ASSESSMENT AND DIAGNOSIS

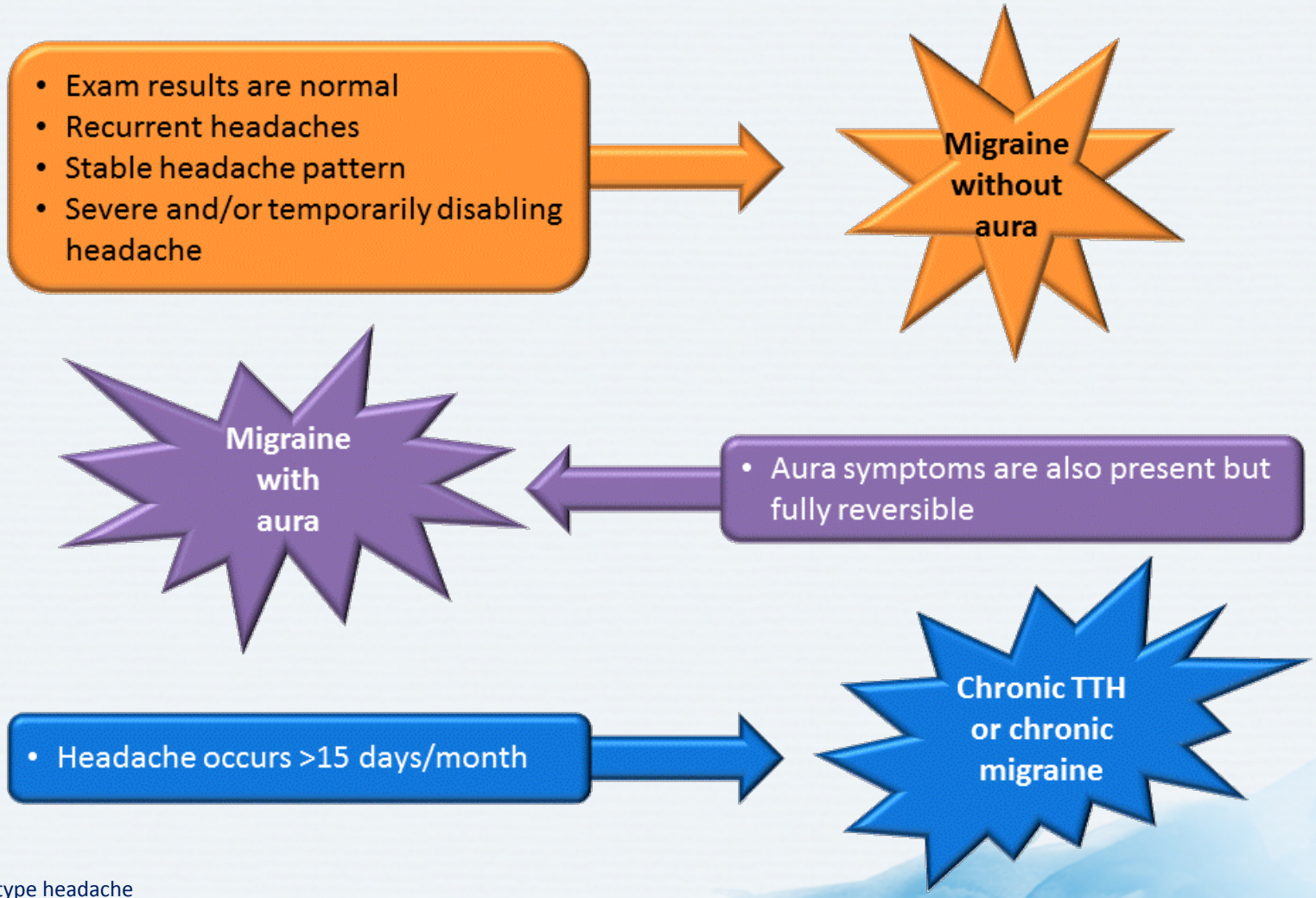
Importance of Diagnosing Migraine

- **Improved** quality of life
- **Reduced**
  - Disability
  - Patient dependency on opioids or barbiturates
  - Overuse of analgesic medications, opioids, or barbiturates
  - Risk of complications or medication overuse headaches
  - Chance of progressing to chronic daily headache (CDH)

Consequences of non-diagnosis include disabling illness, reduced quality of life, and loss of opportunities for early intervention

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December, 2014.

History and Physical Exam



TTH = tension-type headache

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December, 2014.

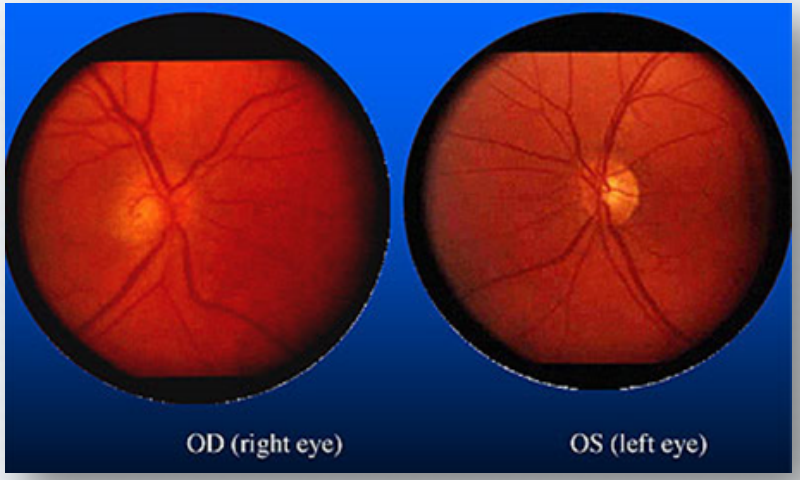
Red Flags in History

- Abrupt onset
- Very severe headache
- Progressive worsening of headache
- Headache precipitated by exertion
- Headache accompanied by generalized illness, fever, nausea, vomiting or stiff neck
- Headache associated with neurological symptoms
- Comorbidities

Red Flags on Examination

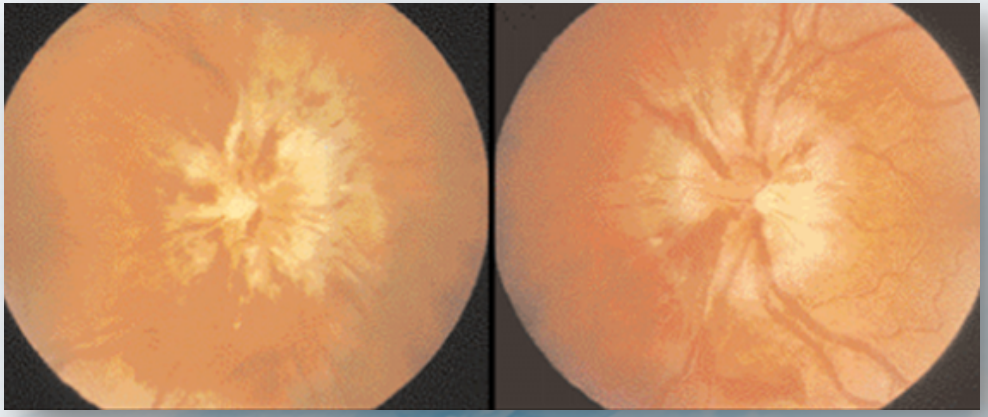
- Abnormal vital signs
- Papilledema
- Signs of meningeal irritation
- Presence of focal neurological signs
- Change in higher intellectual functions or cognition

Papilledema

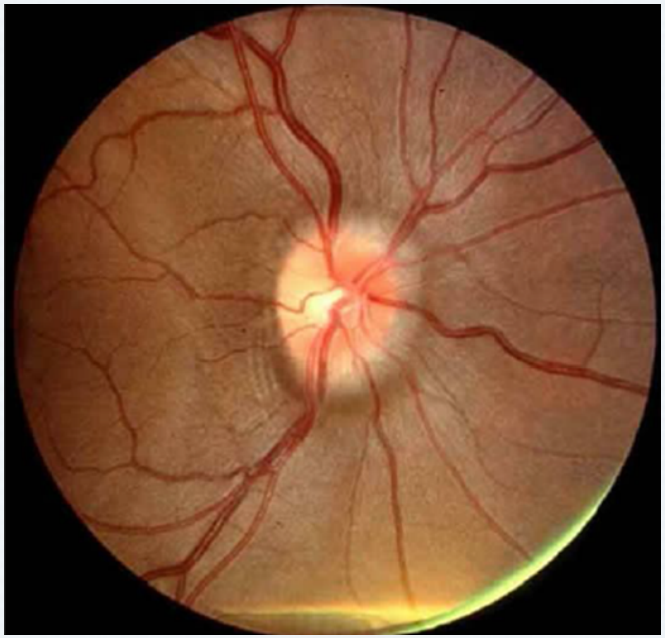


Papilledema in right eye

Bilateral papilledema and hemorrhage



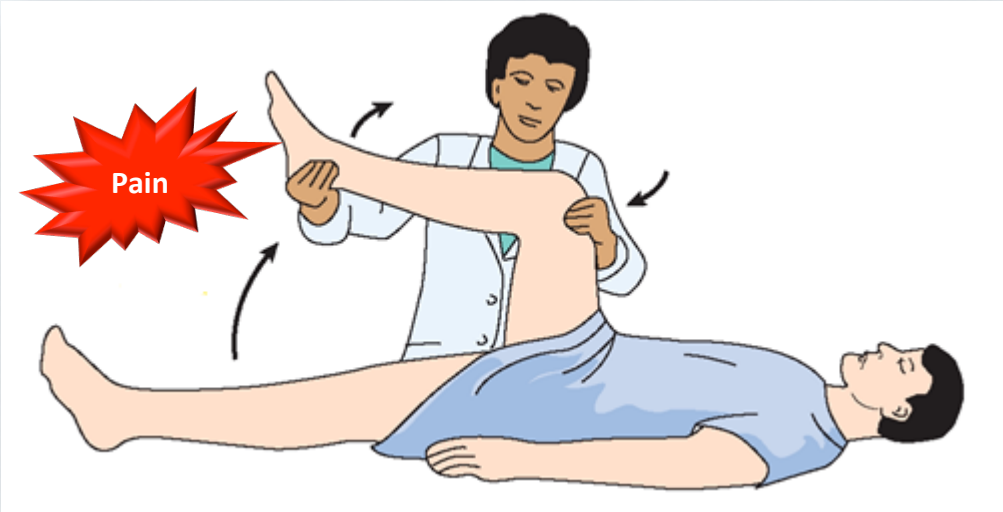
Papilledema



Grade I papilledema is characterized by a C-shaped halo with a temporal gap

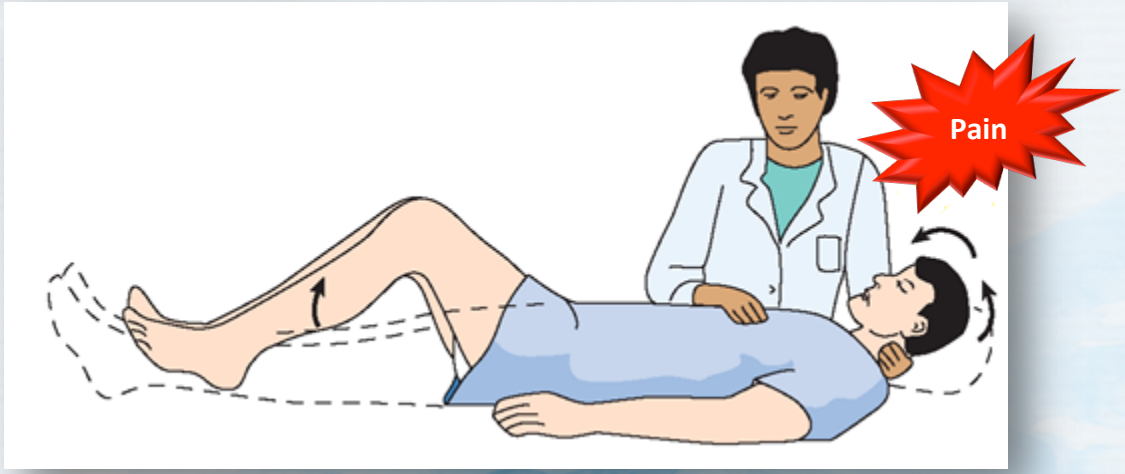
With Grade II papilledema, the halo becomes circumferential

Signs of Meningitis

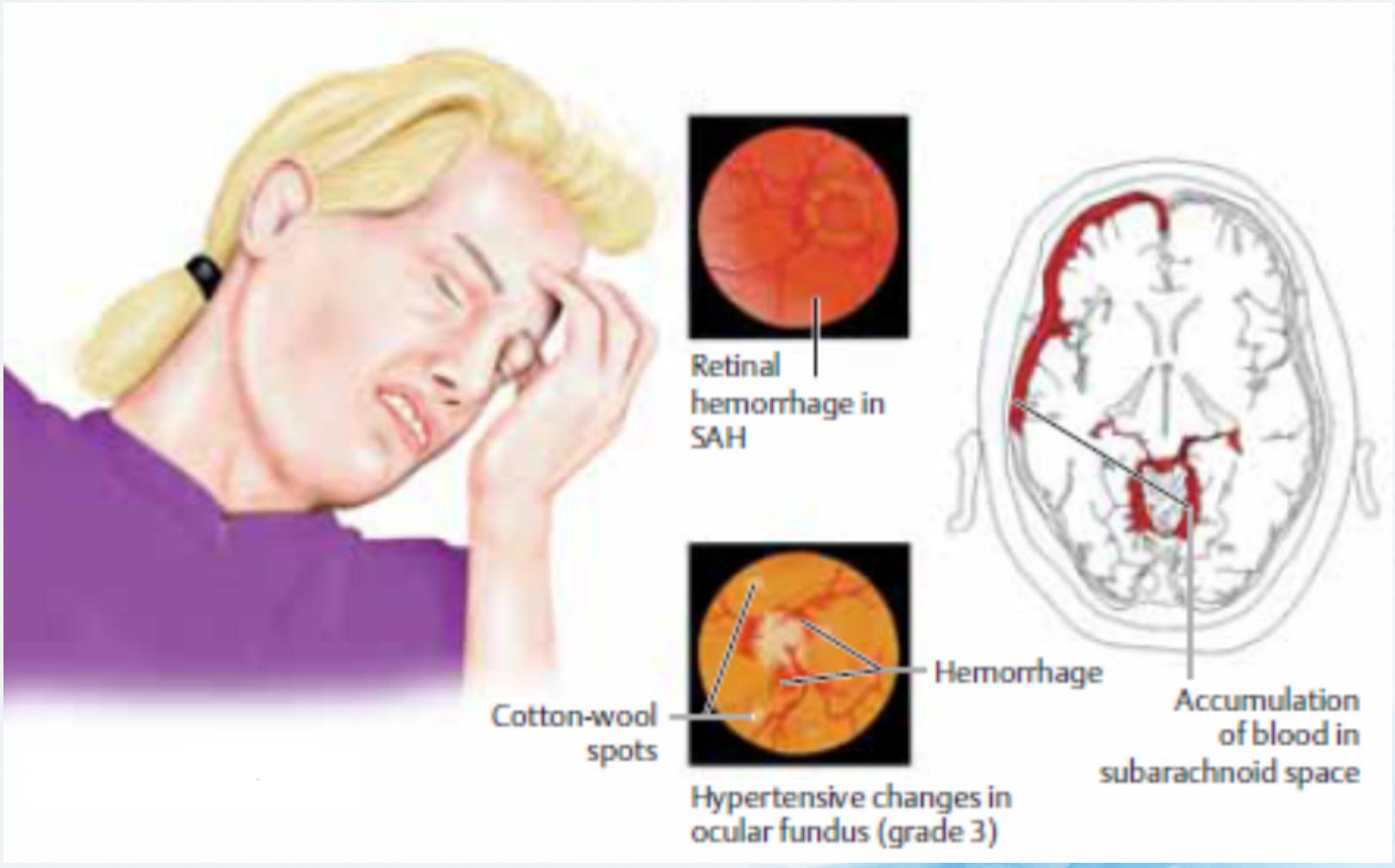


Kernig's sign – Patient supine with hip flexed 90°. Knee cannot be fully extended

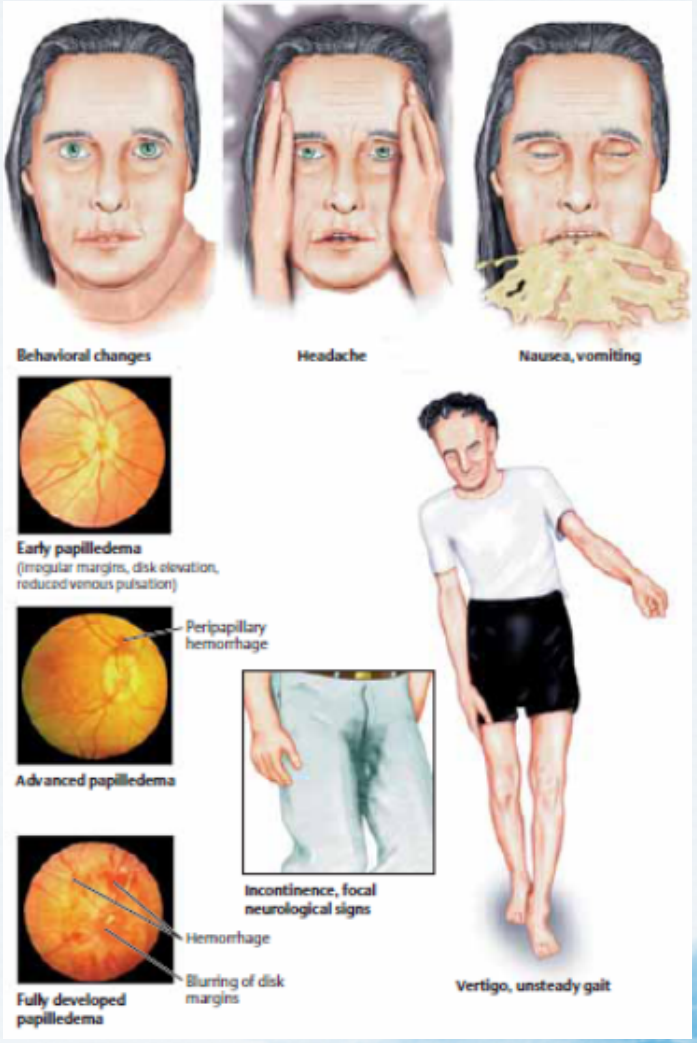
Brudzinski's neck sign – neck rigidity (passive flexion of neck causes flexion of both legs and thighs)



Subarachnoid Hemorrhage



Brain Tumor


Behavioral changes
Headache
Nausea, vomiting
Early papilledema
(Irregular margins, disk elevation, reduced venous pulsation)
Peripapillary hemorrhage
Advanced papilledema
Incontinence, focal neurological signs
Hemorrhage
Blurring of disk margins
Fully developed papilledema
Vertigo, unsteady gait

Temporal Arteritis

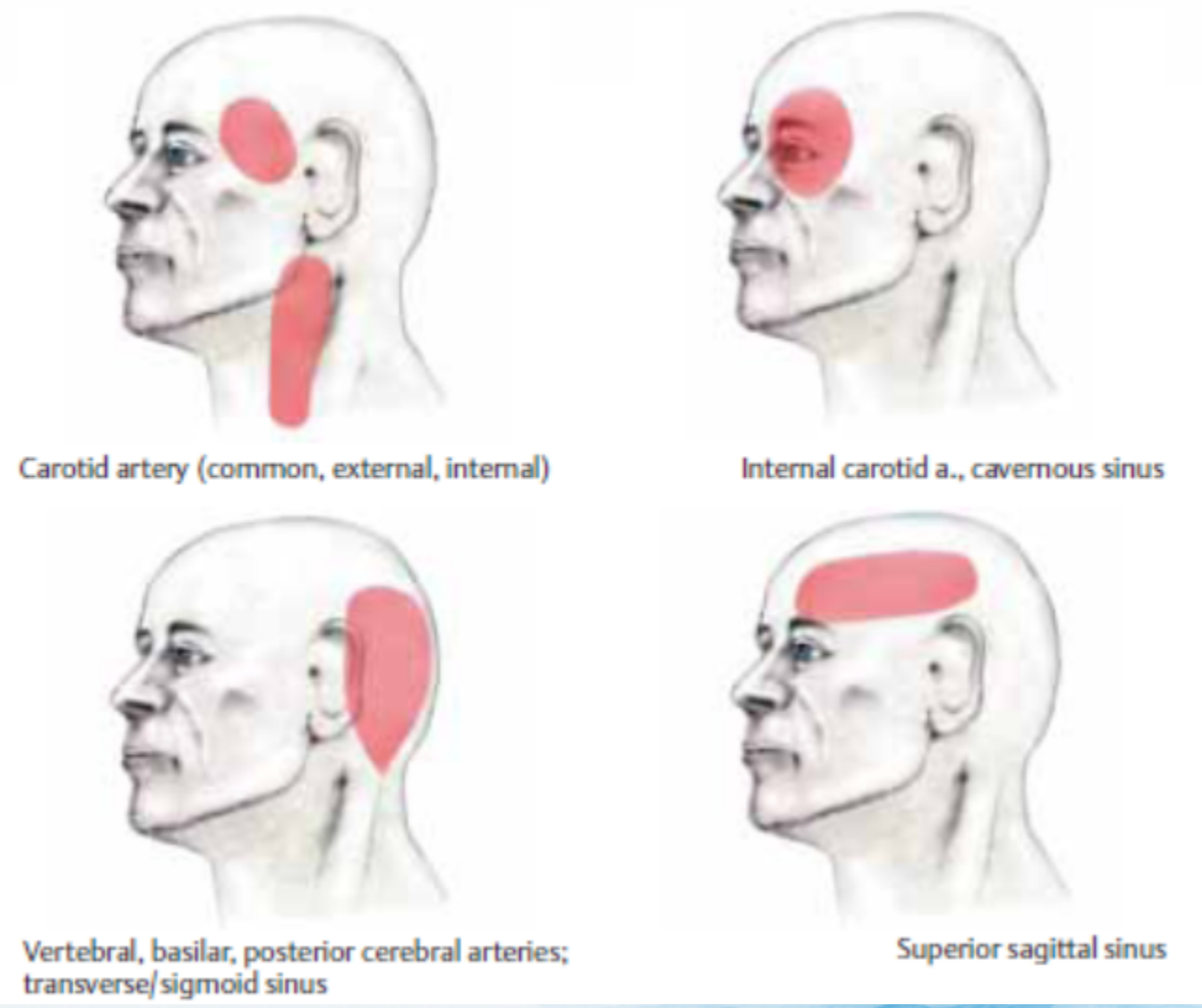
- Tenderness and induration on temporal artery, pulseless on examination
- Jaw claudication
- Myalgia, arthralgia, fatigue
- Increased ESR and CRP in serum
- Prompt evaluation and steroid therapy is required

Prominent temporal artery in patient with giant cell arteritis

Complication: blindness due to ischemic optic neuropathy and diplopia due to ischemic oculomotor neuropathy

CRP = C-reactive protein; ESR = erythrocyte sedimentation rate

Referred Headache Due to Cerebrovascular Lesions



Patient History

- Focus on most severe headache first
- Ask standardized questions
  - Onset
  - Frequency/duration
  - Location
  - Severity
  - Characteristics and other symptoms
  - Family history
  - What makes it better/worse
  - Medications taken
  - Recent changes in pattern
  - Other types of headaches
  - Neurologic symptoms (cognitive changes, changes in speech/language, loss of strength/sensation [including visual loss and diplopia], vertigo, faintness)
- Disability – does the headache interfere with daily life?
- Be alert for comorbid conditions complicating headache or diagnosis

The goal of taking a patient's history and performing a physical exam is to rule out secondary headache and diagnose primary headache

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December, 2014.

Headache History: Useful Questions to Ask Patients

1. When do you think your worst headaches first started?
2. How often do you get headaches that if left untreated are so severe you find it difficult to function?
3. What is the pain like?
4. How long does the pain last?
5. Do you have other symptoms besides head pain with these headaches?
6. What makes your headaches better or worse?
7. How often do you take something for your headaches?
8. What do you take for your headaches?
9. Does anyone else in your family have similar headaches?
10. Do you get other kinds of headaches?
11. Has there been any recent change in your headaches?

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December, 2014.

Risk Factors for Chronic Migraine

Modifiable

- Stressful life events
- Obesity
- Snoring
- Medication overuse

Non-modifiable

- Frequent headache
- Duration of illness

Granella F *et al. Cephalalgia.* 1998;18(Suppl 2):30-3; Scher AI *et al. Curr Pain Headache Rep*. 2002;6:486-91.

Vascular Risk Factors for Migraine

- ↑ CRP levels
- ↑ interleukin levels
- ↑ TNF-α and adhesion molecules (systemic inflammation markers)
- High homocysteine levels
- Oxidative stress and thrombosis
- Hypertension
- Hypercholesterolemia
- Impaired insulin sensitivity
- Stroke
- Coronary heart disease
- Increased body weight

CRP = C-reactive protein; TNF = tumor necrosis factor

Chawla J. 2014. Available at http://emedicine.medscape.com/article/1142556-overview. Accessed 05 January 2014.

Signs and Symptoms of Migraine

Typical Symptoms of Migraine

- Throbbing or pulsatile headache
  - Moderate to severe pain; intensifies with movement or physical activity
- Unilateral and localized pain in frontotemporal and ocular areas
  - Pain may be felt anywhere around head or neck
- Pain builds up over 1 to 2 hours
  - Progresses posteriorly and becomes diffuse
- Headache lasts 4 to 72 hours
- Nausea (80%) and vomiting (50%), anorexia, food intolerance, and light-headedness
- Sensitivity to light and sound

Chawla J. 2014. Available at http://emedicine.medscape.com/article/1142556-overview. Accessed 05 January 2014.

Characteristics of Chronic Migraine

- Onset usually between the ages of 20 and 30[1,2]
  - By age 25 to 40 there is usually a gradual increase in headache frequency[1,2]
- Usually daily or almost daily mild to moderate head, neck, or face pain[1,2]
- Acute attacks resemble episodic migraine[3]
- Day-to-day pain may resemble tension-type headache or hemicrania continua[3]

1. Saper JR. Headache Disorders. 1983; 2. Saper JR *et al. Handbook of Headache Management*. 2nd edition. 1999; 3. Sanin LC *et al. Cephalagia.* 1994;14(6):443-6.

Migraine Aura

- Positive or negative focal neurological symptoms
- May start before or occur during the headache
- Usually lasts 5-20 minutes (<60 min)
- May present as visual, sensory, motor, speech or brainstem disorder
- 80% of patients report headache after aura

Typical Features of Migraine Aura

- May precede or accompany headache phase or may occur in isolation
- Usually develops over 5-20 minutes (~8.5 hours) and lasts <60 minutes
- Most commonly visual, but can be sensory, motor, or a combination
- Positive or negative visual symptoms
  - Most common positive visual phenomenon is the scintillating scotoma, an arc or band of absent vision with a shimmering or glittering zigzag border

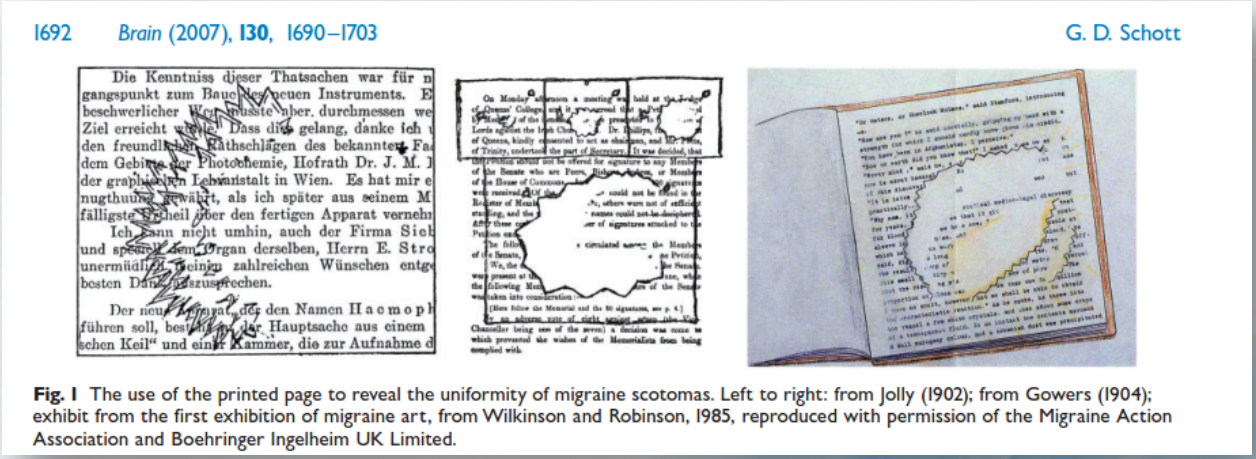


Fig. 1 The use of the printed page to reveal the uniformity of migraine scotomas. Left to right: from Jolly (1902); from Gowers (1904); exhibit from the first exhibition of migraine art, from Wilkinson and Robinson, 1985, reproduced with permission of the Migraine Action Association and Boehringer Ingelheim UK Limited.

Chawla J. 2014. Available at http://emedicine.medscape.com/article/1142556-overview. Accessed 05 January 2014.

Migraine Premonitory Phase

- Present in 80% of migraineurs
- Occurs up to hours before aura or headache
- May come and go before headache phase or may build in intensity
- Persists well beyond resolution of headache
- Associated symptoms:
  - Fatigue
  - Yawning
  - Piloerection
  - Irritability
  - Change in appetite
  - Nausea
  - Change in facial expression or body perception
  - Mood changes
  - Food cravings
  - Stiff neck
  - Difficulty concentrating
  - Bloating
  - Phonophobia

Charles A. *Headache*. 2013;53:413-9.

Pathogenesis of the Premonitory Phase of Migraine

- Role of dopamine? (yawning, nausea, drowsiness, lightheadedness)
- Increased blood flow (shown by PET)
- Increased activity of hypothalamus (mood, appetite, energy)
- Orexin pathway in hypothalamus

PET = positron emission tomography
Charles A. *Headache*. 2013;53:413-9.

Postdrome-Resolution Phase

- Symptoms last for hours to days
  - Fatigue, weakness, cognitive difficulties, mood change, residual head pain, lightheadedness, gastrointestinal symptoms
- Persistence of midbrain, dorsolateral pons, and hypothalamic activation, light-induced activation of visual cortex

Charles A. *Headache*. 2013;53:413-9.

Red Flags in Headache Diagnosis – "SNOOP"

Systemic symptoms OR **S**econdary risk factors	Fever, weight loss HIV, systemic cancer
Neurologic symptoms	Confusion, impaired alertness, papilledema, asymmetry, motor weakness, nuchal rigidity, visual disturbance other than aura, dysphasia
Onset	Sudden, abrupt, split-second, seconds to minute
Older	New onset in an older patient or progressively worsening headache in a middle-aged patient (>50 years)
Progression pattern	First headache or different (change in attack frequency, severity, or clinical features)

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December, 2014.

Red Flags in Headache Diagnosis – Using SNOOP

Headache Red Flag	Differential Diagnosis	Possible Workup
Headache with systemic illness (fever, stiff neck, rash) or New headache in a patient with HIV or cancer	Meningitis, encephalitis, Lyme disease, systemic infection, collagen vascular disease; Meningitis (chronic or carcinomatous), brain abscess (including toxoplasmosis), metastasis	Neuroimaging, lumbar puncture, blood tests; Neuroimaging, lumbar puncture
Neurologic symptoms or signs of disease other than typical aura	Mass lesion, arteriovenous malfunction, stroke, collagen vascular disease (including antiphospholipid antibodies), intracranial hypertension	Neuroimaging, collagen vascular evaluation
Sudden onset headache	Subarachnoid hemorrhage, pituitary apoplexy, bleed into a mass or arteriovenous malformation, mass lesion (especially posterior fossa)	Neuroimaging, lumbar puncture
Headache begins in patient >50 years of age	Temporal arteritis (giant cell arteritis), mass lesion	Erythrocyte sedimentation rate, neuroimaging
Accelerating pattern of headaches	Mass lesion, subdural hematoma, medication overuse	Neuroimaging, drug screen

[1]Adapted from Silberstein SD et al. *Headache in Clinical Practice*. 2nd ed. London: Martin Dunitz; 2002:14.

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December, 2014.

Diagnosing Secondary Headaches

- Secondary headaches are rare; lifetime prevalence is 0.5%
- Very few (0.18%) patients with migraine symptoms and normal neurologic exam have significant intracranial pathology
- Significantly changed headache should be regarded as a new headache
- Abnormal neurologic exam in patients with headache require further evaluation

Diagnosis of migraine does not preclude future development of secondary headache

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December, 2014.

Secondary Headaches: Warning Signs

Warning signs in patients with no history of headaches or with changed headaches and a significantly different pattern:

- Abrupt onset of a new type of severe headache
- Is the worst headache the patient has ever had
- Progressive worsening over of days or weeks
- Headache is brought on by exertion (*e.g.*, coughing, sneezing, bending over, exercise, sexual arousal)
- Headache is accompanied by generalized illness or fever, nausea, vomiting, or stiff neck

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December, 2014.

Secondary Headache: Diagnostic Testing

- Lab testing is **not** routinely needed to evaluate headache
- Patients with warning symptoms or signs of secondary headache must be evaluated

- May be useful to establish a baseline lab screen before new drugs are prescribed
  - Cardiovascular factors should be reviewed before prescribing vasoconstrictors
  - Consider electrocardiogram on a case-by-case basis

Electroencephalogram is not useful in headache evaluation

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December, 2014.

Secondary Headache: Neuroimaging

- Abnormal findings on neurologic exam
- Patient has progressively worsening headache
- Patient has new persistent headache
- Patient has a new, rapid onset headache (thunderclap headache)*
- Headache does not respond to standard therapy

- No focal neurologic findings
- Patient has stable pattern of recurrent headache
- No history of seizures

MRI is more sensitive than CT for most CNS abnormalities

*Sudden onset of a severe headache that reaches peak intensity in <1 minute

CNS = central nervous system; CT = computed tomography; MRI = magnetic resonance imaging

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December,

Ominous Causes of Headache that Routine CT May Miss

- Vascular disease
- Neoplastic disease
- Cervicomedullary lesions
- Infections
- Disorders of intracranial pressure

CT can identify some *but not all* abnormalities that can cause ominous headaches

CNS = central nervous system; CSF = cerebrospinal fluid; CT = computed tomography; MRI = magnetic resonance imaging

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December,

Lab Testing for Migraine

Lab testing is not routinely needed in the evaluation of a patient with headache

Evans RE, Rozen TD, Adelman JU. Wolff's Headache And Other Head Pain. 7th ed. New York: Oxford University Press; 2001:27-49.

Campbell JK, Sakai F. The Headaches. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2000:359-63.

Investigating Migraine: Electroencephalography (EEG)

EEG is not useful in the routine evaluation of headache to exclude structural cause

- EEG may be useful in some instances:
  - Alteration or loss of consciousness
  - Residual focal defects or encephalopathy
  - Atypical migrainous aura

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

Imaging for Migraine

Imaging for Migraine - AAN

Neuroimaging should be considered only in patients with migraine who have atypical headache patterns or neurologic signs.

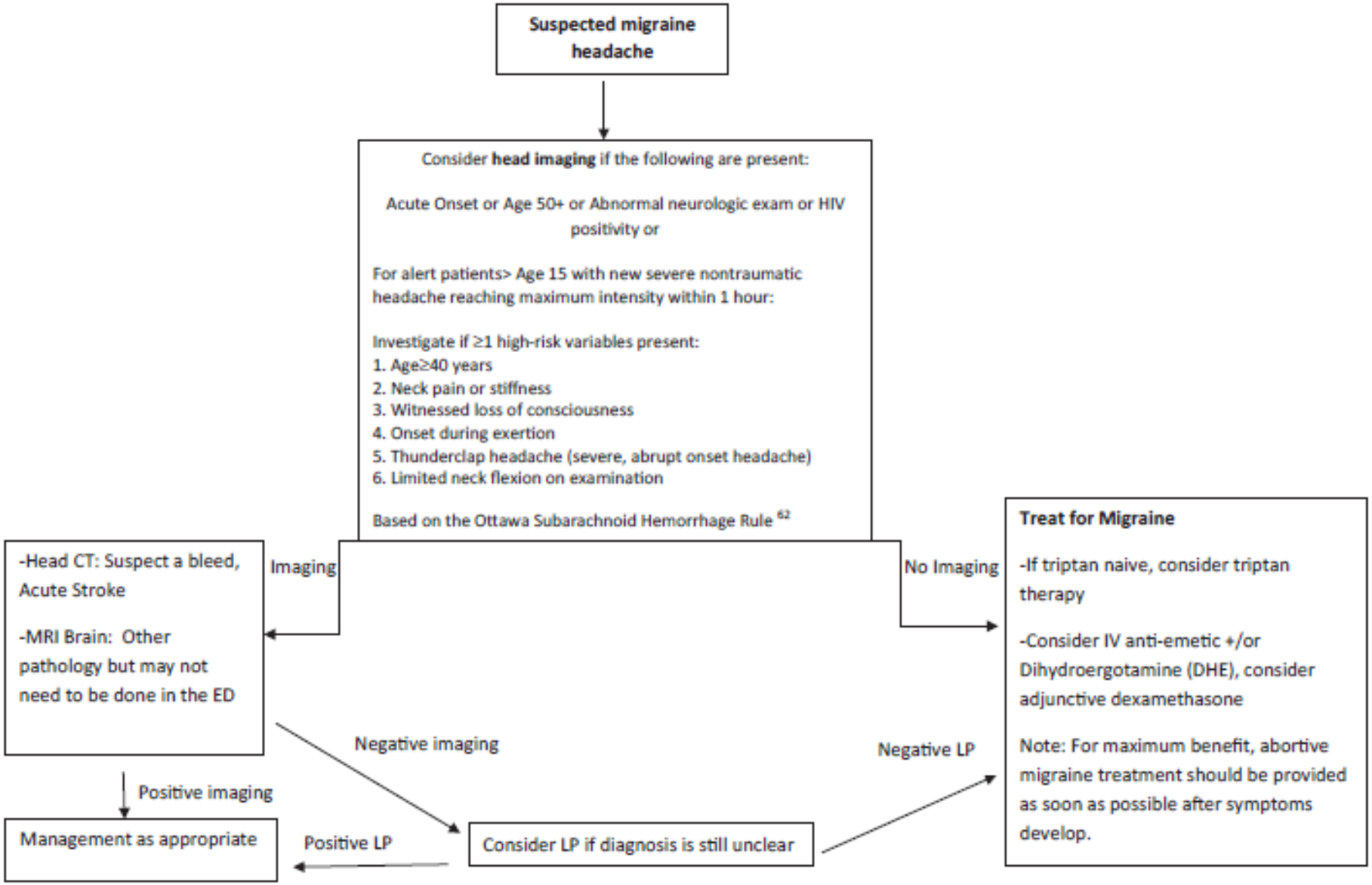
AAN = American Academy of Neurology

Aukerman G *et al. Am Fam Physician.* 2002;66(11):2123-30.

Imaging for Migraine – U.S. Headache Consortium

- Consider neuroimaging in patients with non-acute headache and unexplained findings on neurologic exam
- Patients with neurologic symptoms: insufficient evidence to make specific recommendations.
  - Consider neuroimaging
- Neuroimaging is usually **not** warranted in patients with a normal neurologic exam
  - Threshold may be lowered if headache has atypical features/does not meet strict definition of migraine

Aukerman G *et al. Am Fam Physician.* 2002;66(11):2123-30.



Before Discharge

1. Screen for psychiatric comorbidity with the PHQ2 and the GAD 7 and consider appropriate referrals.

2. Prescribe abortive medication (long acting NSAID and/or triptan and/or anti-emetic for patients with nausea).

3. Consider prescribing preventive medication for individuals with frequent attacks (6+/month) or individuals with less frequent attacks which cause significant disability, suboptimal response to acute treatments and/or individuals at risk of medication overuse.

(*Headache* 2014;54:1131-1145)

Investigating Migraine: CT and MRI

CT or MRI is *not* generally warranted in patients with recurrent migraine

- Exceptions
  - Recent substantial change in headache pattern
  - History of seizures
  - Focal neurologic signs or symptoms
- MRI is more sensitive

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

Communicating a Migraine Diagnosis to Patients: What Patients Need

- A simple and clear explanation for their headaches
- Reassurance and encouragement
- Answers to their questions
- To participate in decisions about their care
- A treatment plan that includes structured follow up
- To have realistic expectations

American Headache Society. Brainstorm. 2004. Available at: http://www.americanheadachesociety.org/assets/1/7/Book_-_Brainstorm_Syllabus.pdf. Accessed 04 December, 2014.

Advantaged Imaging Techniques for Migraine

Positron Emission Tomography (PET)[1]

- Studies are scarce
- Has shown posterior cerebral hypoperfusion accompanying migraine auras may be present in migraine attacks without aura
- Probably due to an increase of intrinsic vasoconstrictive tone in the cerebral circulation

Voxel-based morphometry (VBM)[2]

- Provides detailed information about structural differences in brains of migraineurs vs. non-migraine controls
- allows for structural comparison of white and gray matter between subjects and controls and for comparison of whole brain and regional volumes on a voxel-by-voxel basis
- Migraineurs with high attack frequency and longer duration of disease have differences in grey and white matter density vs. those with fewer attacks and shorter disease duration

Diffusion tensor imaging (DTI)[2]

- MRI technique that allows for visualization of the orientation and anisotropy of white and grey matter
- Based upon the measurement of water diffusion within brain tissue.
- Diffusion is affected by the magnitude of myelination, density, and orientation of axons. Can detect microstructural changes; considered more sensitive than conventional MRI techniques

1. Géraud G *et al. Rev Neurol (Paris)*. 2005;161(6-7):666-70; 2. Schwedt TJ, Dodick DW. *Lancet Neurol.* 2009;8:560-8.

PET- brainstem activation during acute migraine attack

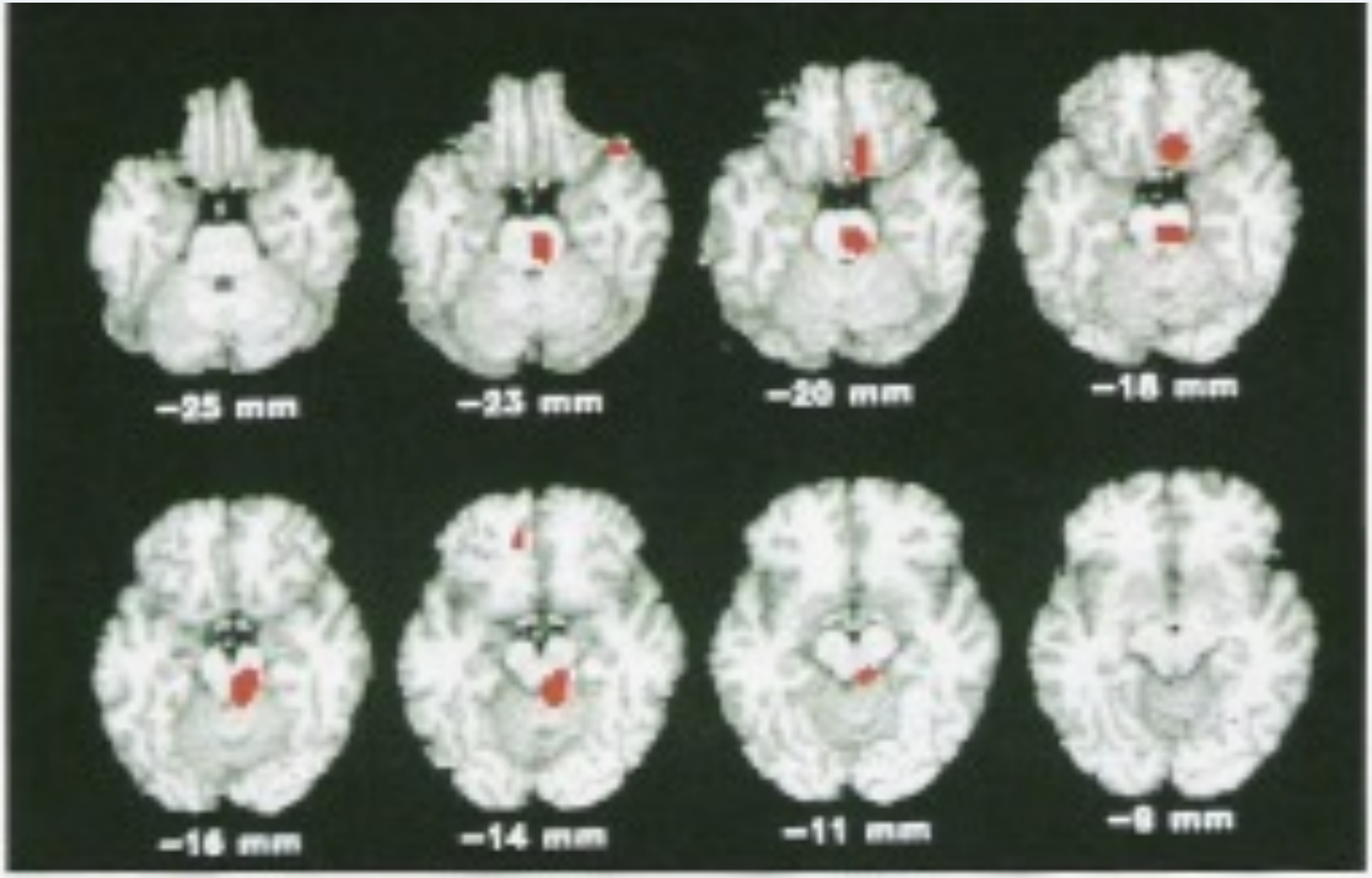
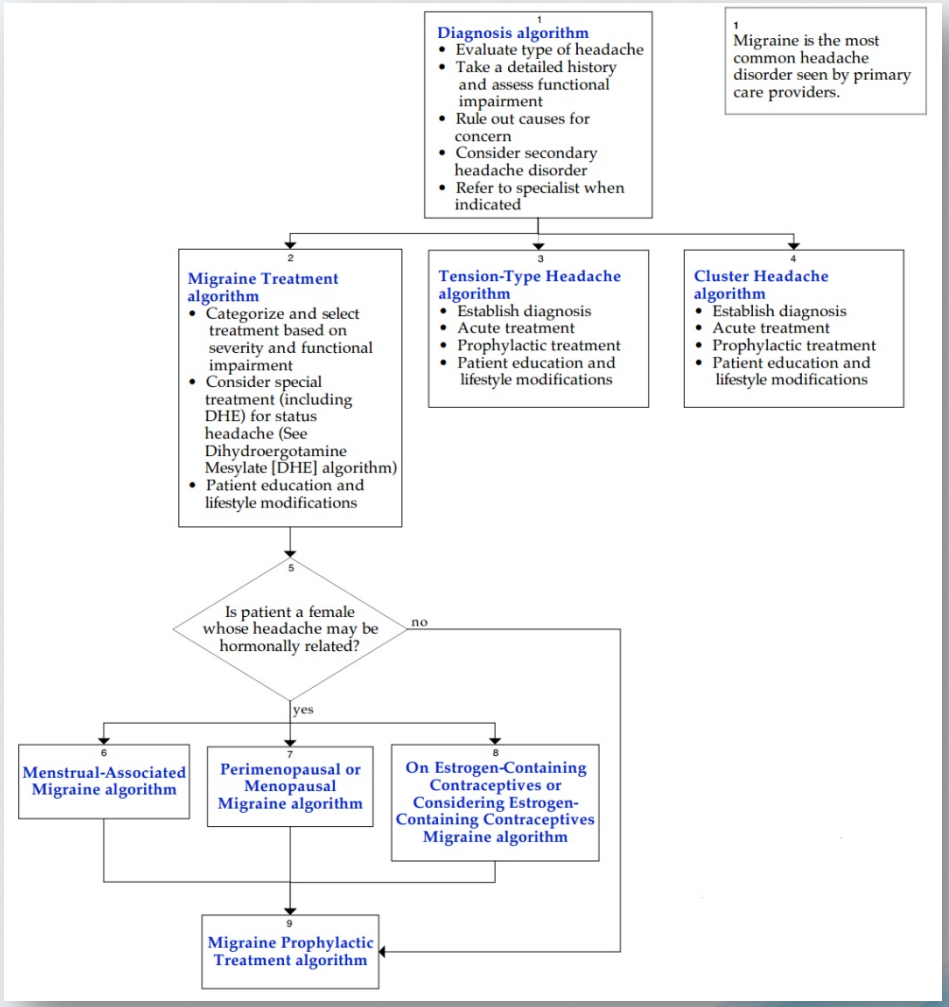


Figure 5.11
Activation of the brainstem with PET during acute migraine.[67]

International Headache Society Diagnostic Criteria

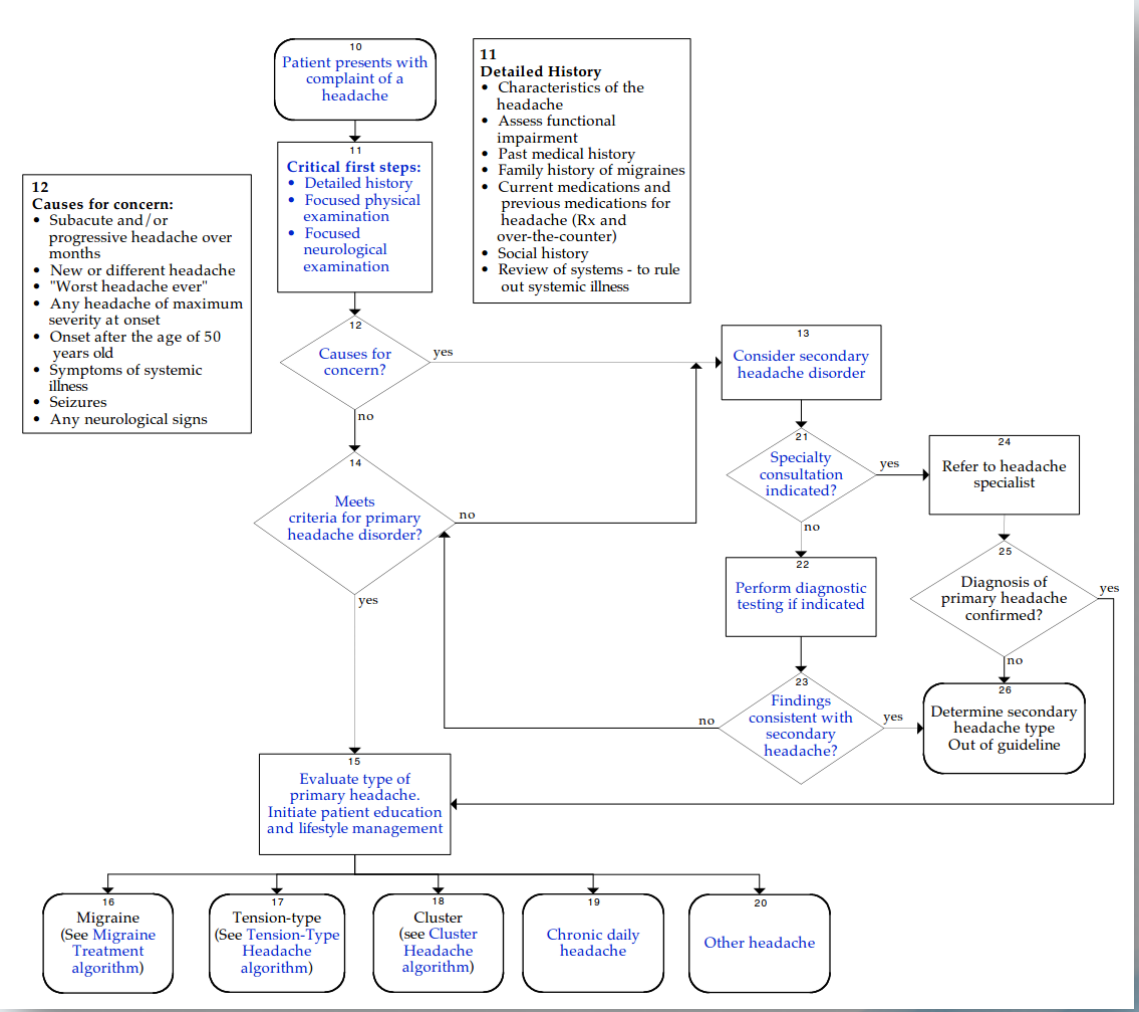
Diagnosis and Treatment of Headache – ICSI Main Algorithm



ICSI = Institute for Clinical Systems Improvement

Beithon J, Gallenberg M, Johnson K, Kildahl P, Krenik J, Liebow M, Linbo L, Myers C, Peterson S, Schmidt J, Swanson J. Institute for Clinical Systems Improvement. Diagnosis and Treatment of Headache. https://www.icsi.org/_asset/qwrzng/Headache.pdf. Updated January 2013.

Diagnosis of Headache – ICSI Algorithm



ICSI = Institute for Clinical Systems Improvement

Beithon J, Gallenberg M, Johnson K, Kildahl P, Krenik J, Liebow M, Linbo L, Myers C, Peterson S, Schmidt J, Swanson J. Institute for Clinical Systems Improvement. Diagnosis and Treatment of Headache.
https://www.icsi.org/_asset/qwrzng/Headache.pdf. Updated January 2013.

IHS Diagnostic Criteria for Cluster Headache

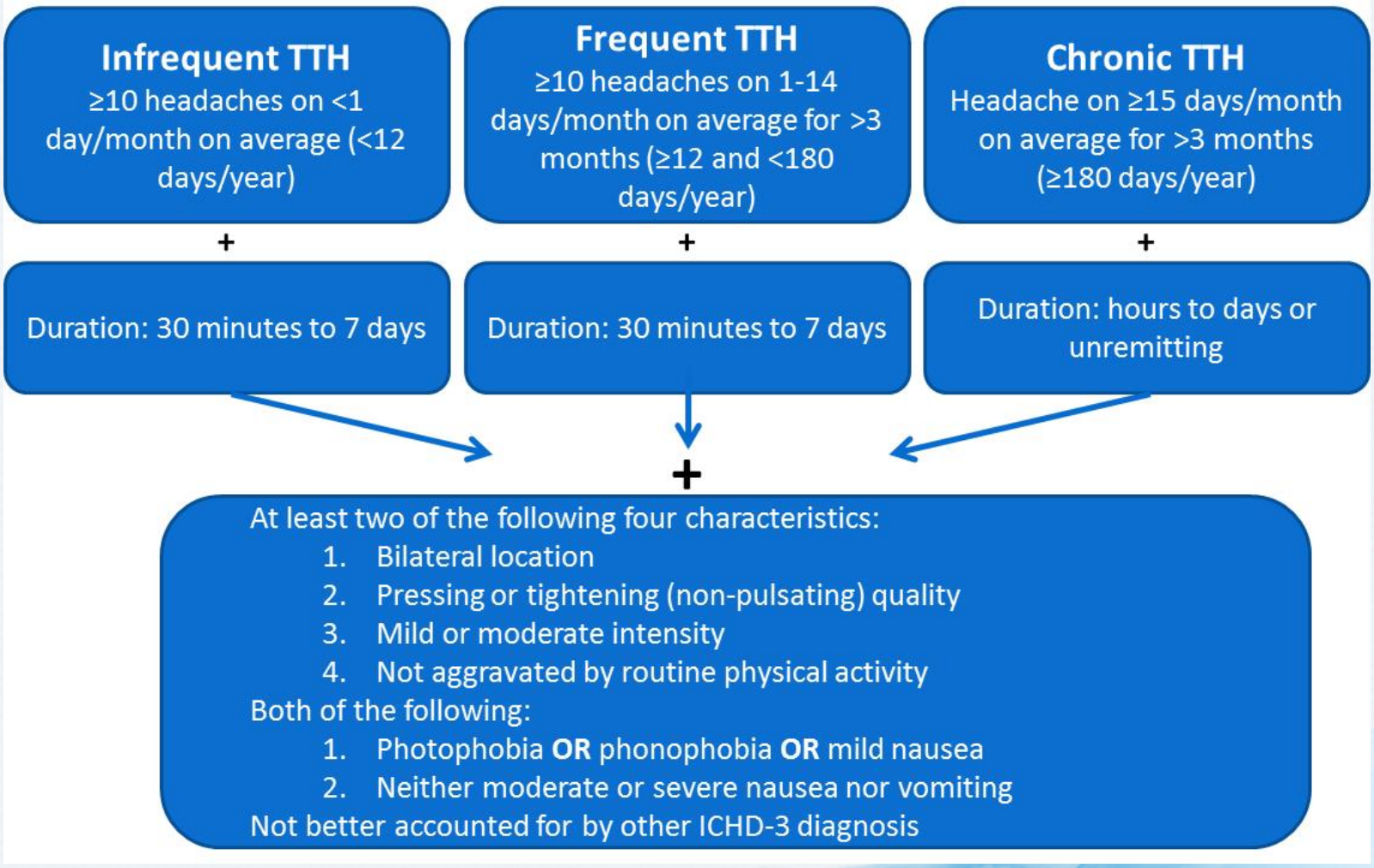
A. At least five attacks fulfilling criteria B to D
B. Severe or very severe unilateral orbital, supraorbital and/or temporal pain lasting 15-180 minutes when untreated
C. Either or both of the following:
    1. At least one of the following symptoms or signs
        a. Conjunctival injection and/or lacrimation
        b. Nasal congestion and/or rhinorrhea
        c. Eyelid edema
        d. Forehead and facial sweating
        e. Sensation of fullness in the ear
        f. Miosis and/or ptosis
    2. A Sense of restlessness or agitation
D. Attacks have a frequency between one every other day and eight per day for more than half of the time when the disorder is active
E. Not better accounted for by another ICHD-3 diagnosis

Link to IHS Diagnosis of Cluster Headache

IHS = International Headache Society

Headache Classification Committee of the International Headache Society (IHS). *Cephalalgia*. 2013;33(9):629-808.

Infrequent vs. Frequent vs. Chronic TTH: Diagnosis



TTH = tension-type headache

1. International Classification of Headache Disorders. 2013.

IHS Diagnostic Criteria for Chronic Tension-type Headache

A. Headache occurring on ≥15 days per month on average for >3 months (≥180 days per year), fulfilling criteria B to D
B. Lasting hours to days, or unremitting
C. At least two of the following four characteristics:
1. Bilateral location
2. Pressing or tightening (non-pulsating) quality
3. Mild or moderate intensity
4. Not aggravated by routine physical activity such as walking or climbing stairs
D. At least two of the following:
    1. No more than one of photophobia, phonophobia, or mild nausea
    2. Neither moderate or severe nausea nor vomiting
E. Not better accounted for by another ICHD-3 diagnosis

Link to IHS Diagnosis of Chronic Tension-type Headache

IHS = International Headache Society

Headache Classification Committee of the International Headache Society (IHS). *Cephalalgia*. 2013;33(9):629-808.

IHS Diagnostic Criteria for Infrequent Episodic Tension-type Headache

A. At least 10 episodes of headache occurring on <1 day per month on average (<12 days per year) and fulfilling criteria B to D
B. Lasting 30 minutes to 7 days
C. At least two of the following four characteristics:
    1. Bilateral location
    2. Pressing or tightening (non-pulsating) quality
    3. Mild or moderate intensity
    4. Not aggravated by routine physical activity such as walking or climbing stairs
D. Both of the following:
    1. No nausea or vomiting
    2. No more than one of photophobia or phonophobia
E. Not better accounted for by another ICHD-3 diagnosis

Link to IHS Diagnosis of Infrequent Episodic Tension-type Headache

IHS = International Headache Society

Headache Classification Committee of the International Headache Society (IHS). *Cephalalgia*. 2013;33(9):629-808.

IHS Diagnostic Criteria for Frequent Episodic Tension-type Headache

A. At least 10 episodes of headache occurring on <1 day per month on average (<12 days per year) and fulfilling criteria B to D
B. Lasting 30 minutes to 7 days
C. At least two of the following four characteristics:
    1. Bilateral location
    2. Pressing or tightening (non-pulsating) quality
    3. Mild or moderate intensity
    4. Not aggravated by routine physical activity such as walking or climbing stairs
D. Both of the following:
    1. No nausea or vomiting
    2. No more than one of photophobia or phonophobia
E. Not better accounted for by another ICHD-3 diagnosis

Link to IHS Diagnosis of Frequent Episodic Tension-type Headache

IHS = International Headache Society

Headache Classification Committee of the International Headache Society (IHS). *Cephalalgia*. 2013;33(9):629-808.

IHS Diagnostic Criteria for Menstrual Migraine

A. Attacks, in a menstruating woman, fulfilling criteria for migraine without aura

B. Attacks occur exclusively on day 1+2 (*i.e.*, days 2 to +3)[1] of menstruation in at least two out of three menstrual cycles and at no other times in the cycle

Link to IHS Diagnosis of Menstrual Migraine

1The first day of menstruation is day 1 and the preceding day is -1; there is no day 0
IHS = International Headache Society
Headache Classification Committee of the International Headache Society (IHS). *Cephalalgia*. 2013;33(9):629-808.

ICHD-3 Diagnostic Criteria for Exogenous Hormone-induced Headache

A. Any headache fulfilling criterion C

B. Regular intake of ≥1 exogenous hormones

C. Evidence of causation demonstrated by both of the following:

1. Headache has developed in temporal relation to the commencement of hormone intake
2. One or more of the following:
    a. Headache has significantly worsened after an increase in dosage of the hormone
    b. Headache has significantly improved or resolved after a reduction in dosage of the hormone
    c. Headache has resolved after cessation of hormone intake

D. Not better accounted for by another ICHD-3 diagnosis

Link to ICHD-3 Diagnosis of Exogenous hormone-induced Headache

ICHD = International Classification of Headache Disorders

Headache Classification Committee of the International Headache Society (IHS). *Cephalalgia*. 2013;33(9):629-808.

ICHD-3 Diagnostic Criteria for Estrogen-withdrawal Headache

A. Any headache fulfilling criterion C

B. Daily use of exogenous estrogen for ≥3 weeks, which has been interrupted

C. Evidence of causation demonstrated by both of the following:

1. Headache or migraine has developed within 5 days after the last use of estrogen

2. Headache or migraine has resolved within 3 days of its onset

D. Not better accounted for by another ICHD-3 diagnosis

Link to ICHD-3 Diagnosis of Estrogen-withdrawal Headache

ICHD = International Classification of Headache Disorders

Headache Classification Committee of the International Headache Society (IHS). *Cephalalgia*. 2013;33(9):629-808.

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