

Approach to Acute Headache in Adults

BARRY L. HAINER, MD, and ERIC M. MATHESON, MD, *Medical University of South Carolina, Charleston, South Carolina*

Approximately one-half of the adult population worldwide is affected by a headache disorder. The International Headache Society classification and diagnostic criteria can help physicians differentiate primary headaches (e.g., tension, migraine, cluster) from secondary headaches (e.g., those caused by infection or vascular disease). A thorough history and physical examination, and an understanding of the typical features of primary headaches, can reduce the need for neuroimaging, lumbar puncture, or other studies. Some red flag signs and symptoms identified in the history or during a physical examination can indicate serious underlying pathology and will require neuroimaging or other testing to evaluate the cause of headache. Red flag signs and symptoms include focal neurologic signs, papilledema, neck stiffness, an immunocompromised state, sudden onset of the worst headache in the patient's life, personality changes, headache after trauma, and headache that is worse with exercise. If an intracranial hemorrhage is suspected, head computed tomography without contrast media is recommended. For most other dangerous causes of headache, magnetic resonance imaging or computed tomography is acceptable. (*Am Fam Physician*. 2013;87(10):682-687. Copyright © 2013 American Academy of Family Physicians.)

► See related editorial on page 672.

Headache is a common pain condition worldwide. It is important for physicians evaluating adult patients with acute headache to determine whether the condition is benign or if it indicates dangerous neurologic or systemic pathology. The most common types of headaches are tension-type headaches, migraines, and cluster headaches, which affect approximately 40, 10, and 1 percent of the adult population, respectively.^{1,2}

Most headache diagnoses are based entirely on the patient history. Only rarely does physical examination provide clues to the diagnosis.³

The International Headache Society has published a system of classification and operational diagnostic criteria for headache based on clinical consensus.⁴ This system is most useful for classifying patients in epidemiologic studies and clinical trials. Classifying headaches into primary (tension, migraine, or cluster) and secondary types (e.g., those caused by infection or vascular disease) is also useful to differentiate headaches that, although perhaps recurrent and temporarily disabling, have no dangerous underlying cause from those that may be a sign of significant pathology, because they represent an underlying systemic or neurologic disorder (*Table 1*).⁵

Primary Headaches

Patients with a history of headache who do not have red flag signs and symptoms are at low risk of serious headache. Additionally, they should have primary headache characteristics (*Tables 1 through 5*).^{4,5} Criteria for low-risk headaches are listed in *Table 6*.⁶ Patients at low risk of serious headache do not require neuroimaging.⁷

TENSION-TYPE HEADACHE

Tension-type headache is the most common form of headache, and affects more than 40 percent of the adult population worldwide.¹ It is characterized by bilateral mild to moderate pressure without other associated symptoms.⁴ Women are affected slightly more often than men.⁸ Nociceptors in the pericranial myofascial tissues are a likely source of tension headaches.^{9,10} Several studies have found that individuals who experience chronic tension-type headaches have increased sensitivity to pressure, electrical stimuli, and thermal stimuli in the pericranial myofascial tissue, and can find even normally harmless stimuli painful.¹⁰⁻¹² Individuals who meet the criteria for tension-type headache but who have normal neurologic examination results require no additional laboratory testing or neuroimaging.¹³ Classification criteria for tension-type headaches are listed in *Table 2*.⁵

Table 1. International Classification of Headache Disorders, 2nd ed. (ICHD-2)

Primary headaches

- Migraine
- Tension-type
- Cluster
- Other (e.g., cold stimulus headache)

Secondary headaches

- Headache attributed to any of the following: head or neck trauma, cranial or cervical vascular disorder, nonvascular intracranial disorder, substance use or withdrawal, infection, disturbance of homeostasis, psychiatric disorder
- Headache or facial pain attributed to disorder of the cranium, neck, eyes, ears, nose, sinuses, teeth, mouth, or other facial or cranial structures

Adapted with permission from the American Academy of Neurology: Lipton RB, Bigal ME, Steiner TJ, et al. Classification of primary headaches. Neurology. 2004;63(3):428. Table 1. First level of The International Classification of Headache Disorders, 2nd edition. <http://www.neurology.org/content/63/3/427.abstract>.

Table 2. ICHD-2 Diagnostic Criteria for Episodic Tension-Type Headache

Infrequent

At least 10 episodes occurring fewer than one day per month on average (fewer than 12 days per year) and fulfilling the following criteria:

- Headache lasts 30 minutes to seven days
- Headache has at least two of the following features: bilateral location, pressing or tightening (nonpulsating) quality, mild or moderate intensity, not aggravated by routine physical activity such as walking or climbing stairs
- Both of the following: no nausea or vomiting (anorexia may occur), either photophobia or phonophobia

Headache is not attributed to another disorder

Frequent

At least 10 episodes occurring on more than one but fewer than 15 days per month for at least three months and fulfilling all of the criteria for infrequent episodic tension-type headache

ICHD-2 = International Classification of Headache Disorders, 2nd ed.

Adapted with permission from the American Academy of Neurology: Lipton RB, Bigal ME, Steiner TJ, et al. Classification of primary headaches. Neurology. 2004;63(3):431. Table 4. ICHD-2 criteria for episodic tension-type headache (TTH). <http://www.neurology.org/content/63/3/427.abstract>.

MIGRAINE HEADACHES

Useful clinical criteria from the history and physical examination for distinguishing migraine from tension-type headache include nausea, photophobia (sensitivity to light), and phonophobia (sensitivity to sound). Physical activity often exacerbates migraine headache. Combined findings useful for distinguishing migraine can be summarized by the POUND mnemonic (pulsatile

Table 3. ICHD-2 Diagnostic Criteria for Migraine with Typical Aura

At least two episodes fulfilling the following criteria:

Aura consisting of at least one of the following, but no motor weakness: fully reversible visual symptoms including positive features (e.g., flickering lights, spots or lines) and/or negative features (i.e., loss of vision); fully reversible sensory symptoms including positive features (i.e., pins and needles) and/or negative features (i.e., numbness); fully reversible dysphasic speech disturbance

At least two of the following: homonymous visual symptoms and/or unilateral symptoms; at least one aura symptom develops gradually over five or more minutes and/or different aura symptoms occur in succession over five or more minutes; each symptom lasts at least five minutes, but no longer than 60 minutes

A headache that fulfills the criteria for migraine without aura (Table 4), and begins during the aura or follows the aura within 60 minutes

Headache not attributed to another disorder

ICHD-2 = International Classification of Headache Disorders, 2nd ed.

Adapted with permission from the American Academy of Neurology: Lipton RB, Bigal ME, Steiner TJ, et al. Classification of primary headaches. Neurology. 2004;63(3):429. Table 3. ICHD-2 criteria for 1.2.1 Typical aura with migraine headache. <http://www.neurology.org/content/63/3/427.abstract>.

quality, duration of four to 72 hours, unilateral location, nausea or vomiting, and disabling intensity). Patients who meet at least four of these criteria are most likely to have a migraine.¹⁴

One study of 1,500 adults with migraine headache found that the presence of nausea alone, or the presence of two of three features from either of these symptom triads (i.e., nausea, photophobia, and pulsating quality; or nausea, photophobia, and worsening of headache with physical activity) had positive likelihood ratios for migraine of 4.8 or greater and negative likelihood ratios of less than 0.23.¹⁵

Aura may be present in some cases of migraine. Aura consists of visual, sensory, or speech symptoms that appear gradually, last no longer than 60 minutes, and are completely reversible. Table 3 lists criteria for migraine with aura⁵; Table 4 lists criteria for migraine without aura.⁵

CLUSTER HEADACHES

Cluster headaches are relatively rare, and are characterized by brief (15 to 180 minutes) episodes of severe head pain with associated autonomic symptoms¹ (Table 5⁴). Although cluster headaches are less common than migraines and tension-type headaches, an estimated 500,000 Americans experience them at least once in a lifetime.¹⁶ The age of onset of cluster headaches varies, with 70 percent of patients reporting onset before 30 years of age.¹⁷

Table 4. ICHD-2 Diagnostic Criteria for Migraine Without Aura

At least five episodes fulfilling the following criteria:

- Headache episodes lasting four to 72 hours (untreated or unsuccessfully treated)
- Headache has at least two of the following characteristics: unilateral location, pulsating quality, moderate or severe pain intensity, aggravated by (or causes avoidance of) routine physical activity such as walking or climbing stairs
- During the headache, the patient experiences at least one of the following: nausea or vomiting; and photophobia and phonophobia

Headache is not attributed to another disorder

ICHD-2 = International Classification of Headache Disorders, 2nd ed.

Adapted with permission from the American Academy of Neurology: Lipton RB, Bigal ME, Steiner TJ, et al. Classification of primary headaches. Neurology. 2004;63(3):428. Table 2. ICHD-2 diagnostic criteria for 1.1 Migraine without aura. <http://www.neurology.org/content/63/3/427.abstract>.

Table 5. ICHD-2 Diagnostic Criteria for Cluster Headache

At least five episodes fulfilling the following criteria:

- Severe or very severe unilateral orbital, supraorbital, or temporal pain lasting 15 to 180 minutes if untreated
- Headache is accompanied by at least one of the following ipsilateral autonomic symptoms: conjunctival injection or lacrimation, nasal congestion or rhinorrhea, eyelid edema, forehead and facial sweating, miosis or ptosis, restlessness or agitation
- Headache episodes occur from one every other day to eight per day

Not attributable to another disorder

Episodic cluster headache

Fulfills all of the above criteria

At least two cluster periods lasting seven to 365 days and separated by pain-free remissions of more than one month

Chronic cluster headache

Fulfills all of the above criteria

Episodes recur for more than one year without remission periods or with remission periods lasting less than one month

ICHD-2 = International Classification of Headache Disorders, 2nd ed.

Information from reference 4.

Patients with cluster headache most commonly describe the pain as sharp, but some report that it can also be pulsating and pressure-like. Although pain can occur on both sides of the head, most patients report unilateral pain. Pain most commonly occurs in the retro-orbital area, followed by the temporal region, upper teeth, jaw, cheek, lower teeth, and neck.¹⁷ Ipsilateral autonomic symptoms such as eyelid edema, nasal congestion, lacrimation, or forehead sweating usually accompany the

Table 6. Criteria for Low-Risk Headaches

- Age younger than 30 years
- Features typical of primary headaches (Tables 1 through 5)
- History of similar headache
- No abnormal neurologic findings
- No concerning change in usual headache pattern
- No high-risk comorbid conditions (e.g., human immunodeficiency virus infection)
- No new, concerning historical or physical examination findings (Table 7)

Information from reference 6.

pain. There tend to be several (up to eight) episodes in the same day, with each episode lasting between 15 and 180 minutes.⁴ In the episodic form (80 to 90 percent of cases), episodes occur daily for a number of weeks followed by a period of remission.⁴ On average, a period of cluster headaches lasts six to 12 weeks, with remission lasting up to 12 months.⁴ In the chronic form (10 to 20 percent of cases), episodes occur without significant periods of remission.⁴

The long delay in diagnosis reported by patients who have cluster headaches is important. Only 25 percent of patients with cluster headaches are diagnosed correctly within one year of symptom onset, and more than 40 percent report a delay in diagnosis of five years or longer.¹⁶ The most common incorrect diagnoses reported in one study were migraine (34 percent), sinusitis (21 percent), and allergies (6 percent).¹⁵ Family history appears to have a role in some cases. A number of comorbidities are associated with cluster headaches, including depression (24 percent), sleep apnea (14 percent), restless legs syndrome (11 percent), and asthma (9 percent).¹⁵ Depression is an important diagnosis, because many individuals who have cluster headaches report suicidal thoughts, and 2 percent of patients in one study had attempted suicide.^{16,18,19}

Dangerous Headaches

Distinguishing dangerous headaches from benign or low-risk headaches is a significant challenge because the symptoms can overlap. Recommendations for differentiating dangerous from benign headaches are provided in Table 7.^{5,20-24} The characteristics of dangerous headaches and associated red flag symptoms are based on observational study and consensus reports. Therefore, they are not absolutely accurate in identifying serious underlying causes in patients who have headache.

Patients with characteristics of secondary headache should be evaluated to determine whether the headache is dangerous. Computed tomography of the head is the most widely used imaging study for acute head trauma because of its availability, speed, and accuracy. However, magnetic resonance imaging of the brain is more

Table 7. Red Flag Signs and Symptoms in the Evaluation of Acute Headache

<i>Danger sign or symptom</i>	<i>Possible diagnoses</i>	<i>Tests</i>
First or worst headache of the patient's life	Central nervous system infection, intracranial hemorrhage	Neuroimaging
Focal neurologic signs (not typical aura)	Arteriovenous malformation, collagen vascular disease, intracranial mass lesion	Blood tests, neuroimaging
Headache triggered by cough or exertion, or while engaged in sexual intercourse	Mass lesion, subarachnoid hemorrhage	Lumbar puncture, neuroimaging
Headache with change in personality, mental status, level of consciousness	Central nervous system infection, intracerebral bleed, mass lesion	Blood tests, lumbar puncture, neuroimaging
Neck stiffness or meningismus	Meningitis	Lumbar puncture
New onset of severe headache in pregnancy or postpartum	Cortical vein/cranial sinus thrombosis, carotid artery dissection, pituitary apoplexy	Neuroimaging
Older than 50 years	Mass lesion, temporal arteritis	Erythrocyte sedimentation rate, neuroimaging
Papilledema	Encephalitis, mass lesion, meningitis, pseudotumor	Lumbar puncture, neuroimaging
Rapid onset with strenuous exercise	Carotid artery dissection, intracranial bleed	Neuroimaging
Sudden onset (maximal intensity occurs within seconds to minutes, thunderclap headache)	Bleeding into a mass or arteriovenous malformation, mass lesion (especially posterior fossa), subarachnoid hemorrhage	Lumbar puncture, neuroimaging
Systemic illness with headache (fever, rash)	Arteritis, collagen vascular disease, encephalitis, meningitis	Blood tests, lumbar puncture, neuroimaging, skin biopsy
Tenderness over temporal artery	Polymyalgia rheumatica, temporal arteritis	Erythrocyte sedimentation rate, temporal artery biopsy
Worsening pattern	History of medication overuse, mass lesion, subdural hematoma	Neuroimaging
New headache type in a patient with:		
Cancer	Metastasis	Lumbar puncture, neuroimaging
Human immunodeficiency virus infection	Opportunistic infection, tumor	Lumbar puncture, neuroimaging
Lyme disease	Meningoencephalitis	Lumbar puncture, neuroimaging

Information from references 5, and 20 through 24.

sensitive for detecting subdural hematoma, and is therefore particularly important in identifying smaller lesions.²⁰

An algorithm for diagnosing headaches is available from the Institute for Clinical Systems Improvement at https://www.icsi.org/_asset/qwrznq/Headache.pdf.³

HISTORY AND PHYSICAL EXAMINATION

History. Thunderclap headache, which is characterized by sudden-onset headache pain, with peak intensity occurring within several minutes, requires prompt evaluation. Subarachnoid hemorrhage, hypertensive emergencies, vertebral artery dissections, and acute angle-closure glaucoma can also present this way.²⁵

Use of illicit drugs, including cocaine and methamphetamine, can increase the risk of intracranial bleeding or stroke. Prescription or over-the-counter medications such as aspirin, other nonsteroidal anti-inflammatory drugs, anticoagulants, and glucocorticoids increase the risk of intracranial bleeding.

A history of human immunodeficiency virus infection or other immunosuppressive conditions in patients

with headache may suggest a brain abscess, meningitis, or malignancy of the central nervous system (CNS).^{21,26} The presence of a coexisting infection in the lungs, sinuses, or orbital areas may precede and cause a CNS infection.

A patient who reports the worst headache of his or her life, especially if the patient is older than 50 years, or who has a headache that occurs with exertion (including sexual intercourse) could be experiencing intracranial hemorrhage or carotid artery dissection.²⁶ Prompt investigation is required for any headaches associated with neurologic findings, including changes in mental status, seizures, and visual disturbances. Additional red flag symptoms and signs are listed in *Table 7*.^{5,20-24}

Physical Examination. Neurologic abnormalities require evaluation and are particularly concerning in association with acute headache. Abnormalities are one of the best predictors of CNS pathology.^{6,14,27} A focal neurologic deficit should not be attributed to migraine headache unless a similar pattern has occurred with a previous migraine. By definition, aura associated with migraine lasts 60 minutes or less. Therefore, headache

SORT: KEY RECOMMENDATIONS FOR PRACTICE

<i>Clinical recommendation</i>	<i>Evidence rating</i>	<i>References</i>
A diagnosis of migraine is highly likely with presence of headache with nausea, or if the patient reports experiencing two of three features from either of these symptom triads: nausea, photophobia, or pulsating pain; or nausea, photophobia, or a headache that worsens with exertion.	C	15
Head computed tomography should be performed before lumbar puncture in all patients with suspected subarachnoid hemorrhage, regardless of findings on neurologic examination.	C	23
A patient with sudden onset of severe headache (e.g., patient reporting the worst headache of his or her life, or maximal from initiation, or thunderclap headache) should be evaluated with computed tomography of the head without contrast media.	C	28
Immunocompromised patients with severe headache should be evaluated with magnetic resonance imaging of the head with and without contrast media.	C	28

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <http://www.aafp.org/afpsort.xml>.

with aura-like symptoms should not be assumed to be benign or a primary headache when aura-like symptoms are present for more than 60 minutes.

Abnormal findings on examination can be pronounced, such as meningismus or unilateral vision loss, or subtle, such as extensor plantar response or unilateral pronator drift. Obtundation or confusion suggests a dangerous headache because these signs do not occur with benign or primary headache.

Patients with headache and fever, papilledema, or severe hypertension (systolic pressure greater than 180 mm Hg or diastolic pressure greater than 120 mm Hg) require evaluation for CNS infection and increased intracranial pressure. Patients also should be evaluated to determine if their blood pressure should be lowered to safer levels to avoid intracranial hemorrhage from malignant hypertension. Contusions and facial or scalp lacerations increase the likelihood of associated intracranial hemorrhage (Table 7^{5,20-24}).

DIAGNOSTIC TESTING

Neuroimaging. Neuroimaging is indicated for all patients who present with signs or symptoms of dangerous headache, because they are at increased risk of intracranial pathology. Although considerable debate exists about the optimal way to perform neuroimaging for acute headaches, the American College of Radiology has made a few specific recommendations (Table 8).²⁸

Lumbar Puncture. Lumbar puncture is useful for identifying infection, the presence of red blood cells (which suggests bleeding), and abnormal cells associated with some CNS malignancies. In adults with suspected

subarachnoid hemorrhage, it is important to perform lumbar puncture to check for blood or xanthochromia. Computed tomography of the head should be performed before lumbar puncture, even if the results of neurologic examination are normal, because there is a risk of central herniation of the brain even in the absence of physical examination findings of subarachnoid hemorrhage. In one supporting study, 5 percent of patients presenting to an emergency department with suspected subarachnoid hemorrhage and a normal neurologic examination had early intracranial herniation or midline shift.²⁹

Table 8. American College of Radiology Recommendations for Neuroimaging in Patients with Headache

<i>Clinical features</i>	<i>Recommended imaging modality</i>
Headache in immunocompromised patients	MRI of the head with and without contrast media
Headache in patients older than 60 years with suspected temporal arteritis	MRI of the head with and without contrast media
Headache with suspected meningitis	CT or MRI of the head without contrast media
Severe headache in pregnancy	CT or MRI of the head without contrast media
Severe unilateral headache caused by possible dissection of the carotid or arterial arteries	MRI of the head with and without contrast media, MRA of the head and neck, or CTA of the head and neck
Sudden onset or severe headache; worst headache of the patient's life	CT of the head without contrast media; CTA of the head with contrast media, MRA of the head with or without contrast media, or MRI of the head without contrast media

CT = computed tomography; CTA = computed tomographic angiography; MRA = magnetic resonance angiography; MRI = magnetic resonance imaging.

Information from reference 28.

Response to Pain Relief. The American College of Emergency Physicians has determined that response to pain relief therapy should not be used as the sole diagnostic indicator of the underlying etiology of an acute headache.¹³ No prospective randomized controlled trials, evidence from meta-analyses, randomized controlled trials, or well-designed cohort studies support or refute the practice of using response to pain relief therapy in nontraumatic headaches as an indicator of potential underlying pathology.

Data Sources: We performed a PubMed search for headache topics, and reviewed recent relevant publications in the Cochrane database, Essential Evidence Plus, and the National Guideline Clearinghouse. The search included expert consensus statements, clinical reviews, and clinical trials. Search terms included headache, acute headache, and classification of headache. Search date: December 2011.

The Authors

BARRY L. HAINER, MD, is a professor in the Department of Family Medicine at the Medical University of South Carolina in Charleston.

ERIC M. MATHESON, MD, is an assistant professor in the Department of Family Medicine at the Medical University of South Carolina.

Address correspondence to Barry L. Hainer, MD, Medical University of South Carolina, MSC 192, Charleston, SC 29425 (e-mail: hainerbl@musc.edu). Reprints are not available from the authors.

Author disclosure: No relevant financial affiliations.

REFERENCES

- Stovner LJ, Hagen K, Jensen R, et al. The global burden of headache: a documentation of headache prevalence and disability worldwide. *Cephalalgia*. 2007;27(3):193-210.
- Leroux E, Ducros A. Cluster headache. *Orphanet J Rare Dis*. 2008;3:20.
- Beithon J, Gallenberg M, Johnson K, et al. Diagnosis and treatment of headache, 11th ed. Institute for Clinical Systems Improvement. January 2013. https://www.icsi.org/_asset/qwrznq/Headache.pdf. Accessed March 17, 2013.
- Headache Classification Subcommittee of the International Headache Society. The international classification of headache disorders: 2nd edition. *Cephalalgia*. 2004;24(suppl 1):9-160.
- Lipton RB, Bigal ME, Steiner TJ, Silberstein SD, Olesen J. Classification of primary headaches. *Neurology*. 2004;63(3):427-435.
- American College of Emergency Physicians. Clinical policy: critical issues in the evaluation and management of patients presenting to the emergency department with acute headache. *Ann Emerg Med*. 2002;39(1):108-122.
- Gentry LR, Godersky JC, Thompson B, Dunn VD. Prospective comparative study of intermediate-field MR and CT in the evaluation of closed head trauma. *AJR Am J Roentgenol*. 1988;150(3):673-682.
- Schwartz BS, Stewart WF, Simon D, Lipton RB. Epidemiology of tension-type headache. *JAMA*. 1998;279(5):381-383.
- Ashina M. Neurobiology of chronic tension-type headache. *Cephalalgia*. 2004;24(3):161-172.
- Bendtsen L, Fernández-de-la-Peñas C. The role of muscles in tension-type headache. *Curr Pain Headache Rep*. 2011;15(6):451-458.
- Fernández-de-Las-Peñas C, Cuadrado ML, Arendt-Nielsen L, Ge HY, Pareja JA. Increased pericranial tenderness, decreased pressure pain threshold, and headache clinical parameters in chronic tension-type headache patients. *Clin J Pain*. 2007;23(4):346-352.
- Buchgreitz L, Lyngberg AC, Bendtsen L, Jensen R. Frequency of headache is related to sensitization: a population study. *Pain*. 2006;123(1-2):19-27.
- Edlow JA, Panagos PD, Godwin SA, Thomas TL, Decker WW; American College of Emergency Physicians. Clinical policy: critical issues in the evaluation and management of adult patients presenting to the emergency department with acute headache. *Ann Emerg Med*. 2008;52(4):407-436.
- Detsky ME, McDonald DR, Baerlocher MO, Tomlinson GA, McCrory DC, Booth CM. Does this patient with headache have a migraine or need neuroimaging? *JAMA*. 2006;296(10):1274-1283.
- Martin VT, Penzien DB, Houle TT, Andrew ME, Lofland KR. The predictive value of abbreviated migraine diagnostic criteria. *Headache*. 2005;45(9):1102-1112.
- Torelli P, Manzoni GC. Pain and behaviour in cluster headache. A prospective study and review of the literature. *Funct Neurol*. 2003;18(4):205-210.
- Rozen TD, Fishman RS. Cluster headache in the United States of America: demographics, clinical characteristics, triggers, suicidality, and personal burden. *Headache*. 2012;52(1):99-113.
- Jürgens TP, Gaul C, Lindwurm A, et al. Impairment in episodic and chronic cluster headache [published correction appears in *Cephalalgia*. 2011;31(6):766]. *Cephalalgia*. 2011;31(6):671-82.
- Bahra A, May A, Goadsby PJ. Cluster headache: a prospective clinical study with diagnostic implications. *Neurology*. 2002;58(3):354-361.
- Edmeads J. Emergency management of headache. *Headache*. 1988;28(10):675-679.
- Clinch CR. Evaluation of acute headaches in adults. *Am Fam Physician*. 2001;63(4):685-692.
- Silberstein SD, Lipton RB, Dalessio DJ. Overview, diagnosis, and classification of headache. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. *Wolff's Headache and Other Head Pain*. 7th ed. New York, NY: Oxford University Press; 2001:6-26.
- Ramírez-Lassepas M, Espinosa CE, Cicero JJ, Johnston KL, Cipolle RJ, Barber DL. Predictors of intracranial pathologic findings in patients who seek emergency care because of headache. *Arch Neurol*. 1997;54(12):1506-1509.
- Ramchandren S, Cross BJ, Liebeskind DS. Emergent headaches during pregnancy: correlation between neurologic examination and neuroimaging. *AJNR Am J Neuroradiol*. 2007;28(6):1085-1087.
- Pascual J, González-Mandly A, Martín R, Oterino A. Headaches precipitated by cough, prolonged exercise or sexual activity: a prospective etiological and clinical study. *J Headache Pain*. 2008;9(5):259-266.
- Rothman RE, Keyl PM, McArthur JC, Beauchamp NJ Jr, Danyluk T, Kelen GD. A decision guideline for emergency department utilization of non-contrast head computed tomography in HIV-infected patients. *Acad Emerg Med*. 1999;6(10):1010-1019.
- Locker TE, Thompson C, Rylance J, Mason SM. The utility of clinical features in patients presenting with nontraumatic headache: an investigation of adult patients attending an emergency department. *Headache*. 2006;46(6):954-961.
- Strain JD, Strife JL, Kushner DC, et al. Headache. American College of Radiology. ACR appropriateness criteria. *Radiology*. 2000;215(suppl):855-860.
- Baraff LJ, Byyny RL, Probst MA, Salamon N, Linetsky M, Mower WR. Prevalence of herniation and intracranial shift on cranial tomography in patients with subarachnoid hemorrhage and a normal neurologic examination. *Acad Emerg Med*. 2010;17(4):423-428.