

## HEALTH EVIDENCE REVIEW COMMISSION (HERC)

### COVERAGE GUIDANCE: NEUROIMAGING FOR HEADACHE

Approved by HERC 8/8/2013; reaffirmed 1/14/2016

This coverage guidance was created under HERC's 2013 coverage guidance process and does not include strength of recommendation, a GRADE-informed framework or coverage guidance development framework.

As a part of the coverage guidance monitoring process, the HERC decided on 1/14/2016 (see Appendix A) to reaffirm the existing coverage guidance and reconsider the need to update the topic during the regular two-year review cycle.

#### HERC COVERAGE GUIDANCE

Neuroimaging is not recommended for coverage in patients with a defined tension or migraine type of headache, or a variation of their usual headache (e.g. more severe, longer in duration, or not responding to drugs).

Neuroimaging is recommended for coverage with headache when 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, lack of coordination, numbness or tingling)
- non-focal neurological symptoms (e.g. altered mental status, dizziness)
- abnormal neurological examination
- headache that changes with posture
- headache wakening the patient up (nota bene migraine is the most frequent cause of morning headache)
- headache precipitated by physical exertion or Valsalva maneuver (e.g. coughing, laughing, straining)
- patients with risk factors for cerebral venous sinus thrombosis
- jaw claudication
- nuchal rigidity
- 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
- cluster headache, paroxysmal hemicrania, short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing (SUNCT), or short-lasting unilateral neuralgiform headache attacks with cranial autonomic features (SUNA)

## 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

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 Health 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.

### *Key Sources Cited in MED Report:*

Detsky, M.E., McDonald, D.R., Baerlocher, M.O., Tomlinson, G.A., McCrory, D.C., & Booth, C.M. (2006). Does this patient with headache have a migraine or need neuroimaging?. *JAMA*, 296(10), 1274-1283.

Frishberg, B.M., Rosenberg, J.H., Matchar, D.B., McCrory, D.C., Pietrzak, M.P., Rozen, T.D., et al. (2000). Evidence-based guidelines in the primary care setting: Neuroimaging in patients with nonacute headache. US Headache Consortium. Minneapolis, MN: American Academy of Neurology. Retrieved from <http://www.aan.com/professionals/practice/pdfs/gl0088.pdf>

McCormack, R.F., & Hutson, A. (2010). 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?. *Academic Emergency Medicine*, 17(4), 444-451.

Scottish Intercollegiate Guidelines Network. (2008). *Diagnosis and Management of Headaches in Adults*. A National Clinical Guideline. Edinburgh: 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**

#### Headache Prevalence

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%.

#### Prevalence of Significant Intracranial Abnormality

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 waking 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.

### SUBCOMMITTEE DELIBERATIONS (EbGS)

The EbGS elected to use the language from the SIGN guideline over an option presented by staff based on the evidence review, in order to include additional medically appropriate indications. The subcommittee also elected to change several phrases in the previous guidance that were too vague or subjective, and were not indications for imaging by themselves; for example, the language for neck stiffness was changed to “nuchal rigidity” to ensure objective evidence of neck stiffness.

### SUBCOMMITTEE DELIBERATIONS (VbBS)

The VbBS discussed modifying the coverage guidance language further for clarity and approved a modified diagnostic guideline.

### **DIAGNOSTIC GUIDELINE D5, NEUROIMAGING FOR HEADACHE**

Neuroimaging is not covered in patients with a defined tension or migraine type of headache, or a variation of their usual headache (e.g. more severe, longer in duration, or not responding to drugs).

Neuroimaging is covered for headache when a red flag\* is present.

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

- A. New onset or change in headache in patients who are aged over 50
- B. Thunderclap headache: rapid time to peak headache intensity (seconds to 5 minutes)
- C. Focal neurological symptoms (e.g. limb weakness, lack of coordination, numbness or tingling)
- D. Non-focal neurological symptoms (e.g altered mental status, dizziness)
- E. Abnormal neurological examination

- F. Headache that changes with posture
- G. Headache wakening the patient up (NB migraine is the most frequent cause of morning headache)
- H. Headache precipitated by physical exertion or valsalva maneuver (e.g. coughing, laughing, straining)
- I. Patients with risk factors for cerebral venous sinus thrombosis
- J. Jaw claudication
- K. Nuchal rigidity
- L. New onset headache in a patient with a history of human immunodeficiency virus (HIV) infection
- M. New onset headache in a patient with a history of cancer
- N. Cluster headache, paroxysmal hemicrania, short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing (SUNCT), or short-lasting unilateral neuralgiform headache attacks with cranial autonomic features (SUNA)

### HERC DELIBERATIONS

At its August 8, 2013 meeting the HERC adopted the draft coverage guidance and revised guideline note as referred by VbBS.

### APPLICABLE CODES

<b>CODES</b>	<b>DESCRIPTION</b>
<b>ICD-9 Diagnosis Codes</b>	
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
<b>ICD-9 Volume 3 (procedure codes)</b>	
87.03	CAT scan of head
88.91	MRI of brain and brainstem
92.11	Radioisotope scan and function study: cerebral
<b>CPT Codes</b>	
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
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
<b>HCPCS Level II Codes</b>	
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.

The Center is not engaged in rendering any clinical, legal, business or other professional advice. The statements in this document do not represent official policy positions of the Center. Researchers involved in preparing this document have no affiliations or financial involvement that conflict with material presented in this document.

## Appendix A: 2015 Rescanning Summary

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**HERC decision (1/14/2016):** Reaffirm the existing coverage guidance and reconsider the need to update it during the regular two-year review cycle.

**Bottom Line:** There continues to be very limited good-quality evidence on the utility of neuroimaging for headache. In general, the sources reviewed below recommend that neuroimaging should not be obtained in the evaluation of primary headache disorders without red-flags. There is some minor variability in the definition of red-flag features, and in most cases these determinations are made on the basis of expert opinion. Most of the red-flag features proposed in other guidelines are captured in the current HERC coverage guidance.

### Scope Statement

<b>Population description</b>	Adults and children with non-traumatic, acute or chronic headache
<b>Intervention(s)</b>	MRI or CT head/brain, with or without contrast enhancement <i>Intervention exclusions: None</i>
<b>Comparator(s)</b>	Usual care, no neuroimaging
<b>Outcome(s) (up to five)</b>	<b>Critical:</b> Morbidity from significant intracranial abnormalities <b>Important:</b> Headache-free days, quality of life, harms from radiation exposure, harms from incidental findings <i>Outcomes considered but not selected for GRADE table: None</i>
<b>Key questions</b>	<ol style="list-style-type: none"> <li>1. What is the comparative effectiveness of neuroimaging for headache in improving patient outcomes or detecting significant intracranial abnormalities?             <ol style="list-style-type: none"> <li>a. Does the effectiveness of neuroimaging for headache vary based on acuity?</li> </ol> </li> <li>2. What are the evidence-supported red-flag features which are indications for neuroimaging for headache?             <ol style="list-style-type: none"> <li>a. Do the evidence-supported red-flag features which indicate neuroimaging vary based on acuity?</li> </ol> </li> <li>3. What are the harms of neuroimaging for headache?</li> </ol>

## Scanning Results

1. Alexiou, G. A. & Argyropoulou, M. I. (2013) Neuroimaging in childhood headache: A systematic review. *Pediatric Radiology*, 43(7):777-784. DOI: 10.1007/s00247-013-2692-3.

Citation 1 is a systematic review of seventeen studies examining the utility of neuroimaging for children with headaches. Of 3,260 children who had undergone neuroimaging for headache, only 82 (2.5%) had imaging findings that led to a change in management, and among these patients only 4 had normal neurologic exams. The overall conclusion is that neuroimaging for headache in children is generally low yield and should be limited to those with “a suspicious clinical history, abnormal neurologic findings or other physical signs suggestive of intracranial pathology.”

2. Beithon, J., Gallenberg, M., Johnson, K., Kildahl, P., Krenik, J., Liebow, M., ... Swanson, J. (2013). Diagnosis and treatment of headache. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2013 Jan. Retrieved from <http://bit.ly/Headache0113>

Citation 2 is a guideline from the Institute for Clinical Systems Improvement (ICSI). It is focused mainly on the diagnosis and management of primary headache disorders, for which neuroimaging is not needed for the diagnosis. The guideline offers the following causes for concern:

- Subacute and/or progressive headaches that worsen over time (months)
- A new or different headache or a statement by a headache patient that "this is the worst headache ever"
- Any headache of maximum severity at onset
- Headaches of new onset after the age of 50 years old
- Persistent headache precipitated by a Valsalva maneuver such as cough, sneeze, bending or with exertion (physical or sexual)
- Evidence such as fever, hypertension, myalgias, weight loss or scalp tenderness suggesting a systemic disorder
- Neurological signs that may suggest a secondary cause. For example: meningismus, confusion, altered levels of consciousness, changes or impairment of memory, papilledema, visual field defect, cranial nerve asymmetry, extremity drifts or weaknesses, clear sensory deficits, reflex asymmetry, extensor plantar response, or gait disturbances
- Seizures

According to the ICSI algorithm, any of the above signs should prompt consideration of secondary headache disorders and additional diagnostic testing (including neuroimaging) or referral for specialty consultation is warranted.

3. Douglas, A. C., Wippold, F. J. II, Broderick, D. F., Aiken, A. H., Amin-Hanjani, S., Brown, D. C., ... Zipfel G. J. (2013). ACR Appropriateness Criteria® headache. [online publication]. Reston (VA): American College of Radiology (ACR).

Citation 3 is the American College of Radiology Appropriateness Criteria for headaches in adults. In general, imaging is usually not appropriate for chronic headaches without new features or abnormalities on neurologic exam. Some form of neuroimaging (e.g., MRI, CT, angiography) may be appropriate or is usually appropriate in the following scenarios:

- Chronic headache with new feature or neurologic deficit
- Sudden onset of severe headache
- Sudden onset of unilateral headache or suspected carotid or vertebral dissection
- Headache of trigeminal autonomic origin
- Headache of skull base, orbital, or periorbital origin
- Headache with suspected intracranial complication of sinusitis and/or mastoiditis
- Headache of oromaxillofacial origin
- New headache in elderly patients, ESR>55, temporal tenderness
- New headache in a cancer patient or immunocompromised individual
- New headache with suspected meningitis/encephalitis
- New headache in a pregnant woman
- New headache with focal neurologic deficit or papilledema
- Positional headache
- Headache associated with cough, exertion, or sexual activity
- Post-traumatic headache

4. Hayes, L. L., Coley, B. D., Karmazyn, B., Dempsey-Robertson, M. E., Dillman, J. R., Dory, C. E., ... Wootton-Gorges, S. L. (2012). ACR Appropriateness Criteria® headache - child. [online publication]. Reston (VA): American College of Radiology (ACR).

Citation 4 is the American College of Radiology Appropriateness Criteria for headaches in children. In general, imaging is usually not appropriate for primary headache disorders (chronic or recurrent headache including migraine without permanent neurologic signs or signs of increased intracranial pressure). Some form of neuroimaging (e.g., MRI, CT, angiography) may be appropriate or is usually appropriate in the following scenarios:

- Headache with signs of increased intracranial pressure or positive neurologic signs
- High-intensity headache of abrupt onset

5. Medical Advisory Secretariat. (2010). Neuroimaging for the evaluation of chronic headaches: an evidence-based analysis. Ontario Health Technology Assessment Service. 2010]; 10(26) 1-57. Retrieved from: [http://www.health.gov.on.ca/english/providers/program/mas/tech/reviews/pdf/rev\\_Headache\\_20101222.pdf](http://www.health.gov.on.ca/english/providers/program/mas/tech/reviews/pdf/rev_Headache_20101222.pdf)

Citation 5 is a health technology assessment and economic analysis from the Medical Advisory Secretariat of the Ontario Ministry of Health and Long-Term Care. Its focus is on the use of neuroimaging in people with chronic headache with a normal neurologic exam. Of note, the GRADE quality of evidence reported for this review was low to very low. The overall pretest probability of intracranial abnormalities in people with chronic headaches without neurologic findings is 0.9%. Summary likelihood ratios for detecting significant intracranial abnormalities were statistically significant for the following findings/ characteristics:

- Abnormal neurologic exam (+LR 5.3, -LR 0.71)
- Undefined headache (+LR 3.8, -LR 0.66)
- Headache aggravated by exertion or Valsalva (+LR 2.3, -LR 0.70)
- Headache with vomiting (+LR 1.8, -LR 0.47)
- Cluster-type headache (+LR 11, -LR 0.95 [NS])
- Headache with aura (+LR 3.2, -LR 0.51 [NS])

The review did not find evidence that neuroimaging reduced anxiety at 1 year.

6. National Clinical Guideline Centre. (2012). Headaches: diagnosis and management of headaches in young people and adults. London (UK): National Institute for Health and Clinical Excellence (NICE).

Citation 6 is a NICE guideline on headache in young people and adults. NICE recommends that people with tension-type or migraine headache should not be referred for imaging if they do not have signs or symptoms of secondary headache. Signs and symptoms of secondary headache are

- Worsening headache with fever
- Sudden-onset headache reaching maximum intensity within 5 minutes
- New-onset neurologic deficit
- New-onset cognitive dysfunction

- Change in personality
- Impaired level of consciousness
- Recent head trauma (typically within the past 3 months)
- Headache triggered by cough, Valsalva, or sneeze
- Headache triggered by exercise
- Orthostatic headache
- Symptoms suggestive of giant cell arteritis
- Symptoms and signs of acute narrow-angle glaucoma
- Substantial change in the characteristics of their headache

NICE guidance also states that further investigation or referral may be warranted for people with new-onset headache and:

- Compromised immunity
- Age under 20 years and a history of malignancy
- A history of malignancy known to metastasize to the brain
- Vomiting without other obvious cause

Note: The NICE guidance is currently being reviewed and updated.

7. Toward Optimized Practice. (2012). Guideline for primary care management of headache in adults. Edmonton (AB): Toward Optimized Practice.

Citation 7 is a guideline from Toward Optimized Practice and the Institute of Health Economics in Alberta. According to these guidelines neuroimaging should not be obtained for common primary headache disorders or to reassure patients. They state that neuroimaging should be obtained:

- Emergently for:
  - Thunderclap headache
  - Headache with meningismus
  - Papilloedema with altered level of consciousness or focal signs
  - Acute angle-closure glaucoma
- Urgently for:
  - Signs of systemic illness in a patient with new onset headache
  - New headache in people over age 50 with other symptoms suggestive of temporal arteritis
  - Papilloedema without focal signs
  - Elderly patients with new headache and subacute cognitive change
- In the outpatient setting for:
  - Atypical headaches and change in headache pattern

- Unexplained focal signs
- Unusual headache precipitants
- Unusual aura symptoms
- Cluster headache and other uncommon primary headache syndromes
- Late onset headache (after age 50)

8. van Ravesteijn, H., vanDijk, I., Darmon, D., vandeLaar, F., Lucassen, P., Hartman, T. O., vanWeel, C. & Speckens, A. (2012). The reassuring value of diagnostic tests: a systematic review. *Patient Education and Counseling*, 86(1), 3-8. DOI: 10.1016/j.pec.2011.02.003.

Citation 8 is a SR and narrative synthesis of studies pertaining to reassurance provided by diagnostic tests. They include one RCT of MRI brain to provide reassurance for patients with chronic headaches which concluded that while anxiety levels improve at 3 months that there is no difference at 1 year.

## Methods

### *Search Strategy*

A full search of the core sources was conducted to identify systematic reviews, meta-analyses, technology assessments, and clinical practice guidelines using the terms “headache” and “imaging” or “neuroimaging.” Searches of core sources were limited to citations published since 2010.

The core sources searched included:

- Agency for Healthcare Research and Quality (AHRQ)
- Blue Cross/Blue Shield Health Technology Assessment (HTA) program
- BMJ Clinical Evidence*
- Canadian Agency for Drugs and Technologies in Health (CADTH)
- Cochrane Library (Wiley Interscience)
- Hayes, Inc.
- Medicaid Evidence-based Decisions Project (MED)
- National Institute for Health and Care Excellence (NICE)
- Tufts Cost-effectiveness Analysis Registry
- Veterans Administration Evidence-based Synthesis Program (ESP)
- Washington State Health Technology Assessment Program

A MEDLINE® (Ovid) search was conducted to identify systematic reviews, meta-analyses, and technology assessments published after the search dates of original evidence sources. The search was limited to publications in English published since 2010.

Searches for clinical practice guidelines were limited to those published since 2010. A search for relevant clinical practice guidelines was also conducted, using the following sources:

- Australian Government National Health and Medical Research Council (NHMRC)
- Centers for Disease Control and Prevention (CDC) – Community Preventive Services
- Institute for Clinical Systems Improvement (ICSI)
- National Guidelines Clearinghouse
- New Zealand Guidelines Group
- NICE
- Scottish Intercollegiate Guidelines Network (SIGN)
- United States Preventive Services Task Force (USPSTF)
- Veterans Administration/Department of Defense (VA/DOD)

*Inclusion/Exclusion Criteria*

Studies were excluded if they were not published in English, did not address the scope statement, or were study designs other than systematic reviews, meta-analyses, technology assessment, or clinical practice guidelines.