Beyond the D's: Posterior Circulation Emergencies

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Disclosures

I have no disclosures to declare

Objectives

Define posterior circulation and its clinical significance in stroke syndromes

Identify key symptoms of posterior circulation emergencies

Identify syndromes associated with posterior circulation emergencies

Discuss diagnostic and management strategies for posterior circulation events in emergency settings

Medicolegal highlights & case study

Pertinent Pearls for dizzy patients

Case study

27 year old male presents to the Emergency Department for evaluation of new headaches that began 2.5 days prior to presentation.

- Headaches bi-temporal, 7-8/10 maximal intensity, lasting for 7-10 seconds
- Isolated singular episodes of NV on each preceding morning, seemed to be after getting up in the morning
- Mild dizziness

- What else do we need to know from the history?
- How do you approach a patient like this?
- What's the worst thing this could be?

Anatomy of Posterior Circulation

Blood Supply: vertebral arteries, basilar artery, and posterior cerebral arteries[1]

Areas perfused: Brainstem, cerebellum, thalamus, parts of occipital and temporal lobes[1]

(Stout, n.d.)

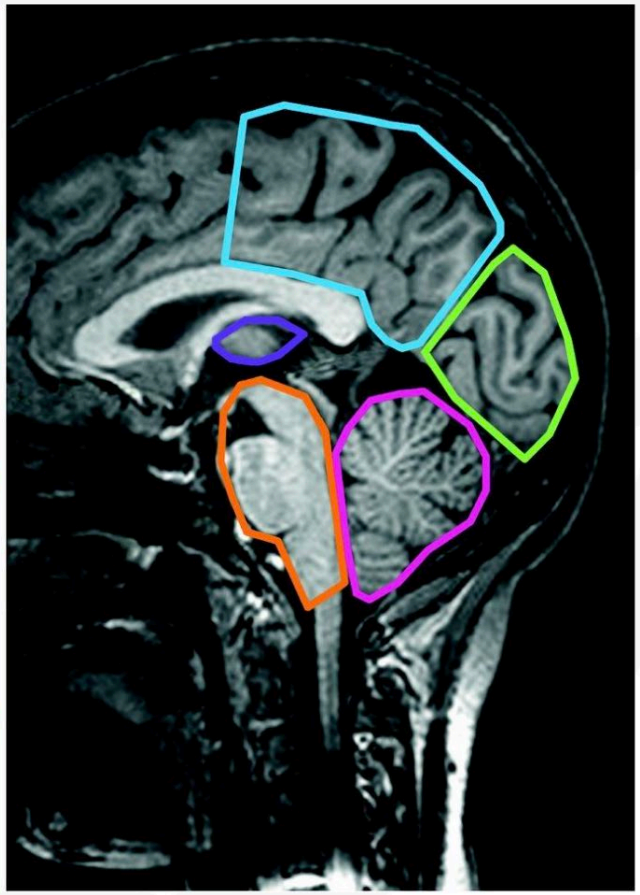
Other cortical regions (including medial temporal and parietal lobes)
Blood supply—Supplied by posterior cerebral artery in some but not all people
Ischaemia symptoms—Neuropsychological such as memory deficits, alexia, acalculia, agraphia, prosopagnosia

Thalamus
Blood supply—Posterior cerebral artery
Ischaemia symptoms—Sensory loss or disturbance

Occipital lobes
Blood supply—Posterior cerebral artery
Ischaemia symptoms—Visual field defects

Brainstem (midbrain, pons, medulla)
Blood supply—Basilar, superior cerebellar, and anterior inferior cerebellar arteries
Ischaemia symptoms—Limb weakness, sensory loss, cranial nerve palsies; classical brainstem syndromes with crossed signs; "locked-in" syndrome; "top of the basilar" syndrome

Cerebellum
Blood supply— Superior, anterior inferior, and posterior inferior cerebellar arteries
Ischaemia symptoms—Vertigo, ataxia, nystagmus, and other cerebellar signs



Spectrum of Posterior Circulation Emergencies

Posterior circulation stroke

- A neurological deficit resulting from impaired perfusion of the brainstem, cerebellum, thalamus, and/or occipitoparietal lobe[2]
- Embolic stroke is most common ischemic cause[2]
- Atherosclerotic plaque-related ischemia next most common[2]
- Vertebral dissection also can cause posterior ischemic stroke; consider in younger patients with neck trauma and neck pain or any patient on anticoagulation[2]
- Hemorrhage (approximately 5-17% of posterior strokes)[3]

Epidemiology of Posterior Circulation Emergencies

Incidence

- Approximately 20% of all strokes[1,2]
- Estimated at 160,000 in the United States annually[2]
- Broad variability in morbidity and mortality depending on affected location
  - 3.6% mortality at 30 days overall vs 80% in basilar artery occlusion[1,2]
- Up to 35% of strokes/TIAs were missed by ED providers who presents with "dizziness"[4]
- Posterior circulation strokes have higher risk of disability compared to anterior circulation strokes at 3 months[2]
- Posterior strokes are 3 times more likely to be misdiagnosed in the ED (Approximately 165,000 strokes/year)[1]

Who do we need to worry about?

CENTRAL RISK FACTORS

- History of previous stroke
- History of vascular disease
- Increasing age
- Complaint of ‘‘instability’’
- Abnormal gait
- Focal neurologic findings
- Vascular risk factors
  - Smoking, obesity, HTN

WHO WE MISS

- Vertebral dissection
- Younger age[5-7]

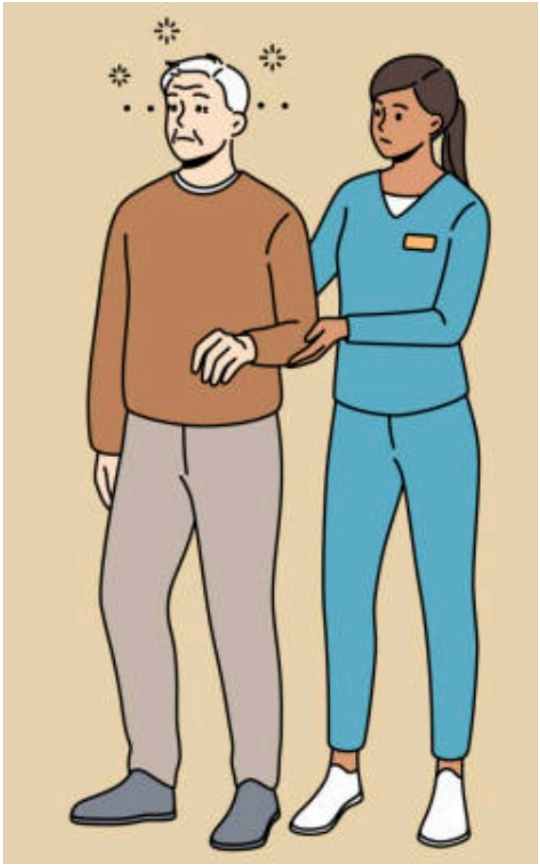
Dizziness in ED

Dizzy

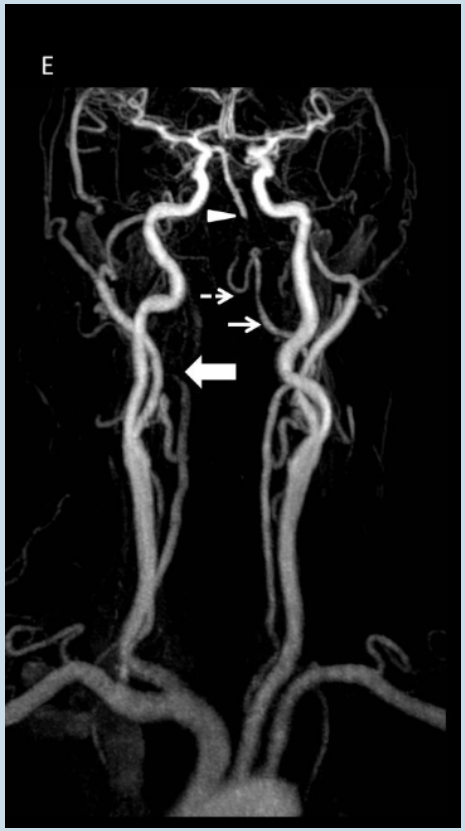
- 3% of ED patients present with cc of dizziness, vertigo, lightheadedness[8]
- Want to avoid MRIs on every patient

Dizzy+

- Dysphagia
- Dysmetria
- Dysphonia
- Diplopia
- Dysdiadochokinesia



Clinical Presentation



Often ***very*** subtle

Dizziness (47%)[9]

Unilateral limb weakness (31%)[9]

Headache (28%)[9]

Nausea/Vomiting (27%)[9]

Ataxia[10]

Nystagmus[10]

AMS[10]

Dysarthria[10]

Blurred Vision[10]

Half of posterior circulation TIAs present as a brief episode of dizziness[5]

Clinical Presentation

Posterior cerebral artery:[11]

- Contralateral homonymous hemianopsia and unilateral cortical blindness

Basilar artery:

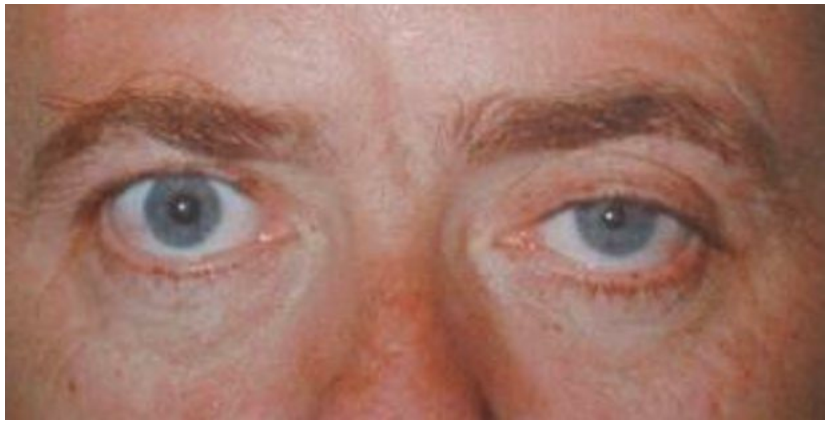
- Dysphagia, dysarthria, sudden loss of consciousness, ataxia, Locked-in syndrome

Vertebrobasilar artery:

- Ataxia, Horner's syndrome

Brainstem:

- Cross neurological symptoms: ipsilateral cranial nerve deficit with contralateral motor weakness



Horner's Syndrome: miosis, partial ptosis, hemifacial anhidrosis

Differential Diagnosis: Dizzy

CENTRAL CAUSES

- Infection
  - Encephalitis, meningitis, TB, neurosyphilis
- Vertebral artery dissection
- PRES
- Intracranial hemorrhage
  - Subarachnoid, subdural, epidural, intraparenchymal
- Traumatic brain injury
- Seizure
- Toxicologic etiology
- Common carotid dissection

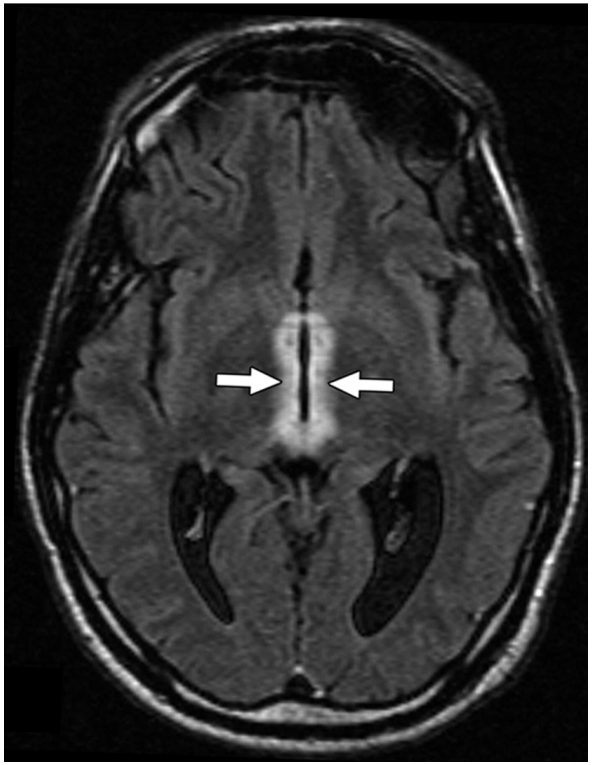
PERIPHERAL CAUSES

- Benign paroxysmal peripheral vertigo
- Meniere's disease
- AOM
- Vestibular Schwannoma
- Aminoglycoside toxicity
- Peripheral infection
  - Neuritis, labrynthitis

Differential Diagnosis Cont.

Other potential causes of dizziness

- Wernicke's Encephalopathy
- Electrolyte disturbances
- Cardiac dysrhythmias
- ACS
- Hypoglycemia
- Hypovolemia
- Hypo/hyperthyroidism
- Multiple sclerosis
- Anemia



Central vs Peripheral[9]

CENTRAL

- Sudden onset
- Symptoms commonly persistent/constant
- Headache possible
- Symptoms may be worse with head movement
- Cranial nerve deficiency may be present
- Poorly defined severity

PERIPHERAL

- Sudden or insidious onset
- Intermittent symptoms
- Headache uncommon
- Intense severity
- Cranial nerves intact
- Symptoms worse with head movement

Presenting Pearls

- Headache occurs in 8-27% of ischemic strokes and is more common in posterior circulation strokes. Headache and neck pain are often present in vertebral artery dissection.[12]
- Slurred speech and dysarthria are more common with cortical PCA infarcts. A quick way to test for dysarthria is having the patient say, **"Pawtucket"** because it tests sounds made using three different parts of the tongue and mouth.[12]
- Vomiting is a risk factor for misdiagnosis as it may be severe enough to be a distract from concomitant symptoms of dizziness and headache.[13]
  - 27% of the 407 patients in the New England posterior circulation stroke registry has nausea or vomiting[12,14]

Diagnostic Approach

History and Physical Exam

- History: onset, timing, aggravating/alleviating symptoms
- Physical exam:
  - NIHSS
  - Cranial nerves, visual fields, EOMs, finger to nose, pronator drift
  - **GAIT (always try to walk the patient)**
  - The head impulse test appears to be the most consistent bedside predictor of pseudolabyrinthine stroke in acute vestibular syndrome[15]

HINTS exam

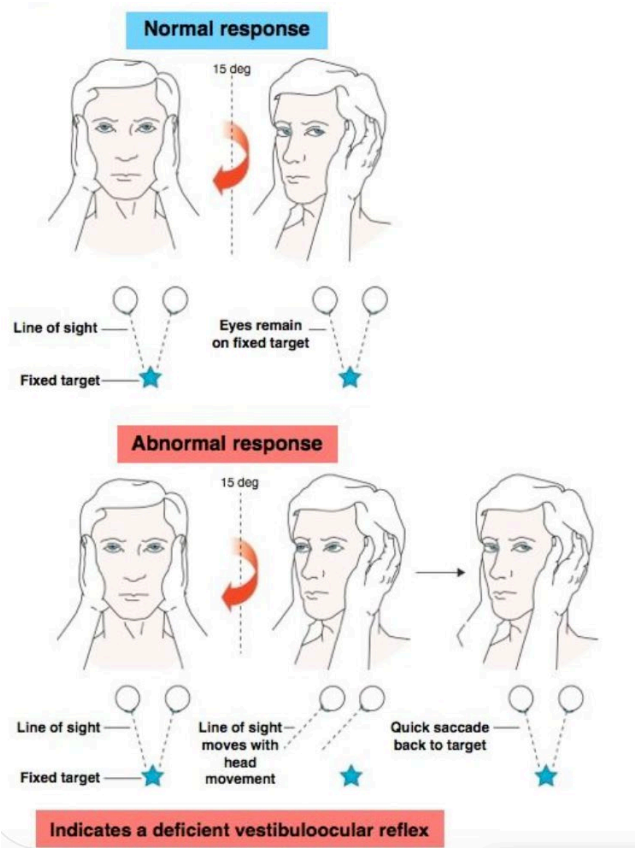
- **H**ead **i**mpulse testing
- **N**ystagmus
- **T**est of **S**kew
- 100% Sensitivity, 96% Specificity[11]
- A 2009 study showed that the HINTS exam was more sensitive than MRI within the first 48 hours for differentiating neuritis from stroke[12]

HiNTS Exam:

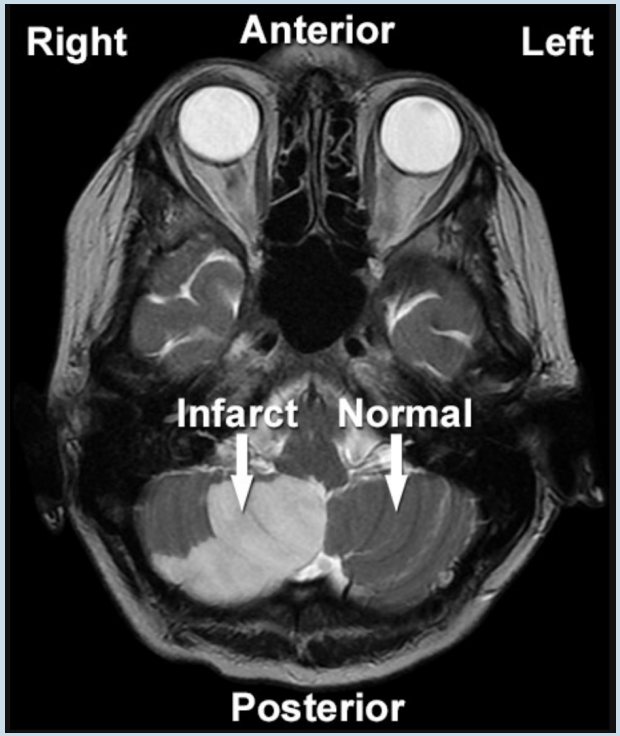
Perform on all patients with Acute Vestibular Syndrome: dizziness + nystagmus

If the four examination components (nystagmus, skew deviation, HIT, and targeted neurologic examination) are benign→ test for **gait ataxia or truncal ataxia**.

Those who cannot walk or sit up unassisted are more likely to have a central cause and require further evaluation[5]



Diagnostic Approach



Laboratory Testing

- Usual ED testing: **GLUCOSE**, CBC, CMP, coags, likely cardiac workup- troponin

Imaging

- CT head without contrast
- If available, CTA head/neck w/contrast
- If positive OR if negative, but still with worrisome presentation→ admit, MRI w/DWI, neurology evaluation

★ **CT and MRI may be normal** during the first 48 hours of ischemic symptoms.

Magnetic resonance imaging with diffusion-weighted images (MRI-DWI) misses 15% to 20% of posterior fossa infarctions in the first 24 hours.[17]

MRI-DWI has maximal sensitivity for brain stem stroke at 72 to 100 hours after infarction.[18]

Posterior Stroke Syndromes

Lateral Medullary Stroke[11]

(Wallenburg's Syndrome)

- Acute dizziness
- May also have dysarthria, dysphagia, or hoarseness.
- Horner's syndrome
- Often thrombolytic candidate due to severity of disability
- High morbidity & mortality

Basilar Artery Stroke[19]

(Locked-in Syndrome)

- Rare by devastating stroke
- Quadriplegia
- Anarthria
- Extremely poor prognosis

Case study

27 year old male presents to the Emergency Department for evaluation of new headaches that began 2.5 days prior to presentation.

- Headaches bi-temporal, 7-8/10 maximal intensity, lasting for 7-10 seconds
- Isolated singular episodes of NV on each preceding morning, seemed to be after getting up in the morning
- Mild dizziness

- What else do we need to know from the history?
- What's the worst thing this could be?
- Would your approach be any different now?

Case Study Continued

NP seeing patient in the ED focused on the bitemporal headache

Discussed case with attending who recommended an outpatient ESR

Decided to obtain a non-contrast head CT

CT read as normal, and he was discharged home with nonspecific headache diagnosis, possibly viral syndrome

Medicolegal Ramifications

Approximately 1 month later, patient was carrying a heavy box heavy upstairs, developed a severe headache, vomiting, and collapsed.

Found by family with ongoing seizure activity who called 911.

Despite aggressive management in the ED, he had a massive cerebellar bleed and extensive vasogenic edema from previously undiagnosed PCA aneurysm.

He was transferred to a academic stroke center, and despite intervention, died several days later.

Family subsequently has brought suit against the ED providers

Malpractice discussion

How often do we see headache and dizziness in the ED?

Should anything have been done differently?

Should posterior circulation emergency be on the differential?

Pearls

- **Findings that suggest Central Causes of Dizziness[11]**
  - Nystagmus that is dominantly vertical or torsional or dominantly horizontal, direction changing on left/right gaze
  - Test of Skew with skew deviation
  - Head Impulse Test – bilaterally normal (no corrective saccade)
  - Limb ataxia, dysarthria, diplopia, ptosis, anisocoria, facial sensory loss (pain/temperature), unilateral decreased hearing
  - Ataxia
  - Abnormal cranial nerve or cerebellar function
  - Diplopia
  - Headache

Pearls

- Have high suspicion, presentation often subtle
- NIH stroke scales of 0 occur with posterior circulation strokes.
- Performing the HINTS exam and targeted neurologic exam of the visual fields, cranial nerves, and cerebellar function including and evaluation of gait and truncal ataxia can help reduce misdiagnosis.
- Early brain imaging is frequently non-diagnostic
- The descriptive words that patients use to describe dizziness are not diagnostically meaningful and should not be used to drive the evaluation[5,20]
- We often miss young patients

Questions

What questions & comments do you have?

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