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Headache

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ACR APPROPRIATENESS CRITERIA

Headache

John E. Jordan, for the Expert Panel on Neurologic Imaging

Headache is one of the most frequent ailments of the human race. Headache prevalence is estimated at 11%–48% in children[1,2] and 6%–71% in adults.[3,4] As with migraine, age, sex, and case definition may largely account for this variance.[5] A higher prevalence has been found in Europe and North America[6-8] than in Asian and South American countries.[4,9] Prevalence of migraine shows a clear sex difference, affecting about 15%–18% of women and 6% of men.[5,10] Muscle contraction or tension accounts for most of the nonmigraine headaches encountered in population surveys.

By comparison, the frequency of pathology presenting with headache is low. The yearly incidence of brain tumors in the US is 46 per 100,000, and for subarachnoid hemorrhage (SAH), 9 per 100,000. Arteriovenous malformations (AVMs) are about one-tenth as frequent as saccular aneurysms. Only a subset of these patients presents with isolated headache. In a retrospective review of the presentation of 111 brain tumors, headaches were a symptom in 48%, equally for primary and metastatic brain tumors.[11] Headaches were similar to tension type in 77%, migraine-type in 9%, and other types in 14%. The typical headache was bifrontal but worse ipsilaterally, and was the worst symptom in only 45% of patients. Sometimes headache precedes the diagnosis of brain tumor by several years, suggesting an association rather than causality.[12,13] In children headache was present in 62%, more often with infratentorial tumors.[14] Because tumors are relatively rare, a large proportion of the imaging studies will be negative.[12]

Several studies have confirmed the low yield of imaging procedures of isolated headache unaccompanied by other neurologic findings.[15,16] Most of them are retrospective reviews. A prospective review of 293 CT scans from an ambulatory setting disclosed that most of them were ordered because of suspected tumor (49%) or SAH (9%). Fifty-nine (17%) were ordered because of patient expectation or medico-legal concerns.[17]

Studies before 1991 on the yield of CT or MR imaging in patients with headache but normal neurologic examination were reviewed.[18-21] Most of the larger ones were performed with first-generation CT. Of 897 studies of migraine patients, only 4 were positive, (3 tumors, 1 AVM), a 0.4% yield of potentially treatable lesions. In patients with unspecified headache, 1825 scans yielded 43 lesions (21 tumors, 8 hydrocephalus, 6 AVMs, 5 subdural hematomas, and 3 aneurysms), a 2.4% yield. However, 2 studies in this group were performed at tertiary referral centers (the Mayo Clinic and the Cleveland Clinic) and had a 500% higher rate of clinically important findings.[19,21] If these 2 studies are excluded, the total number of potentially treatable lesions is reduced to 3 of 725 studies (0.4%).[18] A potential bias for the early series, however, is performance on first-generation equipment, likely to have less sensitivity than current units.

Of 1999 scans reported in other series, including mostly CT, only 21 (1%) disclosed treatable lesions.[17,22-28] Most of the positive cases occurred in the series of Becker et al[17] which included patients with abnormal neurologic findings. If this series is excluded, only 9 of 1999 patients (0.5%) had treatable findings. Low positive yields were also found in emergency department patients.[29]

The indications for imaging a common disorder such as headache are especially important given evolving technologies.[30-33] In common conditions, performance of low-yield studies is more likely to result in false-positives, risking additional unnecessary procedures. As indicated above, only a 0.4% positive yield is seen in patients referred with isolated, nontraumatic headache. Hence the societal cost implications are significant.

One should not assume a lack of social benefit from negative imaging studies of headache however. Headache symptoms can be ominous resulting in tremendous costs in productivity and quality-of-life losses. Moreover, providers perceive value in imaging headache when fearing litigation. Therefore, the costs of imaging headache are always overstated when the value of negative results is not considered.[15]

Some headache presentations require further discussion (Table 1). A severe "thunderclap," nonmigranous headache, clearly different from the patient's usual headaches, is at higher risk of being an SAH. In 3 series, as many as 165 of 350 patients (47%) with thunderclap headache had an SAH.[34-36] If the CT scan is negative, a lumbar puncture should be performed.[35,36] These patients may also require MR angiography (MRA), CT angiography (CTA), and/or conventional angiography.

Sudden severe unilateral headache radiating into the neck accompanied by a Horner syndrome, may be the result of an arterial dissection.[37] In a series of 161 patients, headache was reported by 68% of them. Of these, it was the initial manifestation in 47% of carotid dissections and 33% of vertebral dissections.[38] Although some had strokelike syndromes, others did not, or they developed them several days after initial presentation of isolated headache. The pattern of radiation will often make one suspect that this is an atypical headache. MR imaging, MRA, CTA, and/or conventional angiography may

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Clinical condition—Headache	CT, head, without contrast	CT, head, without and with contrast	MR imaging, brain, without and with contrast	MR imaging, brain, without contrast	MR angiography, head, with or without contrast	CT angiogram, head	Angiography, cerebral	MR angiography, head and neck, with or without contrast	CT angiogram, head and neck
Worsened chronic headache. History of headache.	4	4	4	4	2	2	2	X	X
Sudden onset of severe headache ("Worst headache of one's life, thunderclap headache").	9	6	6[a]	7[a]	8	8	7	X	X
Sudden onset of unilateral headache, or suspected carotid or vertebral dissection or ipsilateral Horner syndrome.[o]	8	6	8[b]	8[b]	X	X	7	8[c]	8[c]
Headache, suspected complication of sinusitis and/or mastoiditis.[p]	7[d]	6[d]	8	7	X	X	X	X	X
New headache in patient older than age 60. Sedimentation rate higher than 55, temporal tenderness. Suspected temporal arteritis.	6	5	7[c]	8[c]	X	X	4[e]	5	5
New headache in HIV+ individual.	6[f]	5	8	8	3[g]	3[g]	2[e]	X	X
New headache in pregnant patient.[q]	8	X	5[h]	8	5[i]	2[j]	X	X	X
New headache. Suspected meningitis/encephalitis.	8[k]	6[l]	8	6[m]	6[i]	3[n]	X	X	X

Note:—Appropriateness criteria scale from 1 to 9, 1–least appropriate, 9–most appropriate; [a], may be helpful after CT depending on CT findings; [b], with diffusion-weighted sequences; [c], usage of CT versus MR imaging depends on local preference and availability; [d], include sinuses; [e], if noninvasive imaging unrewarding; [f], if MR imaging not available; [g], if vascular lesion suspected; [h], pregnancy is a relative contraindication to gadolinium administration, reserve for urgent medical emergency; [i], MR venography (MRV) should also be performed; [j], if MR imaging not available, contraindicated or inconclusive; [k], to exclude intracranial pressure changes; [l], MR imaging preferable, depending on availability; [m], needs contrast; [n], useful for problem solving or if there is a strong suspicion of vascular disease; [o], US, neck (carotid duplex) rating of 3; [p], x-ray skull rating of 4; [q], CT, head, with contrast rating of 3.

be useful. Since current practice is to anticoagulate these patients, identification of the pathology is important.

In 315 children with isolated headache at Boston Children's Hospital, 4% had surgical space-occupying lesions.[39] Sleep-related headache and no family history of migraine were the strongest predictors.

Patients older than 55 years of age with new onset headache in the temple regions should be studied for temporal arteritis.[40,41] Treatment with steroids may forestall visual loss or brain stem strokes.

New onset headache in other high risk populations also results in a higher yield at imaging. For instance, a series of 49 HIV patients had an 82% positive yield (cryptococcal meningitis [39%], toxoplasmosis [16%], and other mass lesions) identified by CT.[42] Patients with known cancer should also be scanned when a headache develops or changes in character.[43] In the Andes population, the rate of headache is low, whereas cysticercosis is common. Hence, CT of patients with headache yielded a 33% rate of positive studies.[9]

In summary, screening patients with isolated, nontraumatic headache by means of CT or MR imaging is not warranted. However, for some types of headache or populations at risk, imaging may provide a higher yield. Thunderclap headaches, headaches radiating to the neck, and temporal headaches in an older individual are examples of headaches where imaging may be helpful. Suspected meningitis and headaches in pregnancy also pose diagnostic challenges.[44-46] HIV and cancer patients, or other populations at high risk of intracranial disease should be screened when presenting with new-onset headaches.

Review Information

This guideline was originally developed in 1999. The last review and update was completed in 2006.

Appendix

Expert Panel on Neurologic Imaging: John E. Jordan, MD, Principal Author, Little Company of Mary Hospital, Torrance, Calif; David J. Seidenwurm, MD, Panel Chair; Patricia C. Davis, MD; James A. Brunberg, MD; Robert Louis De La Paz, MD; Pr. Didier Dormont; David B. Hackney, MD; John P. Karis, MD; Suresh Kumar Mukherji, MD; Patrick A. Turski, MD; Franz J. Wippold II, MD; Robert D. Zimmerman, MD; Michael W. McDermott, MD, American Association of Neurologic Surgeons; Michael A. Sloan, MD, MS, American Academy of Neurology.

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