



## **Headache Diagnosis and Testing**

New Technology  
**Ambassador** Program

## HEADACHE DIAGNOSIS AND TESTING

### Objectives

- Evaluate the prevalence of primary and secondary headache disorders in the general population and clinical practice
- Identify warning signs of serious secondary headaches
- Review the clinical features, diagnostic criteria, and differential diagnosis of migraine
- Assess the value of diagnostic testing in primary and secondary headache disorders

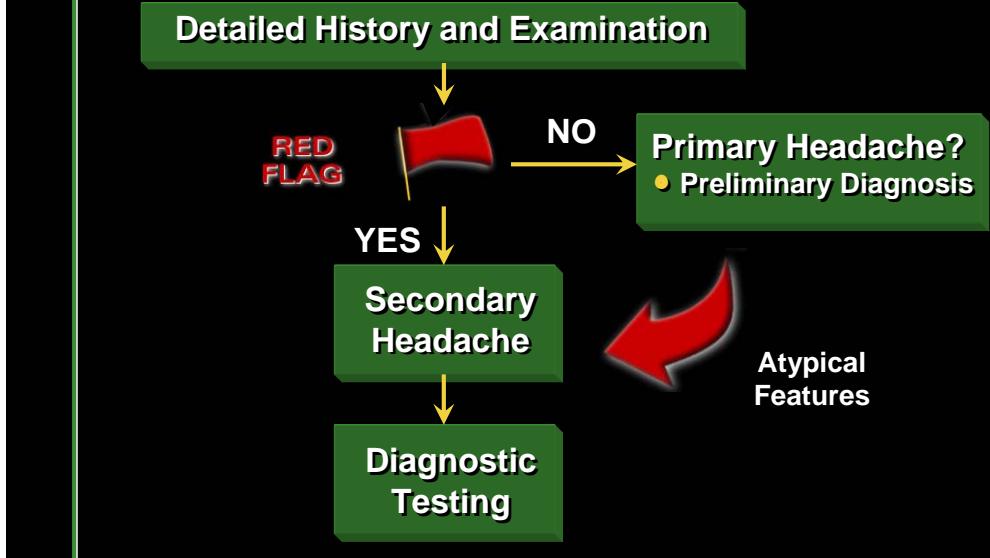
Headache is, without question, one of the most common symptoms that neurologists evaluate. Not unexpectedly, the differential diagnosis of this highly prevalent symptom is vast, with over 300 different headache types and etiologies. Understanding headache classification and diagnosis is, therefore, a clinical imperative and a requisite for diagnostic testing and treatment.

In 2004, the International Headache Society (IHS) formulated and published the second edition of the headache classification system with operational diagnostic criteria for a broad range of headache disorders. These criteria are based on an international consensus of expert opinion and have been endorsed by the World Health Organization and incorporated into the International Classification of Diseases (ICD-10). These criteria have:

- Established a uniform terminology and consistent diagnostic criteria
- Facilitated epidemiologic studies and multinational clinical trials
- Provided the basis for the current research and treatment guidelines

Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders. *Cephalalgia*. 2004;24(suppl 1):1:160.

# DIAGNOSIS AND TESTING

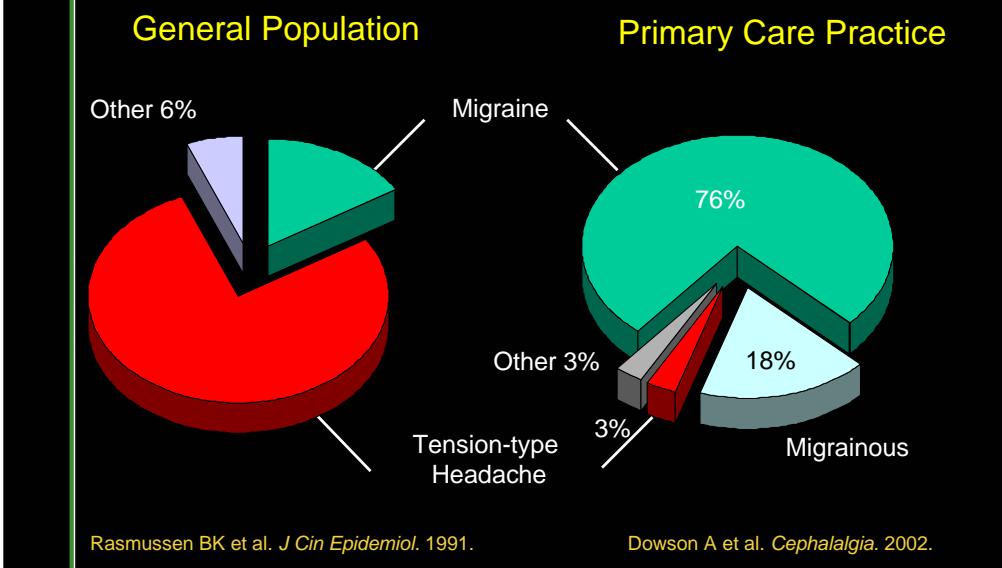


The cause or type of most headaches can be determined by a careful history and physical examination. The clinical imperative is to recognize the warning signals that raise red flags and prompt further diagnostic testing. In the absence of worrisome features in the history or examination, the task is then to diagnose the primary syndrome based upon the clinical features. If atypical features are present or the patient does not respond to conventional therapy, the diagnosis should be questioned and the possibility of a secondary headache disorder should be revisited (1,2).

Because migraine and tension-type headache (TTH) account for over 90% of the primary headache disorders in clinical practice, this discussion will focus on their clinical features, the warning signals of serious secondary headaches, and the role of diagnostic testing in the evaluation of headache (3).

1. Silberstein SD, Lipton RB, Goadsby PJ. *Headache in Clinical Practice*. London, England: Martin Dunitz; 2002.
2. Olesen J, Tfelt-Hansen P, Welch KMA. *The Headaches*. 2nd ed. Philadelphia, PA: Lippincott, Williams & Wilkins; 2000.
3. Rasmussen BK, Jensen R, Schroll M, Olesen J. Epidemiology of headache in a general population – a prevalence study. *J Clin Epidemiol*. 1991;44:1147-1157.

## PRIMARY HEADACHE: CLINICAL PRACTICE VS. POPULATION



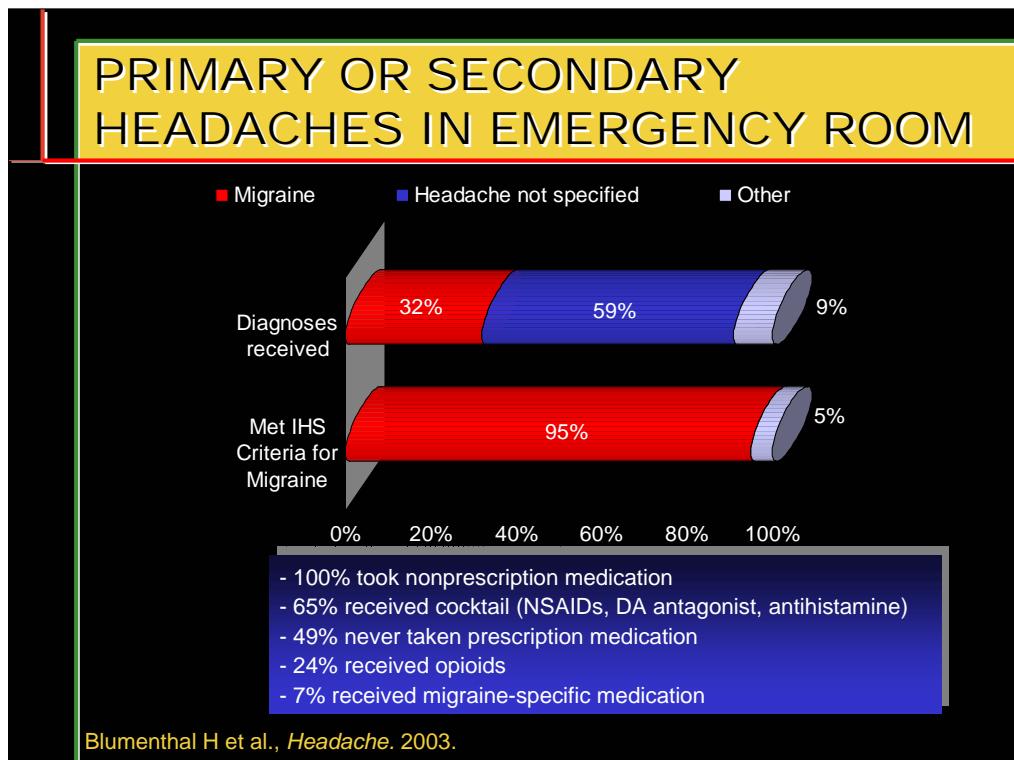
In one international study done in primary care offices, a total of 377 patients returned completed diaries. Of the 94% who consulted their primary care physicians for headache, 76% had migraine and 18% had migrainous headache. Few patients had tension-type headache. If a “Sinus Headache” was diagnosed, it would have been coded as “Other”; therefore, this would represent a small percentage of the total study's population.

For the US patients in this study, the results were almost identical. Of the 162 patients who returned diaries, 75% of those who consulted their primary care physicians with headache had migraine, and 19% had migrainous headache. Few of these patients (4%) had tension-type headache.

However, when surveying the general population, what we see is a larger prevalence of tension-type headache. This suggests that patients with tension-type headache do not frequent primary care physicians for medical care. In contrast, patients with migraine seek medical treatment.

Dowson A, Dahlof C, Tepper S, Newman L. Prevalence and diagnosis of migraine in a primary care setting. *Cephalgia*. 2002;22:590-591.

Rasmussen BK, Jensen R, Schroll M, Olesen J. Epidemiology of headache in a general population — a prevalence study. *J Clin Epidemiol*. 1991;44:1147-1157.



This study investigated the diagnosis and clinical outcome of patients who went to the emergency department for treatment of headache.

Fifty-seven patients treated for acute primary headache in the emergency department completed a questionnaire. Overall, 95% of the 57 respondents met International Headache Society diagnostic criteria specifically for migraine. However, only 32% received an actual diagnosis of migraine. Fifty-nine percent were diagnosed as having “cephalgia” or “headache NOS” (not otherwise specified). All patients had taken nonprescription medications, 24% received opioids, and

7% received a migraine-specific medication; 65% received a “migraine cocktail” comprised of a variable mixture of a nonsteroidal anti-inflammatory agent, a dopamine antagonist, and/or an antihistamine. Forty nine percent had never taken a triptan.

All 57 patients reported that they had to rest or sleep after being discharged, and they were unable to return to normal function. Additionally, 60% of the patients reported either recurrent or persistent headache 24 hours after being discharge from the emergency department.

Blumenthal HJ, Weisz MA, Kelly KM, Mayer RdL, Blonsky J. Treatment of primary headache in the emergency department. *Headache*. 2003;43(10):1026-1031.

## WORRISOME HEADACHE RED FLAGS “SNOOP”

- Systemic symptoms (fever, weight loss) or Secondary headache risk factors (HIV, systemic cancer)
- Neurologic symptoms or abnormal signs (confusion, impaired alertness, or consciousness)
- Onset: sudden, abrupt, or split-second
- Older: new onset and progressive headache, especially in middle-age >50 (giant cell arteritis)
- Previous headache history or headache progression: first headache or different (change in attack frequency, severity, or clinical features)

An attempt to elicit these worrisome features should be part of every new-headache evaluation because their presence may signify an underlying pathological condition for which diagnostic testing is obligatory.

Systemic symptoms, such as fever, malaise, or weight loss, should suggest an underlying infectious or systemic inflammatory disorder. Newly acquired neurologic signs or symptoms should always raise concern.

The mode of onset is perhaps the most important characteristic of a headache to be delineated. Patients who have a sudden or abrupt headache that peaks in seconds or minutes require careful assessment to exclude causes such as subarachnoid hemorrhage (SAH), venous sinus thrombosis, arterial dissection, or raised intracranial pressure.

Any new or progressive headache that begins in middle age or any headache that deviates significantly from a previous pattern should be investigated further.

If these features are addressed, the chances of overlooking a sinister cause for headache are greatly diminished.

Silberstein SD, Lipton RB, Dalessio DJ. Overview, diagnosis, and classification. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. *Wolff's Headache And Other Head Pain*. 7th ed. Oxford, England: Oxford University Press; 2001:20.

## IHS *MIGRAINE* AND *TENSION-* TYPE HEADACHE

### **Migraine**

- ≥5 attacks lasting 4 to 72 hours
- ≥2 of the following 4
  - Unilateral
  - Pulsating
  - Moderate or severe intensity
  - Aggravation by routine physical activity
- ≥1 of the following
  - Nausea and / or vomiting
  - Photophobia and phonophobia
- Not attributable to another disorder

### **Tension-type**

- ≥10 attacks lasting 30 minutes to 7 days
- ≥2 of the following 4
  - Bilateral
  - Not pulsating
  - Mild or moderate intensity
  - Not aggravated by routine physical activity
- No nausea or vomiting
- One or neither photophobia or phonophobia
- Not attributable to another disorder

The major criteria and associated symptoms required for the IHS diagnosis of migraine are so well known as to be almost intuitive for many clinicians. However, these criteria were established to diagnose headaches, not patients. When used literally, the sensitivity and specificity may be diminished.

Distinguishing between migraine and tension-type headache (TTH) can sometimes be difficult because the conditions have overlapping features, and patients have more than one type of headache. Their ability to ascribe symptoms to a specific headache on recall may be unreliable.

Although TTH is the most common primary headache disorder, it is the least distinctive, most poorly understood, and most frequently mimicked by underlying diseases. In fact, its clinical diagnosis is based chiefly on the absence of the symptoms that characterize migraine.

What we call TTH may be the lower end in a normal distribution of painful episodic headaches. Whether some TTH is simply a mild migraine or a distinct entity is still an area of debate.

Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders. *Cephalalgia*. 2004;24(suppl 1):1:160.

## MIGRAINE DIAGNOSTIC CONSIDERATIONS

- No single criterion necessary nor sufficient for diagnosis
- Up to 1/3 of patients have a neurological aura
- IHS criteria do not require GI symptoms
- Vomiting occurs in <1/3 of patients
- 41% of migraine patients report bilateral pain
- 50% of the time, pain is nonpulsating

**Recurring moderate-to-severe headache is migraine until proven otherwise**

Russell MB, et al. *Cephalgia*. 1996.  
Pryse-Phillips WEM, et al. *Can Med Assoc J*. 1997.

Although research demonstrates that some criteria are more predictive of migraine than others, no single criterion is sufficient. Likewise, no single criterion is essential to confirm a diagnosis of migraine.

A common misconception is that aura is the telltale sign of migraine. Eighty five percent of migraine patients do not experience aura. Many, but not all, patients have other symptoms that they recognize as premonitory. Common amongst these are: tiredness, stiff neck, craving for sweets, and yawning.

Although nausea is common in migraine patients, vomiting occurs much less frequently. Most migraine patients experience nausea with a large proportion of their headaches, vomiting with a few of their headaches, and neither symptom with some of their headaches. Many migraine patients report never having vomited in association with their headaches.

Unilateral pain is a common characteristic of migraine and can be a key symptom in making the diagnosis. However, many migraine patients report headaches that begin bilaterally and then settle on one side or headaches that remain bilateral throughout, but nonetheless meet the other criteria for migraine.

Similarly, pulsating or throbbing pain is a common characteristic of migraine but just as many migraine patients will report a penetrating, boring, or stabbing pain.

Because approximately 80% of migraine patients also have other headaches and may have more than one headache type at the same time, parsing out migraine symptoms can be challenging. Headache specialists widely believe that moderate-to-severe, recurrent headache is migraine until proven otherwise.

Pryse-Phillips WEM, Dodick DW, Edmeads JG, et al. Guidelines for the diagnosis and management of migraine in clinical practice. *Can Med Assoc J*. 1997;156(9):1273-1287.

Russell MB, Rasmussen BK, Fenger K, Olesen J. Migraine without aura and migraine with aura are distinct clinical entities: a study of four hundred and eighty-four male and female migraineurs from the general population. *Cephalgia*. 1996;16(4):239-245.

## MIGRAINE ADDITIONAL FEATURES

- Predictable timing around menstruation (or ovulation)
- Stereotyped premonitory symptoms
- Characteristic triggers
- Abatement with sleep
- Positive family history
- Childhood precursors (motion sickness, episodic vomiting, episodic vertigo)
- Osmophobia

Pryse-Phillips WEM et al. *Can Med Assoc J.* 1997.

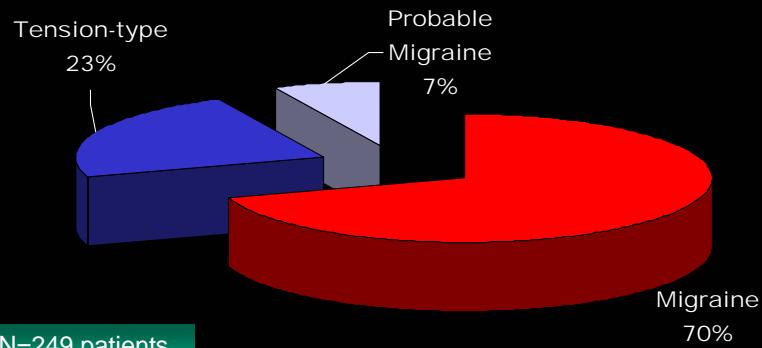
As experienced clinicians who care for patients know, pattern recognition is an invaluable diagnostic technique in clinical practice, particularly for heterogeneous disorders such as migraine.

Although not included in the IHS criteria, a number of additional and characteristic features of the migraine syndrome are considered to be strongly supportive of the diagnosis. These features, when present, may substantially increase diagnostic accuracy, particularly in patients who do not fully satisfy IHS criteria.

For example, osmophobia, in addition to photophobia and phonophobia, has been shown to be a highly sensitive and specific feature of migraine.

Pryse-Phillips WEM, Dodick DW, Edmeads JG, et al. Guidelines for the diagnosis and management of migraine in clinical practice. *Can Med Assoc J.* 1997;156(9):1273-1287.

## MIGRAINEURS HAVE MORE THAN ONE TYPE OF HEADACHE



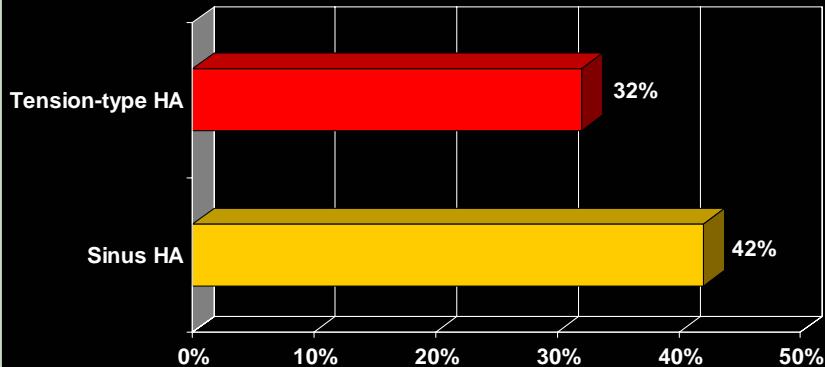
Lipton RB et al. *Headache*. 1999.

Perhaps one of the challenges migraine patients have is that their headaches present with a host of different signs and symptoms, some of which meet diagnostic criteria for migraine. Other headaches are either tension-type or probable migraine headaches. It is important for patients and physicians to recognize the differences in these headache types so appropriate care is taken regarding treatment. This study evaluated the efficacy of sumatriptan in treating a host of different headache types. Migraineurs with severe disability, as assessed with the Headache Impact Questionnaire score 250 or greater, were enrolled in a randomized, double-blind, placebo-controlled, crossover study.

Patients treated up to 10 headaches, and headache features, recorded prior to treatment, were used to classify each headache using IHS criteria. Two hundred forty-nine migraineurs treated 1576 moderate or severe headaches: migraine ( $n=1110$ ), migrainous ( $n=103$ ), and tension-type ( $n=363$ ). This study documents that patients with a diagnosis of migraine also may experience other headache types.

Lipton RB, Stewart WF, Cady R, Hall C, O'Quinn S, Kuhn T, Guterman D. 2000 Wolfe Award. Sumatriptan for the range of headaches in migraine sufferers: results of the Spectrum Study. *Headache*. 2000;40(10):783-791.

## MIGRAINE MOST FREQUENTLY MISDIAGNOSED AS:



Lipton RB et al. *Headache*. 2001.

The challenges in sorting through the overlapping features in making a migraine diagnosis are illustrated in this chart.

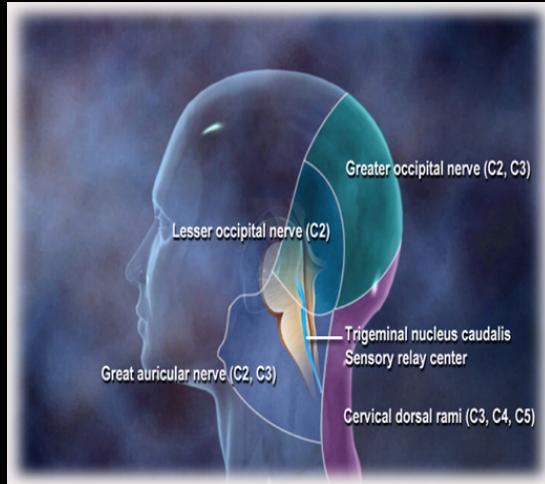
The American Migraine Study II, published in 2001, replicated a survey conducted a decade earlier, questioned 29,727 respondents about their headaches (1). Self-reported symptoms were assessed to determine whether they met the individual's IHS diagnostic criteria for migraine. In addition to IHS-defined status, self-reported physician diagnosis was determined. Individuals were assigned to self-reported categories of physician diagnosis based solely on their reported diagnosis and whether they met IHS criteria for migraine (1).

Forty-one percent of male and 51% of female respondents reported receiving a physician diagnosis of migraine. This chart shows the percentage of respondents who met the IHS criteria for migraine who reported receiving a diagnosis other than migraine. Thirty-two percent of undiagnosed migraine respondents reported a diagnosis of TTH. Forty-two percent reported a diagnosis of sinus headache (2). The prevalence in the population of TTH is 78%, and sinus headache is 15% (3).

1. Lipton RB, Stewart WF, Diamond S, et al. Prevalence and burden of migraine in the United States: Data from the American Migraine Study II. *Headache*. 2001;41(7):646-657.
2. Lipton RB, Diamond S, Reed M, et al. Migraine diagnosis and treatment: Results from the American Migraine Study II. *Headache*. 2001;41(7):638-645.
3. Rasmussen BK, Jensen R, Schroll M, Olesen J. Epidemiology of headache in a general population – a prevalence study. *J Clin Epidemiol*. 1991;44:1147-1157.

## WHY IS MIGRAINE MISTAKEN FOR TENSION-TYPE HEADACHE?

- Neck pain is very common during migraine attacks (75%)
- Stress is a common migraine trigger
- Migraine headache is often bilateral (40%)



The pain process is a product of direct factors, such as activation of the nociceptors of pain-producing intracranial structures, combined with reduced function of the endogenous pain-control pathways that normally gate the pain. The pain pathways associated with migraine also include referred pain pathways involving C1, C2, and C3 projections. Approximately 75% of migraine patients also have neck pain, and tension associated with stress can be a trigger. TTH is often bilateral; similarly, migraine headache pain may be bilateral in about 40% or more of patients.

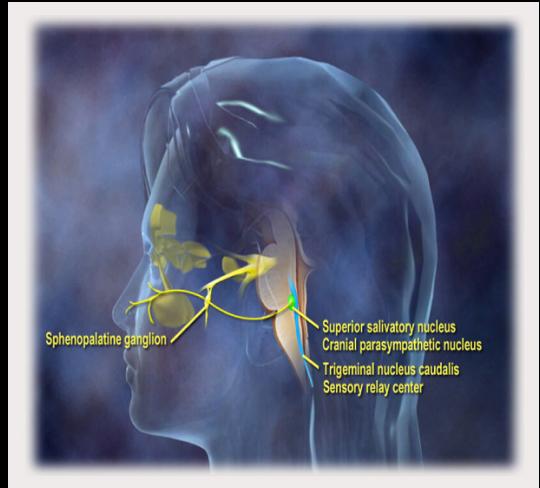
Raskin NH. *Headache*. 2nd ed. New York: Churchill Livingstone; 1988.

Barbanti P, Fabbrini G, Pesare M, Cerbo R. Neurovascular symptoms during migraine attacks. *Cephalgia*. 2001;21(4):295. Abstract.

Kaniecki R. Migraine headache exacerbation with sumatriptan injection: a sign of supratherapeutic dosing? *Cephalgia*. 2001;21(4):413. Abstract.

## WHY IS MIGRAINE FREQUENTLY MISTAKEN FOR SINUS HEADACHE?

- Pain is often located over the sinuses
- Migraine is frequently triggered by weather changes
- Tearing and nasal congestion common during attacks
- Sinus medication may help migraine



Migraine may be confused with sinus headache because in both conditions pain may localize over the frontal sinuses. With migraine, however, this pain is considered to be referred pain from V1 pathways. Patients report that changes in weather trigger headache, and not realizing that weather changes may be a trigger for migraine, they assume such headaches are sinus headaches. Up to 50% of patients also report autonomic symptoms that resemble sinus disease (rhinitis, tearing, and congestion among others). When these symptoms are present, it is assumed that the patient has sinus disease and sinus headache. However, these symptoms are also associated with migraine.

Barbanti P, Fabbrini G, Pesare M, et al. Unilateral cranial autonomic symptoms in migraine. *Cephalgia*. 2002;22:256-259.

## DIAGNOSING MIGRAINE IN PATIENTS COMPLAINING OF HEADACHE

### Strongest predictors of migraine diagnosis

#### Nausea

*Are you nauseated or sick to your stomach when you have a headache?*

#### Disability

*Has a headache limited your activities for a day or more in the last 3 months?*

#### Photophobia

*Does light bother you when you have a headache?*

2 out of 3 symptoms: PPV 93%

3 out of 3 symptoms: PPV 98%

Lipton RB et al. *Neurology*. 2003.

Because migraine is substantially underdiagnosed, a simple, 3-question, self-administered screening tool called ID Migraine™ was developed to help detect patients with unreported headache complaints in the primary care setting. The questionnaire was developed from a 9-item questionnaire that was in turn designed to evaluate patients based on the criteria for diagnosis of migraine established by the IHS. Of the 9 diagnostic screening questions, it was found that a 3-item subset of disability, nausea, and photophobia had the best performance. The sensitivity and specificity of the questionnaire were similar regardless of sex, age, presence of comorbid headaches, or previous diagnoses.

The predictive ability of these 3 sets of symptoms are reflected in patients' responses to 3 questions:

1. *Are you nauseated or sick to your stomach when you have a headache?*
2. *Has a headache limited your activities for a day or more in the last 3 months?*
3. *Does light bother you when you have a headache?*

Lipton RB, Dodick D, Sadovsky R, Kolodner K, Endicott J, Hettiarachchi J, Harrison W. A self-administered screener for migraine in primary care: the ID Migraine™ validation study. *Neurology*. 2003;61:375-382

## MIGRAINE AURA (TYPICAL) [At least 2 attacks]

Aura is fully reversible visual and / or sensory and / or speech symptoms but no motor weakness

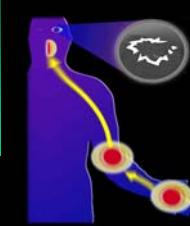
At least two of the following:

- Unilateral symptoms including positive and / or negative features
- At least one symptom develops gradually over >5 minutes and / or different symptoms occur in succession
- Each symptom lasts >5 minutes and <60 minutes

Headache meets criteria for migraine without aura, and headache begins during the aura or follows aura within 60 minutes

Aura is not attributable to another disorder

Headache Classification Subcommittee of the International Headache Society. *Cephalgia*. 2004.



The Neurological symptoms/signs reflecting cortical or brainstem dysfunction.

Visual is the most common with somatosensory being the secondary most common type of aura. Speech/language, motor, or brainstem deficits also may occur (e.g., vertigo, ataxia, diplopia).

Characteristically, these neurological symptoms evolve over a period of minutes, and may persist for up to 20 minutes or more. The gradual evolution of the neurological symptoms may reflect a spreading neurological event across the visual and somatosensory cortices. In some patients, the aura, symptoms may progress from one sensory modality to the next in a sequential fashion (e.g., visual then sensory).

Characteristically, the aura usually precedes and terminates prior to headache, usually within 60 minutes. In others, it may persist or begin during the headache phase. Aura is not always clearly demarcated and may extend into the headache phase.

Russell MB, Olesen J. A nosographic analysis of the migraine aura in a general population. *Brain*. 1996;119:335-361.

Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders. *Cephalgia*. 2004;24(suppl 1):1:160.

## AURA: MIMICS AND SECONDARY CAUSES

Demyelinating disease	Tumor
Hereditary disorder	Vasculitis
Carotid artery dissection	AVM
Venous sinus thrombosis	TIA
Vasculitis	HIV
Simple partial seizure	APL

Bousser MG, et al. In: *Wolff's Headache And Other Head Pain*. 2001

Campbell JK, Sakai F. In: *The Headaches*. 2000

Silberstein SD, et al. *Headache in Clinical Practice*. 2002

Although the aura of migraine is a benign and reversible phenomenon, a number of pathologic disease states may closely mimic the migraine aura.

Aura may be present without headache. This is usually seen in the elderly, and the differentiation between migraine and other disorders, such as transient cerebral ischemia, becomes difficult. Late age of onset, short duration or evolution of the focal symptoms, and negative rather than positive visual phenomenon, particularly in a patient with vascular risk factors, should raise concern and prompt further investigations for an underlying vascular etiology.

Visual hallucinations of migraine and occipital lobe epilepsy can sometimes be difficult to differentiate. The visual symptoms of both disorders may be elementary negative hallucinations (scotoma, hemianopia) or positive (phosphenes, sparks, or flashes). Perceptive illusions in which objects appear distorted, such as a change in size (macropsia, micropsia), shape (metamorphopsia), or distance may also occur in both migraine and epilepsy. The distinction between epilepsy and migraine in clinical practice is rarely difficult because of the accompanying headache with migraine and the psychic or overt seizure with epilepsy. In cases where distinction is unclear, electroencephalography may be helpful.

Bousser MG, Good J, Kittner SJ, Silberstein SD. Headache associated with vascular disorders. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. *Wolff's Headache And Other Head Pain*. 7th ed. New York: Oxford University Press; 2001:349-392.

Campbell JK, Sakai F. Diagnosis and differential diagnosis. In: Olesen J, Tfelt-Hansen P, Welch KMA. *The Headaches*. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2000:359-363.

Silberstein SD, Lipton RB, Goadsby PJ. *Headache in Clinical Practice*. London, England: Martin Dunitz; 2002.

## MIGRAINE AURA VS. TIA

### Migraine

vs.

### TIA

Positive visual symptoms	Visual loss
Gradual onset / evolution	Abrupt
Sequential progression	Simultaneous occurrence
Repetitive attacks of identical nature	
Flurry of attacks mid-life	
Duration up to 60 minutes	Duration <15 minutes
Headache follows ~ 50%	Headache uncommon accompaniment

Fisher CM. *Stroke*. 1986

One important clinical concern is distinguishing migraine, especially migraine “equivalents” that occur later in life, from cerebrovascular disease. It is difficult to distinguish the transient ischemic attacks from migraine. These are some of the clinical features that can help distinguish between migraine and a TIA.

Fisher CM. Late-life migraine accompaniments — further experience. *Stroke*. 1986;17:1033-1042.

## CHRONIC MIGRAINE

### Chronic Migraine

- A. Headache fulfilling criteria *Migraine without aura* on  $\geq 15$  days per month for  $>3$  months
- B. Not attributed to another disorder

### Probable Chronic Migraine

Not attributed to another disorder, but there is, or has been within the last 2 months, medication overuse fulfilling criterion for medication overuse headache

Headache Classification Subcommittee of the International Headache Society. *Cephalalgia*. 2004

Chronic migraine is characterized by having daily or almost daily head pain more than 15 days per month for more than a 1-month period. The average headache duration is more than four hours, if untreated. Additionally, patients present with at least one of the following features: history of episodic migraine, history of increasing headache frequency with decreasing average severity of migrainous features (photophobia, nausea, phonophobia, throbbing, unilateral pain) during at least the last three months, and headaches that meet at least some of the established IHS criteria for migraine.

Silberstein SD, Lipton RB, Sliwinski M. Classification of daily and near daily headaches: field trial of revised I criteria. *Neurology*. 1996;47:871-875.

Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders. *Cephalalgia*. 2004;24(suppl 1):1:160.

## MEDICATION-OVERUSE HEADACHE

Diagnostic criteria:

- Intake on  $\geq 10$  days per month on a regular basis for  $\geq 3$  months ( $> 15$  days for simple analgesics)
- Headache has developed or markedly worsened during overuse
- Headache resolves or reverts to its previous pattern within 2 months after discontinuation of ergotamine

Applies to:

- Ergotamine, triptan, analgesic, opioid, and combination medication-overuse headache

Headache Classification Subcommittee of the International Headache Society. *Cephalalgia*. 2004.

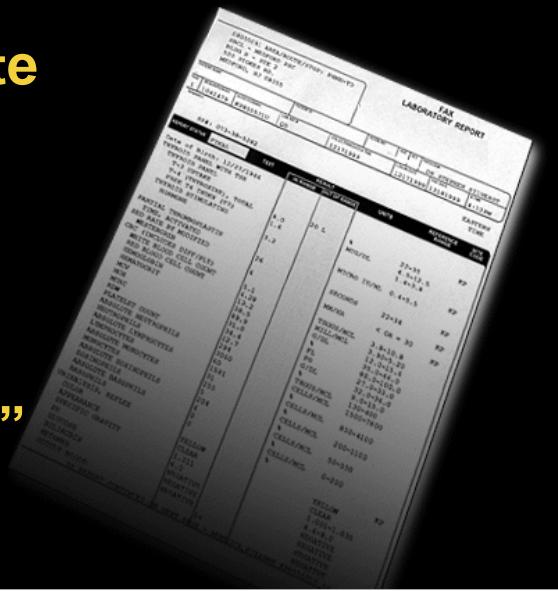
Diagnostic criteria is defined as taking medications 10 or more days per month on a regular basis for 3 or more months. This includes taking 15 days or more per month of simple analgesics. Additionally, headaches develop or are markedly worsened, during overuse with medications. Most headaches will resolve or revert to their previous pattern within 2 months following discontinuation of ergotamine.

Medication overuse headache has been associated with ergotamine, triptan, analgesic, opioid, and combination medication-overuse headaches.

Headache Classification Subcommittee of the International Headache Society. *Cephalalgia*. 2004;24(suppl 1):1:160.

## EVALUATION STRATEGIES

### “Investigate the Atypical and the Red Flags”



Laboratory testing is not routinely needed in the evaluation of a headache patient. The necessity for and extent to which laboratory tests are obtained will be determined by the clinical suspicion of a secondary headache disorder, for example, temporal arteritis. A practical suggestion in this setting is to appropriately investigate the atypical, as well as the red flags.

Occasionally, depending on the medications prescribed, a pertinent screening baseline laboratory assessment may be necessary, for example, divalproex sodium levels.

Evans RE, Rozen TD, Adelman JU. Neuroimaging and other diagnostic testing in headache. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. *Wolff's Headache And Other Head Pain*. 7th ed. New York: Oxford University Press; 2001:27-49.

Campbell JK, Sakai F. Diagnosis and differential diagnosis. In: Olesen J, Tfelt-Hansen P, Welch KMA. *The Headaches*. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2000:359-363.

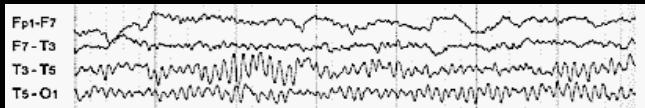
## DIAGNOSTIC TESTING ELECTROENCEPHALOGRAPHY

### EEG is not useful in

- Routine evaluation of headache to exclude structural cause

### EEG may be useful in

- Alteration or loss of consciousness
- Residual focal defects or encephalopathy
- Atypical migrainous aura



Report of Quality Standards Subcommittee of AAN. *Neurology*. 1995.

The absence of controlled clinical trials hampers selection of appropriate diagnostic tests in identifying headache disorders. Nevertheless, the American Academy of Neurology (AAN) has advanced a rational series of guidelines based upon the available evidence.

After a thorough review of the literature, the AAN concluded that EEG lacks both sensitivity and specificity and, therefore, is not routinely useful in the evaluation of patients with headache.

EEG may, however, have value in certain clinical circumstances, including patients with alteration or loss of consciousness or diminished alertness. EEG may be particularly important when residual focal or global neurologic deficits accompany the headache, or when an epileptiform abnormality is suspected in patients with an unusual or atypical aura.

Report of the Quality Standards Subcommittee of the American Academy of Neurology. Practice Parameter: The electroencephalogram in the evaluation of headache [summary statement]. *Neurology*. 1995;45:1411-1413.

## DIAGNOSIS TESTING CT AND MRI

■ In patients with recurrent migraine, neither CT nor MRI is warranted except in cases with:

- Recent substantial change in headache pattern
- History of seizures
- Focal neurologic symptoms or signs

■ Role of CT or MRI in patients with nonmigraine headache is unclear

■ Consensus expert opinion

- MRI is more sensitive



Report of Quality Standards Subcommittee of AAN. *Neurology*. 1994.  
Silberstein. *Neurology*. 2000.

In its systematic review of the efficacy of diagnostic testing, the AAN also concluded that CT and MRI are unlikely to significantly increase diagnostic yield or uncover pathologic entities. Thus, their routine use is not warranted in patients whose headaches fit a broad definition of recurrent migraine and who have had no recent change in headache pattern, no history of seizures, and no focal neurologic findings.

The AAN determined the data are insufficient at this time to make an evidence-based recommendation on the relative sensitivity of CT compared with MRI in the evaluation of patients with migraine or other headache.

However, while little evidence exists to support the use of MRI over CT in the nonemergent evaluation of headache, the AAN's consensus view is that the "sensitivity of MRI exceeds that of CT imaging, particularly for posterior fossa- and dural-based abnormalities."

Report of the Quality Standards Subcommittee of the American Academy of Neurology. Practice Parameter: the utility of neuroimaging in the evaluation of headache in patients with normal neurological examinations [summary statement]. *Neurology*. 1994;44:1353-1354.

Silberstein SD. Practice parameter: evidence-based guidelines for migraine headache (an evidence-based review): report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology*. 2000;55(6):754-762.

## LUMBAR PUNCTURE (If CT is Normal)

- The first unusually severe headache
- Thunderclap headache with negative CT head
- Subacute progressive headache
- Headache associated with fever, confusion, meningism, or seizures
- High or low CSF pressure suspected (even if papilledema is absent)



Evans RE et al. In: *Wolff's Headache And Other Head Pain*. 2001.

Although no formal guidelines exist on the use of lumbar puncture as a diagnostic test in headache, lumbar puncture is critical in a number of situations. Unless a patient is suspected of having an subarachnoid hemorrhage (SAH), meningoencephalitis, or a high- or low-pressure syndrome, a lumbar puncture is unnecessary during a headache.

Nonetheless, patients who present with thunderclap headache or their first unusually severe headache should always be considered as having an acute neurologic event, even though a variety of benign headaches may present in this fashion. If the initial CT is negative, a lumbar puncture must be performed in this situation.

Patients with a subacute and progressive headache syndrome should have a lumbar puncture to exclude other disease conditions, including infections (fungal, Lyme), inflammation (vasculitis), or neoplasms (carcinomatous leptomeningeal disease).

Lumbar puncture is crucial in any patient suspected of having an acute intracranial infection, as well as in patients suspected of having raised or low intracranial pressure.

In patients suspected of having pseudotumor, a lumbar puncture should be performed, even in the absence of papilledema, since idiopathic intracranial hypertension has been well described in patients with normal fundoscopic examinations. Normal cranial imaging is required before lumbar puncture is performed.

Evans RE, Rozen TD, Adelman JU. Neuroimaging and other diagnostic testing in headache. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. *Wolff's Headache And Other Head Pain*. 7th ed. New York: Oxford University Press; 2001:27-49.

## MR AND CONVENTIONAL ANGIOGRAPHY

### MR Angiography

- Aneurysm (>5 mm)
- AV malformation
- Arterial dissection
- Venous thrombosis  
(MR venography)

### Angiography

- Acute SAH
- CNS vasculitis
- Arterial dissection

Leclerc X et al. *Neuroradiology*. 1999.

Magnetic resonance angiography (MRA) and magnetic resonance venography (MRV) are safe and noninvasive imaging modalities that are becoming increasingly sophisticated tools for visualizing the craniocerebral circulation, particularly the large cervicocephalic vessels and the circle of Willis(1).

These are very useful screening procedures for a suspected aneurysm or AV malformation in patients who have not had an SAH and for patients suspected of having a carotid or vertebral dissection. It is also the preferred imaging modality for the detection of a cerebral venous sinus thrombosis.

Unless aneurysm, vasculitis, or arterial dissection are highly suspected and not adequately defined by MRA, there is no reason to perform angiography in a patient with headache who has a normal neurologic examination and normal brain MRI.

Leclerc X, Gauvrit JY, Nicol L, Pruvo JP. Contrast-enhanced MR angiography of the craniocervical vessels: a review. *Neuroradiology*. 1999;41(12):867-874.

## INDICATIONS FOR GADOLINIUM-ENHANCED MRI

### Cerebrovascular

- Arterial dissection (MRA)
- Cerebral venous sinus thrombosis (MRV)
- CNS vasculitis

### Herpes encephalitis

### Tumors

- Posterior fossa
- Pituitary
- Leptomeninges

### High and low intracranial pressure syndromes

Bousser MG et al; Wall M et al; Mokri B et al  
In: *Wolff's Headache And Other Head Pain*.  
2001. Tien RD et al. *Am J Roentgenol*. 1993.

MRA = magnetic resonance angiography  
MRV = magnetic resonance venography

Cervicocephalic arterial dissections are an important cause of ischemic stroke, particularly in the young, in whom they account for up to 20% of strokes. MRA is highly sensitive for dissection; it may show a false lumen, pseudoaneurysm, a string sign or elongated stenosis with slow flow, absence of an arterial signal, or an abnormal signal along the length of the hematoma with an increase in the wall of the vessel. Once thought a rare and devastating disease, advances in neuroimaging, such as MRA and MRV, have made early diagnosis of cerebral venous sinus thrombosis possible. MR offers major advantages for the evaluation of suspected cerebral venous thrombosis because of its sensitivity to blood flow and the ability to visualize the thrombus. MRI can positively identify herpes simplex viral encephalitis more quickly and definitively than CT as soon as 2 days after symptoms appear. Early involvement of the limbic system and temporal lobes is characteristic of herpes simplex encephalitis. The cortical abnormalities are first noted as ill-defined areas of high signal on T2-weighted scans, usually beginning unilaterally but progressing to become bilateral. Edema, mass effect, and gyral enhancement may also be present. Meningeal gadolinium-enhancement MRI has also revolutionized the diagnosis and management of patients with CSF leakage abnormalities.

Bousser MG, Good J, Kittner SJ, Silberstein SD. Headache associated with vascular disorders. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. *Wolff's Headache And Other Head Pain*. 7th ed. New York: Oxford University Press; 2001:349-392.

Mokri, B. Headache associated with abnormalities in intracranial structure or function: low cerebrospinal fluid pressure headache. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. *Wolff's Headache And Other Head Pain*. 7th ed. New York: Oxford University Press; 2001:417-433.

Newman LC, Solomon S. Infectious, toxic, and metabolic headache. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. *Wolff's Headache And Other Head Pain*. 7th ed. New York: Oxford University Press; 2001:435-446.

Tien RD, Felsberg GJ, Osumi AK. Herpes virus infections of the CNS: MR findings. *Am J Roentgenol*. 1993;161:167.

Wall M, Silberstein SD, Aiken RD. Headache associated abnormalities in intracranial structure or function: high cerebrospinal fluid pressure headache and brain tumor. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. *Wolff's Headache And Other Head Pain*. 7th ed. New York: Oxford University Press; 2001:393-416.

## CSF XANTHOCHROMIA AFTER SAH SPECTROPHOTOMETRY

TIME AFTER HEMORRHAGE	PROBABILITY (%)
12 HOURS	100
1 WEEK	100
2 WEEKS	100
3 WEEKS	> 70
4 WEEKS	> 40

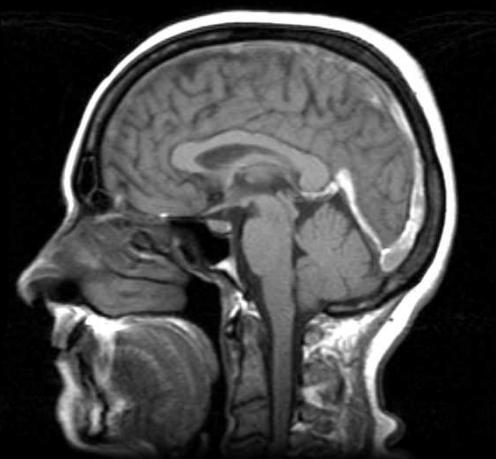
Vermulen M et al. *J Neurol Neurosurg Psychiatry*. 1989.

If there is a strong suspicion of a SAH and the CT scan is normal, then a lumbar puncture should be performed. Bloody cerebrospinal fluid may be caused by a traumatic lumbar tap, and a decrease in the red-cell count from the first to the last tube is an unreliable basis for ruling out a subarachnoid hemorrhage.

Xanthochromia (yellow discoloration) of the supernatant after centrifugation of the CSF, however, is diagnostic of a SAH. Xanthochromia is caused by the breakdown of blood products in the CSF, and it takes several hours for those blood products to break down and circulate to the lumbar theca. A lumbar puncture performed within 6 hours of a SAH may, therefore, be falsely negative. With the use of spectrophotometry, xanthochromia is detected in all patients with SAH between 12 hours and 2 weeks after the hemorrhage, and is still detectable in more than 70% at 3 weeks and 40% at 4 weeks.

Vermulen M, Hasan D, Blijenberg BG, Hijdra A, van Gijn J. Xanthochromia after subarachnoid hemorrhage needs no revisit. *J Neurol Neurosurg Psych*. 1989;52:826-828.

## CEREBRAL VENOUS SINUS THROMBOSIS



Bousser MG et al. In: *Wolff's Headache And Other Head Pain*. 2001.

Headache occurs in about 80% of patients with cerebral venous sinus thrombosis (CVST). The patient shown in this MRV had a thrombosis of the **SAGGITAL AND STRAIGHT VENOUS SINUSES**

Thunderclap headache (TCH) in patients with CVST is well described. Headache, not necessarily TCH (82%), papilledema (51%), focal neurologic symptoms and signs (39%), seizures (42%), and mental status changes (31%) are the most common features at presentation.

A CT scan, with or without contrast, detects only about 20% of cases with CVST. The best current diagnostic tool is MRI, and it is the only tool that visualizes the thrombus itself, which is usually obvious between day 5 and day 30. MRV, helical CT venography, or conventional angiography is indicated when MRI is equivocal and for very early (before day 5) or very late (after 6 weeks) stages, when false negatives may occur.

Bousser MG, Good J, Kittner SJ, Silberstein SD. Headache associated with vascular disorders. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. *Wolff's Headache And Other Head Pain*. 7th ed. New York: Oxford University Press; 2001:349-392.

SUDDEN-ONSET HEADACHE	
Primary	Secondary
Primary thunderclap headache (TCH)	SAH
Sexual headache	Venous sinus thrombosis
Exertional headache	Pituitary apoplexy
Cough headache	Arterial dissection
	Meningoencephalitis
	Acute hydrocephalus
	Hypertensive crisis
	Spontaneous intracranial hypotension

Dodick DW. JNNP 2002

Although a number of primary headache syndromes exist that can present with sudden, severe headache, many underlying diseases that can be clinically indistinguishable, from benign thunderclap headache (TCH) to SAH, also occur. These include:

- Venous sinus thrombosis
- Pituitary apoplexy
- Arterial dissection
- Meningoencephalitis
- Acute hydrocephalus
- Acute hypertension

Some of these conditions may be difficult to detect on CT scan, which underscores the need for MRI in patients with bloodless CT and CSF who present with a sudden-onset severe headache.

de Bruijn SF, Stam J, Kappelle LJ. For the Cerebral Venous Sinus Thrombosis Study Group. Thunderclap headache as first symptom of cerebral venous sinus thrombosis. *Lancet*. 1996;348(9042):1623-1625.

de Bruijn SF, Stam J, Vandebroucke JP. For the Cerebral Venous Sinus Thrombosis Study Group. Increased risk of cerebral venous sinus thrombosis with third-generation oral contraceptives. *Lancet*. 1998;351(9113):1404.

Dodick DW. Thunderclap headache. *J Neurol Neurosurg Psychiatry*. 2002 Jan;72(1):6-11.

## CASE STUDY 25-YEAR-OLD WOMAN

3 year history of daily headaches

- 1 to 2 attacks per day
- Strictly unilateral (left frontal / supraorbital)
- 2 to 4 hours in duration

1 week history of continuous left frontal headache

- Severe
- 2 episodes of emesis

This is a case discussion of a patient who is 25 years old Her history and exam include:

3 year history of daily headaches

- 1 to 2 attacks per day
- Strictly unilateral (left frontal / supraorbital)
- 2 to 4 hours in duration

1 week history of continuous left frontal headache

- Severe
- 2 episodes of emesis

## CASE STUDY 25 YEAR OLD WOMAN

- What questions do you now have?
- Would you investigate or treat symptomatically and observe?
- Which investigations or treatment would you pursue?

Discussion questions for group leader to review with audience:

- What questions do you now have?
- Would you investigate or treat symptomatically and observe?
- Which investigations or treatment would you pursue?

## INITIAL CT SCAN BRAIN



CT scan of the brain “appears” unremarkable...

## CASE STUDY 25 YEAR OLD WOMAN

- Patient appears incoherent and disoriented for 30 minutes, 7 days after headache began
- Patient has witnessed generalized seizure while in church
- Patient referred at family request for further workup
  - *Pseudoseizure is presumptive diagnosis*

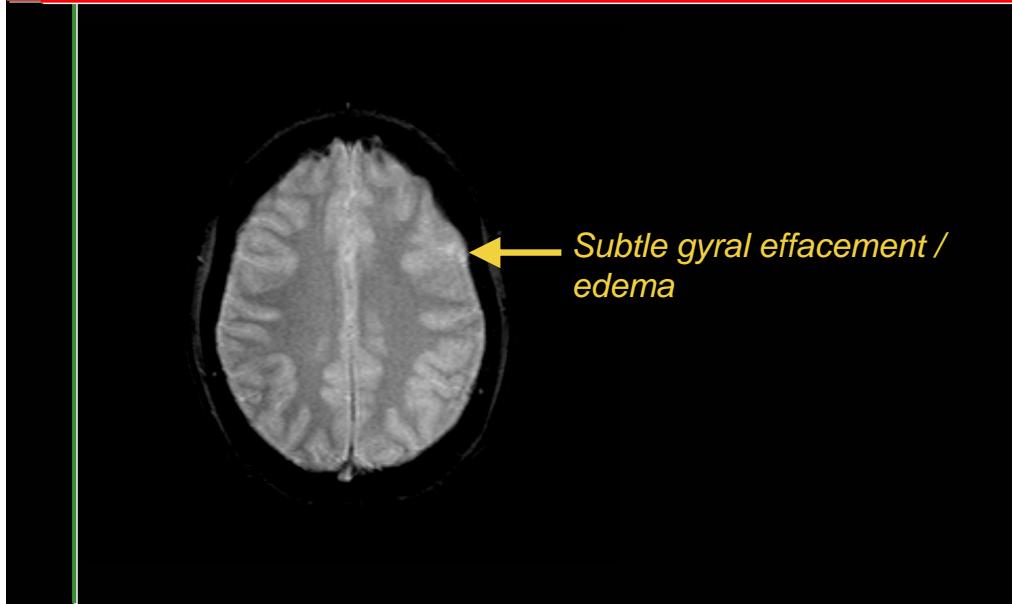
However, with ongoing study, the patient appears incoherent and disoriented for 30 minutes, 7 days after headache began

Patient has witnessed generalized seizure while in church

Patient referred at family request for further workup

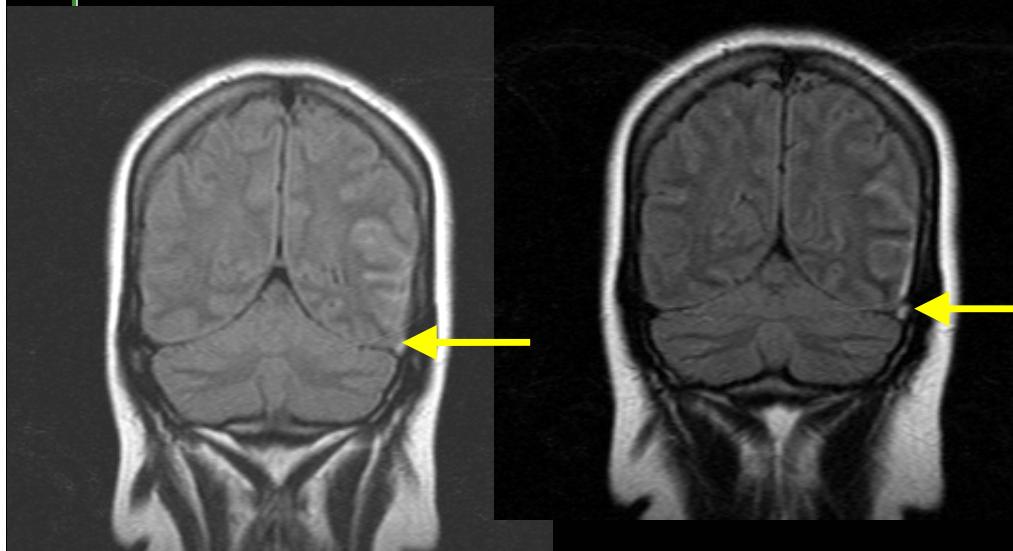
One might think that this patient has *Pseudoseizures* ...

## AXIAL T2 MRI BRAIN

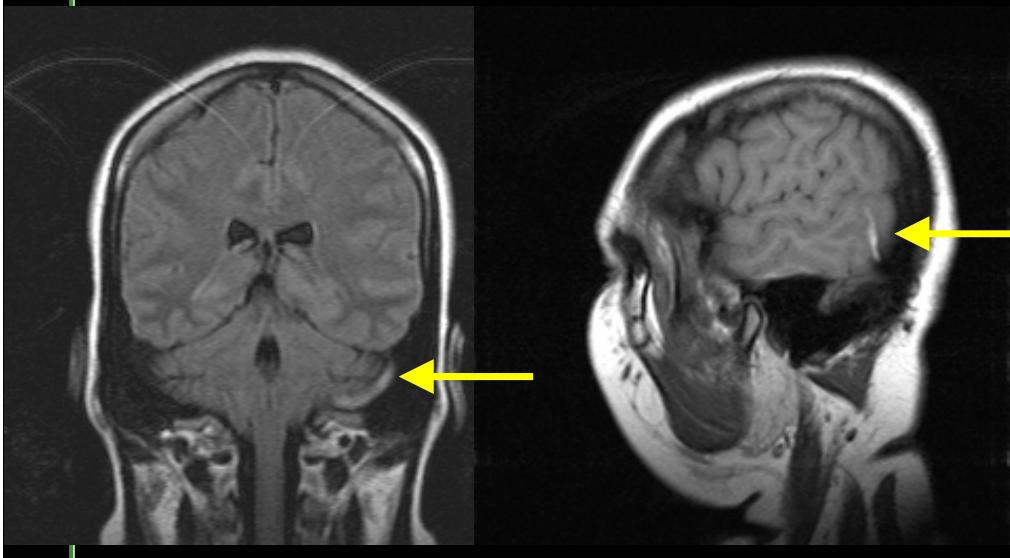


Upon further exam the patient underwent an MRI of the brain and this is where there was evidence of an abnormal finding. Specifically, subtle gyral effacement and edema was evident.

## CORONAL MRI BRAIN



## CORONAL MRI BRAIN



## MR VENOGRAPHY



## WORRISOME HEADACHE RED FLAGS “SNOOP”

- Systemic symptoms (fever, weight loss) or Secondary headache risk factors (HIV, systemic cancer)
- *Neurologic symptoms or abnormal signs (confusion, impaired alertness, or consciousness)*
- Onset: sudden, abrupt, or split-second
- Older: new onset and progressive headache, especially in middle-age >50 (giant cell arteritis)
- *Previous headache history or headache progression: first headache or different (change in attack frequency, severity, or clinical features)*

So, the exercise is to review the diagnostic process and assess where the red flags were missed with this patient. Specifically, she presented with abnormal neurological symptoms. She also had a change in headache history

## CONCLUSIONS

- Migraine is the most common headache disorder seen in ambulatory and emergency practice
- A systematic approach to headache diagnosis using diagnostic criteria and a simple mnemonic for secondary causes will:
  - Distinguish between primary and secondary headache disorders
  - Lead to an accurate diagnosis
- CT Brain will miss many secondary causes for headache – MRI is the imaging procedure of choice (except for SAH) in patients with RED FLAGS

Migraine is the most common headache disorder seen in ambulatory and emergency practice.

A systematic approach to headache diagnosis using diagnostic criteria and a simple mnemonic for secondary causes will:

Distinguish between primary and secondary headache disorders

Lead to an accurate diagnosis

CT Brain will miss many secondary causes for headache – MRI is the imaging procedure of choice (except for SAH) in patients with RED FLAGS.