



Tips on when to request an imaging assessment (RMI, CT, or angiography) in a patient suffering from a headache

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Abstract

This article is a mini-narrative review covering practical aspects of when to request an imaging evaluation of a headache patient. The vast majority of patients who seek help in a medical office receive as a diagnostic hypothesis one of the primary headaches, such as migraine, tension-type headache, or cluster headache. The vast majority of patients who arrive with a headache at the neurologist's office are migraineurs; individuals who suffer from tension-type headaches rarely seek the neurologist's help. In the emergency scenario, there is a more significant occurrence of secondary headaches when compared to patients treated in an outpatient clinic. In evaluating a patient with a headache, the physician should pay attention to red flags or signs that may indicate a secondary cause for the pain the patient reports. In primary headaches, with the exception of trigeminal autonomic cephalalgias, there is no need to investigate by imaging. In cluster headache, in some cases, intracranial lesions may be found as the cause, mainly parasellar lesions such as cerebral aneurysms. Thus, image evaluation is indicated. Depending on the diagnostic suspicion in secondary headaches, different imaging examinations should be requested, the most frequent being MRI, CT, and angiography.



Introduction

Headache is one of the most frequent symptoms or complaints, and in some situations it should be considered a warning sign, since it can express serious problems for several causes.¹⁻⁴

The first classification of headaches was made in 1988 and modified in 2004 by the *International Classification of Headache Disorders - second edition* (ICHD-2). The diagnosis is currently based on criteria updated in 2018, published as ICHD-3. The classification of headaches is clinically useful because it standardises the nomenclature of the different types and subtypes of headaches, scientifically assisting in the diagnosis, prognosis and more accurate and uniform treatment.

Headaches are classified in three groups: (1) Primary Headaches; (2) Secondary Headaches; and (3) Painful cranial neuropathies, other facial pain, and other headaches.

Doctors are regularly faced with the question of whether or not imaging evaluations are necessary to confirm or clarify the cause of a headache.³ In addition, many patients come to the consulting room afraid they are suffering from a serious illness and, therefore, ask the doctor to request a CT of an MRI, sometimes unnecessarily.¹⁻³ Considering the cost-benefit,¹⁻³ radiation protection and adverse effects (mainly from iodinated contrast), and cumulative (in relation to gadolinium), it is difficult to justify performing the imaging exam without clinical evidence that in the case in question the examination is indicated.¹⁻³

It was observed that there are no changes in imaging tests in most cases in which they were performed in patients with headache, especially when there are no other associated neurological symptoms.^{1,3,5} So, considering cost-benefit, how to identify which patient with a headache needs and will benefit from an imaging exam?

Criteria to identify which patients with headache need and will benefit from an image exam

In order to make a responsible clinical and economic decision, it is important to differentiate between a primary headache (where the patient has no underlying organic brain abnormality as a cause of the primary headache) and secondary headaches (which are often associated with organic brain disease).¹⁻³

The clinical features that alert for the diagnosis of secondary headache and that should lead to an imaging exam are¹⁻³:

- Headache that reaches high peak intensity in less than five minutes;
- New type of headache;
- Change in the pattern of a previously stable headache;
- Headache that changes with posture, for example if the patient is in an upright position;
- Headache that awakens the patient;
- Headache triggered by physical activity or Valsalva maneuver (e.g., coughing, laughing);
- Onset after 50 years of age;
- Presence of neurological symptoms and/or signs;
- A history of recent trauma;
- High temperature;
- History of malignancy or HIV;
- Epileptic seizures;
- Active infections.

Neuroimaging findings are important to define the possibility of performing lumbar puncture to assess the presence of blood, infection and cellular abnormalities in the cerebrospinal fluid, without risk to the patient, as it serves to identify the existence of an expansive lesion and hydrocephalus that would contraindicate the puncture due to the risk of herniation of the cerebellar tonsils and other brain structures.¹⁻³

Primary and Secondary Headaches

Primary Headaches

The diagnosis of primary headache is clinical. One is dealing with a “chronic, repetitive headache,” without any medical condition being detected as a cause. It is classified by the profile of symptoms, being a benign entity, of mild to severe intensity, not representing a risk to life.¹⁻³ The most frequent types are:

- Tension-type headache – it is the most frequent type, affecting 60-78% of the population³ lasting from minutes to days; the pain is typically bilateral, “squeezing” or “pressing”, from mild to moderate intensity; lacking nausea, but may happen with photophobia and phonophobia, predominantly in males.³
- Migraine – is the second most frequent type; chronic neurological disease, with a prevalence of 15% defined



as an abnormal neurovascular reaction, which occurs in a genetically vulnerable organism; more frequent in the female sex. It is characterised by recurrent episodes of pulsatile headache, uni- or bilateral, with associated manifestations such as nausea, vomiting, photophobia, phonophobia and osmophobia, visual disturbances, and drowsiness.³ Very often, it can be associated with triggering factors, such as sleep disturbances, alcohol consumption, fatty or spicy foods, stress, great physical exertion, etc.

Despite being a primary headache, some imaging studies have shown, however, that there is a higher frequency of hyperintensity foci in FLAIR and T2 in brain white matter.^{6,7} It was also observed that stroke occurs more frequently in patients with aura (8% of subclinical cerebellar infarctions).⁷ A retrospective study showed that patients with migraine with aura may have hypoperfusion in only one of the cerebellar hemispheres, or that this hypoperfusion may be associated with a reduction in contralateral cerebral cortical perfusion. (crossed cerebellar diaschisis).⁸ Other studies show regional hyperperfusion in the affected cerebral cortex, corresponding to neurological manifestations during the aura.⁹

- Cluster headache – it is the least frequent, 0.2% to 3%¹⁰, being, also, of the neurovascular type. Some findings suggest that its origin may be in the hypothalamus. Despite being a primary headache, an investigation by MRI is recommended because patients with para-sellar lesions open the picture with a headache that fulfills the criteria for cluster headache.

Secondary Headaches

Secondary headaches are usually due to an underlying disease, which can be primary from the central nervous system or from other organs, such as sinus infections, pneumonia, etc.^{1,3}

Headaches caused by disorders of the central nervous system are more acute, of recent onset, often accompanied by vomiting, visual disturbances (double vision, blurred vision), motor and/or sensory deficits in the limbs, epileptic seizures, language disorders, and changes in the level of consciousness. The most frequent causes of secondary headaches are infections, vascular, trauma and tumors.

Final Considerations

The majority of patients with headaches who go to

emergency services generally respond well to the therapy used, with no need for imaging evaluation. If the headache presents atypical features, the neurologic examination is abnormal, and/or the patient does not respond to conventional therapy, the possibility of a secondary headache should be investigated and imaging studies indicated.

Below we summarise the most indicated exams according to the recommendation of the *American College of Radiology* (ACR, 2019):

- Sudden, severe headache (worst headache of life): CT without venous contrast, with the use of contrast-enhanced computed tomography angiography in all these patients being controversial.
- New headache associated with papilledema: MRI with and without venous contrast or MRI without contrast or CT without contrast.
- Post-traumatic headache: CT without contrast.
- New or progressive headache with warning signs (e.g., physical exertion, neurological deficit, known or suspected cancer, immunosuppression, ≥ 50 years of age): CT without contrast or MRI with and without venous contrast or MRI without contrast.
- Headache of suspected trigeminal autonomic origin: MRI with and without venous contrast.
- Chronic headache with new associated findings or increased frequency: MRI with and without venous contrast or MRI without contrast.
- Migraine, tension-type headache, and chronic headache with no other associated findings: no imaging evaluation required.

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