

From Vertigo to Brain Stem Syndromes

Tzong-Luen Wang
MD, PhD, JM, FESC, FACC, FAPSC
Chief, ED, SKH
Professor, MC, FJCU
102.12.31

1

ED Pitfalls

- Mistake syncope as vertigo / dizziness
- Miss the stroke without motor weakness
- Cannot pick up central vertigo / VBI from related population
- Always jump from brain stem reflexes
- Consider all peripheral vertigo as OPD cases

What kind of peripheral vertigo should be stayed for admission?

2

What are these?

- Ramsay-Hunt Syndrome
- Weber's Syndrome
 - Others: Claude, Benedict, Nothnagel, Parinaud, etc.
- Wallenburg's Syndrome
- Millard-Gübler Syndrome
- Foville's Syndrome

3

Vertigo and Dizziness

- Prevalence
 - 1 in 5 adults report dizziness in last month
 - Increases in elderly
 - Worsened by decreased visual acuity, proprioception and vestibular input
- Dizziness
 - Non-specific term
 - Different meanings to different people
 - Could mean

- Vertigo	- Syncope	- Presyncope
- Weak	- Giddiness	- Anxiety
- Anemia	- Depression	- Unsteady

4

Vertigo and Dizziness

- Vertigo
 - Perception of movement
 - Peripheral or Central
- Syncope **Aborted Sudden Death**
 - Transient loss of consciousness with loss of postural tone

5

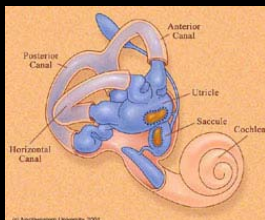
Vertigo and Dizziness

- Presyncope
 - Lightheadedness-an impending loss of consciousness
- Psychiatric dizziness
 - Dizziness not related to vestibular dysfunction
- Disequilibrium
 - Feeling of unsteadiness, imbalance or sensation of "floating" while walking

6

Vestibular Labyrinth

- Pathophysiology
 - Complex interaction of visual, vestibular and proprioceptive inputs that the CNS integrates as motion and spatial orientation
- 3 semicircular canals
 - rotational movement
 - cupula
- 2 otolithic organs
 - utricle & saccule
 - linear acceleration
 - Macula



7

Vertigo and Dizziness

- Normally there is balanced input from both vestibular systems
- Vertigo develops from asymmetrical vestibular activity
- Abnormal bilateral vestibular activation results in truncal ataxia

8

Vertigo and Dizziness

- Nystagmus
 - Rhythmic slow and fast eye movement
 - Direction named by fast component
 - Slow component due to vestibular or brainstem activity
 - Slow component usually ipsilateral to diseased structure
 - Fast component due to cortical correction
- Physiologic Vertigo
 - "motion sickness"
 - A mismatch between visual, proprioceptive and vestibular inputs
 - Not a diseased cochleovestibular system or CNS

9

Vertigo-Differential Diagnoses

- Etiologies of Vertigo
 - BPPV
 - Labyrinthitis
 - Acute suppurative
 - Serous
 - Toxic
 - Chronic
 - Vestibular neuronitis
 - Vestibular ganglionitis
 - Ménière's
 - Acoustic neuroma
 - Perilymphatic fistula
 - Cerumen impaction
- CNS infection (TB, Syphilis)
- Tumor (Benign or Neoplastic)
- Cerebellar infarct
- Cerebellar hemorrhage
- Vertebrobasilar insufficiency
- AICA syndrome
- PICA syndrome
- Multiple Sclerosis
- Basilar artery migraine
- Hypothyroidism
- Hypoglycemia
- Traumatic
- Hematologic (Waldenstroms)

10

Vertigo-History

- Is it true vertigo?
- Autonomic symptoms?
- Pattern of onset and duration
- Auditory disturbances?
- Neurologic disturbances?
- Was there syncope?
- Unusual eye movements?
- Any past head or neck trauma?
- Past medical history?
- Previous symptoms?
- Prescribed and OTC medications?
- Drug and alcohol intake?

11

Vertigo-Physical Exam

- Cerumen/FB in EAC
- Otitis media
- Pneumatic otoscopy
- Tympanosclerosis or TM perforation
- Nystagmus
- Fundoscopic exam
- Pupillary abnormalities
- Extraocular muscles
- Cranial nerves
- Internuclear ophthalmoplegia
- Auscultate for carotid bruits
- Orthostatic vital signs
- BP and pulse in both arms
- Dix-Hallpike maneuver
- Gross hearing
- Weber-Rinne test
- External auditory canal vesicles
- Muscle strength
- Gait and Cerebellar function

12

1. Nystagmus due to peripheral causes has all of the following features except:

- a. Diminishes with fixation
- b. Unidirectional fast component
- c. Can be horizontorotary or vertical
- d. Nystagmus increases with gaze in direction of fast component
- e. Can be accentuated by head movement

13

Nystagmus due to peripheral causes has all of the following features except:

- c. Can be horizontorotary or vertical

Peripheral nystagmus is typically horozonto-rotary, not pure horizontal or rotary and is definitely not vertical.

14

2. Nystagmus due to central causes has all of the following features except:

- a. Does not change with gaze fixation
- b. Can be unidirectional or bidirectional
- c. Can be horizontal, rotary or vertical
- d. Nystagmus increases with gaze in direction of fast component
- e. Can be dramatically accentuated by head movement

15

Nystagmus due to central causes has all of the following features except:

- e. Can be dramatically accentuated by head movement

Vertigo and nystagmus produced by central causes does not significantly worsen with head movement

16

3. All of the following will have hearing loss and tinnitus associated with the vertigo except:

- a. Vestibular neuronitis
- b. Acute labrynthitis
- c. BPPV
- d. Acoustic neuroma
- e. Ménière Disease

17

All of the following will have hearing loss and tinnitus associated with the vertigo except:

- c. BPPV will not have associated hearing loss or tinnitus

All of the other responses will have hearing loss and tinnitus to varying degrees

18

4. T or F The Dix-Halpike maneuver is useful in the treatment of BPPV?

False

The Dix-Halpike is used to precipitate the nystagmus if the nystagmus and vertigo have resolved so a correct diagnosis can be made.

The Epley maneuver is used to relocate the otoliths and therefore treat the BPPV.

19

Dix-Hallpike Maneuver

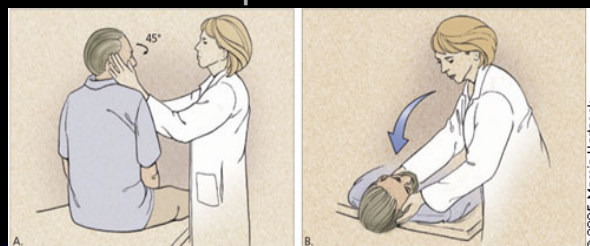


Figure 1. Dix-Hallpike maneuver (used to diagnose benign paroxysmal positional vertigo). This test consists of a series of two maneuvers: With the patient sitting on the examination table, facing forward, eyes open, the physician turns the patient's head 45 degrees to the right (A). The physician supports the patient's head as the patient lies back quickly from a sitting to supine position, ending with the head hanging 20 degrees off the end of the examination table. The patient remains in this position for 30 seconds (B). Then the patient returns to the upright position and is observed for 30 seconds. Next, the maneuver is repeated with the patient's head turned to the left. A positive test is indicated if any of these maneuvers provide vertigo with or without nystagmus.

5. All of the following have been implicated in causing vertigo including:

- a. Loop diuretics
- b. Anticonvulsants
- c. Aminoglycosides
- d. NSAIDS
- e. Fluoroquinolones
- f. All of the above

F All of the above

Many everyday medications can cause vertigo which is easily reversible if recognized.

21

Acute vertigo and dizziness are associated with what type(s) of strokes?

- a. Middle cerebral artery infarctions
- b. Pontine lacunar strokes
- c. Lateral medullary infarctions
- d. Cerebellar strokes
- e. Thalamic hemorrhages

22

Acute vertigo and dizziness are associated with what type(s) of strokes?

c. and d.

Both cerebellar strokes and lateral medullary infarction (Wallenberg syndrome) typically have prominent vertigo and dizziness as symptoms

23

Acute Dizziness: Important Emergency Room Considerations

- Characteristics of peripheral vertigo and dizziness
- Characteristics of vertigo and dizziness of central origin
- Recognizing stroke syndromes that may present with dizziness as a prominent feature
- Treatment considerations in dizziness of central origin
- Treatment of peripheral vestibular dysfunction

24

Case

A 30-year-old male wakes up in the middle of the night with a headache and dizziness. He is unable to fall back asleep, vomits once, and comes to the ED at 6 AM saying that he needs a note for work so he can stay home. The headache is diffuse, nonspecific, not positional, does not radiate into his neck. He has no past history of headaches. The dizziness is described as spinning and present when lying still with his eyes closed.

25

Nystagmus: Characteristics

- Nystagmus of Central Origin
 - May be purely vertical
 - May be purely horizontal
 - May be horizonto-rotary
 - May change direction with gaze
 - Not diminished by fixation

25

Nystagmus: Characteristics

- Nystagmus of Peripheral Origin
 - Horizontal and torsional
 - Diminished by fixation
 - May fatigue (if elicited by head movement)
 - Does not change direction with gaze change
 - Diminishes with fixation

27

Vertigo-Characteristics

	Peripheral	Central
Onset	Sudden	Usually slow
Severity of Vertigo	Intense	Usually mild
Pattern	Paroxysmal	Constant
Exac. by movement	Yes	Variable
Autonomic	Frequent	Variable
Laterality	Unilateral	Uni or bilat
Nystagmus	Horizontorotary	Any
Fatigable/Fixation	Yes	No
Auditory symptoms	Yes	No
TM	May be abnormal	Normal
CNS symptoms	Absent	Present

28

Head - Tilt Test (Nylen-Bárány)

- Produces nystagmus with peripheral lesions
- Nystagmus and vertigo occur when diseased side turned downward
- Peripheral nystagmus may fatigue with repeated maneuvers
- Central lesions are not significantly changed

29

Head - Tilt Test (Nylen-Bárány)

- Nystagmus with peripheral lesions may have latency of 2-20 second and be of short duration (<30 seconds)
- Symptoms of peripheral nystagmus can be dramatically changes with head movement
- Peripheral nystagmus may fatigue with repeated maneuvers
- Peripheral nystagmus typically produced in one head position

30

Vertigo-Ancillary Tests

- CT-if cerebellar mass, hemorrhage or infarction suspected
- Glucose and ECG in the “dizzy” patient
- Cold caloric testing
- Angiography for suspected VBI
- MRI
- Electronystagmography and audiology

31

Acute Dizziness and Vertigo: Peripheral Causes

- Acute vestibular neuronitis
- Acute neurolabyrinthitis
- Meniere's syndrome (endolymphatic hydrops)
- Head trauma (labyrinth trauma)
- Drug-induced (aminoglycosides, phenytoin, phenobarbital, carbamazepine, salicylates, quinine)

32

Peripheral Vertigo-Differential

- Labyrinthine Disorders
 - Most common cause of true vertigo
 - Five entities
 - Benign paroxysmal positional vertigo (BPPV)
 - Labyrinthitis
 - Ménière disease
 - Vestibular neuronitis
 - Acoustic Neuroma

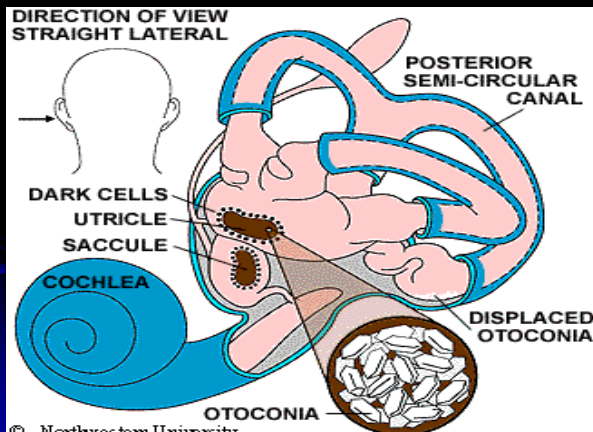
33

Benign Paroxysmal Positional Vertigo

- Extremely common
- Otoconia displacement
- No hearing loss or tinnitus
- Short-lived episodes brought on by rapid changes in head position
- Usually a single position that elicits vertigo
- Horizontorotary nystagmus with crescendo-decrescendo pattern after slight latency period
- Less pronounced with repeated stimuli
- Typically can be reproduced at bedside with positioning maneuvers

34

Otoconia in BPPV



Labyrinthitis

- Associated hearing loss and tinnitus
- Involves the cochlear and vestibular systems
- Abrupt onset
- Usually continuous
- Four types of Labyrinthitis
 - Serous
 - Acute suppurative
 - Toxic
 - Chronic

35

Labyrinthitis

- Serous
 - Adjacent inflammation due to ENT or meningeal infection
 - Mild to severe vertigo with nausea and vomiting
 - May have some degree of permanent impairment
- Acute suppurative labyrinthitis
 - Acute bacterial exudative infection in middle ear
 - Secondary to otitis media or meningitis
 - Severe hearing loss and vertigo
 - Treated with admission and IV antibiotics

37

Labyrinthitis

- Toxic
 - Due to toxic effects of medications
 - Still relatively common
 - Mild tinnitus and high frequency hearing loss
 - Vertigo in acute phase
 - Ataxia in the chronic phase
 - Common etiologies
 - Aminoglycosides
 - Erythromycin
 - Phenytoin
 - Quinidine
 - Alcohol
 - Vancomycin
 - Barbiturates
 - Furosemide
 - Salicylates

38

Labyrinthitis

- Chronic
 - Localized inflammatory process of the inner ear due to fistula formation from middle to inner ear
 - Most occur in horizontal semicircular canal
 - Etiology is due to destruction by a cholesteatoma

39

Vestibular Neuronitis

- Suspected viral etiology
- Sudden onset vertigo that increases in intensity over several hours and gradually subsides over several days
- Mild vertigo may last for several weeks
- May have auditory symptoms
- Highest incidence in 3rd and 5th decades

40

Vestibular Ganglionitis

- Usually virally mediated-most often VZV
- Affects vestibular ganglion, but also may affect multiple ganglions
- May be mistaken as BPPV or Ménière disease
- Ramsay Hunt Syndrome
 - Deafness
 - Facial Nerve Palsy
 - Vertigo
 - EAC Vesicles

41

Ménière Disease

- First described in 1861
- Triad of vertigo, tinnitus and hearing loss
- Due to cochlea-hydrops
 - Unknown etiology
 - Possibly autoimmune
- Abrupt, episodic, recurrent episodes with severe rotational vertigo
- Usually last for several hours

42

Ménière Disease

- Often patients have eaten a salty meal prior to attacks
- May occur in clusters and have long episode-free remissions
- Usually low pitched tinnitus
- Symptoms subside quickly after attack
- No CNS symptoms or positional vertigo are present

43

Acoustic Neuroma

- Peripheral vertigo that ultimately develops central manifestations
- Tumor of the Schwann cells around the 8th CN
- Vertigo with hearing loss and tinnitus
- With tumor enlargement, it encroaches on the cerebellopontine angle causing neurologic signs
- Earliest sign is decreased corneal reflex
- Later truncal ataxia
- Most occur in women during 3rd and 6th decades

44

Acute Dizziness and Vertigo: Central Causes

- Cerebellar infarction
- Cerebellar hemorrhage
- Lateral medullary infarction (Wallenberg's syndrome)
- Other brainstem ischemia
- Multiple sclerosis

45

Central Vertigo-Differential

- Central Vertigo
 - Vertebrobasilar Insufficiency
 - Atheromatous plaque
 - Subclavian Steal Syndrome
 - Drop Attack
 - Wallenberg Syndrome
 - Cerebellar Hemorrhage
 - Multiple Sclerosis
 - Head Trauma
 - Neck Injury
 - Temporal lobe seizure
 - Vertebral basilar migraine
 - Metabolic abnormalities
 - Hypoglycemia
 - Hypothyroidism

46

Vertebrobasilar Insufficiency

- Important causes of central vertigo
- Related to decreased perfusion of vestibular nuclei in brain stem
- Vertigo may be a prominent symptom with ischemia in basilar artery territories
- Unusual for vertigo to be only symptom of ischemia

47

Vertebrobasilar Insufficiency

- Most commonly will also have:
 - Dysarthria
 - Ataxia
 - Facial numbness
 - Hemiparesis
 - Diplopia
 - Headache
- Tinnitus and hearing loss unlikely
- Vertical nystagmus is characteristic of a (superior colliculus) brain stem lesion
- Up to 30% of TIA's are VBI with pontine symptoms and a focal neurologic lesion

48

Drop attack

- Abruptly falls without warning, but does not lose consciousness
- Believed to be caused by transient quadraparesis due to ischemia at the pyramidal decussation

49

Subclavian Steal Syndrome

- Rare, but treatable
- Arm exercise on side of stenotic subclavian artery usually causes symptoms of intermittent claudication
- Blood is shunted away from brainstem into ipsilateral vertebral artery
- Classic history occurs only rarely

50

Wallenberg Syndrome

- Occlusion of PICA
- Relatively common cause of central vertigo
- Associated Symptoms:
 - nausea -vomiting -nystagmus
 - ataxia -Horner syndrome
 - palate, pharynx and laryngeal paresis
 - loss of pain and temperature on ipsilateral face and contralateral body

51

Dorsolateral Medullary Infarction: Wallenberg's Syndrome

- Nystagmus and dizziness
- Nausea and vomiting
- Ataxia and ipsilateral asynergia
- Hoarseness
- Ipsilateral Horner's syndrome
- Ipsilateral facial analgesia; contralateral body analgesia
- No weakness

52

Cerebellar Hemorrhage

- Neurosurgical emergency
- Suspected in any patient with sudden onset headache, vertigo, vomiting and ataxia
- May have gaze preference
- Motor-sensory exam usually normal
- Gait disturbance often not recognized because patient appears too ill to move

53

Multiple Sclerosis

- Vertigo is presenting symptom in 7-10%
- Thirty percent develop vertigo in the course of the disease
- May have any type of nystagmus
- Internuclear ophthalmoplegia is virtually pathognomonic
- Onset during 2nd to 4th decade
- Rare after 5th decade
- Usually will have had previous neurological symptoms

54

Head and Neck Trauma

- Due to damage to the inner ear and central vestibular nuclei, most often labyrinthine concussion
- Temporal skull fracture may damage the labyrinth or eighth cranial nerve
- Vertigo may occur 7-10 days after whiplash
- Persistent episodic flares suggest perilymphatic fistula
- Fistula may provide direct route to CNS infection

55

Vertebral Basilar Migraine

- Syndrome of vertigo, dysarthria, ataxia, visual changes, paresthesias followed by headache
- Distinguishing features of basilar artery migraine
 - Symptoms precede headache
 - History of previous attacks
 - Family history of migraine
 - No residual neurologic signs
- Symptoms coincide with angiographic evidence of intracranial vasoconstriction

56

Metabolic Abnormalities

- Hypoglycemia
 - Suspected in any patient with diabetes with associated headache, tachycardia or anxiety
- Hypothyroidism
 - Clinical picture of vertigo, unsteadiness, falling, truncal ataxia and generalized clumsiness

57

Cerebellar Infarction

- Nystagmus and dizziness
- Nausea and vomiting
- Ataxia and ipsilateral asynergia
- No weakness

58

Imaging in Posterior Circulatory Cerebrovascular Events

- CT good for cerebellar hemorrhage
- CT can miss brainstem acute cerebellar infarctions
- MRI much more sensitive than CT for acute infarction
- Diffusion-weighted imaging may increase yield
- MRA can reveal some, but not all pathology

59

Vertebral Artery Dissection

- May present with posterior circulatory infarction
- May be associated with neck trauma or manipulation, but may be spontaneous
- MRA may reveal double-lumen, but full angiography has higher yield
- Anticoagulation may prevent occlusion or emboli

60

Management

- Based on differentiating central from peripheral causes
- VBI should be considered in any elderly patient with new-onset vertigo without an obvious etiology
- Neurological or ENT consult for central vertigo
- Suppurative labyrinthitis-admit and IV antibiotics
- Toxic labyrinthitis-stop offending agent if possible

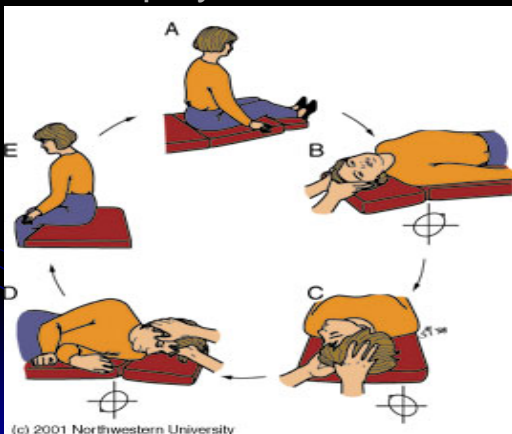
61

Management

- Severe Ménière disease may require chemical ablation with gentamicin
- Attempt Epley maneuver for BPPV
- Mainstay of peripheral vertigo management are antihistamines that possess anticholinergic properties
 - Meclizine
 - Promethazine
 - Scopolamine
 - Diphenhydramine
 - Droperidol

62

Epley Maneuver



(c) 2001 Northwestern University

63

Epley Maneuver

- University of Baltimore
 - 107 patients
 - Diagnosed with BPPV
 - Right ear affected 54%
 - Posterior semicircular canal in 105 patients
 - Treated with 1.23 treatments
 - Successful in 93.4%

64

Treatment of Cerebellar Infarction or Hemorrhage

- Elevated blood pressure may be reflex response - do not treat unless markedly elevated (>180/120)
- Decreasing level of consciousness or hemiparesis suggests brainstem compression - surgical intervention indicated
- Watch for development of hydrocephalus

65

Treatment of Posterior Circulatory Ischemia

- Recombinant tissue plasminogen activator (if in first 3 hours)
- Anticoagulation (heparin)
- Antiplatelet agents (aspirin, ticlopidine, clopidogrel)

66

Medications for Acute Vertigo

Drug	Dosage	Route
Dimenhydramine IV, PR	50 - 100 mg qid	PO, IM,
Diphenhydramine IV	25 - 50 mg tid to qid	PO, IM,
Meclizine	12.5 - 25 mg bid to qid	PO
Promethazine IV, PR	25 mg bid to qid	PO, IM,
Hydroxyzine	25 - 100 mg tid to qid	PO, IM

(adapted from Lerner, 1995)

67

From: The Brainstem: Anatomy, Assessment, and Clinical Syndromes

J Neuropsychiatry Clin Neurosci. 2010;22(1):v-7.

TABLE 3. Brainstem Syndromes

Syndrome	Symptoms
Midbrain	
Waller	CN III palsy (ipsilateral); weakness and vertical gaze palsy (contralateral)
Claude	CN III palsy (ipsilateral); ataxia, tremor and vertical gaze palsy (contralateral)
Benedict	CN III palsy (ipsilateral); ataxia, tremor and weakness (contralateral)
Parinaud	CN III palsy (ipsilateral); ataxia and vertical gaze palsy (contralateral)
Parinaud	Paralysis of upgaze, convergence-retraction syndrome, lid retraction and light near dissociation
Pons	
Raymond-Cestan	Interocular ophthalmoplegia (ipsilateral); ataxia and weakness (contralateral)
Raymond	CN VI palsy (ipsilateral); weakness (contralateral)
Albin-Benignus	Weakness and ataxia (contralateral)
Millard-Gubler or	CN VI and VII palsy (ipsilateral); weakness (contralateral)
Caillie	CN VI and sometimes VII palsy (ipsilateral); weakness and sensory loss (contralateral)
Facile	
Medulla	
Waller	Ataxia, loss of pain and temperature for face, weakness of soft palate, larynx and pharynx, Horner's (ipsilateral); loss of pain and temperature for body (contralateral)
Rubral-Nageotte	Ataxia, loss of pain and temperature for face, weakness of soft palate, larynx and pharynx, Horner's (ipsilateral); weakness and loss of pain and temperature for body (contralateral)
Cestan-Chenier	Loss of pain and temperature for face, weakness of soft palate, larynx and pharynx, Horner's (ipsilateral); weakness and loss of pain and temperature for body (contralateral)
Rathbald	Ataxia, loss of pain and temperature for face, weakness of soft palate, larynx, pharynx and tongue, Horner's (ipsilateral); weakness and loss of touch, pain and temperature for body (contralateral)
Avellis	Weakness of soft palate, larynx, and pharynx (ipsilateral); weakness and loss of touch for body (contralateral)
Vernet	Weakness of palate, CN XI palsy, decreased taste posterior tongue (ipsilateral); weakness (contralateral)
Jackon	CN XII palsy, weakness of soft palate, larynx, and pharynx (ipsilateral); weakness (contralateral)
Djerjine	CN XII palsy (ipsilateral); hemiplegia and sometimes loss of position and vibration (contralateral)

Adapted from Harman et al.⁷ and Mers and Thomsen⁸

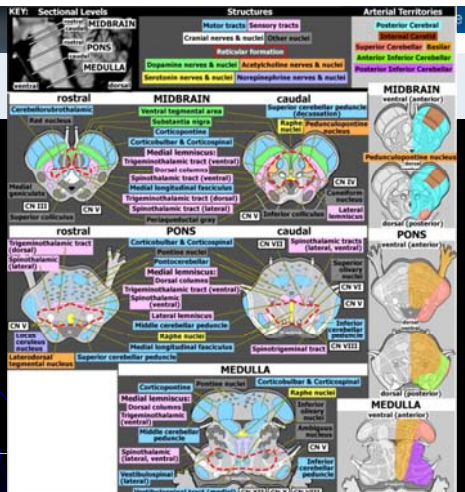
Date of download:
12/29/2013

Copyright © American Psychiatric Association.
All rights reserved.

68

From: The Brainstem: Anatomy, Assessment, and Clinical Syndromes

J Neuropsychiatry Clin Neurosci. 2010;22(1):v-7.



Date of download:
12/29/2013

Summary

- Ensure you understand what the patient means by "dizzy"
- Try to differentiate central from peripheral
 - Often there is significant overlap
- Not every patient needs a head CT
- Central causes are usually insidious and more severe while peripheral causes are mostly abrupt and benign
- Most can be discharged with antihistamines

70

The Neurological Examination

Questions?

知與行

71