, nausea and vomiting, intolerance to head motions, spontaneous nystagmus, unsteady gait and postural instability caused by injury to peripheral OR central vestibular structures. Must persist at least 24 hours for this title.

Your patients presenting with vertigo will roughly break down into 40% having peripheral vestibular dysfunction, 15% with psychiatric disorder, 10% with ventral brainstem vestibular lesions, and a quarter with presyncope or dysequilibrium. This leaves ten percent that we won't sort it out.

Now they haven't requested the actual overall approach to this dizzy patient, and it might be tough to follow on an audio podcast, but we're going to give it a try so give us all your focus and lets give it a try!

They made this objective far too broad with the title of just 'dizziness'. If you're good with your history above though, you will be able to pick out if this is true vertigo, or not, which is the first step in your approach to the dizzy patient. This is a mashup of the approach from Tintinalli's and the AAFP.

Now if it is NOT true vertigo based on your probing history, then we are heading down the pre-syncope, cardiac or psychiatric route:

- Ask about postural changes, did they just get up when it happens? - consider orthostasis
- Other causes of pre-syncope may include hypoglycemia, thyroid disease, intoxication/withdrawal from alcohol/drugs, previous concussion
- Ask about chest pain, palpitations, shortness of breath? - consider ECG and troponins
- Also consider psychiatric dizziness if all else comes up negative

If it IS true vertigo, next steps on history to hit are:

- First, is it continuous? Or is it episodic?
 - If it is continuous, and seemed to come on spontaneously, then carry out your HINTS exam to see if it is peripheral in nature or central

- Of course if there are suspicions of contributing toxins or it came on with trauma then that is a different pathway
- If it IS episodic, ask about triggers for the vertiginous episodes:
 - Head movements will make all vertigo worse, but if it is ABSENT as rest, then triggered by a specific head movements as trigger might shift you towards suspecting BPPV and you should do a Dix-Hallpike maneuver to assess
 - Valsalva, trauma, etc suggests perilymphatic fistula
 - Although I've only seen this once, if a definite head turn such as shoulder checking when backing up is the cause, think of carotid hypersensitivity.
 - If the 'dizziness' is related to when they get up from lying or sitting and does not sound like true vertigo, then orthostatic hypotension needs to be considered.

We'll include a recreation of a table from Tintinalli's relating how the duration of episodic dizziness can help guide us towards a likely aetiology as well.

Time Course of Episodes	Likely Vertigo Conditions
Lasting Seconds	Probably BPPV or Postural Hypotension
Minutes	Transient Ischemic attacks, especially if associated neurological symptoms or signs
Lasting Hours	Thing of Meniere's disease
Constant for more than 24 hours	This is an Acute Vestibular Syndrome: assess for peripheral or central

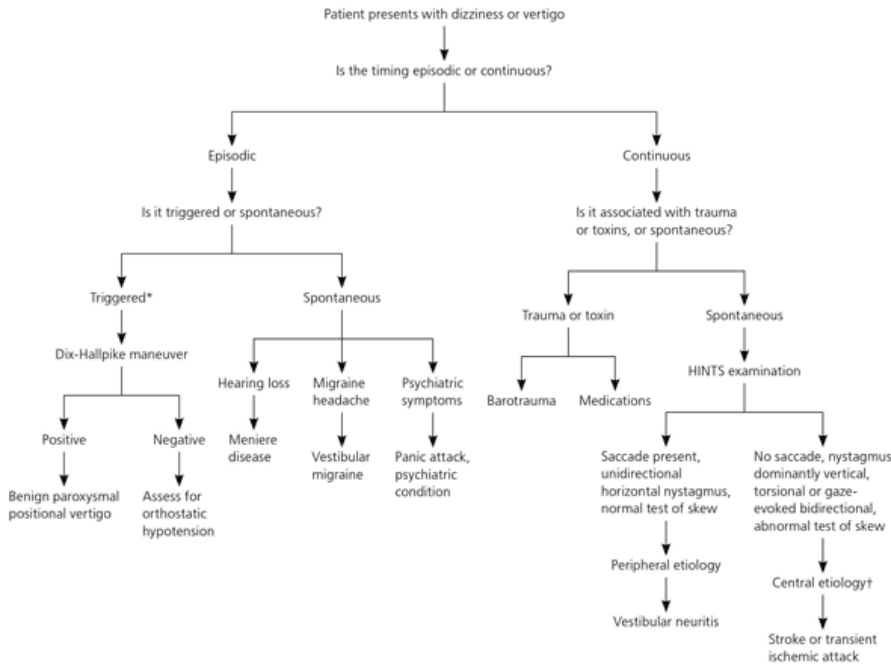
The various peripheral causes of vertigo can be distinguished by a few key features:

		Hearing loss	
		Yes	No
Vertigo	Peristent	Labrynthitis	Vestibular neuritis
	Episodic	Ménière's disease	BPPV

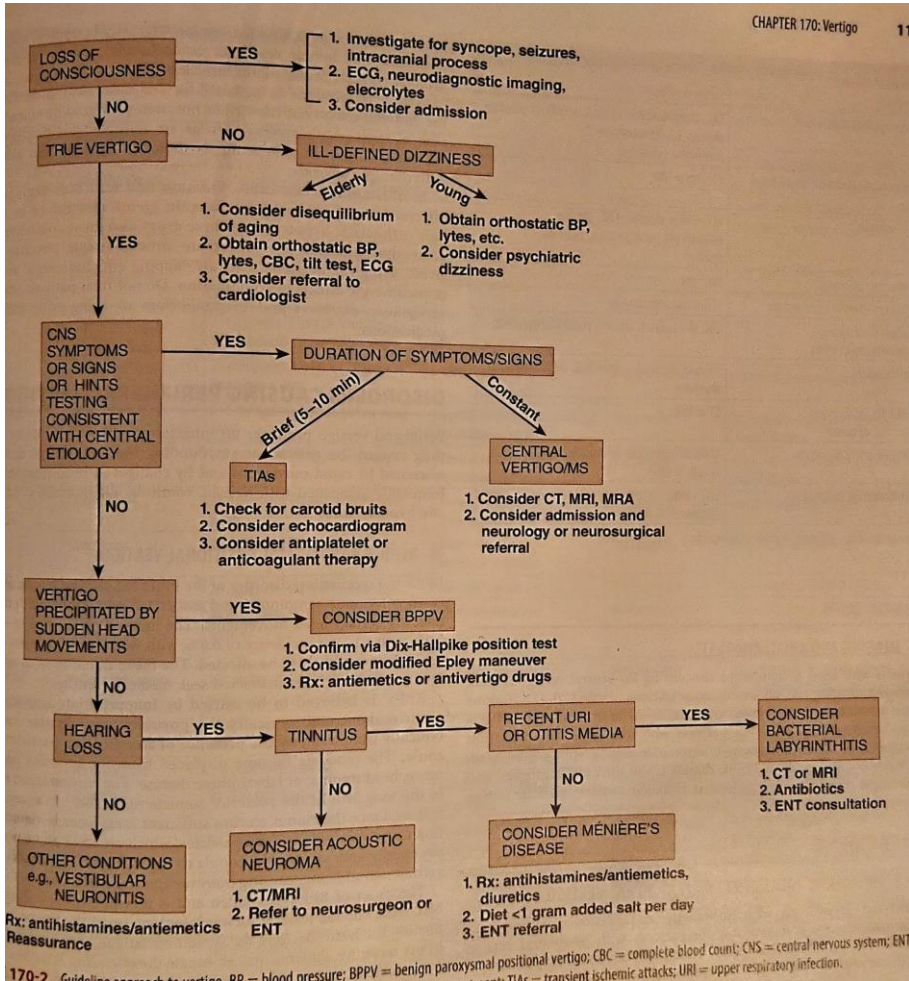
Commented [1]: awesome addition, thank you!

- Now ask about other associated symptoms with the vertigo
 - Hearing loss, aural fullness or tinnitus should make you think of Meniere disease
 - Headache, photophobia you might think of a vertiginous migraine
 - Other neuro symptoms you should be thinking of central causes:
 - Multiple Sclerosis
 - Stroke
 - Transient Ischemic Attack

- being the big ones



*—Exacerbation of symptoms with movement does not aid in determining whether the etiology is peripheral vs. central.
 †—Central causes can also occur with patterns triggered by movement.



Objective Three:

In patients complaining of dizziness, measure postural vital signs.

As easy as it is to forget this, your patient almost certainly has not read your medical textbooks. You have probably already discovered that 'dizzy' means many different things to different people.

One of those things is actually pre-syncope or colloquially 'light headedness'

Because of this, it is important to assess for orthostasis. The most effective way to assess this is by taking a blood pressure and heart rate measure at least 2 minutes after lying supine, and then another 1 minute after they have stood up.

The interpretation of the results are often thought of as the 30-20-10 rule. Orthostasis is traditionally considered likely if:

- The heart rate increases by 30 or more when standing
- The systolic blood pressure falls by 20 mmHg or more when standing
- The diastolic blood pressure falls by 10 mmHg or more when standing
- Of course if they're too symptomatic to stay standing and say they're feeling lightheaded, the vitals aren't really required any more

In an awesome study in 1999 JAMA they actually phlebotomized people for moderate or large blood loss then checked these vitals.

- The two most useful findings were:
 - Those who were unable to stand long enough to do vitals due to lightheadedness, and
 - A HR increase of 30 or more was both sensitive and specific for large intravascular loss
- A decrease of sBP >20 mmHg was not very sensitive but VERY specific
- While a supine tachycardia or Supine hypotension >95mmHg were both quite specific for low intravascular volume.

The two common causes for orthostatic hypotension are:

1. Failure of compensatory mechanisms - such as autonomic insufficiency required to squeeze the veins in the legs and to pump up the heart rate, or
2. Excessive loss of intravascular volume

Objective Four:

Examine patients with dizziness closely for neurologic signs.

What more to say here? Do a full neuro exam for these folks. Including Romberg.

And why is this so important?

- Because the presence of associated neurological signs are going to make you more concerned for central aetiologies.
 - If there were neurological signs that were present with the vertigo briefly, 5-10 minutes, then suddenly a TIA is on the radar and you should be checking for carotid bruits and considering carotid dopplers. [Holter's and CT Head as is the case for all suspected TIAs](#)
 - Of course if there is persistent vertigo with persistent neurological symptoms or signs, you need to look into their brain for central causes: stroke, mass, multiple sclerosis, etc.

Objective Five:

In hypotensive dizzy patients, exclude serious conditions (e.g., MI, abdominal aortic aneurysm, sepsis, gastrointestinal bleeding) as the cause.

Here they're saying, your hypotensive patient with 'dizziness', more in line with a syncope or pre-syncope, either isn't moving blood well enough, or they don't have enough blood to move.

MI

Come on, you know this, review your signs and symptoms of MI, get an ECG and a troponin.

Abdominal Aortic Aneurysm

If you've done some POCUS training, you can scan an abdominal aorta. Curvilinear, dive your depth, find the vertebrae and the thick walled, non-compressible, non-respiratory-responsive structure near field to the vertebrae and scan from the xiphoid until they bifurcate around the umbilicus. Anything bigger than 3cm is a AAA. But most often these bleed into the retroperitoneum so you are unlikely to see intraabdominal fluid. Nonetheless, you should look for it, because AAA + free fluid is an autodial to the surgeon.

- Otherwise, get an ultrasound or a CT-A if you're suspecting this.

While you're bedside with your probe, you might as well grab a view of the heart to rule out pericardial effusion that might be tamponading and get a gross assessment of the LV function.

Sepsis

You know how to look for Sepsis.

Gastrointestinal Bleeding

Upper: they might be coughing up bright red blood or coffee-ground material. Or, if it's coming out the bottom end it will be more like a tarry-black melena.

- If its upper GI and still bright red coming out the anus, that is a bad day
- Add a urea to your labs, as a significant elevation can lead you to suspect UGIB in the right clinical context

Lower: could be bright red from the anus, or a darker maroon if it's slow in transit.

Objective Six:

In patients with chronic dizziness, who present with a change in baseline symptoms, reassess to rule out serious causes.

Not a lot here to add. If they've lived with chronic dizziness, but they say that this is different, then treat this as a new case of dizziness and rule out the scary stuff we talked about in Objective One, then on to your workup.

Objective Seven:

In a dizzy patient, review medications (including prescription and over-the-counter medications) for possible reversible causes of the dizziness.

What are these medications that could cause dizziness? For these continue with the earlier differential of what dizziness means to patients. Remember it could be: vertigo, dysequilibrium, pre-syncope.

So what are some of the more common medications that can cause vertigo?

Here again we see the problem with the vague nature of 'dizziness' and so the offending medications are also broken down into aetiologic categories. The best table we found was from the AAFP.

Table 2. Medications Associated with Dizziness

<i>Medication</i>	<i>Causal mechanism</i>	
Alcohol	Cardiac effects: hypotension, postural hypotension, torsades de pointes, other arrhythmias	
Antiarrhythmics, class 1a		
Antidementia agents		
Antiepileptics		
Antihistamines (sedating)		
Antihypertensives		
Anti-infectives: anti-influenza agents, antifungals, quinolones		
Antiparkinsonian agents		
Attention-deficit/hyperactivity disorder agents		
Digitalis glycosides		
Dipyridamole		
Narcotics		
Nitrates		
Phosphodiesterase type 5 inhibitors		
Skeletal muscle relaxants		
Sodium–glucose cotransporter-2 inhibitors		
Urinary anticholinergics		
Skeletal muscle relaxants		Central anticholinergic effects
Urinary and gastrointestinal antispasmodics		
Antiepileptics	Cerebellar toxicity	
Benzodiazepines		
Lithium		
Antidiabetic agents	Hypoglycemia	
Beta adrenergic blockers		
Aminoglycosides	Ototoxicity	
Antirheumatic agents		
Anticoagulants	Bleeding complications (anticoagulants), bone marrow suppression (antithyroid agents)	
Antithyroid agents		

Information from references 1, 13, and 14.

Objective Eight:

Investigate further those patients complaining of dizziness who have:

- signs or symptoms of central vertigo.
- a history of trauma.
- signs, symptoms, or other reasons (e.g., anticoagulation) to suspect a possible serious underlying cause.

Tintinalli's offers a table comparing features of peripheral(vestibular) vertigo vs central(brainstem/cerebellum) vertigo.

Some of the biggies for Central Vertigo though are:

- Ill defined and less intense severity
- The vertigo is constant
- The signs and symptoms are not fatigueable, that is, eliciting them persistently does not cause them to go away
- Does not come with hearing loss, tinnitus or changes to tympanic membrane
- And often comes with CNS signs and symptoms

	PERIPHERAL VERTIGO	CENTRAL VERTIGO
Onset	Sudden	Can be Sudden or Slow
Severity	Intense Spinning	Ill defined and often less intense
Pattern	Paroxysmal and Intermittent	Constant
Aggravated by position/movement	Yes	Variable
Associated Nausea or Diaphoresis	Frequently	Variable
Fatigue of Symptoms/Signs	Yes	No
Hearing loss or tinnitus	May occur	Does not occur
Abnormal tympanic membrane	May occur	Does not occur
Nystagmus	Rotary-vertical, or horizontal	Vertical
CNS Symptoms/Signs	Absent	Usually present

- a history of trauma.

Here consider the possibility of dissection of the vertebral artery, as discussed in earlier objectives. In this case you need imaging to rule out a dissection if clinical suspicious.

Of course, also harken back to your Canadian CT Head Rules to assess whether you need a CT brain to rule out a bleed that may be causing their vertigo.

• **signs, symptoms, or other reasons (e.g., anticoagulation) to suspect a possible serious underlying cause.**

Of course your radar should be turned up to 11 when you have patients at higher risk of central causes of their vertigo, particularly in the case of acute vestibular syndrome. These risk factors might include:

- Someone with cancer that could have gone metastatic to the brain
- Someone on anticoagulation for whatever reason
- Someone with vascular risk factors:
 - Hypertension, elderly, diabetes, previous stroke, known cardiovascular disease, AFib, etc.

Symptom Management

One thing that was not in the objectives that should probably also be mentioned here is, what if you work the patient up and see no indication of a central cause.

Maybe it is episodic but severe, so you think BPPV or Meniere's. Or it is persistent but your HINTS and/or brain imaging were negative so you're thinking a Vestibular Neuritis, and so you're going to discharge but want to help them with their symptoms, what can you offer?

- If it is episodic, triggered by predictable head movements, and so you're suspecting BPPV, you can give them meds we'll mention, but also advise them on the Epley Maneuver and that they can trial it at home. In practice, some patients often aren't able to complete this maneuver successfully. In these patients, it may be worthwhile to refer to physiotherapy for vestibular therapy.
- It is persistent, HINTS and/or imaging indicate peripheral and no auditory changes and a prior viral URTI, so you suspect Vestibular Neuritis
 - You can consider Methylprednisolone and/or Valacyclovir, but just know the effectiveness of this is a pretty evidence free zone
- If you suspect there is a strong anxiety component to a peripheral vertigo, you can consider benzos, always ensuring this is short term only and could delay vestibular compensation
- A peripheral vertigo, episodic but lasting hours, with tinnitus, unilateral ear fullness, and some hearing loss, so you suspect Meniere's
 - You can offer betahistine.
 - This is actually the only good indication for betahistine, though you'll often see it offered for all sorts of peripheral vertigo
- A vertigo with associated migraine headache symptoms, of course treat for migraine. Can also consider prophylaxis for migraine if recurrent and affecting function.
- For any severe vertigo with nausea you can trial:
 - Antihistamines: Dimenhydrinate, Diphenhydramine or Meclizine
 - Antiemetics: Metoclopramide, Ondansetron
 - Anticholinergic: Scopolamine, transdermal patch

Resources Used

- 1 . Kaski D, Agarwal K, Murdin L. Acute vertigo. BMJ. 2019 Sep 12;366:l5215. Full text (<https://www.doi.org/10.1136/bmj.l5215>) Abstract (<http://www.ncbi.nlm.nih.gov/pubmed/31515203?tool=bestpractice.bmj.com>)
- 2 . <https://www.aafp.org/afp/2017/0201/p154.html#afp20170201p154-t1>
- 3 . <https://bestpractice.bmj.com/topics/en-gb/71/urgent-considerations>
4. Tintinalli's Emergency Medicine 8th Edition - Chapter 170: Vertigo