HEALTH EVIDENCE REVIEW COMMISSION (HERC)

COVERAGE GUIDANCE: NEUROIMAGING FOR HEADACHE

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HERC COVERAGE GUIDANCE

In patients who present with a variation of their usual headache (e.g. more severe, longer in duration, or not responding to drugs), CT or MRI should not be covered.

Neuroimaging (CT or MRI) should not be covered for those with a clear history of migraine, unless a red flag* is present.

*The following represent red flag conditions for underlying abnormality with headache:

- new onset or change in headache in patients who are aged over 50
- thunderclap headache: rapid time to peak headache intensity (seconds to 5 min)
- focal neurologic symptoms (e.g. limb weakness, aura <5 min or >1 hour)
- non-focal neurological symptoms (e.g. cognitive disturbance)
- change in headache frequency, characteristics or associated symptoms
- abnormal neurological examination
- headache that changes with posture
- headache wakening the patient up
- headache precipitated by physical exertion or valsalva manoeuvre (e.g. coughing, laughing, straining)
- patients with risk factors for cerebral venous sinus thrombosis
- jaw claudication or visual disturbance
- neck stiffness
- new onset headache in a patient with a history of human immunodeficiency virus (HIV) infection
- new onset headache in a patient with a history of cancer
- headache with a history of dizziness, lack of coordination, numbness or tingling
- cluster headache, paroxysmal hemicrania or Short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing) (SUNCT).

RATIONALE FOR GUIDANCE DEVELOPMENT

The HERC selects topics for guideline development or technology assessment based on the following principles:

- Represents a significant burden of disease
- Represents important uncertainty with regard to efficacy or harms
- Represents important variation or controversy in clinical care
- Represents high costs, significant economic impact
- Topic is of high public interest

Oregon Health Authority

Coverage guidance development follows to translate the evidence review to a policy decision. Coverage guidance may be based on an evidence-based guideline developed by the Evidence-based Guideline Subcommittee or a health technology assessment developed by the Heath Technology Assessment Subcommittee. In addition, coverage guidance may utilize an existing evidence report produced by one of HERC's trusted sources, generally within the last three years.

EVIDENCE SOURCES

Clark, E.E., Little, A., & King, V. (2010). *Red flags and imaging in headache*. Portland, OR: Center for Evidence-based Policy, Oregon Health & Science University.

Sources Cited in MED Report:

Detsky ME, McDonald DR, Baerlocher MO, Tomlinson GA, McCrory DC, Booth CM. Does this Patient with Headache Have a Migraine or Need Neuroimaging? 2006. *JAMA*; 206:1274.

Frishberg BM, Rosenberg JH, Matchar DB, McCrory DC, Pietrzak MP, Rozen TD, Silberstein Sd. Evidence-based Guidelines in the Primary Care Setting: Neuroimaging in Patients with Nonacute Headache. 2000. US Headache Consortium. American Academy of Neurology. Accessed at: http://www.aan.com/professionals/practice/pdfs/gl0088.pdf

McCormack RF, Hutson A. Can Computed Tomography Angiography of the Brain Replace Lumbar Puncture in the Evaluation of Acute-onset Headache After a Negative Noncontrast Cranial Computed Tomography Scan? 2010. *Acad. Emerg. Med*.; *17*:444

Scottish Intercollegiate Guidelines Network. (2008). *Diagnosis and Management of Headaches in Adults.* A National Clinical Guideline. Edinburg: Scottish Intercollegiate Guidelines Network. Retrieved from http://www.sign.ac.uk/pdf/qrg107.pdf

The summary of evidence in this document is derived directly from these evidence sources, and portions are extracted verbatim.

SUMMARY OF EVIDENCE

Clinical Background

Headache is a common condition. Lifetime prevalence of headache is estimated at more than 90% and annual prevalence is estimated at 20% to 40%. Most headaches are classified as primary, meaning that they are not associated with organic disease. Secondary headaches are caused by underlying organic disease. The prevalence of organic disease or significant intracranial abnormality causing headache is low. Since

headaches are common and there are many causes, clinical evaluation may be difficult. Red flags have been proposed to help identify patients with significant intracranial abnormality. MRI and CT are often used to identify significant intracranial abnormalities. MRI and CT of the brain are commonly performed, high cost imaging procedures. The combination of high prevalence of headaches, low prevalence of significant intracranial abnormalities and frequent use of MRI and CT may lead to unnecessary harms through radiation and false positives (incidental findings).

Statistical Background for Interpreting the Evidence

The statistic used to quantify the usefulness of a feature in predicting a finding is the likelihood ratio (LR). A likelihood ratio incorporates both the sensitivity and the specificity of the test and provides a direct estimate of how much a test result will change the odds of having a disease. Sensitivity is the ability of a test to correctly identify people with a condition. A test with high sensitivity will nearly always be positive for people who have the condition. Specificity is the ability of a test to identify correctly people without a condition. A test with high specificity will rarely be wrong about who does NOT have the condition. The LR for a positive result (LR+) tells you how much the odds of the disease increase when a test is positive. The LR for a negative result (LR-) tells you how much the odds of the disease decrease when a test is negative. Likelihood positive ratios that are > 1.0 increase the probability of disease and likelihood negative ratios less than 1.0 (e.g., 0.2, 0.05) decrease the probability of disease. Likelihood ratios have a large and more significant impact on the probability of disease when they are > 10 or < 0.1.

Evidence Review

<u>Headache Prevalence</u>
There are a number of epidemiologic surveys of different populations from the US and elsewhere, which give widely varying prevalence rates. Migraine headache in adults in the US is reported at 6% to 18% per year, while tension headaches have been reported as 38% of adults per year. Frequent or severe headaches have been reported in 10% to 28% of children per year. Headaches were the presenting complaint for 2% of all emergency room visits in a sample of emergency room visits in one sample, while sudden severe headache was the presenting complaint in 0.7%.

<u>Prevalence of Significant Intracranial Abnormality</u>
Of the two systematic reviews identified, McCormack (2010) reports that patients presenting to the emergency room with sudden severe headache have a prevalence of subarachnoid hemorrhage of 3% to 16%. Another study reported subarachnoid hemorrhage in 25% of 148 patients who presented to general practitioners with thunderclap headache in the Netherlands over 5 years. Frishberg (2000) reports

average prevalence of significant intracranial abnormality in migraine patients of 0.18% and average prevalence of significant intracranial abnormality in tension headache of 0%. Individual studies report prevalence of significant intracranial abnormalities in adults with chronic headache of 0.7%, in adults with headache of 1.2%, and in adults with a normal neurological examination of 0.9%.

For children, individual studies have reported the prevalence of significant intracranial abnormalities in children with chronic headache to be 2%, and in children with headache presenting to a specialty clinic to be 10%, although in the latter study, positive findings included Chiari malformation, sinusitis, dilated Virchow Robin spaces, gliosis, arachnoid cysts, leukomalacia. Most of these would not be considered significant intracranial abnormalities or responsible for headaches by most authors, and their inclusion in the significant intracranial abnormality category overstates the prevalence of significant intracranial abnormality in these patients.

Red Flags (Clinical Features that Distinguish Between Patients with and without Significant Intracranial Abnormality

There are two systematic reviews that examine clinical features (red flags) as predictors for the presence of significant intracranial abnormalities on neuroimaging (Detsky 2006; Frishberg 2000). Several additional retrospective and prospective case series address the value of red flags in the prediction of significant intracranial abnormalities in patients with headaches.

Detsky (2006) performed a systematic review of 11 case series assessing performance characteristics of screening questions and clinical examination in predicting the presence of underlying intracranial pathology on neuroimaging. Clinical features with a high positive likelihood ratio include cluster headache (LR + = 11), abnormal neurological examination (LR + = 5.3), “undefined headache” (LR + = 3.8), headache with aura (LR + = 3.2) and headache with focal symptoms (LR + = 3.1). Clinical features with low negative likelihood ratios included absence of an abnormal neurological examination (LR - = 0.71), headache not aggravated by Valsalva maneuver (LR - = 0.70), absence of vomiting (LR - = 0.47) and defined type (migraine and tension) headache (LR - = 0.66).

Frishberg (2000) performed a systematic review of 28 case series. Clinical features with a high positive likelihood ratio included abnormal neurological exam (LR + = 1.7-5.4), rapidly increasing headache frequency (LR + = 12), headache awakening from sleep (LR+ = 1.7 - 98), history of dizziness, lack of coordination, numbness or tingling (LR+ = 49), headache with Valsalva maneuver (LR+ = 2.3). Clinical features with a low negative likelihood ratio included absence of abnormal neurological exam (LR - = 0.7), absence of rapidly increasing headache frequency (LR - = 0.73), headache not awakening from sleep (LR - = 0.72), absence of headache with Valsalva maneuver (LR - = 0.67).

In one case series adult patients with non-acute headache referred to a neurology clinic, neuroimaging studies identified significant intracranial abnormalities in 1.2% of patients. The only red flag that had a significant positive likelihood ratio for significant intracranial abnormality was abnormal neurological examination (LR + = 42). Gender of patient, intensity of headache, duration of headache, worsening of headache all had LR that were close to 1.0.

Two studies from emergency rooms in Italy evaluated a clinical pathway (guideline) for the emergency room evaluation of non-traumatic headaches. One study grouped patients into three clinical scenarios and the other grouped patients into four clinical scenarios. The three common scenarios were Group 1: sudden, severe headache, "worst headache ever", abnormal neurological signs, associated syncope, nausea or vomiting or headache after exertion. Group 2: recent onset of headache, worsening headache or first headache in patient age > 40 yrs. Group 3: usual headache but more severe, longer in duration or not responding to drugs. The additional Group 4 was severe headache with fever or neck stiffness. Groups 1, 2 and 4 received a CT scan in the emergency room. Group 3 did not receive CT. Computed tomography (CT) and 6 month clinical follow-up were used to make the final diagnosis. The first study reported only one missed diagnosis of 247 patients using the clinical pathway and noted a reduction in neurological consultations and shorter hospital stays compared to a similar group of patients from the year prior to the initiation of the clinical pathway. The second study reported that sensitivity of the clinical pathway was 100% and specificity was 64%, while positive likelihood ratio was 2.67 and negative likelihood ratio was 0.04.

Diagnostic Parameters for Neuroimaging in Patients with Headache

There is no comparative evidence demonstrating superior diagnostic performance in detecting significant intracranial abnormalities for either CT or MRI.

Effect of Neuroimaging on Patient Management or Outcomes

There is no evidence that suggests that MRI or CT use results in altered management or improved outcomes for patients with headache, whether the neurologic exam is normal or not.

Four good quality guidelines were identified in this report, one of which was from the Scottish Intercollegiate Guidelines Network (SIGN), published in 2008. They identify the following red flags which should prompt referral for further investigation:

- new onset or change in headache in patients who are aged over 50
- thunderclap headache: rapid time to peak headache intensity (seconds to 5 min)
- focal neurologic symptoms (e.g., limb weakness, aura <5 min or >1 hour)
- non-focal neurological symptoms (e.g., cognitive disturbance)
- change in headache frequency, characteristics or associated symptoms

- abnormal neurological examination
- headache that changes with posture
- headache wakening the patient up
- headache precipitated by physical exertion or valsalva manoeuvre (e.g., coughing, laughing, straining)
- patients with risk factors for cerebral venous sinus thrombosis
- jaw claudication or visual disturbance
- neck stiffness
- fever
- new onset headache in a patient with a history of human immunodeficiency virus (HIV) infection
- new onset headache in a patient with a history of cancer

In addition, the guideline recommends the following:

- Brain MRI should be considered in patients with cluster headache, paroxysmal hemicrania or SUNCT.

Overall Summary

The prevalence of headache is high in adults, children and emergency room patients. The prevalence of significant intracranial abnormalities in headache patients is low, occurring 1% to 2% of children and adults, with the exception of subarachnoid hemorrhage in patients presenting to the emergency room with sudden, severe (thunderclap) headache, which has a prevalence between 3% and 25%. The red flags that have likelihood ratios sufficiently high to be helpful in predicting the presence of significant intracranial abnormalities are cluster headaches, rapidly increasing headache frequency, headache awakening from sleep, headache with a history of dizziness, lack of coordination, numbness or tingling and an abnormal neurologic examination. There are no individual red flags that have likelihood ratios sufficiently low to be helpful in predicting the absence of significant intracranial abnormalities, although some clinical pathways may reach this goal. There is no evidence that suggests that MRI or CT use results in altered management or improved outcomes for patients with headache and a normal neurologic exam.

PROCEDURE

Computed Tomography of the head
Magnetic Resonance Imaging of the head

DIAGNOSES

Headache

APPLICABLE CODES

CODES	DESCRIPTION
ICD-9 Diagnosis Codes	
191	Malignant neoplasm of brain
192.1	Malignant neoplasm of cerebral meninges
225.0	Benign neoplasm of brain
225.2	Benign neoplasm of cerebral meninges
237.5	Neoplasm of uncertain behavior of brain and spinal cord
237.6	Neoplasm of uncertain behavior of meninges
320,321,322	Meningitis
331.0-9	Hydrocephalus
323	Encephalitis
324	Intracranial abscess
346.0-9	Migraine and variants
339.0	Cluster Headache and other trigeminal autonomic cephalgias
339.1	Tension type headache
339.2	Post-traumatic headache
339.4	Complicated headache syndromes
339.8	Other specified headache syndromes
348.0	Cerebral cysts
348.4	Compression of brain
349.89	Other specified disorders of the nervous system
430	Subarachnoid hemorrhage
431	Intracerebral hemorrhage
432	Other and unspecified intracranial hemorrhage
461	Acute sinusitis
473	Chronic sinusitis
741.0	Spina bifida with hydrocephalus
742.0	Encephalocele
742.2	Reduction deformities of the brain
779.7	Periventricular leukomalacia
784.0	Headache
784.2	Mass in head
ICD-9 Volume 3 (Procedure Codes)	
87.03	CAT scan of head
88.91	MRI of brain and brainstem
92.11	Radioisotope scan and function study: cerebral
CPT Codes	
70450	CT Head without contrast material
70460	CT head with contrast material
70470	CT head without followed by with contrast material
70496	CT angiography with contrast material, including post processing

CODES	DESCRIPTION
70544	MRI brain without contrast material
70545	MRI brain with contrast material
70546	MRI brain without followed by with contrast material
70551	MRI brain including brainstem without contrast material
70552	MRI brain including brainstem with contrast material
70553	MRI brain including brainstem without followed by with contrast material
HCPCS Codes	
None	

Note: Inclusion on this list does not guarantee coverage

Coverage guidance is prepared by the Health Evidence Review Commission (HERC), HERC staff, and subcommittee members. The evidence summary is prepared by the Center for Evidence-based Policy at Oregon Health & Science University (the Center). This document is intended to guide public and private purchasers in Oregon in making informed decisions about health care services.

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