When Primary Care and Acute Care Overlap: Vivisection of Vertigo

George L. Higgins III, MD, FACEP
Emeritus Professor of Emergency Medicine
Maine Medical Center, Portland, ME
Director of Education and Emergency Partner
BlueWater Health, Brunswick, ME
Clinical Professor of Emergency Medicine
University of New England College of Osteopathic Medicine
Portland, ME

CONTINUING EDUCATION COMPANY

1

Disclosure

I have no financial interests or relationships to disclose.

CONTINUING EDUCATION COMPANY

2

Objectives

- Focus on the two categories of vertigo
- Describe the important clues that differentiate peripheral from central vertigo
- Review the treatment options for peripheral vertigo

3

"DIZZINESS"

What are the Broad Categories?

4

DIZZINESS: Broad Categories

- **Peripheral vestibular dysfunction:**
  - 40%
- **CNS lesion:**
  - 10%
- **Psychiatric disorder:**
  - 15%
- **Pre-syncope/Disequilibrium:**
  - 25%
- **Uncertain:**
  - 10%

VERTIGO } Our Focus Today

5

DIZZINESS: Sorting Out the Causes

- **An accurate history will help you determine if the patient actually is vertiginous**
  - Sit down
  - Ask open-ended questions
  - Listen

6

VERTIGO

7

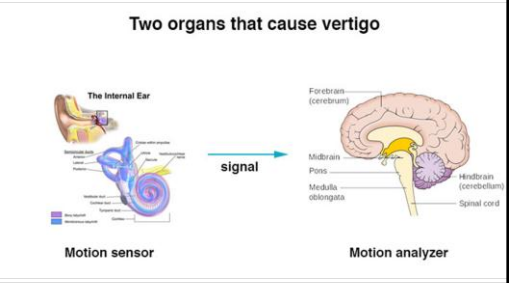
VERTIGO: What Is It?

- A symptom of illusory movement
  - Perceived self-motion
  - Perceived motion of the environment
- We all experienced this as children

8

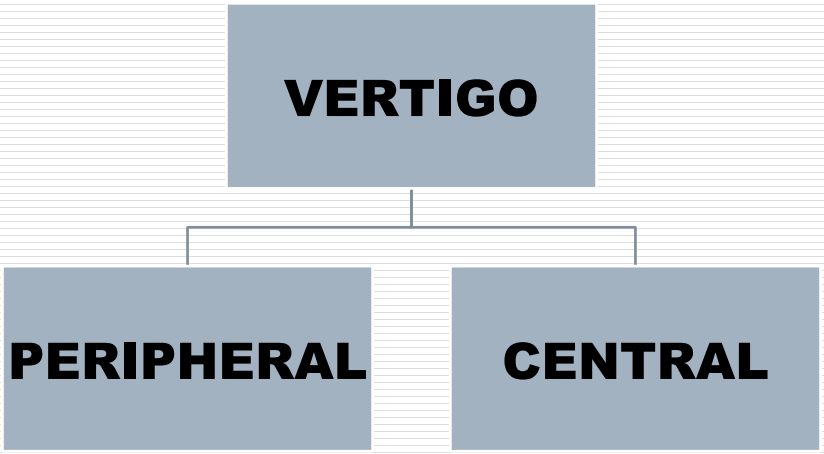
VERTIGO:
What Are the "Motion" Organs?

- **Peripherally (motion sensors):**
  - Semicircular canals sense angular motion
  - Otolithic organs sense linear motion
  - Vestibular labyrinths (bilateral) send signals to the brainstem and cerebellum
- **Centrally (motion analyzer):**
  - The CNS (especially the cerebellum) processes signals from the inner ear and eyes



9

VERTIGO:
The Most Critical Decision



10

Central Vertigo: Causes We Care About

- Cerebellar ischemia, hemorrhage or tumor
- Brainstem ischemia
- Vestibular Migraine

11

CENTRAL VERTIGO: Important Clues

- Any neurologic deficit, including gait instability, no matter how trivial
- Positive Test of Skew
- "Abnormal" Nystagmus
- Negative Head Impulse Test in a persistently symptomatic patient

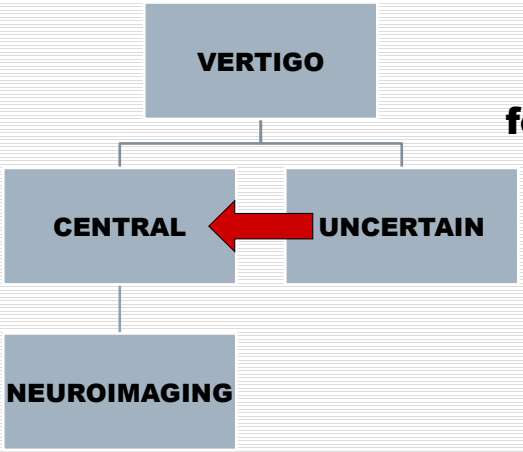
HINTS

- Risk factors: older age, prior stroke/TIA, inability to ambulate, diabetes, etc.
- Worrisome experiential gestalt

All of these should be addressed in your MDM in order to document your comprehensive decision making

12

VERTIGO: Neuroimaging Decisions



Uncertainty occurs when a focused history, neurologic exam, gait testing and a HINTS exam all suggest peripheral, but your experiential gestalt still makes you worry

E.g. an elderly patient with risk factor(s)

13

Basic Reminder of Important Test Characteristics

- **Specificity**
  - **HighSPIN**
  - **High specificity helps RULE IN a condition**
- **Sensitivity**
  - **HighSNOUT**
  - **High sensitivity helps RULE OUT a condition**

14

Neuroimaging Accuracy: Central vs. Peripheral Vertigo

DIAGNOSTIC TEST	Specificity	Sensitivity
Non-contrast CT	99% [95% CI 93-100]	29% [95% CI 14-48]
CTA	98% [95% CI 94-100]	14% [95% CI 2-43]
MRI	99% [95% CI 66-100]	80% [95% CI 71-86]

What does this tell us?

Shah VP: Academic Emergency Medicine 2023

15

Neuroimaging Accuracy: Central vs. Peripheral Vertigo

- ☐ CT is accurate at ruling in a central cause of vertigo
- ☐ CT is inaccurate at ruling out a cause
- ☐ MRI has emerged as the better study, but only when indicated, and still risks missing a central cause

16

Central Vertigo: CT

This patient would be severely symptomatic, making CT a reasonable option.

17

Central Vertigo: MRI

These patients would have subtle findings, making MRI the better option.

18

Neuroimaging Accuracy: Central vs. Peripheral Vertigo

High/Intermediate pretest probability for central vertigo + negative CT = follow-up emergent MRI

19

HINTS

An Essential Bedside Skill

- ☐ **H**ead **I**mpulse test
- ☐ **N**ystagmus
- ☐ **T**est of Skew

Stroke 2009;40:3504
Ann Emerg Med 2014;64:265

20

HINTS

Essential Bedside Skill

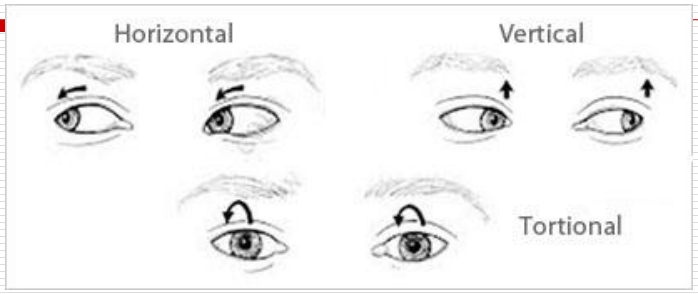
- ☐ **H**ead **I**mpulse test
- ☐ **N**ystagmus
- ☐ **T**est of Skew

These simple bedside tests are still not being performed correctly in the ED setting

Dmitriew C: Academic Emergency Medicine 2021

21

NYSTAGMUS



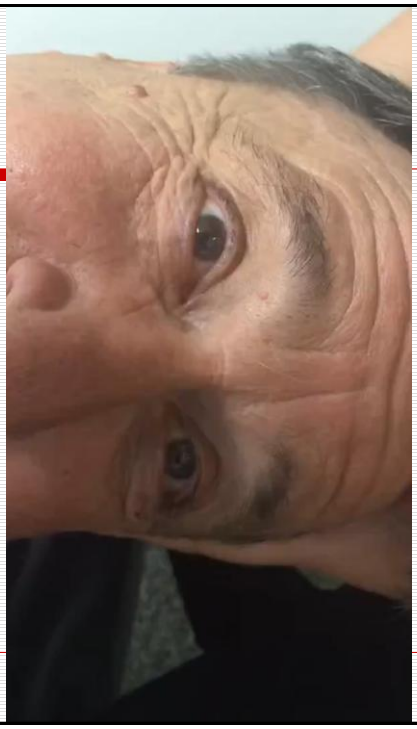
Good Nystagmus:
horizontal, unidirectional

Bad Nystagmus:
vertical, bidirectional, tortional

22

BPPV
Unidirectional
Horizontal
Nystagmus

Produced with Dix-Hallpike Maneuver



23

Bidirectional
Nystagmus

24

Vertical Nystagmus

25

Bidirectional & Vertical Nystagmus

26

TEST of SKEW
ANOTHER CENTRAL CLUE

Have the patient focus on your nose.
Rapidly alternate covering each eye.
Watch for a corrective saccade.
A positive test = central vertigo!

Neurology 2012;79:e146

27

"POSITIVE" Test of Skew

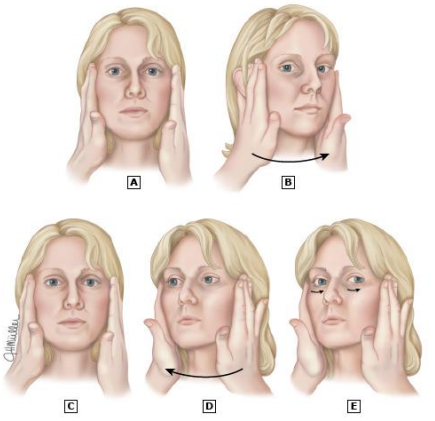
28

Head Impulse Test

- Use it to differentiate vestibular neuritis from central vertigo
- Not a BPPV test
- Patients need to be **persistently symptomatic** at the time of testing
- I perform this as my last HINTS test

29

Head Impulse Test



Watch for a Corrective Saccade

NEJM 2003;348:1027

30

31

"POSITIVE" Right Unilateral Head Impulse Test

32

“POSITIVE” Left Unilateral Head Impulse Test

33

“POSITIVE” Bilateral Head Impulse Test

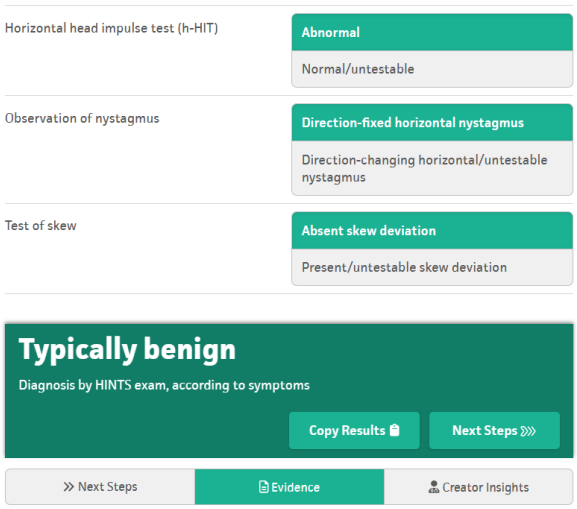
34

Head Impulse Test

- The HIT has an OK specificity, but a not so good sensitivity, so…
- **A positive test = peripheral vertigo (not intuitive!!)**
  - Vestibular nerve dysfunction
- A negative test does not as clearly = central vertigo

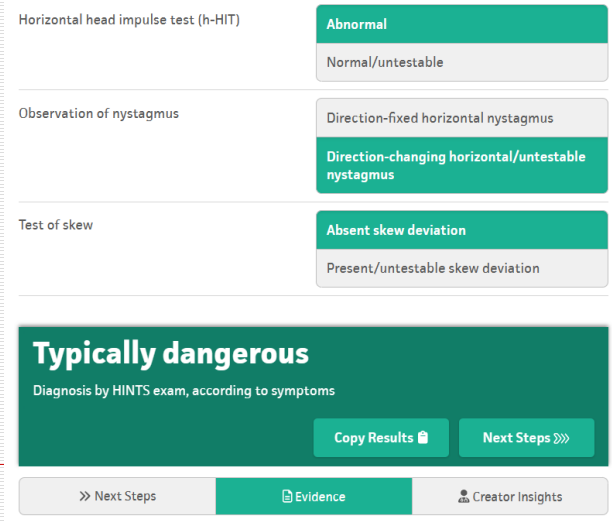
35

HINTS for Stroke in Acute Vestibular Syndrome



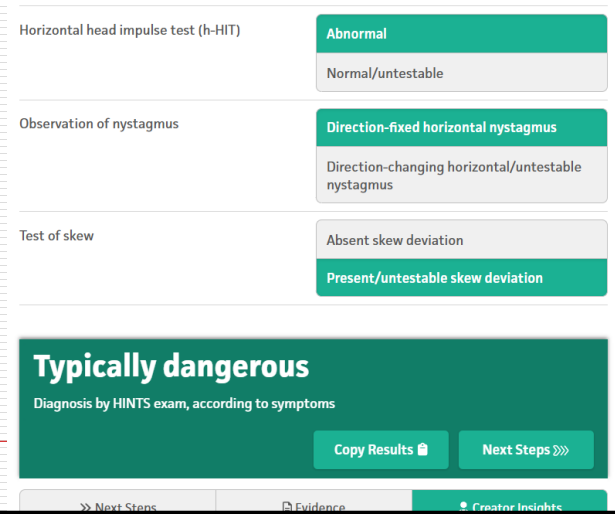
36

HINTS for Stroke in Acute Vestibular Syndrome



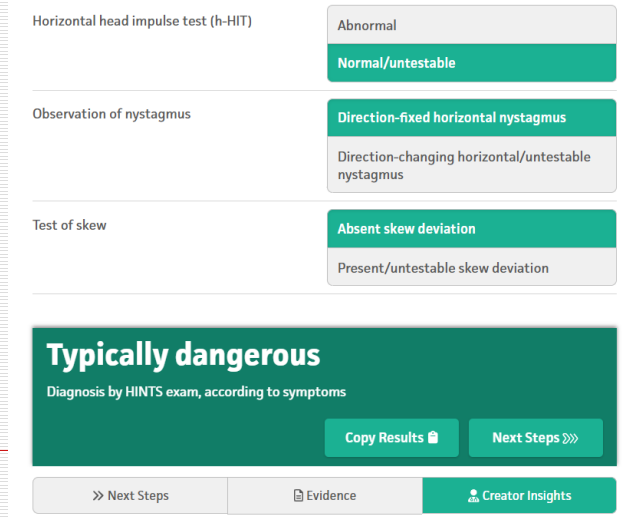
37

HINTS for Stroke in Acute Vestibular Syndrome



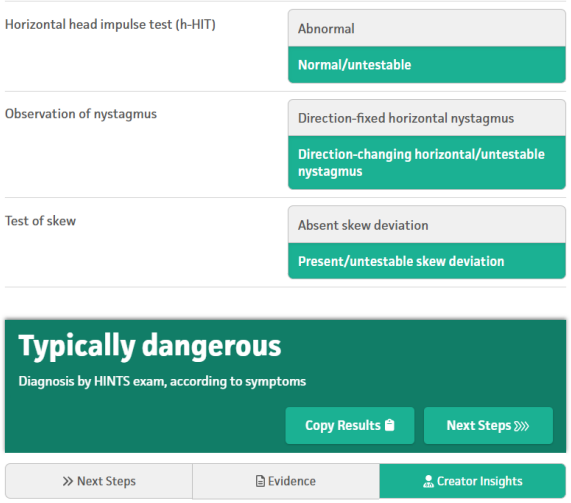
38

HINTS for Stroke in Acute Vestibular Syndrome



39

HINTS for Stroke in Acute Vestibular Syndrome



40

Basic Reminder of Important Test Characteristics

- **Specificity**
  - **HighSPIN**
  - **High specificity helps RULE IN a condition**
- **Sensitivity**
  - **HighSNOUT**
  - **High sensitivity helps RULE OUT a condition**

41

GRACE-3 Systematic Review Findings: Central vs. Peripheral Vertigo

DIAGNOSTIC TEST	Specificity	Sensitivity
Abnormal General Neuro Exam	99% [95% CI 76-98]	47% [95% CI 32-62]
Limb Weakness/ Hemiparesis	98% [95% CI 97-99]	11% [95% CI 5-24]
Truncal/Gait Ataxia	84% [95% CI 52-96]	70% [95% CI 43-88]

Shah VP: Academic Emergency Medicine 2023

42

GRACE-3 Systematic Review Findings: Central vs. Peripheral Vertigo

DIAGNOSTIC TEST	Specificity	Sensitivity
Skew Deviation	98% [95% CI 96-99]	24% [95% CI 15-35]
Negative Head Impulse Test	89% [95% CI 76-96]	77% [95% CI 43-88]
Abnormal Nystagmus	99% [95% CI 92-100]	51% [95% CI 41-60]
HINTS Overall	83% [95% CI 70-92]	93% [95% CI 79-98]

Shah VP: Academic Emergency Medicine 2023

43

GRACE-3 Diagnostic Recommendations

- To help distinguish central from peripheral causes of acute vestibular syndrome:
  - Conduct a complete neuro exam
  - Observe gait for ataxia/unsteadiness
  - Learn and use the HINTS exam as a first-line test
  - Use MRI only for patients with an abnormal or equivocal HINTS exam or neuro exam
  - Do not use CT imaging

Edlow JA: Academic Emergency Medicine 2023

44

A Sample MDM Describing Diagnostic Decision Making

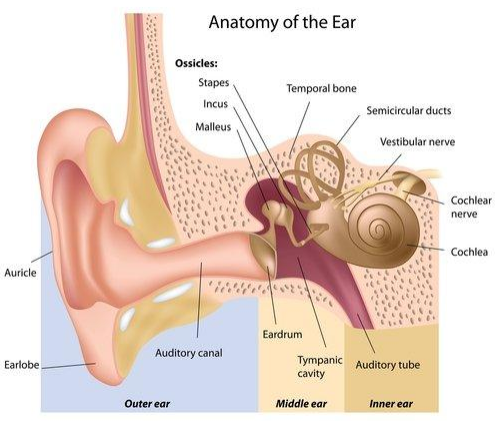
This generally healthy 58-year old woman presents with typical intermittent vertiginous episodes which last less than 5 minutes and clear completely between episodes. These appear to be triggered by head movement. There has been no associated headache. Symptoms began yesterday during usual activity. She denies similar episodes in the past and also denies having vestibular migraine. Her gait has been normal without ataxia. She has experienced no changes in her vision. She reports no concerning risk factors for stroke.

On initial exam, she was alert and asymptomatic at rest. I observed the patient walk about the exam room without ataxia or imbalance. A complete neurologic exam, with particular focus on her cranial nerves, was normal. The HINTS exam revealed no nystagmus initially. However, a Dix-Hallpike provocative maneuver performed later at the bedside caused the onset of acute vertigo with her head turned to the right, associated with horizontal, unidirectional rightward gaze nystagmus. No bidirectional, vertical or tortional nystagmus was observed. Her symptoms and nystagmus resolved spontaneously within two minutes. Her Test of Skew was negative without corrective saccade. The Head Impulse Test was not performed because the patient was not symptomatic at that time.

I feel that the most likely cause of this patient's vertigo is Benign Paroxysmal Positional Vertigo. As this time, given the testing results described above, I believe a central cause is unlikely. Therefore, neuroimaging is not indicated.

45

PERIPHERAL VERTIGO



46

VERTIGO: Peripheral Causes

Peripheral causes
Benign paroxysmal positional vertigo
Vestibular neuritis
Herpes zoster oticus (Ramsay Hunt syndrome)
Meniere disease
Labyrinthine concussion
Perilymphatic fistula
Semicircular canal dehiscence syndrome
Cogan's syndrome
Recurrent vestibulopathy
Acoustic neuroma
Aminoglycoside toxicity
Otitis media

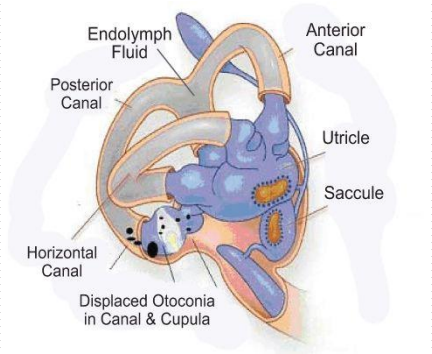
A comprehensive neurologic exam is essential.

Any abnormal finding, even subtle, eliminates peripheral causes from consideration.

47

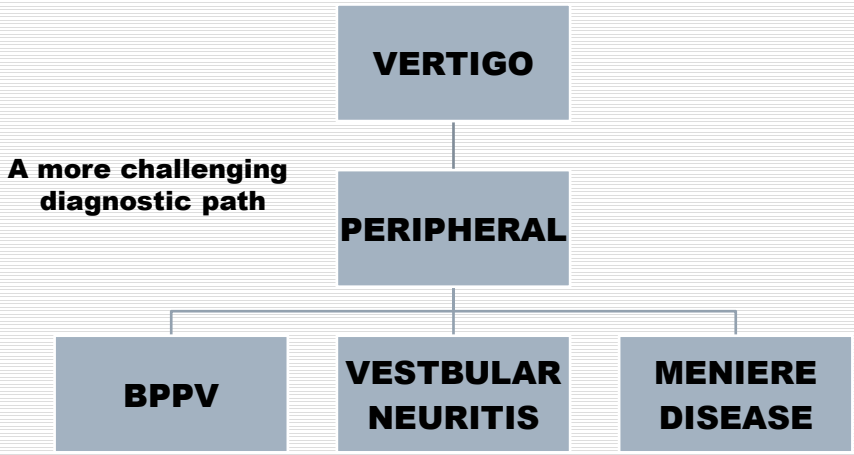
VERTIGO: Most Common Peripheral Causes

- ☐ **BPPV**
- ☐ **Vestibular Neuritis**
- ☐ **Meniere Disease**



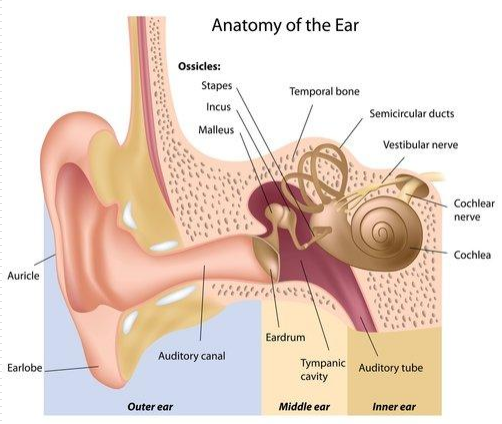
48

VERTIGO: Multiple Binary Decisions



49

Benign Paroxysmal Positional Vertigo



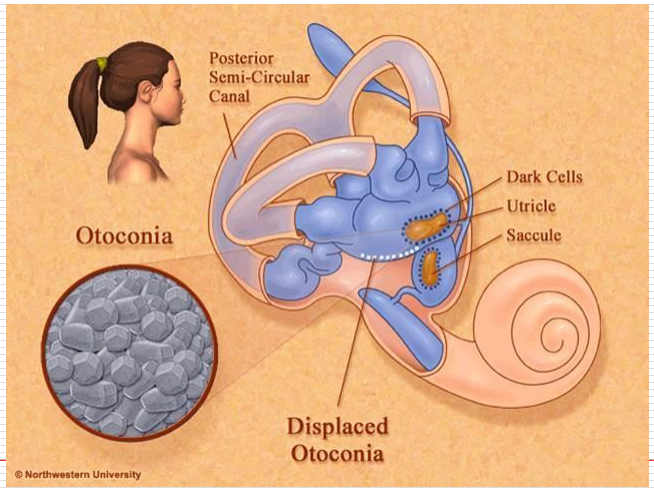
50

VERTIGO: BPPV

- Most common cause of vertigo
- Attributed to displaced otolithic debris within the semicircular canals
  - Canalithiasis
- Diagnosis made by careful history and confirmatory bedside testing
  - E.g. Dix-Hallpike maneuver

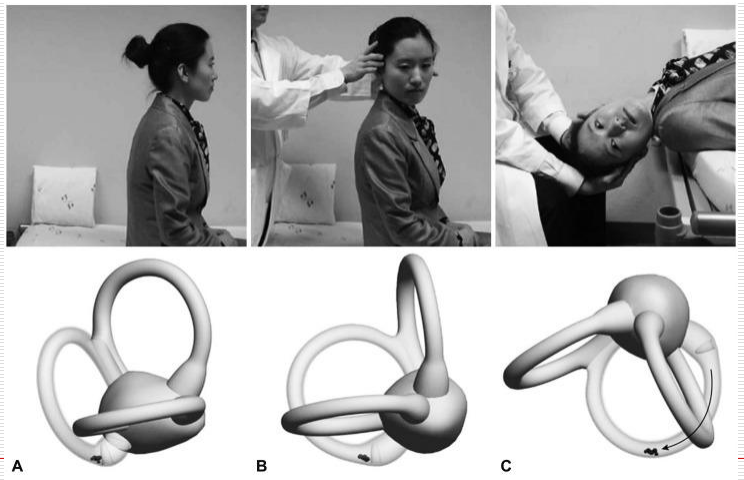
51

VERTIGO: BPPV



52

BPPV VERTIGO: Dix-Hallpike Maneuver



53

VERTIGO: Dix-Hallpike Maneuver

- Performed to provoke symptoms in an asymptomatic patient with a history consistent with vertigo
- It is not required in symptomatic patients
  - And they will never forgive you if you do make them even more symptomatic

54

VERTIGO: Dix-Hallpike Maneuver

- Head is turned to one side and lowered over the edge of the stretcher
- Symptoms and nystagmus may develop within several seconds and improve in about 30 seconds
- If not, repeat the procedure with the head turned to the other side

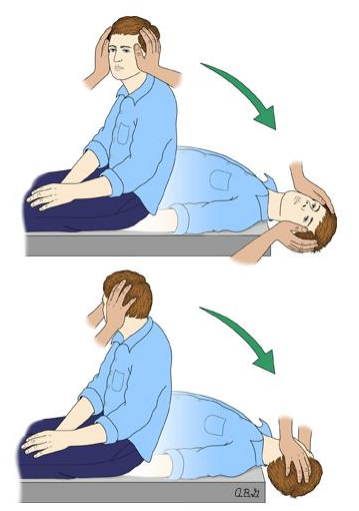
55

VERTIGO: Dix-Hallpike Maneuver

- A well performed D-H maneuver that produces no symptoms suggests spontaneous resolution of BPPV
- A positive D-H maneuver is consistent with BPPV
  - I don't repeat if because I'll move on to the Epley maneuver

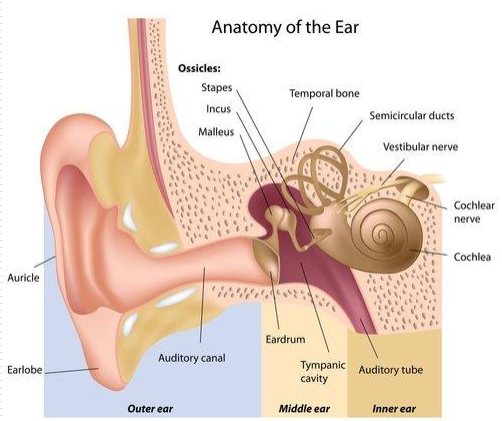
56

BPPV VERTIGO: Dix-Hallpike Maneuver



57

VESTIBULAR NEURITIS & MENIERE DISEASE



58

VERTIGO: Vestibular Neuritis

- Inflammatory disorder of the vestibular nerve
- Symptoms and signs are severe and persistent
  - Vertigo, nausea, vomiting, gait instability
- May include unilateral hearing loss
  - Labyrinthitis

59

VERTIGO: Vestibular Neuritis

- Clinical features mimic cerebellar hemorrhage or infarction
  - Comprehensive neurologic exam essential
  - Lower threshold for neuroimaging
- Symptoms may persist for weeks, but will eventually and gradually resolve

60

VERTIGO: Meniere Disease

- Attributed to excess endolymphatic fluid pressure
- Symptoms may persist for weeks, but will eventually and gradually resolve
- Usually associated with unilateral tinnitus, hearing loss and ear "fullness"

61

BPPV PERIPHERAL VERTIGO

62

Canalith Repositioning Maneuvers Win

- Systematic review
- Vestibular suppressants are not effective in BPPV
- Maneuvers to reposition the obstructing otoliths are
  - Master your favorites
  - Teach your patients and their partners how to perform them at home several times daily until symptoms resolve

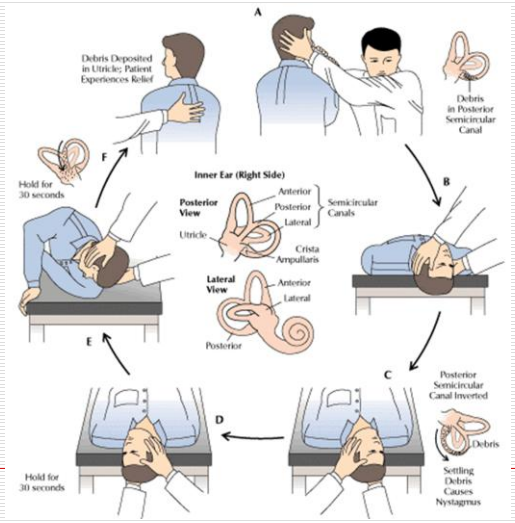
Sharif S: Academic Emergency Medicine 2022

63

Maneuvers for Otolithic Peripheral Vertigo

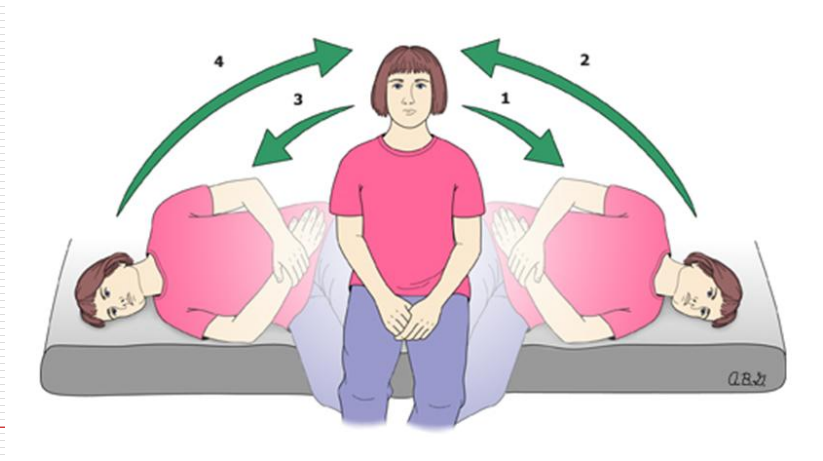
64

Epley Maneuver for Otolithic Peripheral Vertigo



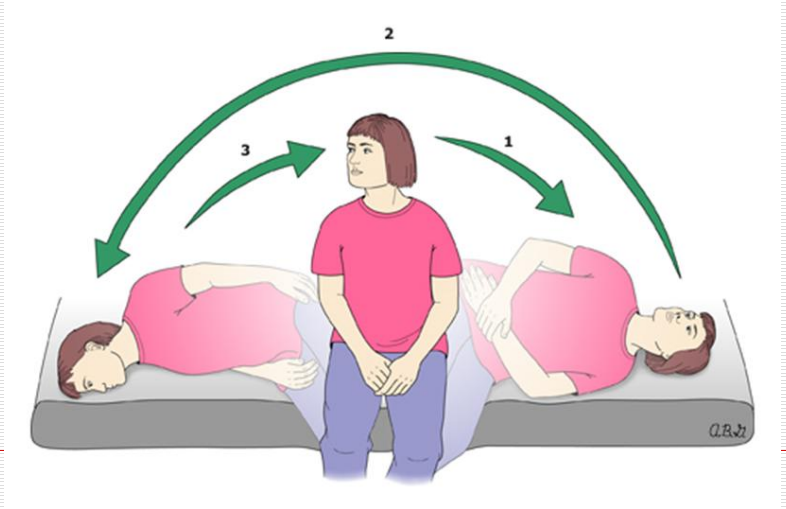
65

Brandt-Daroft Maneuver for Otolithic Peripheral Vertigo



66

Semont Maneuver for Otolithic Peripheral Vertigo



67

VERTIGO: Vestibular Neuritis/Meniere Rx

- **Antihistamines:**
  - meclizine, dimenhydrinate, diphenhydramine
- **Anti-emetics:**
  - prochlorperazine, promethazine, metoclopramide, ondansetron
- **AVOID benzodiazepines:**
  - Not proven to be helpful
  - Clearly proven to be potentially harmful

Hunter BR: JAMA Neurology 2022

68

VERTIGO: Vestibular Neuritis/Meniere Rx

- Discontinue symptomatic treatment as soon as possible
- Avoid compromising long-term adaptation to vestibular loss by the brain
- Vestibular rehabilitation may be required

69

All of the Following Bedside Tests Can Be Helpful in Differentiating Central from Peripheral Vertigo Except:

A. Test of skew deviation
B. Head Impulse test
C. Characteristics of nystagmus
D. Weber/Rinne testing

CONTINUING EDUCATION COMPANY

70

The Dix-Hallpike Maneuver Is Helpful in Diagnosing Which of the Following Causes of Vertigo?

A. Vestibular neuritis
B. Benign paroxysmal positional vertigo
C. Central vertigo
D. Meniere disease

Clinically Relevant Take Aways

- **Vertigo, like chest pain, is a high risk symptom for both the patient and the clinician**
- **Like chest pain, the majority of patients with vertigo have a benign cause**
- **Focused history, observation and physical exam can reliably identify patients at both high and low risk**
  - **A correctly performed HINTS exam is essential**

Clinically Relevant Take Aways

- When neuroimaging is indicated, MRI is currently the better choice if available
- Both CT and MRI will miss a central cause
- High/Intermediate pretest probability for central vertigo + negative CT = follow-up emergent MRI

73

Clinically Relevant Take Aways

- The Dix-Hallpike provocative maneuver, performed in an asymptomatic patient, is a BPPV diagnostic test
- BPPV should be treated with therapeutic maneuvers such as Epley, Semont+ or/or Brant-Daroft

74

Clinically Relevant Take Aways

- Anything other than unidirectional horizontal nystagmus is concerning
- Skew deviation of the eyes = central
- The Head Impulse Test is only performed in a patient with persistent vertigo. A positive result (a corrective saccade) = peripheral vertigo

75

Clinically Relevant Take Aways

The MDM in the medical record should clearly document the critical decision making involved

76