

IMAGING OF PATIENTS WITH HEADACHES & OTHER COMMON OUTPATIENT COMPLAINTS: WHEN? WHY? WHAT?

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Evaluation of the outpatient with a headache

Headache is a virtually universal experience. Almost everyone at some time has experienced a headache. However, almost 30 million Americans have frequent and severe headaches, generally migraine headaches. Half of these individuals have functional disability as a result of these headaches. One in four families has at least one member with severe headaches. Headaches span the human life cycle with infants and centenarians suffering the effects of migraines; however, the peak age for migraines is 25 to 55 years.

The International Headache Society (IHS) has published systematic definitions and classification of different types of headaches (International Classification of Headache Disorders, 3rd edition beta) in an effort to improve headache diagnosis and treatment. Some of the IHS criteria for major headache types are given below.

Most patients who present with a history of chronic headaches do not need to have a neuro-imaging procedure. Headache characteristics, obtained by a careful history, are crucial to the diagnosis of headache types but neuroimaging plays an important role in headache types associated with an underlying structural pathology. If the history and physical examination are consistent with migraine or tension-type headaches, and if there are no "red flags", then an imaging procedure is not needed. If one of the above is present, then brain imaging should be arranged. If the patient does not respond as expected to the appropriate migraine or tension-type headache treatment, then imaging, generally an MRI scan of the brain without contrast should be obtained. A CT scan of the head is of limited utility in outpatients with chronic headaches.

"Red Flags" in the headache history that decrease the likelihood of a primary headache

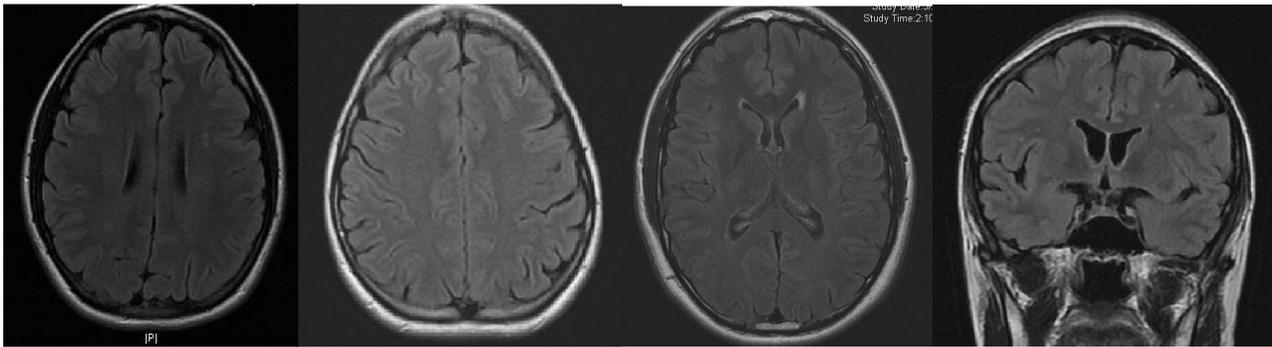
- Unusually severe persistent headache of apoplectic onset
- Unexplainable significant worsening and changing character of previously existing headaches
- Significant unexplained change in the character of typical headache
- Headache that significantly worsens when recumbent, coughing, sneezing
- New-onset unexplained headaches at an older age (>50 years) without family history or in patients with cancer or HIV
- Headache associated with systemic illness (e.g. fever, rash, stiff neck)
- Focally abnormal neurological examination - including presence of papilledema
- Focal symptoms that do not disappear after resolution of the headache
- Chronic headaches, TVO, pulsatile tinnitus in an obese young woman

Headache Types

Primary Headaches

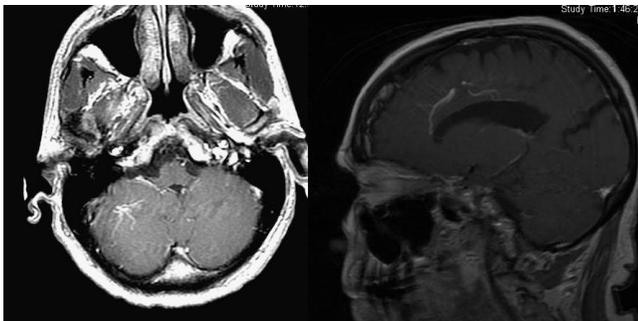
Primary headaches are not associated with anatomic or physiological abnormalities and are not associated with pathological finding on imaging. Approximately 98% of patients who present for medical evaluation will have a type of primary headache. The major primary headaches are migraine headache (with or without aura), tension-type headache, and cluster headache.

Most patients who seek neurological attention for chronic headaches have migraine headaches, either as their primary headache type or in combination with tension-type headaches or chronic daily headache. Although no concerning findings are found on imaging studies in patients with migraines, often lesions are found, especially on MRI scanning, that need to be explained to patients. The most common abnormalities found on MRI in migraineurs are subcortical or periventricular white matter lesions seen best on FLAIR images.



Incidental Findings on Brain Imaging in Headache

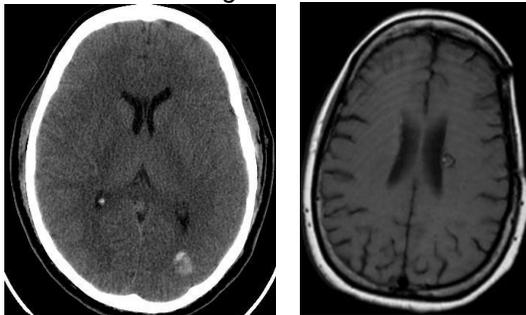
While the most common headaches are primary headaches, in which routine neuroimaging studies are not indicated or useful, imaging is often used to "reassure" the patient, and the physician, that there is no cause of headaches that needs more than pain-directed treatment. However, incidental findings, unrelated to headaches but a significant source of patient anxiety and potentially inappropriate intervention, may be found on brain imaging of patients with migraines. Commonly noted "incidentalomas" include:



Developmental venous anomalies (DVAs) - most common cerebral vascular malformation, occurring in approximately 4% of the population. They are composed of dilated veins separated by normal brain tissue, generally in cerebral hemispheres.

MRI of a cerebellar DVA with a group of radiating, linear flow voids (a "caput medusae") centered on a large collecting MRI of a cortical DVA with radiating vessels.

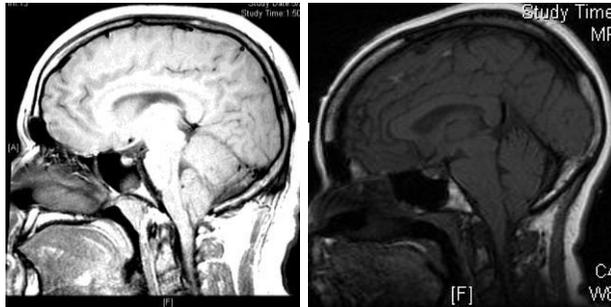
Cavernous malformation - well-circumscribed sinusoidal vascular channels containing blood and blood products; angiographically occult lesions; well-defined, lobulated ("popcorn") lesions with a heterogeneous signal on MRI; may hemorrhage. *CT and MRI images of cavernous malformations.*



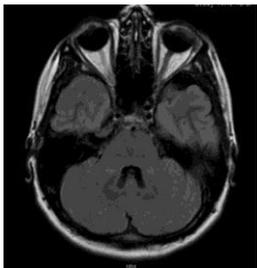
Capillary telangiectasia - dilated capillary-type blood vessels, separated by normal brain parenchyma. These lesions are generally found incidentally and do not hemorrhage.

Arteriovenous malformation (AVM) - variably sized blood vessels separated by normal brain parenchyma. When an AVM is discovered incidentally on an MRI scan of a patient with headaches, the appropriate intervention depends on the specific characteristics of the lesion and the patient.

CT and MRI images of AVMs.



Chiari type 1 malformation - cerebellar tonsils lie 2-5 mm below the foramen magnum. Generally, a Chiari type 1 malformation is an incidental asymptomatic finding on MRI. Surgical treatment is controversial. *Sagittal views of a Chiari type 1 malformation with caudal protrusion below the foramen magnum.*



Arachnoid cyst - intra-arachnoid spinal fluid cyst that does not communicate with the ventricular system; more common in men than in women; differentiate from other non-neoplastic cysts and subdural fluid collections; no need for treatment of incidental, stable lesion without mass effect. *A small arachnoid cyst seen at the temporal tip in the left middle cranial fossa.*

Incidental tumors/cysts/aneurysms noted incidentally unrelated to headache - pituitary adenoma, pineal cyst, meningioma, aneurysms, etc. are among the lesions found which may or may not require further imaging and evaluation. *Incidental findings shown include: meningioma, mammillary body lipoma, pituitary macroadenoma, LMCA aneurysm.*



Secondary Headaches

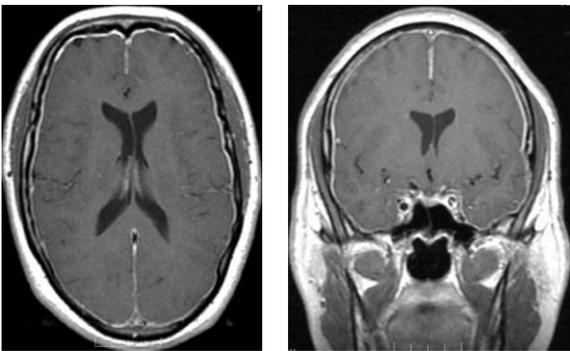
Secondary headaches are due to a distinct and known anatomic, physiological, or infectious cause. While they are much less common than primary headaches, secondary headaches should be considered in all patients who present for evaluation of headaches. However, in the outpatient setting secondary headaches are relatively rare. Patients who have a primary headache disorder may also develop unrelated secondary headaches, so primary headache patients should be questioned about a change in headache character or frequency. Patients with cerebrovascular disease causing headache generally present to the emergency department with severe headaches and focal neurological findings. Other common causes of secondary include brain tumors which are generally accompanied by focal neurological signs and symptoms, that may be evaluated in the outpatient clinic. Infections, including meningitis, encephalitis, and brain abscess, may present with headache; but fever, alteration in consciousness, and focal neurological signs and symptoms may indicate the diagnosis of a secondary headache. When there is a suspicion of a secondary headache, neuro-imaging with an MRI scan (or CT scan if MRI is contraindicated) should be obtained.

Disorders of Cerebrospinal Fluid (CSF) Dynamics

Increased CSF pressure headache / idiopathic intracranial hypertension- Obesity, females; steroids, cerebral venous thrombosis (CVT); holocephalgic pain; pulsatile tinnitus; VI palsy, transient visual obscurations; IIH- normal CT/MRI; "slit-like ventricles; "partially empty sella; posterior sclera flattening or enlarged, tortuous optic nerve

Decreased CSF pressure headache/Post dural puncture headache - Lumbar puncture; trauma; spontaneous; leakage of CSF through dural tear; holocephalgia pain worse upright; improved recumbent (or reverse).

The MRI images show enhancement of leptomeninges seen with PDPH



Special Headache Types



Sinus headache - due to a bacterial infection of the ethmoid/maxillary sinuses; face (perinasal, periocular) pain with purulent nasal discharge; fever and evidence of sinus infection on CT or MRI.

MRI with right ethmoid and maxillary sinus inflammation

References

The International Classification of Headache Disorders, 3rd edition (beta version).

Cephalalgia. 2013;33(9):629–808.

Douglas AC et al. ACR Appropriateness Criteria Headache. J Am Coll Radiol. 2014 Jul;11(7):657-67.

Mechtler L, Neuroimaging of Headaches. Continuum Life Long Learning Neurol 2008;14(4):94-117

Evaluation of the Dizzy Outpatient

The utility of neuroimaging, and the appropriate type of imaging, in the evaluation of a patient with dizziness in the ED may be problematic. In many patients, neuroimaging (e.g. computed tomography (CT), magnetic resonance (MR), MR angiography (MRA), catheter angiography) is performed to rule out other pathologies and to confirm the diagnosis that is suspected clinically. Imaging with head CT is often performed initially to exclude a central cause; however, diagnostic yield is low in patients with dizziness, especially without other neurological symptoms. While an emergency CT scan of the head is appropriate to rule out an intracranial hemorrhage, its yield in the evaluation of isolated dizziness is very low. A CT scan of the head is unlikely to discern an acute intracranial lesion in emergency department patients with dizziness with a normal neurological examination and no other significant neurological symptoms.

The Diagnosis of Dizziness

The first step in evaluating a patient with vertigo or dizziness is an in-depth history and an appropriate examination. The distinction should be made between a central and a peripheral cause of the patient's sense of disequilibrium or movement. A peripheral cause is more likely to be diagnosed in patients with dizziness without focal neurological symptoms or signs. Patients evaluated for dizziness in the outpatient setting are much more likely to have a peripheral, as compared to a concerning central, cause of their symptoms. However, this crucial differentiation may be problematic and testing, including neuroimaging, is often necessary. The differentiation between peripheral (vestibular) and central (central nervous system) causes of dizziness narrows the possible causes of the patient's complaints and is particularly helpful in choosing the appropriate imaging strategy. Imaging is generally always indicated in suspected central causes of dizziness, but may not be useful for some causes of peripheral dizziness. In most cases the central cause of vertigo is more precisely determined by MRI scan of the brain. A CT scan of the head may be the appropriate imaging for initial detection of a posterior fossa hemorrhage, head trauma or of hydrocephalus.

Central causes of vertigo/dizziness are generally diagnosed by brain imaging (MRI/MRA scans, CTA scan). The most frequent vestibular disorders of vertigo/ dizziness are BPPV, Meniere's disease and neuronitis/labyrinthitis which generally do not warrant diagnostic imaging for reasons other than to rule out other masquerading pathologies. Less common neuro-otological disorders may also present with prominent dizziness, often without imaging correlates.

Central Causes of Vertigo

Cerebrovascular Disease

Posterior circulation ischemia and infarcts

Intracranial hemorrhage, subclavian steal syndrome, cerebral venous thrombosis, reversible cerebral vasospasm syndrome and posterior reversible encephalopathy syndrome (PRES).

Multiple sclerosis

Posterior fossa mass lesions

CNS infections

Migraine

Neurodegenerative disorders

Trauma

Peripheral Causes of Vertigo

Benign paroxysmal positional vertigo

Labyrinthian disease

Meniere disease

Peri-lymphatic fistula

Acute otitis media, otitis media with effusion

Cholesteatoma

References

Connor SE, Sriskandan N, Imaging of dizziness. Clin Radiol 2014;69:111-112

Navi BB, et al. The use of neuroimaging studies and neurological consultation to evaluate dizzy patients in the emergency department. Neurohospitalist 2013;3:7-14.

Evaluation of the outpatient with low back pain

Low back pain is a common outpatient complaint which generally has a benign pathology. Imaging of the spine, in the patient without myelopathic or radicular symptoms, often does not correlate with symptoms or does not change symptomatic management. A course of anti-inflammatory medications and non-medical therapy (e.g. yoga, acupuncture) is recommended for patients with isolated low back pain and a normal neurological examination, in the absence of concerning conditions such as cancer, bleeding risk, infection or trauma. As most cases of low back pain are self-limited, imaging is recommended only when appropriate conservative treatment fails. Also, spinal degeneration occur with normal aging, often making the correlation between imaging abnormalities and symptoms tenuous. Plain films are rapidly and inexpensively acquired to document traumatic and degenerative causes of low back pain. However, the utility of plain films in most cases of outpatient low back pain is limited. The intradural insertion of non-ionic intrathecal iodinated contrast material followed by a CT scan (CT myelogram) has been generally supplanted by MRI scanning of the spine which better delineates the spinal cord and nerve roots, as well as surrounding soft tissue structures.

Bartynski WS, Petropoulou KA. The MR imaging features and clinical correlates in low back pain-related syndromes. Magn Reson Imaging Clin N Am. 2007;15(2):137-54

Hansen BB' et al. Imaging in mechanical back pain: Anything new? Best Pract Res Clin Rheumatol. 2016;30(4):766-785.