Complete Summary

GUIDELINE TITLE

Headache - child.

BIBLIOGRAPHIC SOURCE(S)

Strain JD, Cohen HL, Fordham L, Gunderman R, McAlister WH, Slovis TL, Smith WL, Rothner AD, Expert Panel on Pediatric Imaging. Headache--child. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 6 p. [36 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Strain JD, Strife JL, Kushner DC, Babcock DS, Cohen HL, Gelfand MJ, Hernandez RJ, McAlister WH, Parker BR, Royal SA, Slovis TL, Smith WL, Rothner AD. Headache. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):855-60.

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

COMPLETE SUMMARY CONTENT

SCOPE
METHODOLOGY - including Rating Scheme and Cost Analysis
RECOMMENDATIONS
EVIDENCE SUPPORTING THE RECOMMENDATIONS
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS
QUALIFYING STATEMENTS
IMPLEMENTATION OF THE GUIDELINE
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES
IDENTIFYING INFORMATION AND AVAILABILITY
DISCLAIMER

SCOPE

DISEASE/CONDITION(S)

Headache in children

GUIDELINE CATEGORY

Diagnosis
Evaluation

CLINICAL SPECIALTY

Family Practice
Neurology
Pediatrics
Radiology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for children with headache

TARGET POPULATION

Children with headache

INTERVENTIONS AND PRACTICES CONSIDERED

1. Computed tomography (CT), with and without contrast
2. CT angiography (CTA)
3. Magnetic resonance imaging (MRI), with and without contrast
4. Magnetic resonance angiography (MRA)
5. Invasive (INV), catheter angiography
6. Nuclear medicine (NUC), single photon emission-computed tomography (SPECT)

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of peer-reviewed medical journals and the major applicable articles were identified and collected.

NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not stated

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed for reaching agreement in the formulation of the appropriateness criteria. The American College of Radiology (ACR) Appropriateness Criteria panels use a modified Delphi technique to arrive at consensus. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1 to 9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty percent agreement is considered a consensus. This modified Delphi technique enables individual, unbiased expression, is economical, easy to understand, and relatively simple to conduct.

If consensus cannot be reached by the Delphi technique, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible. If "No consensus" appears in the rating column, reasons for this decision are added to the comment sections.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria®

Clinical Condition: Headache - Child

Variant 1: Isolated headache (unaccompanied by neurologic signs and symptoms or historical data).

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT, head, without contrast	2	
CT, head, with contrast	2	
CTA, head	2	
MRI, head, without contrast	2	
MRI, head, with	2	

Radiologic Exam Procedure	Appropriateness Rating	Comments
contrast		
MRA, head	2	
INV, catheter angiography	2	
NUC, SPECT, head	2	
Appropriateness Criteria Scale **1 2 3 4 5 6 7 8 9** **1 = Least appropriate 9 = Most appropriate**		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Headaches with positive neurologic signs or symptoms.

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT, head	8	CT or MRI should be performed in every patient.
MRI, head	8	CT or MRI should be performed in every patient.
INV, catheter angiography	2	Unless indicated by other studies.
NUC, SPECT, head	2	Only helpful when further evaluating the lesion.
Appropriateness Criteria Scale **1 2 3 4 5 6 7 8 9** **1 = Least appropriate 9 = Most appropriate**		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Headaches with supporting historical data (diplopia, morning vomiting, headaches that awaken patient from sleep).

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRI, head	9	

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT, head	8	MRI is recommended but CT is acceptable alternative.
MRA, head	2	
INV, catheter angiography	2	
NUC, SPECT, head	2	
Appropriateness Criteria Scale **1 2 3 4 5 6 7 8 9** **1 = Least appropriate 9 = Most appropriate**		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Acute severe (thunderclap) headache and absence of family history of migraine.

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT, head	9	Non contrast preferred.
MRI, head	8	Either CT or MRI, not both.
CTA, head	7	Indicated if subarachnoid or parenchymal blood is identified on CT, MRI, or LP. Either CTA or MRA, not both.
MRA, head	7	Indicated if subarachnoid or parenchymal blood is identified on CT, MRI, or LP. Either CTA or MRA, not both.
INV, catheter angiography	6	If MRA or CTA not available or if intervention is considered.
NUC, SPECT, head	2	
Appropriateness Criteria Scale **1 2 3 4 5 6 7 8 9** **1 = Least appropriate 9 = Most appropriate**		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Common or classic migraine (without neurologic findings).

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT, head	2	
MRI, head	2	
MRA, head	2	
INV, catheter angiography	2	
NUC, SPECT, head	2	
Appropriateness Criteria Scale **1 2 3 4 5 6 7 8 9** **1 = Least appropriate 9 = Most appropriate**		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Headache is very common in children. The prevalence of headaches, in patients age 7 years of age or younger, is 19 to 51%, with migraine representing 1 to 5%. In large cross-sectional studies, 60% of children 7 to 15 years of age suffered from headaches, and 3 to 4% suffered from migraines. In a U.S. study, the prevalence of headaches in studies of adolescent boys and girls was 56% and 74%, respectively, with migraines accounting for 3.8% and 6.6%, respectively.

Occasionally, headache heralds the development of a brain tumor or other structural abnormality in a child; however, a large percentage of the pediatric population suffers from headaches, whereas the annual incidence of brain tumor in the pediatric age group approximates only 3 per 100,000 (0.003%). The need to distinguish headaches due to other causes from headaches due to structural abnormalities is a major dilemma. A review of the literature finds that most articles are retrospective case series and have inherent bias. Reviews from pediatric neurology or pediatric neurosurgical referrals bias the data when evaluating structural anomalies associated with headache. Similar bias comes from retrospective reviews provided through large brain tumor consortiums. It is difficult to assess the health outcome of early detection of any intracranial lesions, because the type, size, and location determine their management. These issues are not unique to the pediatric patient; they have also been discussed in a series of adult literature reviews. Clinical experience from primary care physicians, pediatricians, and neurologists indicates that neuroimaging studies have a limited role in children with headaches.

The high prevalence of headaches and the low yield of imaging in pediatric patients presenting with headaches alone bring into question the value of screening for patients with "isolated" headaches. There are, however, clinical conditions that influence the yield of positive examinations. Numerous studies, most of which are retrospective, help identify those findings or clinical

characteristics that, when associated with headaches, appear to be useful predictors of positive imaging evaluation and therefore influence the appropriateness of imaging. An isolated headache unaccompanied by neurologic signs, presence of a seizure, or supporting historical data needs no imaging.

Headaches with Positive Neurologic Signs or Symptoms

Major studies addressing the issues of brain tumors and indications for imaging, including the data from 3,291 children described in the Childhood Brain Tumor Consortium, 315 children in the Boston Children's review, and 72 children in the data of Honig and Charney, suggest that nearly all children with intracranial tumors had symptoms or neurologic signs accompanying their headache. The Childhood Brain Tumor Consortium and the Honig and Charney data show that 94% of children with brain tumors have abnormal neurologic findings at diagnosis. Sixty percent had papilledema. Other neurological findings included gait disturbance, abnormal reflexes, cranial nerve findings, and altered sensation. Another research team identified papilledema, nystagmus, and gait disturbances as univariant predictors of brain tumor. Confusion and other assorted abnormal neurological findings were multivariant predictors of brain tumors. It would appear appropriate from this retrospective data to consider intracranial imaging, CT (with and without contrast), or MRI in any patient presenting with headache and positive neurologic findings.

Supporting Historical Data

There also appear to be specific historical data or headache characteristics that are associated with intracranial pathology. Headaches that awaken the child from sleep or occur on arising appear to have clinical significance. Intense, prolonged, and incapacitating headaches with an absent family history for migraine may indicate an underlying pathology. Patients with headaches increasing in frequency, duration, and intensity might benefit from imaging. Vomiting accompanied headaches in 78% of patients in the study by Honig and Charney, and it was also predictive of pathological process in the study by other researchers. Individuals who have these specific historical data of headache characteristics may benefit from CT with and without contrast.

Sudden Severe Headache (thunderclap headache)

Sudden severe headaches are more common in adults than in children. These "thunderclap headaches" are predictive of subarachnoid hemorrhage and place patients at risk for aneurysm or arteriovenous malformation. Childhood intracranial aneurysms are rare, but many such case reports document severe acute headache as the presenting symptom. Sudden severe unilateral headaches in the pediatric population and in young adults correlate with carotid or vertebral dissection, especially when associated with neurologic signs and symptoms. In sudden severe headaches, particularly in the absence of a family history of migraine, a CT scan with and without contrast is recommended. If subarachnoid or parenchymal hemorrhage is detected, CTA should be performed. Catheter angiography may provide more definitive information but, more importantly, may be considered for neurovascular intervention.

Common or Classic Migraines

By 15 years of age, children experience migraine headaches with a frequency that varies from 3 to 5%, according to published studies. There is a female predominance in migraines. The 1988 International Headache Society described two types of migraine: migraine with aura (classic), and migraine without aura (common). In classic migraine, headache is preceded by an aura (17%). Common migraine is defined as characteristically paroxysmal and separated by symptom-free intervals. The most common symptoms are nausea, vomiting, abdominal pain, and disturbance of vision. Visual symptoms include scintillating scotomata, blurriness, transient hemianopia, or complete blindness in one eye (amaurosis fugax). A family history of the disorder can be elicited in more than half of the patients. Other symptoms include numbness and tingling in one arm over the entire side, hemiplegia, aphasia, or apraxia.

Clinicians have difficulty distinguishing the first, second, or third migraine headache from headache caused by brain tumor, subarachnoid hemorrhage, vasculopathy, arteriovenous malformation, or other underlying disease processes. These patients may be imaged before the diagnosis of migraine is established. One of the clues in differentiating these headaches may relate to transient neurologic findings versus persistent findings in tumor headaches. In 72 patients with brain tumor headaches as described by Honig and Charney, abnormal physical signs were present in 94% of the patients. Although migraine may have many manifestations, it is usually not difficult to diagnose. If the child has typical migraine with or without aura, most clinicians would recommend no imaging studies. Children with migraine are symptom free between headaches. No imaging is recommended in cases of common migraine of more than 6 months' duration in patients with a family history of migraine and nonprogressive migraine attacks.

Complicated Migraine (Those with Neurologic Deficit)

Because the presenting signs and symptoms of complicated migraines with focal neurologic findings cannot be discriminated from similar presentations related to intracranial neoplasms, imaging is recommended. Ophthalmologic migraine with focal neurologic symptoms of unilateral ptosis or complete third nerve palsy is recommended to distinguish it from other intracranial abnormalities.

In patients with miscellaneous migraine findings or syndromes such as in vertigo, basilar artery migraine syndrome, persistent confusion migraine syndrome, progressive chronic headache, or hemiplegic migraine, imaging may be appropriate to exclude an aneurysm, a space-occupying lesion, or other intracranial abnormality. Basilar artery migraine syndrome includes vertigo, tinnitus, ataxia, dysarthria, and diplopia that precede the onset of headache. These findings are believed to result from brainstem ischemia; however, they must be differentiated from stroke or other causes of ischemic lesions. MRI with diffusion is recommended in these patients. Occasionally, arteriography or MRA may be warranted.

Sinogenic Headache

Sinus disease may present with headache or may be associated with it. The diagnosis of acute sinusitis in children is made clinically; however, in children who present with severe and persistent headache as the dominant feature of sinusitis, imaging may be warranted. Clinical signs suggesting intracranial abnormality

include high fever, confusion, and change in mental status with and without focal signs. Headache is the most common symptom identified with the intracranial spread of infection resulting from dural irritation and localized encephalitis. Occasionally, patients who present with various primary headache syndromes without significant nasal or sinus symptoms and fail to respond to conventional therapy are found to have evidence of sinusitis on CT.

Epidural empyemas are collections of suppurative fluid located between the skull and dura. They are less prevalent in young children than adolescents. The most common underlying abnormality is paranasal sinusitis. The differential diagnosis includes meningitis, subdurals, brain abscess, and subarachnoid bleeding. Imaging is decisive and aids treatment. The diagnostic choice is either CT or MRI. Contrast enhancement can increase the conspicuousness of a subtle collection. MRI may be preferable for diagnosing epidural empyemas because of its ability to distinguish between different types of fluid. For patients who present with transient headaches and sinus disease, no imaging is warranted. For patients in whom headache is the dominant presenting problem or for those with headache associated with mental status change or neurologic findings, imaging is appropriate.

Trauma

Headache is rarely a presenting feature of acute trauma. Craniocervical trauma accounts for 50% of deaths of children between 1 and 14 years of age. Eighty percent of children who die from multisystem trauma have associated head injuries. Trauma to the central nervous system is the greatest cause of morbidity and mortality in children. In addition, nonaccidental trauma is the leading cause of morbidity and mortality in the abused child. Typically, the abused child presents without external signs of trauma to the head, face, and/or neck, and the intracranial injury is related to whiplash - shaken infant syndrome. Clearly, intracranial imaging plays a critical role in the evaluation of the acutely injured patient; however, because headache is rarely a major indication for imaging, in the context of the clinical condition headache, only the evaluation of headache related to subacute or remote trauma will be considered.

Patients who have a history of subacute or remote trauma may present with headaches. Currently, there is no published series evaluating headaches that correlate neurologic signs and symptoms with imaging findings. However, in adults, the complaint of headache has been associated with an increased risk of intracranial injury, even in patients suffering minor head trauma with Glasgow's coma scores greater than 13. Thus, in children who have previous minor head trauma and who are awake and alert with no neurological deficit, the indications for CT or MR are not clear. Certainly, it would be prudent to consider imaging of patients in whom neurologic signs or symptoms are positive, whose headaches are associated with vomiting, or whose headaches are increasing in frequency, duration, or severity, regardless of the severity of the initial trauma.

Headache with Fever or Known Underlying Disease

Headache may accompany a febrile illness. Additional testing may be required when meningitis or encephalitis is suspected. Neurologic signs and symptoms such as nuchal rigidity or alteration in consciousness may be indications for

imaging. In addition, there are known underlying disease processes that predispose patients to intracranial pathology. Children with underlying disease -- such as immunocompromised patients, children with known neoplasms, sickle cell patients, and patients with coagulopathy or hypertension -- are predisposed to intracranial pathology. In high-risk groups, the presence of a severe headache may indicate significant intracranial pathology. It would seem appropriate to consider a lower threshold for imaging in this patient population.

Abbreviations

- CT, computed tomography
- CTA, CT angiography
- INV, invasive
- LP, lumbar puncture
- MRA, magnetic resonance angiography
- MRI, magnetic resonance imaging
- NUC, nuclear medicine
- SPECT, single photon emission computed tomography

CLINICAL ALGORITHM(S)

Algorithms were not developed from criteria guidelines.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Selection of appropriate radiologic imaging procedures for evaluation of children with headache

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring

physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Personal Digital Assistant (PDA) Downloads

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Strain JD, Cohen HL, Fordham L, Gunderman R, McAlister WH, Slovis TL, Smith WL, Rothner AD, Expert Panel on Pediatric Imaging. Headache--child. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 6 p. [36 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1999 (revised 2005)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

GUIDELINE COMMITTEE

Committee on Appropriateness Criteria, Expert Panel on Pediatric Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Panel Members: John D. Strain, MD; Harris L. Cohen, MD; Lynn Fordham, MD; Richard Gunderman, MD, PhD; William H. McAlister, MD; Thomas L. Slovis, MD; Wilbur L. Smith, MD; A. David Rothner, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

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The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.

ACR Appropriateness Criteria® *Anytime*, *Anywhere*™ (PDA application). Available from the ACR Web site.

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- ACR Appropriateness Criteria®. Background and development. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.

PATIENT RESOURCES

None available

NGC STATUS

This NGC summary was completed by ECRI on March 30, 2006.

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DISCLAIMER

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Readers with questions regarding guideline content are directed to contact the guideline developer.

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