

CLINICAL PRESENTATION AND RADIOLOGY QUIZ QUESTION

A 63 year old man awoke at 3 AM and set off for the bathroom, but was stricken with a spinning sensation so severe that it interfered with his ability to ambulate. He became nauseated and vomited. He was brought to the emergency room in an ambulance and treated with ondansetron and diazepam with little relief of symptoms. He had a transient headache and diplopia but these shortly resolved. He has no neck pain, sinus symptoms, fever, or chills and denies recent head trauma or upper respiratory infection. He has no history of stroke, heart attack, or diabetes. A complete blood count, comprehensive metabolic panel, creatine kinase, and troponin are all unremarkable. The patient complains that he has the sensation that the room is moving when he closes his eyes. Moving his head makes the sensation worse. An imaging study was performed:



Which of the following additional imaging studies would be most helpful in further evaluation of the patient's symptoms?

- (a) CT angiogram from the aortic arch through the skull vertex
- (b) Magnetic resonance (MR) imaging of the brain
- (c) Carotid and vertebral artery ultrasound examination
- (d) Plain films of the skull

RADIOLOGY QUIZ QUESTION, ANSWER, AND EXPLANATION



Which of the following additional imaging studies would be most helpful in further evaluation of the patient's symptoms?

- (a) CT angiogram from the aortic arch through the brain
- (b) Magnetic resonance (MR) imaging of the brain and MRA from the aortic arch through the brain
- (c) Carotid and vertebral artery ultrasound examination
- (d) Plain films of the skull

Evaluation and imaging of the patient with dizziness relies on correctly placing the patient into one of four categories: *vertigo*, *disequilibrium*, *presyncope*, or *nonspecific dizziness*. Approximately 50% of patients have vertigo, which has many causes, and many patients with vertigo will need imaging (see below), whereas patients in the other categories (each of which has its own list of causes) are less likely to need imaging (see Table).

Vertigo is the illusion of motion: the patient inappropriately feels that either he is in motion or the environment is in motion (turning, moving from side-to-side, or moving from front-to-back). Moving the head almost invariably worsens vertigo. The presence of nystagmus supports vertigo as the cause of dizziness. If true vertigo is present, the next step is to evaluate for tinnitus and/or deafness. If there is no associated tinnitus and/or deafness and the neurologic and ear exam is normal, the patient most likely has benign paroxysmal positional vertigo or vestibular neuronitis. Such patients are typically either treated medically for 24-48 hours with clinical follow-up or sent to physical therapy for treatment with a Dix-Hallpike maneuver.

If the patient has vertigo and tinnitus and/or deafness, a neurologic examination and ear exam will help further classify the patient. If the neurologic exam is normal and the ear exam is abnormal, otitis media is most likely. If the neurologic exam is normal except for the acoustic nerve, then vestibular schwannoma and Meniere's disease are most likely. If there are other neurologic findings (for example, ataxic gait, headache, double vision, visual

loss, slurred speech, numbness of the face or body, weakness, or lack of co-ordination), then multiple sclerosis, vertebrobasilar artery TIA/stroke, and brain tumor must be considered.

Disequilibrium is a sense of imbalance that occurs primarily when walking. If the history and physical examination indicate a peripheral cause (peripheral neuropathy or musculoskeletal disorder), no CNS imaging is typically necessary. If the exam shows cerebellar signs (for example, gaze-evoked nystagmus, poor smooth pursuit, or downbeat nystagmus), and/or if there are vascular risk factors, MRI/MRA to evaluate for brainstem and cerebellar disease is indicated.

Presyncope is a sense of impending passing out and may be accompanied by a feeling of warmth, diaphoresis, nausea, or visual blurring. The workup of presyncope is the same as for syncope. There are multiple causes of presyncope/syncope, including orthostatic hypotension, cardiac arrhythmias, congestive heart failure, and coronary artery disease; most of these patients should probably undergo chest radiography for this reason.

Nonspecific dizziness is often associated with psychiatric symptoms and may be secondary to tachypnea. There are no physical signs that are diagnostic of nonspecific dizziness, but reproduction of the symptoms with voluntary hyperventilation is supportive of the diagnosis. Most of these patients are young and otherwise healthy and do not require imaging.

Table. Imaging of Dizziness/Vertigo

Indication	Examination
Vertigo (sensation of motion, worse with head movement, nystagmus)	If there is no associated tinnitus/deafness, no accompanying neurologic symptoms (ataxic gait, headache, double vision, visual loss, slurred speech, numbness of the face or body, weakness, or lack of co-ordination), and no cerebrovascular risk factors (hypertension, known vascular disease elsewhere), imaging can typically be delayed while the patient undergoes treatment for 48 hours. If there are neurologic signs and symptoms, a new headache, or risk factors for stroke (history of vascular disease, hypertension, or diabetes), consider emergent MRI/MRA of the brain.
Disequilibrium	No imaging is generally indicated for disequilibrium secondary to peripheral causes (peripheral neuropathy or musculoskeletal disorder). If there is suspicion of a cerebellar disorder (gaze-evoked nystagmus, poor smooth pursuit, or downbeat nystagmus), consider MRI of the brain, along with MRA if there are vascular risk factors or suspected ischemic disease.
Presyncope	Workup is as for syncope; CXR is reasonable given the multiple cardiac causes (aortic stenosis, congestive heart failure, cardiac dysrhythmia).
Nonspecific dizziness	No imaging is generally indicated for nonspecific dizziness.
ABBREVIATIONS	
MRI = magnetic resonance imaging; MRA = magnetic resonance angiography; CXR = chest radiography	

This patient had vertigo along with headache and diplopia. He was initially evaluated with head CT (as is often the case in the emergency room, for a variety of reasons) but now needs an MRI/MRA of the, and answer (a) is correct.

IMAGING STUDY AND QUESTIONS

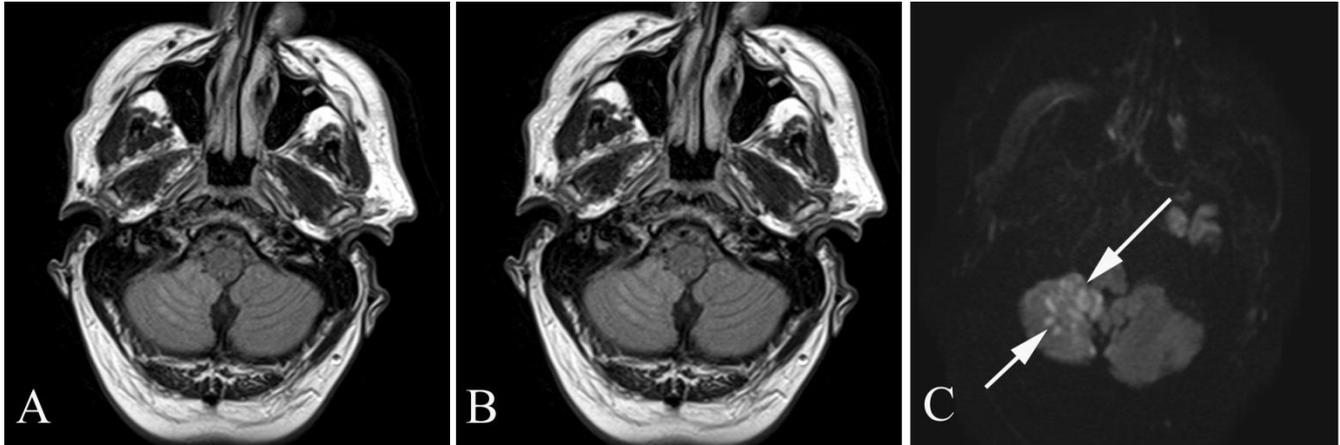
An additional imaging study was performed:



Imaging questions:

- 1) What type of study is shown?
- 2) Are there any abnormalities?
- 3) What is the most likely diagnosis?
- 4) What is the next step in management?

IMAGING STUDY QUESTIONS AND ANSWER



Imaging questions:

- 1) What type of study is shown? (A) is an unenhanced axial T1 weighted MR image, (B) is an unenhanced axial FLAIR image, and (C) is an unenhanced diffusion weighted image of the brain at the level of the cerebellar hemispheres.
- 2) Are there any abnormalities? Yes. There is increased signal (arrows) indicated restricted diffusion in the right cerebellar hemisphere on the diffusion weighted image.
- 3) What is the most likely diagnosis? Given the rapid onset of symptoms, lack of significant abnormality on the T1 and FLAIR images, and striking abnormality on the diffusion weighted image, the imaging findings represent an acute cerebellar infarction.
- 4) What is the next step in management? Treatment for acute stroke.

PATIENT DISPOSITION, DIAGNOSIS, AND FOLLOW-UP

The patient was referred to another institution, and subsequently lost to follow-up.

SUMMARY

Presenting symptoms: The patient presented with dizziness. He had a sensation that the room was spinning and worsening of his symptoms when he moved his head, indicating that he had vertigo (rather than disequilibrium, presyncope, or nonspecific dizziness). In addition, he had associated neurologic symptoms including diplopia and headache.

Imaging work-up: Imaging for patients with vertigo and neurologic symptoms who present to the emergency department frequently begins (as in this case) with head CT. CT is typically immediately available at all hours and takes less time to do than MR. However, if MRI/MRA is available on an emergent basis, it is probably a better choice of initial examination than head CT if the patient is stable.

Establishing the diagnosis: In a patient with the acute onset of neurologic symptoms, MRI findings of restricted diffusion in an area of brain tissue that shows normal signal on all other imaging sequences is pathognomic for infarction.

Take-home message: The first step in evaluating a patient with dizziness is to place them into one of four categories: vertigo, disequilibrium, presyncope, and nonspecific dizziness. In a patient with vertigo and associated neurologic signs and symptoms or risk factors for stroke, an emergent MRI/MRA of the brain should be performed.

REFERENCES

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