

Vertigo Mythbusters

A Straightforward Approach To Vertigo

Matthew McArthur CCFP(EM)



Learning Objectives

- adopt a simple, safe, and effective approach to vertigo
- recognize red flag clinical features that are worrisome for a dangerous central cause of acute dizziness/vertigo
- confidently diagnose the two common types of BPPV (posterior and horizontal canal), using history and physical exam maneuvers (Dix Hallpike and Supine Roll Test)
- treat posterior canal BPPV using the Epley maneuver
- understand how the HINTS+ exam can help establish a diagnosis of vestibular neuritis in a patient with the acute vestibular syndrome

Learning

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- recogni
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- treat po
- underst
neuritis



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Shout Out to Dr Johns



Peter Johns

@PeterJohns · 32.7K subscribers · 65 videos

Hi, I'm Peter Johns, an emergency physician (retired from clinical practice since 2023) in ...more

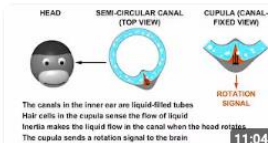
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Why do patients have trouble



What does fatigue/fatigability mean



Dizzy and no nystagmus seen:



Syndromic vs diagnosis based approach to dizziness/vertigo:...

5.6K views · 7 m

JUST THE FACTS

Just the Facts: How to assess a patient with constant significant vertigo and nystagmus in the emergency department

Peter Johns, MD, FRCPC*; Hans Rosenberg, MD, CCFP-EM*



Chapter 170: Vertigo

Brian Goldman; Peter Johns

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Why Is Vertigo So *Tricky*

Can be caused by many diagnoses from benign to serious

Patients have a hard time describing what they are feeling

Poorly taught in medical education

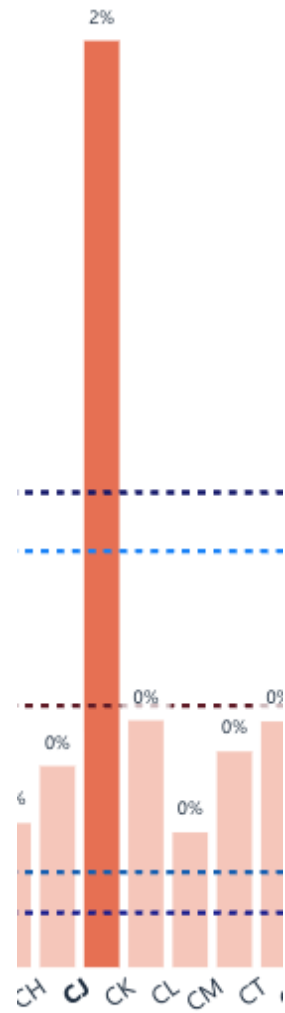
ED Docs Struggle With Vertigo

- Retrospective Chart Review of 2309 dizzy patients (2021, Dmitriew et al, Sudbury)
 - 19.5% of dizzy patients received the HINTS exam
 - **96.9%** of those who received the HINTS exam, it was NOT indicated
 - 53% of patients who had indications for DHT, received DHT
 - 29% of patients who received DHT, had clear contraindications for DHT
- Retrospective Chart Review of 175 dizzy patients (2025, Nolan et al, Miami)
 - 71% of HINTS exam were performed on inappropriate patients

Dmitriew C et al. Acad Emerg Med. 2021 Apr;28(4):387-393

Dmitriew C et al. CJEM. 2021 Sep;23(5):613-616

Nolan K et al. Am J Emerg Med. 2025 Aug;94:185-187



Definitions

Vertigo - illusory sensation of movement even when still

Dizziness - non-specific term for being off balance, woozy, etc

Nystagmus – repetitive, involuntary eye movements



Differential for Acute Dizziness

- 1) **Presyncope**
- 2) **Central Causes of Dizziness**
- 3) **Peripheral Causes of Dizziness**
- 4) **“Weak and Dizzy” aka general medical cause**

Differential for Acute Dizziness

1) **Presyncope**

a) Orthostatic, vasovagal, cardiac, etc...

2) **Central Causes of Dizziness**

3) **Peripheral Causes of Dizziness**

4) **“Weak and Dizzy” aka general medical cause**

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- a) Cerebrovascular accident (stroke/TIA/ICH)
- b) Multiple sclerosis
- c) CNS tumour
- d) Drug intoxication or side effect
- e) Post Concussion Syndrome
- f) Vestibular migraine

3) **Peripheral Causes of Dizziness**

4) **“Weak and Dizzy” aka general medical cause**

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- a) BPPV
- b) Vestibular neuritis
- c) Meniere's Disease
- d) Superior Canal Dehiscence Syndrome
- e) Acoustic Shwannoma

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"weak
and dizzy"

"malaise"

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"malaise"

5) Metabolic: eg hypoglycemia, hyponatremia...

Simplified “Big 3” Approach for Acute Dizziness

- 1) **BPPV** – common, you can accurately diagnose on H+P
- 2) **Vestibular Neuritis** – common, you can accurately diagnose on H+P
- 3) **Dizzy Stroke/CVA** – uncommon but serious, you don't want to miss it

Key Anatomy/Physiology Concepts

1) Vestibular Apparatus

- Senses Movements of the Head

2) Vestibular Nerve

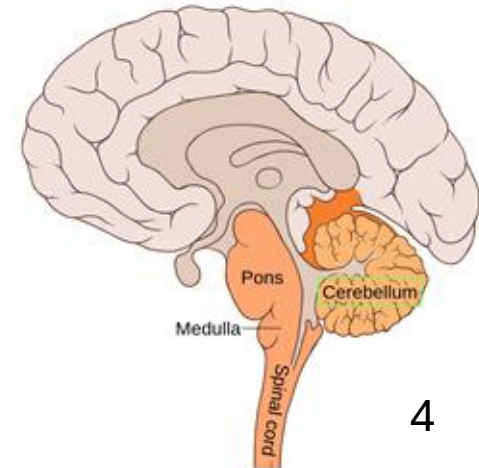
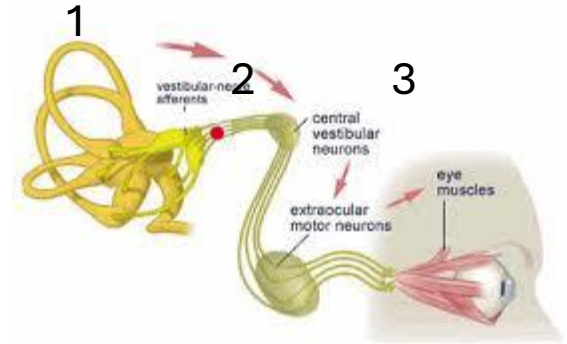
- Relays information from VA

3) Vestibulo-Ocular Reflex

- **extra-ocular muscles** receive **continuous input** from vestibular apparatus (auto-stabilize)

4) Cerebellum

- Controls balance and coordination



1. BPPV

Most common cause peripheral vertigo

Median age ~52

Caused by loose debris (otoconia) within the semicircular canals

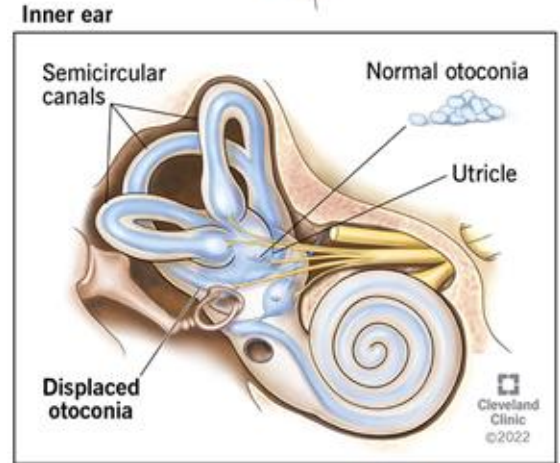
Intermittent intense, short-lived vertigo episodes initiated by head movements

Eventually resolves after otoliths return to utricle

- Takes average of ~2-6 weeks to resolve without treatment
- Appropriate particle repositioning maneuvers should result in immediate cure

Benign Paroxysmal Positional Vertigo

BPPV



Key Word: Paroxysmal

- Typical presentation for BPPV is someone who gets **sudden intense dizzy spells lasting <1min that are triggered by lying down or turning over in bed and resolve when still**

CAVEATS:

patients are often nauseous and feel generally unwell for minutes/hours after attack

patients sometimes feel a milder “residual dizziness” between attacks



2. Vestibular Neuritis

Acute unilateral vestibular nerve dysfunction

- Thought to be postviral/inflammatory

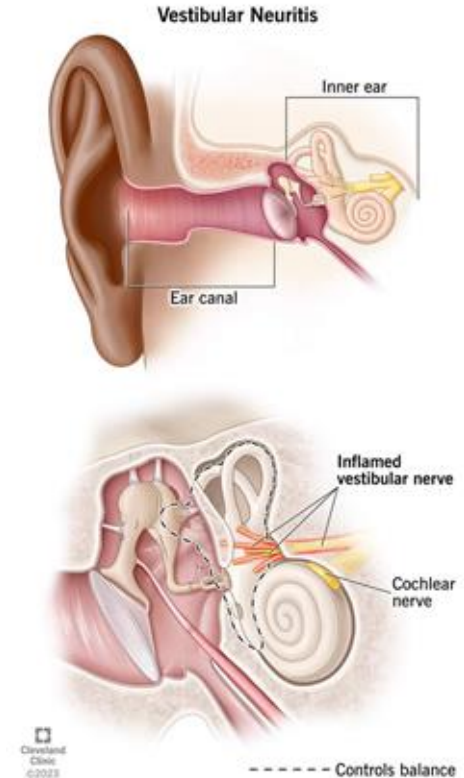
Most common in ages 30-50

Causes acute onset of **continuous** vertigo, nystagmus, imbalance, nausea, vomiting lasting hours to days (Acute Vestibular Syndrome)

Dizziness is continuous, even when patient is completely still, but worse with head movements

Self-limited, dizziness is usually worst on day 1-2 and resolves gradually over days-weeks

Causes unidirectional, horizontal nystagmus*



3. Dizzy Stroke

Infarction of cerebellum / posterior circulation

~2-5% of all Dizzy ED patients

Sudden onset continuous dizziness and/or imbalance

- NB: Acute Vestibular Syndrome = dizziness, nystagmus, N/V, imbalance x hours-days

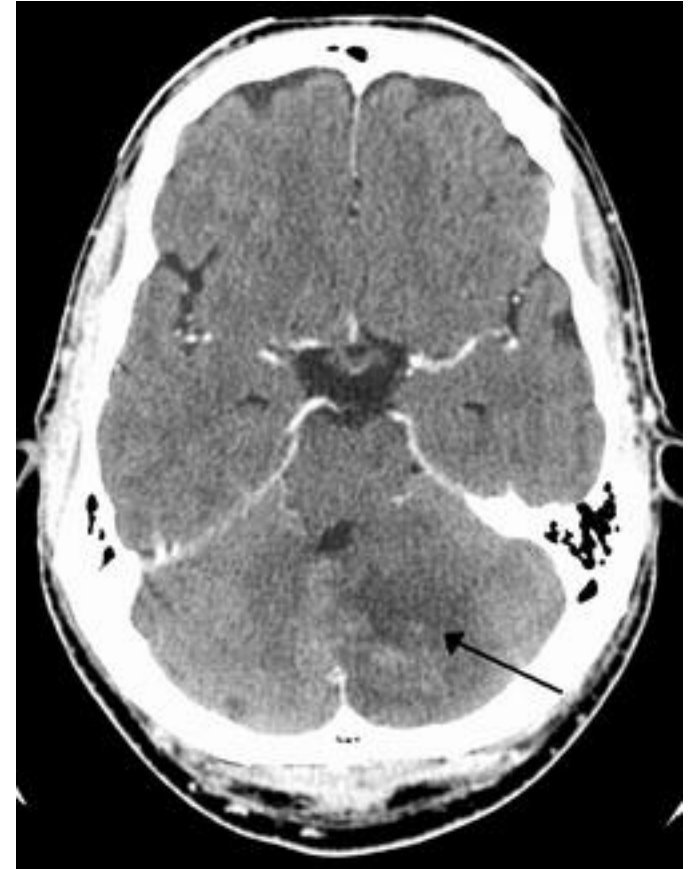
Often + other neurological features

Significant Ataxia / Inability to walk is worrisome for stroke

Nystagmus may or may not be present

Significant morbidity and mortality

Not well seen on CT



Approach to Evaluating Acute Dizziness

Step 1 - Screen For Central Features!!

New significant headache or neck pain

Focal Neurologic Symptoms

5 Dangerous D's (Dysarthria, Diplopia,
Dysphagia, Dysmetria, Dysphonia)

Vertical Nystagmus at Rest

New significant ataxia / inability to walk



All of these patients need workup for stroke/central causes

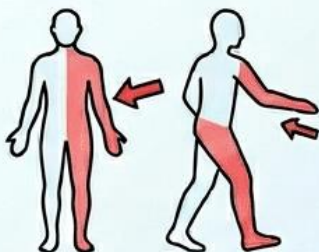
VERTIGO & DIZZINESS SCREENING

WORK-UP FOR CENTRAL CAUSE IF ANY OF THE FOLLOWING ARE PRESENT:

1. SYMPTOMS & SIGNS

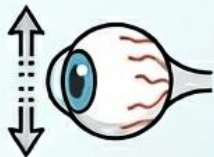


**NEW, SIGNIFICANT
HEADACHE OR NECK PAIN**



**NEW FOCAL WEAKNESS
OR SENSORY DEFICIT**

2. EYE MOVEMENT & GAIT



VERTICAL NYSTAGMUS



**INABILITY TO WALK UNAIDED
(OR ANY NEW GAIT ABNORMALITY
IF NO NYSTAGMUS)**

3. DANGEROUS/DEADLY D'S:



**DIPLOPIA
DOUBLE VISION**



**DYSARTHRIA
SLURRED SPEECH**



**DYSMETRIA
LACK OF COORDINATION
(finger to nose)**



**DYSPHONIA
HOARSE VOICE**



**DYSPHAGIA
TROUBLE SWALLOWING**

IF PRESENT: CONSIDER IMAGING (MRI), NEURO CONSULT.

Myth: Asking A Patient “What Do You Mean By Dizzy” is a Reliable Way to Determine Cause

4 subjective sensations of dizziness:

- vertigo (vestibular problem)
- presyncope (cardiac problem)
- disequilibrium (cerebellar problem)
- nonspecific dizziness (psychiatric or metabolic)

But is it really that simple???

Patients suck at describing dizziness

- 2007 Study of ~300 ED patients who complained of dizziness
 - 62% selected more than one type of dizziness
 - Asked to select from a list; 54% did not pick a symptom they previously endorsed in open ended description
 - 70% who initially did not identify spinning; did say spinning with direct questioning
 - 52% changed their response when re-surveyed 5-10min later

What do you
mean by "dizzy?"

I mean I'm dizzy!!!



Myth Busted:

Subjective description of dizziness unreliable and inconsistent

Conversely- other parts of the history including: onset, trigger, duration, intensity, associated symptoms **ARE** reliable

Patient's subjective description of dizziness **cannot** definitely rule in or out any cause



MOST IMPORTANT QUESTION FOR DIZZINESS

~~“What do you mean by dizzy?”~~

“What were you doing when the dizziness started?”

History Pearl

2018 Study of 149 Patients Seen at an ENT Dizziness Clinic in Sweden

59/149 were diagnosed with BPPV

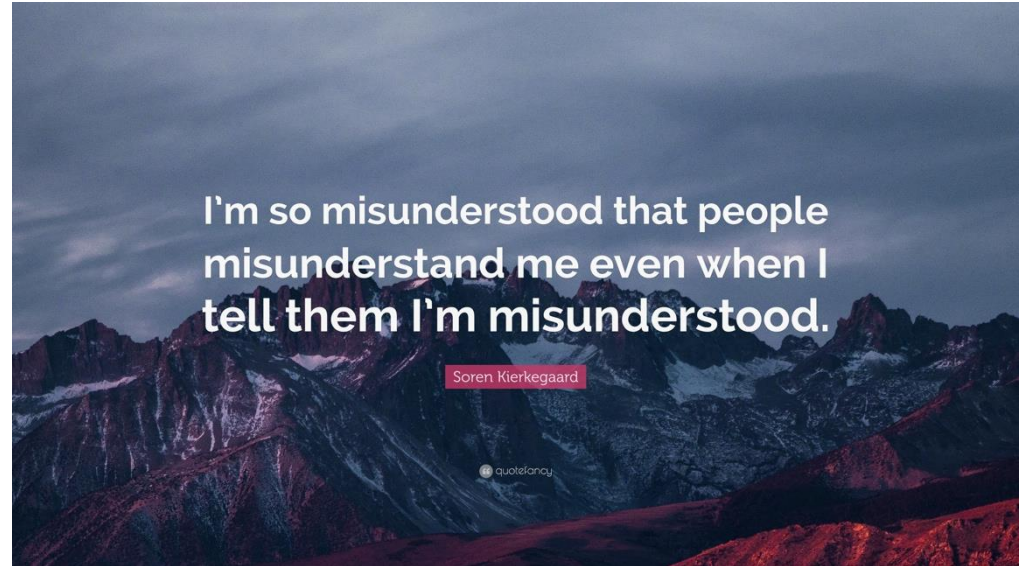
“Dizziness when laying down or turning in bed”

Odds Ratio for BPPV = 60

“Continuous dizziness duration (as opposed to lasting seconds)”

Odds Ratio for BPPV = 0.06

Let's Talk About Clinical Vertigo Maneuvers



Dix Hallpike Knowledge Question

You are seeing a patient who reports 30-second attacks of intense dizziness triggered by turning over in bed that subside when lying still. Right ear Dix Hallpike is unremarkable. You perform a Left Ear Dix Hallpike and see subtle horizontal, left beating nystagmus lasting 10 seconds and the patient feels a little dizzy. What is your next best step?

- a) Proceed with Left Ear Epley to treat left ear BPPV
- b) Perform a Supine Roll Test
- c) Proceed with Right Ear Epley
- d) Perform the Gufoni Maneuver

BPPV, not a single diagnosis

- There are 2 ears
- Each ear has 3 semicircular canals
- Different provocative tests are designed to move otoconia in different canals
- Otoconia produce different types of nystagmus depending on which canal they are in

==> Therefore, we can **localize** which ear and canal the stones are in using provocative testing, **by watching to see if the correct nystagmus occurs**

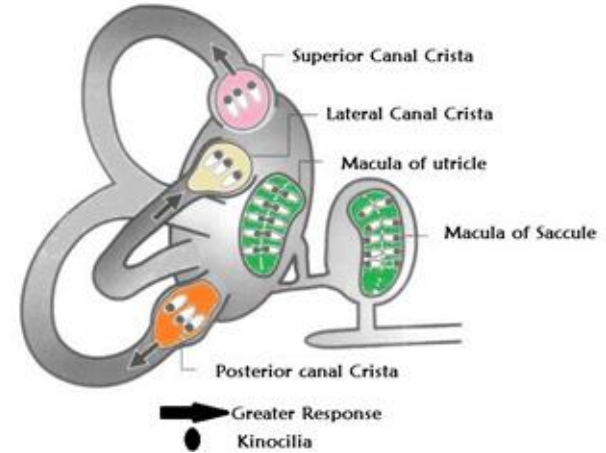
Posterior Canal BPPV

Most common BPPV subtype
= **~60-65% of all BPPV**

Otoconia are in posterior canal

Dix Hallpike is the provocative test for these patients

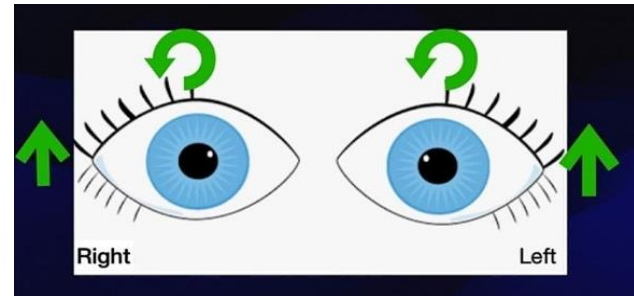
Provocative Testing Produces Torsional Nystagmus



Dix Hallpike



Dix Hallpike on the affected side is positive **ONLY** if you see ~5-40 seconds of nystagmus with an **upward** and **torsional** component

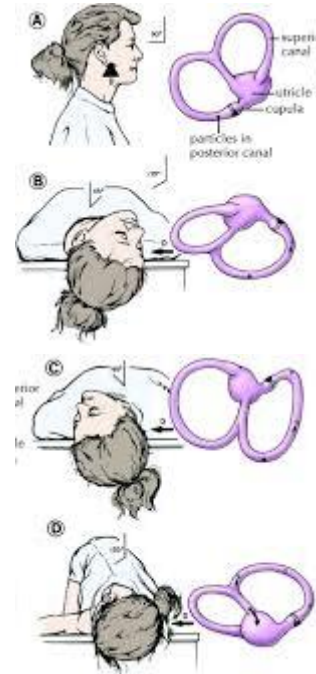


Nystagmus seen in R ear BPPV

Positive Dix-Hallpike Test

Peter Johns MD, FRCPC
Department of Emergency Medicine
University of Ottawa

Epley Manuever to Cure Posterior Canal BPPV

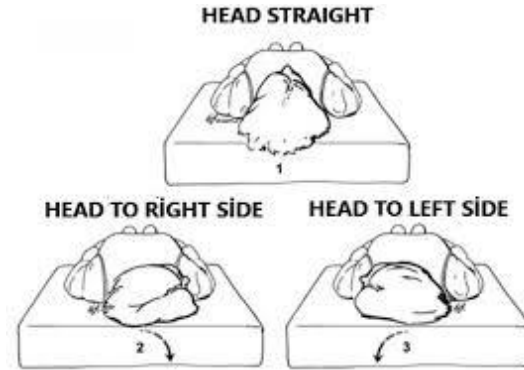




Horizontal Canal BPPV

~30% of BPPV

Supine Roll Test



SRT produces **horizontal nystagmus** which either beats towards the ground or away from the ground (geotropic or apogeotropic)

Gufoni Maneuver is the curative maneuver

HUGE Pearl - if you do a Dix Hallpike but see horizontal nystagmus or no nystagmus, do a Supine Roll Test to check for HC BPPV

Which is the affected ear?

- The side with the more intense nystagmus is “pointing” at the affected ear.

Dix Hallpike Knowledge Question

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a) Proceed with Left Ear Epley to treat left ear BPPV

b) Perform a Supine Roll Test

... horizontal nystagmus suggests horizontal canal BPPV, which is tested for with supine roll test

c) Proceed with Right Ear Epley

d) Perform the Gufoni Maneuver

+ve Dix Hallpike = upward, torsional nystagmus

HINTS Exam Knowledge Question

You are seeing a patient with acute vestibular syndrome, continuous for 3 hours now. Negative for central features and you suspect vestibular neuritis. The patient has right beating horizontal nystagmus present in primary gaze, which gets more intense when the patient looks to the right. If the patient has vestibular neuritis, what will you see when you perform a head impulse test?

- a) Catch up saccade when head is moved quickly to the right only
- b) Catch up saccade when the head is moved quickly to the left only
- c) Catch up saccade when head is moved quickly in either direction
- d) No catch up saccade with quick head movements in either direction

Intro to HINTS+

You are seeing a 60y/o M - 3h ago was at home eating breakfast and had progressive onset over 5 minutes of continuous dizziness, nausea, imbalance, with 2 episodes of vomiting. The symptoms have been **constant** over 3h. He is lying still on the stretcher with eyes closed, and when he opens his eyes you notice nystagmus.

What Syndrome does he have?

Negative for central features on history and screening neuro exam.

What could be the cause of his ongoing vertigo+nystagmus? What is the next step?

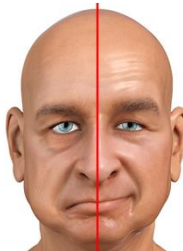
Simplified Analogy

Any patient with acute unilateral face droop

→ Your main job is to determine if they are having Bell's Palsy (nerve problem) or a stroke (brain problem)

Any patient with acute vestibular syndrome

→ Your main job is to determine if they are having Vestibular Neuritis (nerve problem) or a stroke (brain problem)



HINTS+ exam

Key question: in a patient with AVS, are there any physical exam findings / bedside tests that can accurately differentiate peripheral from central cause?

HINTS = clinically validated, battery of 3 physical exam findings that accurately differentiate vestibular neuritis vs central lesion (mostly stroke) in patients who have acute vestibular syndrome with nystagmus

Plus a bedside test of hearing (finger rub)

In patients with **AVS with nystagmus**; Central (as opposed to peripheral) HINTS+ exam had **sensitivity 99.0 specificity 84.8** for central cause

Most recent meta-analysis: HINTS+ LR(-) is **0.11**

N->TS->HI

(save head impulse for last)

A central finding on any one of these tests means the overall HINTS exam is central

N = Typical Nystagmus in Vestibular Neuritis (VN)

WHAT IT IS

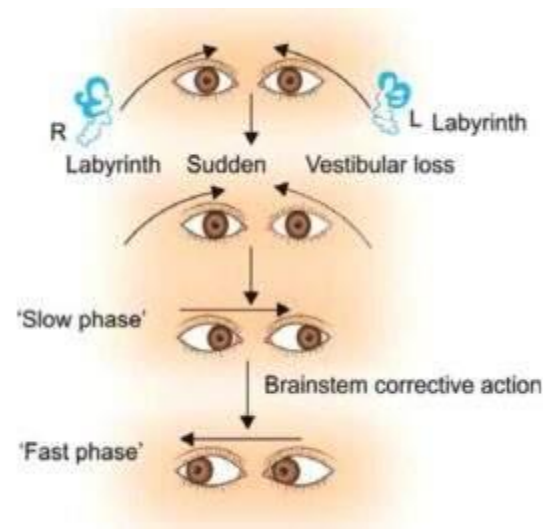
- Unidirectional, horizontal, beating away from the affected ear
- More pronounced when patient gazes in the direction of the nystagmus
- Fades as symptoms improve, sometimes subtle (best seen on day 0-1 of symptoms)
- Decreased by visual fixation

^if you're thinking VN, the nystagmus should look like this

WHAT IT ISN'T

- Direction changing with gaze
- Vertical

^If you see either of these, you're probably dealing with a stroke



Nystagmus of VN -unidirectional, increases w gaze in direction of nystagmus



DIRECTION CHANGING NYSTAGMUS – Cannot be VN



T = Test of Skew

Skew Deviation =
vertical/diagonal
misalignment of the eyes
attributable to a central lesion

Alternate from L eye covered to
R eye covered. At no time
should both eyes be
uncovered.

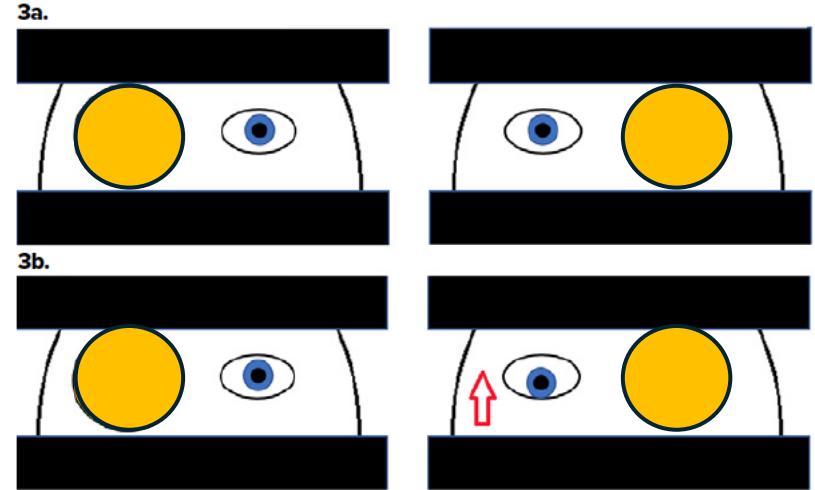


FIGURE 3. A test of skew with no vertical skew (3a) compared to one with a vertical skew that begins to correct when the eye is uncovered (3b).

Vertical/Diagonal Skew Deviation – NEVER VN

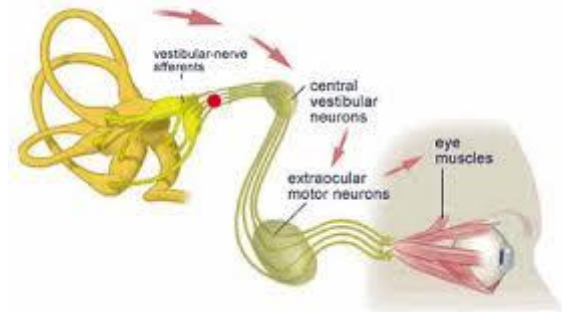


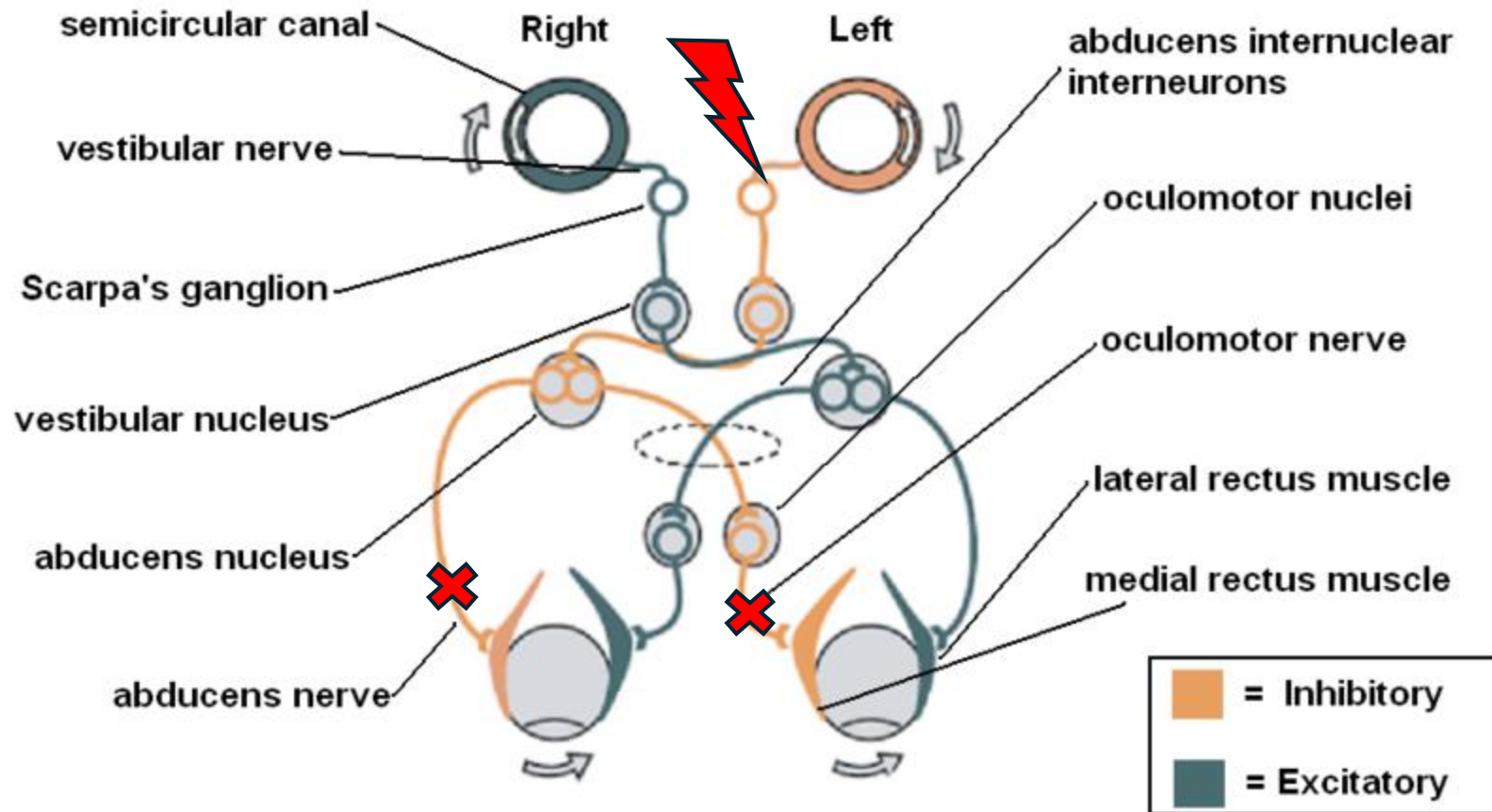
HI = Head Impulse Test for Vestibulo-Ocular Reflex

Vestibulo-ocular reflex (VOR) = continuous vestibular input to eye muscles, causes eyes to automatically adjust to head movements

Patients with VN *must, by definition*, have an **impaired VOR on the affected side**

We can demonstrate impaired VOR with the with head impulse test





How to Perform a Head Impulse Test

Explain exam to patient, ask them to keep their eyes on your nose

Hold their skull with your hands

Move their head slowly back and forth 30 degrees left and right

Perform sudden rapid head movements back to midline while observing their eyes

In VN, catch up saccade should occur when only when head is moved quickly towards the affected ear

Counterintuitive

Abnormal Head Impulse Test => reassuring (it **will** be abnormal if they are having vestibular neuritis)

Normal Head Impulse Test => worrisome (it means they **can't** be having vestibular neuritis so they're probably having a stroke)

*Note: Since VN causes **unilateral** vestibular nerve dysfunction, HIT should only be abnormal in **one direction** (towards affected ear)





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Left ear VN produces R beating nystagmus and an abnormal L HIT

What if my dizzy patient has no nystagmus?

Vestibular neuritis CAUSES nystagmus (at least in the first couple days)

HINTS exam will only be **peripheral** if the patient **actually has** vestibular neuritis, all other patients will test central regardless of etiology

Patients who are “dizzy” without nystagmus could have many things wrong with them (including BPPV, vestibular migraine, dehydration, hypoglycemia, anemia, arrhythmia, orthostatic hypotension, MI, anxiety, hyponatremia, sepsis etc etc)
→ HIT will **falsely** suggest stroke in all these patients

But “dizzy” patients without nystagmus could be having a STROKE
→ HIT not helpful here as it doesn't differentiate stroke vs non-stroke Ddx

Be **vigilant** for central features – **especially new objective difficulty walking**

NO NYSTAGMUS?

**NO HINTS EXAM FOR
YOU!**

Diagnosis and Management of VN

Your documented history and exam findings must be consistent with your diagnosis (eg L VN produces R beating unidirectional nystagmus and abnormal L HIT)

Central screen negative, HINTS+ peripheral -> if they can ambulate they can be safely discharged

Counsel on diagnosis and expected trajectory -> 1st few days are worst, gradual improvement over days-weeks

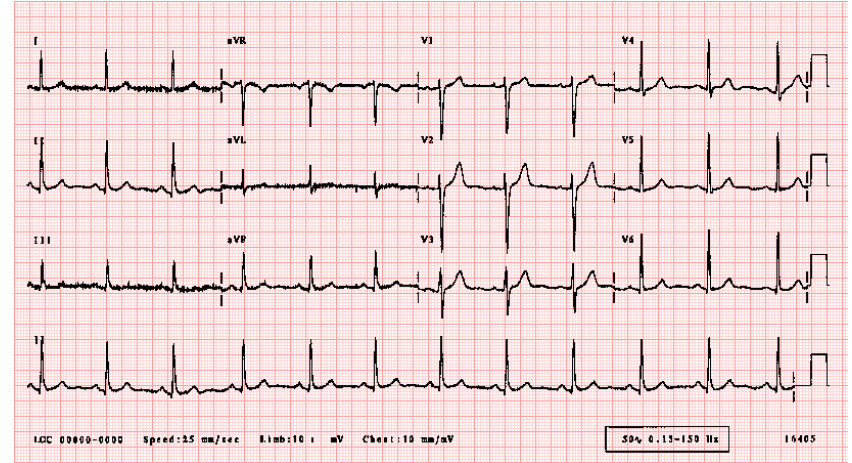
Vestibular Rehabilitation IS helpful

Steroids and antivirals not well-supported by evidence

Dimenhydrinate PRN for nausea for maximum 3 days

Clear return to ED instructions

Can Non-Specialists Use the HINTS Exam?



Myth - Normal CT Means My Dizzy Patient Is Not Having A Stroke

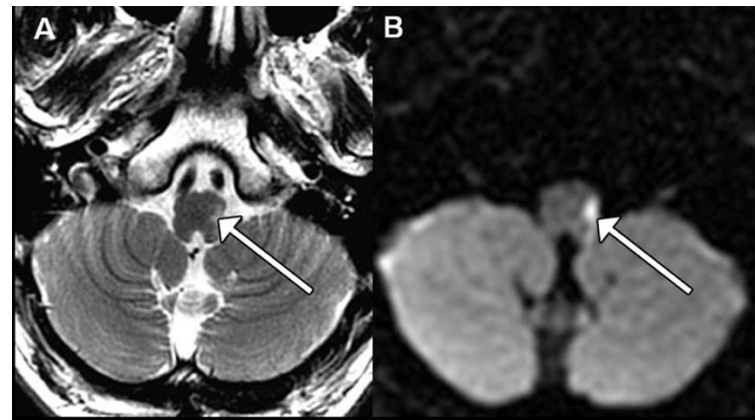
CT Sensitivity 28.5 %

CTA Sensitivity 14.3 %

MRI Sensitivity 79.8 %

(delayed MR after ~48 hours is more sensitive than early MR)

HINTS+ Sensitivity 99.0%



Putting it all together

Patient with acute
dizziness/vertigo:
Simplified Approach

Central Features Present?

New headache/neck pain, focal neuro symptoms,
Dangerous D's, vertical nystagmus at rest, new
inability to stand/walk unaided

Must workup for stroke, CONSIDER

- CT/CTA to r/o bleed/dissection
- Admission for observation + MRI
- Antiplatelet
- Consult Neuro
- Local hyperacute / "Code Stroke" protocol if new profound/disabling deficits <24h

Central Features Absent?

Always consider general
medical causes + postural
hypotension

**<2min attacks of dizziness
triggered by head movements:**
provocative testing for BPPV,
particle repositioning maneuver
if positive

**Spontaneous, continuous
dizziness+N/V+nystagmus
lasting hours to days: HINTS+**
peripheral and can ambulate – dx
with VN and dispo home

HINTS+ central

Big 3 + 1 = Vestibular Migraine

Common

Recurrent (≥ 5), transient episodes of vertigo lasting minutes-days

Episodes often have migraine features (eg progressive onset over 30 minutes-hours, photophobia, phonophobia, activity avoidance, visual symptoms)

Episodes often associated with headache

In a patient with history of migraine-type headaches

Helpful Educational Resources

- **Peter Johns' Youtube Channel**
- **Spin Class** – online CME course by Peter Johns + Scott Weingart
- **VertiGuide** – smartphone app hosted by Johns Hopkins based on GRACE-3 guidelines

References

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A few other considerations

BPPV on History but Positional Testing Negative?

Eg, You are seeing a 60F patient who reported sudden onset intense vertigo lasting 1 minute after turning over in bed. It settled when she lay still but then she had 4x similar episodes every time she repositioned or tried to get up out of bed, so she called EMS. She vomited once. Last episode was 3h ago now, in ED she feels milder residual dizziness and nausea but nothing like the episodes at home.

Screens -ve for central features. Dix Hallpike is -ve. Supine roll test is -ve.

→BPPV is a self-limiting condition that eventually resolves without treatment.

No red flags for central dizziness, and history consistent with BPPV – you can discharge with a diagnosis of resolved BPPV and good followup instructions

Ask patient “go ahead and do something you think will make you dizzy” prior to dc

What About Transient Dizziness? Could it be TIA?

Dizzy TIA mimics = common, dizzy TIA = uncommon

Always consider TIA mimics, eg postural hypotension, BPPV, vestibular migraine, Meniere's, post concussion syndrome, cardiac syncope...

Transient dizziness with other central features → workup and manage as TIA

Not consistent with TIA mimic, AND patient has stroke risk factors → workup and manage as possible TIA

If not an obvious TIA mimic but low risk for stroke, consider local practice patterns

What about Labyrinthitis?

- Some debate around the nomenclature
- Generally accepted that VN causes pure vertigo while labyrinthitis causes vertigo PLUS additional inner ear symptoms (ie vertigo + tinnitus/hearing loss)
- SSNHL may present as labyrinthitis (hearing loss, vertigo, tinnitus)
- SSNHL often idiopathic, but could be caused by AICA stroke (so new hearing loss is a central finding in HINTS+)
- If concern for SSNHL = contact ENT **emergently** and **start prednisone** 60mg PO daily
 - Pt will likely require MR to rule out AICA stroke or other lesion – depending on overall presentation, will need to decide if admission for MR/stroke pathway vs outpatient ENT/audiology pathway
- Hum test is helpful to differentiate conductive vs sensorineural

Sudbury Vertigo Score

- Prospective Cohort, 3 academic centres
- 4559 ED patients w chief complaint of vertigo, dizziness, or imbalance
 - 2.3% had serious diagnosis
- Low Risk: score <5 points - 0% risk of stroke
- Mod risk: score 5-8 – 0.9% risk of stroke
- High Risk score >8 – 16% risk of stroke

Sudbury Vertigo Risk Score.

Predictor	Points
Stroke risk factors	
Male	1
Age >65	1
Diabetes	1
Hypertension	3
Neurological deficits	
Motor/sensory	5
Cerebellar ^a	6
BPPV diagnosis	-5

Problem: BPPV diagnosis+neuro deficits doesn't make sense!

Could miss YOUNG patients with strokes if clinician thinks it's BPPV or subtle neuro find

Could mislead for older patients with obvious BPPV who just need epley/gufoni

Appendix/Extras

Dix Hallpike video

<https://www.youtube.com/watch?v=7ePecb9azS4>

Epley Maneuver Video

<https://youtu.be/kvVnEsGVLUY?si=XcO8sliRAL1yRuG4&t=120>

Supine Roll Video

<https://youtu.be/VRjRTnlw9YE?si=geK5KKaGFfZgemue&t=231>

HINTS exam video

<https://youtu.be/-VXwD2nskhQ?si=-h16dXI5CJlftcqW&t=161>

<https://youtu.be/lkjWjFSVFGM?si=Ol8MmE5VhTtQOojt&t=340>

End Gaze Nystagmus (normal variant)

<https://www.youtube.com/watch?v=2Ej3jwgwMU>