



Radiology Rounds

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Janet Cochrane Miller, D.Phil., Author

Susanna I. Lee, M.D., Ph.D., Editor

Headache - When is Neuroimaging Needed?

The vast majority of patients that come to see their physician complaining of headache have primary headache disorders, such as migraine, cluster, and tension type headaches and no identifiable pathology. Since neuroimaging will not have any bearing on the treatment of primary headaches, there is no reason to order a head scan for these patients.

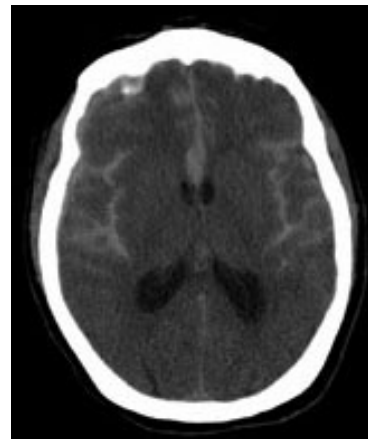
However, it is not always easy to rule out a secondary headache, which may be a symptom of life threatening disease, and it is tempting to err on the side of caution. As a result, there is a high referral rate for neuroimaging, most of which result in either normal scans or show incidental abnormalities that in turn cause anxiety and lead to unnecessary additional tests ([see box](#)).

For example, patient expectations or medicolegal concerns were cited as the primary reason for 17% of those referred in a Canadian study in which approximately 3% of patients with headache were referred for neuroimaging. Most of this cohort (85%) had no neurological abnormalities. In 49% of these patients, the referring physician suspected an intracranial tumor. However, the yearly incidence of brain tumors is only 49 per 100,000 in the USA and only about 8% of those have an isolated headache as a first and only symptom.

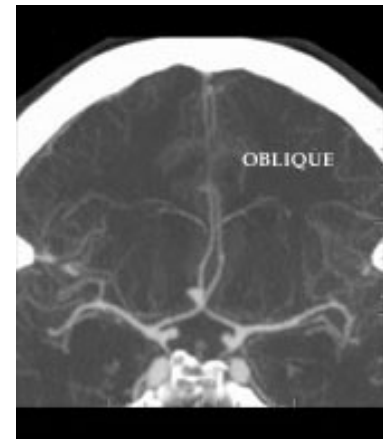
Neuroimaging for Headache: Diagnostic yield from 3026 patients with normal neurological exam (Evans, 1996)

Brain tumor	0.8%
Arteriovenous malformation	0.2%
Hydrocephalus	0.2%
Aneurysm	0.3%
Sub-dural hematoma	0.2%
Stroke, including chronic ischemic processes *	1.2%

*Unlikely to be cause of headache



(A)



(B)

(A) Head CT without contrast shows diffuse subarachnoid hemorrhage.

(B) Subsequent CT angiographic image (with contrast agent) in the same patient demonstrates an anterior communicating artery aneurysm.

When should Neuroimaging be Considered for an Isolated Headache?

The US Headache Consortium, the American College of Emergency Physicians, and the American College of Radiology have all conducted extensive studies of the literature to come up with some recommendations for neuroimaging for patients with headache. Based on the accumulated evidence, they have concluded that screening patients with isolated headache by CT or MRI is generally not warranted. They also recommend that the pain response to therapy not be used as the sole diagnostic indicator of the underlying etiology of an acute headache.

The specific instances of isolated headache for which neuroimaging should be considered include "thunderclap" headache (a sudden excruciating headache that reaches its maximal intensity within seconds), headache radiating to the neck, temporal headache in an older individual, and new onset headache in patients with HIV, cancer, or in those who are in a population at high risk for intracranial disease.

Neuroimaging in Non-Isolated Headaches

Patients who present with a thunderclap headache and abnormal findings in a neurological examination should undergo emergent non-contrast head CT scan since these symptoms may be indicative of a cerebrovascular event (usually subarachnoid hemorrhage or intracerebral hemorrhage).

When a non-acute headache (one that has occurred for at least 4 weeks during a patient's life) is accompanied by an abnormal neurological examination, there is a three-fold increase in the likelihood of finding significant intracranial pathology (e.g. brain tumor, arteriovenous malformation, hydrocephalus). Significant neurological findings that suggest an intracranial abnormality include papilledema, visual field deficits, unilateral loss of sensation, weakness, or hyperflexia, and altered mental status. Neuroimaging should be considered in these cases. However, the significance of some other symptoms is not clear, including a headache that is

worsened by the Valsalva maneuver, causes awakening from sleep, is progressively worsening, or is a new headache in an older person.

A headache that is accompanied by a fever can be caused by meningitis, especially if it is accompanied by nuchal rigidity. In these cases, a head CT is needed to check for hydrocephalus to determine whether it is safe to do a diagnostic lumbar puncture. This precaution is also necessary in cases of headache in patients exhibiting signs of increased intracranial pressure, including papilledema, absent venous pulsations on fundoscopic examination, altered mental status, or focal neurological deficits. If the CT scan is negative, the opening pressure is normal, and the CSF analysis does not indicate the presence of blood, the available evidence suggests that there is no need for an emergent angiography.

Guidelines for Neuroimaging in Patients with Headache¹

Emergent neuroimaging recommended	"Thunderclap" headache with abnormal neurological exam
Neuroimaging recommended to determine if it is safe to do lumbar puncture	Headache accompanied by signs of increased intracranial pressure Headache accompanied by fever and nuchal rigidity
Neuroimaging should be considered	Isolated "Thunderclap" headache Headache radiating to neck Temporal headache in an older individual New onset headache in patient who is <ul style="list-style-type: none"> - HIV positive - has a prior diagnosis of cancer - is in a population at high risk for intracranial disease Headache accompanied by abnormal neurological examination, including papilledema or unilateral loss of sensation, weakness, or hyperflexia
Neuroimaging not usually warranted	Migraine and normal neurological exam
No recommendation (Some evidence for increased risk of intracranial abnormality, not sufficient for recommendation)	Headache worsened by Valsalva maneuver, wakes patient from sleep, or is progressively worsening
No recommendation (insufficient data)	Tension type headache and normal neurological exam

¹ From guidelines developed by US Headache Consortium, the American College of Emergency Physicians, and the American College of Radiology

CT or MRI?

Although MRI has better soft tissue contrast than CT, nearly every life threatening condition that could cause a headache can be seen on a non-contrast CT. A few very rare disorders, including venous sinus thrombosis, and vasculitis can be found by MRI and not CT. However, MRI can be too sensitive, finding small abnormalities, such as a small aneurysm or an arachnoid cyst that have no clinical significance.

If an abnormality is found on non-contrast CT, contrast agent will be administered. The use of contrast CT will be at the discretion of the radiologist unless the referring physician specifically advises that contrast agent is contraindicated.

Acknowledgements

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Scheduling and Reporting

If emergency neuroimaging is warranted, the patient should be sent to the Emergency Department at MGH, where a CT will be performed. In other cases, neuroimaging can be performed at Mass General West Imaging in Waltham, Mass General Imaging in Chelsea or the main MGH campus and can be ordered online via the Radiology Order Entry (ROE) system <http://mghroe/> or by calling 4-XRAY (617-724-9729). Results are made available to physicians online within 24-48 hours.

Further Information

For further questions on neuroimaging, contact [Pamela Schaefer, M.D.](#)

For general questions about web-based Radiology scheduling, call 617-726-0304

For general questions about Radiology Services, call 617-724-4902

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[Susanna I. Lee, M.D., Ph.D., Editor](#)