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Headache in Childhood

Rob Forsyth, MD* and Kevin Farrell, MD*

OBJECTIVES

After completing this article, readers should be able to:

1. Describe what most parents who want help for a child who has a headache are seeking.
2. List the most common cause of severe headache in children.
3. Describe what tests must be performed prior to lumbar puncture in any patient who has a headache.
4. Determine common causes of chronic daily headache.

Chronic or recurrent headache is common in children, occurring in approximately 40% of children by 7 years of age and 75% of children by 15 years. Most parents who seek help for a child who has headaches are looking for reassurance that the headache is not due to a serious cause.

Pathogenesis and Pathophysiology

Pain referred to the head can arise from the following structures:

1) intracranial or extracranial arteries, large intracranial veins, or venous sinuses; 2) cranial or spinal nerves; 3) basal meninges; 4) cranial and cervical muscles; and 5) extracranial structures such as the nasal cavity and sinuses, teeth, mucous membranes, skin, and subcutaneous tissues. The brain, most of the meninges overlying the convexity, and the bony skull are not sensitive to pain. Pain arising from the cranial circulation and supratentorial structures travels primarily via the trigeminal nerve and is referred to the anterior part of the head. Pain arising from posterior fossa structures travels mainly via the first three cervical nerves, resulting in pain in the back of the head and neck as well as the forehead. The glossopharyngeal and vagal nerves innervate part of the posterior fossa, and pain is referred to the ear and throat.

There are two major hypotheses regarding the pathogenesis of

migraine. The vascular hypothesis proposes that vasoconstriction results in aura or focal neurologic signs and is followed by painful vasodilatation. The neurogenic hypothesis proposes that afferent inputs to the brainstem result in a slowly spreading cortical neuronal depression that is followed by dilation and inflammation of the cranial vasculature innervated by the trigeminal nerve. Serotonin (5 hydroxytryptophan [5HT]) plays a complex role in this process, and agonists and antagonists to a variety of subtypes of 5HT receptors appear to be important in both symptomatic relief of acute attacks and prophylaxis.

Clinical Evaluation

Headache is a symptom of an underlying problem. To understand the cause, it is helpful to characterize the headaches as isolated acute, recurrent acute, chronic nonprogressive, or chronic progressive.

THE FIRST ACUTE HEADACHE

Management of the child who has a first acute headache emphasizes the importance of considering headache as a symptom rather than a neurologic disorder. Although the headache may be the initial presentation of migraine, it is important to consider other possible causes. In a recent study, the most common causes of isolated headaches in an emergency department were viral illness, sinusitis, and migraine. Spontaneous subarachnoid or intracerebral hemorrhage and acute-onset hydrocephalus are rare causes but

require immediate management. Cranial trauma, meningitis, sinusitis, and dental abscess also require specific treatment, but they usually are associated with clinical clues. Headache occasionally may be the initial manifestation of hypertension, and blood pressure should be measured. The acute onset of headache in the child who is otherwise well may occur following minor head trauma. In adolescents, a clear history of headache related to athletic or other exertion is common; these headaches usually are benign.

RECURRENT OR CHRONIC HEADACHES

History

Chronic or acute recurrent headaches are a common problem in the general pediatric office practice. Characterization of the features of the headache is crucial to the development of a differential diagnosis. Table 1 provides a list of questions that may clarify the situation. It is important to inquire specifically about the occurrence of neurologic symptoms or signs before, during, or after the headache. A general history should be obtained, with attention paid to any items suggestive of renal, cardiac, sinus, or dental disease or previous head trauma. A social and educational history is particularly important and may identify significant stresses. Finally, the past strategies of analgesic use should be clarified.

Examination

All children require a complete physical examination, including measurement of growth parameters, head circumference, and blood pressure (Table 2). The teeth should be examined, and evidence of sinusitis sought. Patients who have an arteriovenous malformation may present with headaches and demonstrate an asymmetric, machinery-like cranial bruit. It is important to appreciate that cranial bruits are heard in approximately 50% of healthy 5-year-olds and 10% of healthy 10-year-olds. Asymmetry of the

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TABLE 1. Evaluation of Headache by History

QUESTIONS	COMMENTS
How many different kinds of headache do you have?	<ul style="list-style-type: none"> • A mixed picture implies multifactorial etiology
What has been the course of the headache?	<ul style="list-style-type: none"> • Try to characterize as acute, acute recurrent, chronic nonprogressive, or chronic progressive
Can you describe a typical episode?	<ul style="list-style-type: none"> • Is there a warning before the episode (eg, visual aura)? • Where does it hurt? • What is the pain like? • How long do the headaches last? • How often do they occur? • How severe are they? Do they interfere with activities? • Is there abdominal pain, nausea, and/or vomiting?
Are there focal neurologic signs or symptoms?	<ul style="list-style-type: none"> • Examples: visual disturbance, paraesthesia, or weakness occurring before, during, or after the headache
Does the child look sick?	<ul style="list-style-type: none"> • Children who have migraines look unwell during an attack
What makes the headaches worse?	<ul style="list-style-type: none"> • Activities that raise intracranial pressure (eg, coughing, bending over) • Bright light or noise
What helps the headaches?	<ul style="list-style-type: none"> • Sleep often helps a migraine headache • Dark, quiet room? Cold cloth over forehead?
What time of day do the headaches occur?	<ul style="list-style-type: none"> • Headaches that waken the child may be due to increased intracranial pressure • Headaches in the late afternoon may be due to low blood glucose levels precipitating migraine
Can you identify precipitating factors?	<ul style="list-style-type: none"> • Are they related to the school week or term? • Certain foods, lack of sleep, stress, excitement, menstrual cycle, exertion?
What medications and dosages have you used?	<ul style="list-style-type: none"> • Was the medicine appropriate? Was the dose correct? Was the medicine used correctly?
Is there a family history of headaches?	<ul style="list-style-type: none"> • Many parents who have migraines attribute their headaches to other causes (eg, sinus headaches). Ask parents to describe their headaches. Did they have headaches when they were younger?

bruit or elimination by compression of the ipsilateral carotid artery suggests an organic basis. The child's cognitive function and emotional status should be assessed, particularly general affect, the attitude of the child (and family) toward the symptoms, and the interaction between family members.

Careful funduscopic examination is employed to look for evidence of papilledema. The presence of retinal venous pulsation on funduscopy provides evidence of normal intracranial pressure. However, retinal

venous pulsation may be difficult to recognize in approximately 10% of the healthy population. Visual acuity should be measured. A detailed neurologic examination is essential.

Investigations

No further investigations are necessary in most patients who have chronic or recurrent headaches. In a large tertiary center series, no patient who had normal results on neurologic examination exhibited a brain tumor on imaging. If the his-

tory is typical for migraine, there is a family history of migraine, and results of the neurologic examination are normal, no imaging is required.

If the differential diagnosis includes increased intracranial pressure or an intracranial lesion, a computed tomographic (CT) head scan should be performed promptly. Such a scan will demonstrate nearly all structural causes of headache. Magnetic resonance imaging (MRI) occasionally may be required to diagnose subtle vascular abnormali-

TABLE 2. Physical and Neurological Examination of the Child Who Has Headaches

FEATURE	SIGNIFICANCE
Growth parameters	<ul style="list-style-type: none"> • Chronic illness may affect linear growth • Hypothalamopituitary dysfunction may disturb growth
Head circumference	<ul style="list-style-type: none"> • Increased intracranial pressure prior to fusion of the sutures may accelerate head growth
Skin	<ul style="list-style-type: none"> • Evidence of trauma or a neurocutaneous disorder
Blood pressure	<ul style="list-style-type: none"> • Hypertension
Neurologic examination	<ul style="list-style-type: none"> • Signs of increased intracranial pressure • Neurologic abnormality
Cranial bruits	<ul style="list-style-type: none"> • May reflect an intracranial arteriovenous malformation

ties or hypothalamopituitary lesions. Sinus films may be useful to confirm a clinical suspicion of sinusitis.

Lumbar puncture may be helpful in assessing chronic headache if pseudotumor cerebri is being considered. However, lumbar puncture may result in herniation of the brain in patients who have obstructive hydrocephalus, an intracranial mass lesion, or cerebral edema. Consequently, any patient who has headache and requires a lumbar puncture should have neuroimaging performed prior to the procedure.

Causes of Headache

MIGRAINE

Migraine is the most common cause of intermittent headaches in children. The diagnosis in children is based on an overall interpretation of clinical symptoms. The International Headache Society criteria, while useful for research purposes, are less practical in children; the more pragmatic criteria of Pinsky are more helpful in this age group (Table 3). There may be a preceding aura, which usually involves visual phenomena. The older child typically describes unilateral or bilateral recurrent throbbing headache often associated with nausea or vomiting. The child often appears pale or has "dark rings under the eyes". A history of photophobia or phonophobia

is common. Characteristically, the headache is relieved by sleep or by simple analgesics in adequate doses.

It is usually more difficult to diagnose migraine in the younger child, who has a limited ability to describe the seemingly bizarre experiences of the pain and accompanying aura. It is important to question the young child directly about these symptoms. A history of unilateral headache is less common in young children, and the duration of the headache is typically shorter.

A family history of migraine is obtained in up to 80% of children who have migraine. A family history of motion and travel sickness also is

TABLE 3. Pediatric Migraine: Diagnostic Criteria of Pinsky

Episodes characterized by at least three of the following:
<ul style="list-style-type: none"> • Hemicranial pain
<ul style="list-style-type: none"> • Throbbing or pulsatile character to pain
<ul style="list-style-type: none"> • Associated abdominal pain, nausea, or vomiting
<ul style="list-style-type: none"> • Complete relief after rest
<ul style="list-style-type: none"> • Visual, sensory, or motor aura
<ul style="list-style-type: none"> • Family history of migraine in first-degree relatives

common. Many parents are unaware that their headaches are due to migraine, and it is helpful to have the parents describe their own headaches. Finally, the propensity to migraine in adolescence or young adulthood may have waned by the time a parent is being interviewed; thus, lack of a current history of headache may be misleading.

Migraine episodes may be triggered by a variety of factors, including stress, lack of sleep, excitement, menstruation, or less commonly, certain foods (Table 4). The use of a food diary may help to distinguish the occasional children in whom certain foods act as migraine triggers. We ask the parents or child to

TABLE 4. Potential Triggers of Migraine Headaches*

<ul style="list-style-type: none"> • Emotional stress
<ul style="list-style-type: none"> • Changes in behavior <ul style="list-style-type: none"> —Missing a meal; hypoglycemia —Sleeping more or less than normal
<ul style="list-style-type: none"> • Environmental factors <ul style="list-style-type: none"> —Bright or flickering light —Loud noise —Weather change
<ul style="list-style-type: none"> • Foods and chemicals <ul style="list-style-type: none"> —Chocolate —Nuts, peanut butter —Hot dogs, smoked meats, spiced meats —Chinese food, soy sauce, monosodium glutamate —Beef concentrates —Cheese —Cola drinks and other caffeine-containing beverages —Oranges, bananas, plums, pineapples —Aspartame
<ul style="list-style-type: none"> • Drugs <ul style="list-style-type: none"> —Atenolol, hydralazine, reserpine, nifedipine —Cimetidine, H₂-receptor blockers —Oral contraceptives —Nitrofurantoin

**Modified from Pryse-Phillips, et al (see Suggested Reading).*

make a note of any foods on the list that are eaten in the 12 hours prior to an attack. In susceptible children, episodes also may be precipitated by minor head trauma. In practice, stress is the most important precipitating factor.

Migraine can be classified as migraine with aura, migraine without aura, complicated migraine, or migraine equivalent.

Migraine With Aura

Classic migraine is characterized by the occurrence of an aura prior to the onset of the headache that lasts 5 to 20 minutes. The headache may occur immediately or after an interval of up to 60 minutes. Occasionally, the aura may be the sole manifestation of the attack. The aura is usually visual and may manifest as photopsia (flashing lights), fortification spectra (zigzags), black dots, colored lights, scotomata (field defects), or rarely distortions of size (micropsia/macropsia). Young children may be distressed by these effects, but may lack the vocabulary to describe them. Use of a pictorial card that illustrates typical visual auras ("Do they look like this?") can be helpful.

Migraine Without Aura

Common migraine is characterized by occurrence of the typical headache in the absence of an aura. In this situation, the character of the headache and a family history of migraine are key to the confidence with which one can diagnose migraine, and Prenskey's criteria (Table 3) are very useful.

Complicated Migraine

Migraine associated with a transient, focal neurologic abnormality is categorized as complicated. The most common neurologic abnormalities include hemiparesis, hemianesthesia, visual field deficits, and cranial nerve palsies (typically oculomotor). Migraine is the most common cause of third cranial nerve palsy in children. "Basilar" migraine is characterized by symptoms referable to the posterior circulation—vertigo,

ataxia, tinnitus, and visual disturbance—and is seen more often in adolescent or young adult females.

Individuals may establish a particular pattern of complicated migraine with a characteristic neurologic deficit, and this pattern may run true in several family members. Once such a pattern is established, management is symptomatic, and no further investigation of an otherwise typical episode is required. However, evaluation of the first episode should include a CT or MRI head scan.

Migraine Equivalent

A number of episodic phenomena of childhood that are believed to have a migrainous etiology usually are not associated with headache. Confusional migraine is characterized by confusion and agitation, which may occur up to 15 minutes after minor head trauma. It may be associated with prominent expressive or receptive aphasia, and a history of head-

It is usually more difficult to diagnose migraine in the younger child, who has a limited ability to describe the seemingly bizarre experiences of the pain and accompanying aura.

ache may be difficult to obtain. Benign paroxysmal vertigo occurs in preschool children and is characterized by brief episodes of unsteadiness whose onset is abrupt. The child appears frightened, and rapid eye movements may be observed if the eyes are open. The child may be able to indicate that there is a feeling of dizziness. There is no loss of consciousness.

Alice in Wonderland syndrome is characterized by visual or auditory illusions. Lewis Carroll had migraines, and it has been suggested that the novel *Alice in Wonderland* was inspired by a migraine equivalent. The relationship between cyclical vomiting, "abdominal migraine" (episodic abdominal pain or vomiting without prominent headache associated with pallor and family history of migraine), and migraine is controversial. However, 20% of children have experienced both headache and abdominal pain at different times by 10 years of age.

CLUSTER HEADACHE

Cluster headache is rare in children younger than 10 years of age, but it may manifest during adolescence (90% of sufferers are male). It is characterized by clusters of recurrent extreme, nonthrobbing deep pain in and around one eye (characteristically always the same one) that spreads onto the face on the affected side. Accompanying facial flushing is characteristic. The eye typically becomes swollen and watery.

STRESS-RELATED HEADACHE

Tension headache is characteristically diffuse, symmetrically distributed, and often described as having a "band-like" distribution around the head. The headache typically is present most of the time, but there may be symptom-free periods. Although generally it is a constant ache, there may be a partially throbbing character to the pain. Stress-related headache is more common in older girls.

It can be difficult to distinguish between muscular tension headache and migraine without aura. Indeed, migraine headaches that occur on a daily basis nearly always are related to stress. Fatigue is a common feature of tension headache, but nausea and vomiting are more characteristic of migraine or a headache due to increased intracranial pressure. The pain may be present on waking, although sufferers usually can appreciate that the headache itself did not wake them.

Nearly all children who have daily headaches, in whom an organic cause has been eliminated, have underlying emotional or social difficulties. Academic difficulties, problems with peers, and home-related stress are the most common causes. The source of the stress may be readily identifiable, such as worsening of the headache during the school day and improvement during school vacation periods and weekends. However, psychological

stresses often can be difficult to recognize, and referral of such children to a psychologist or counselor prior to the use of prophylactic medication should be considered. Depression also may be a contributing factor to daily headaches in some children and may require appropriate treatment.

CHRONIC HEADACHE DUE TO INCREASED INTRACRANIAL PRESSURE

Expanding space-occupying lesions within the skull may cause progressively worsening headache either due to their direct expansion or by secondary obstruction of cerebrospinal fluid flow. Hydrocephalus, with or without a tumor, is the most common cause. A less common cause is a subdural hemorrhage. Pseudotumor cerebri is relatively common.

Headache due to increased intracranial pressure (ICP) is characteristically worse at night or immediately after waking. When headaches occur at night, it is important to distinguish between those that awaken the child from sleep and those that are noticed after the child has awakened normally. Headaches due to increased ICP typically worsen upon lying flat and during maneuvers that increase venous pressure, such as bending over, coughing, sneezing, or straining to stool. Transient visual obscurations also may occur at these times. The headache may be associated with vomiting, which may provide temporary relief.

It is important to examine the fundi carefully for papilledema and to look for focal neurologic abnormalities in all children who present with headache. The headache, however, may be the only symptom of increased ICP. Auscultation may reveal the bruits of arteriovenous malformations. When increased ICP is suspected as the cause of headache, the child should be investigated urgently and brain imaging performed.

Pseudotumor cerebri is a neurologic disorder in which increased ICP is associated with normal findings on CT or MRI head scan. The pathophysiologic basis involves impaired reabsorption of cerebrospinal fluid with or without increased intracerebral blood volume. Papill-

edema is nearly always evident. There may be an enlarged blind spot, sixth nerve palsy, and occasionally a mild ataxia. The diagnosis can be established by measuring the opening pressure at lumbar puncture, but this procedure should be performed only after a CT or MRI head scan has demonstrated no abnormalities. Repeated lumbar punctures may be used to normalize pressure. In some cases, diuretics, steroids, or surgical optic nerve sheath fenestration may be used to protect visual function.

OTHER CAUSES OF HEADACHE

Refractive errors are an uncommon cause of headaches, but visual acuity should be examined. Refraction should be performed if there is a clear history of reading-related headache that is relieved by rest. Headache can be both an ictal and a postictal phenomenon, but it is usually very clear that the patient has had a seizure.

Management and Therapy

Education of the parents and child is extremely important in the management of headache. The underlying cause should be explained to all parties. Most parents have an underlying fear that the headache is due to a brain tumor. Reassurance as to the benign nature of the headache, where appropriate, is one of the most important aspects of clinical management. It is also very helpful to explain to the child and the parents when and how the medication should be used. Similarly, helping the child to recognize situations that precipitate or exacerbate the headache may allow him or her to gain some control over the problem.

MIGRAINE HEADACHE

Management of Acute Episodes

Sleep is effective in curing most attacks of migraine. The child should be encouraged to rest in a darkened room and try to sleep. Oral promethazine (1 mg/kg up to 25 mg) often results in sleep and is generally effective. Intramuscular chlorpromazine (1 mg/kg) can be used for severe attacks.

Simple analgesics, such as acetaminophen, ibuprofen, or naproxen,

may be effective if given in adequate dosage at the onset of the attack (Table 5). Once a migraine attack is established, gastric motility and absorption are reduced, which diminishes the effectiveness of oral analgesics. This emphasizes the importance of early treatment. Metoclopramide, used alone or in combination with acetaminophen or a nonsteroidal anti-inflammatory drug (NSAID), also can be effective. Because migraine is a recurrent problem, narcotics and other addictive drugs should not be used to treat an acute attack.

Sumatriptan, a selective 5-HT agonist, is an effective albeit expensive treatment for migraine. One subcutaneous dose of 6 mg has been reported to be effective and safe in school-age children. The value of oral sumatriptan in children is less well established. A recent randomized controlled trial failed to demonstrate any significant benefit over placebo in children who had migraine. Sumatriptan is also available as an intranasal spray, which may be a useful alternative to the subcutaneous preparation when nausea and vomiting preclude oral administration.

Intravenous dihydroergotamine mesylate (DHE) is often effective when used with metoclopramide in the treatment of an intractable migraine headache. The metoclopramide can be given orally or intravenously prior to the DHE, which is administered over 3 minutes at a dose of 0.5 to 1 mg. The DHE can be repeated every 8 hours. A nasal spray formulation of DHE recently was demonstrated to be effective.

Prophylaxis

Migraine may be precipitated by a variety of factors, including stress, certain foods, lack of sleep, hormonal changes during the menstrual cycle, alcohol, and certain medications such as oral contraceptives (Table 4). It is important to determine if management of these factors can influence the frequency or severity of the attacks. Difficulty dealing with stress is the most common precipitating factor, particularly in the child who experiences frequent headaches. The more common

TABLE 5. Drug Dosages in the Treatment of Migraine

Acute Episode	
Simple analgesics	
Acetaminophen	Initial dose of 20 mg/kg PO followed by 10 to 15 mg/kg q 4 h up to a maximum dose of 65 mg/kg per day (maximum, 3,000 mg/day)
Ibuprofen	<i>1 to 12 years:</i> 10 mg/kg PO q 4 to 6 h <i>More than 12 years:</i> 200 to 400 mg PO q 4 h; maximum dose, 1,200 mg/day
Naproxen	5 mg/kg PO q 12 h; maximum dose, 750 mg/day
Antiemetics	
Promethazine	Initial dose of 1 mg/kg PO (maximum, 25 mg); can be repeated at doses of 0.25 to 1 mg/kg q 4 to 6 h
Metoclopramide	0.1 to 0.2 mg/kg PO (maximum, 10 mg)
Chlorpromazine	1 mg/kg IM for severe attacks
Other Drugs	
Sumatriptan	6 mg SC
Dihydroergotamine mesylate	0.5 to 1 mg IV over 3 min in children >10 y. Can be repeated q 8 h. Often used in combination with metoclopramide.
Prophylactic Agents	
Amitriptyline	<i>6–12 years:</i> 10 to 30 mg/day bid <i>Adolescents:</i> 10 to 50 mg/day tid
Cyproheptadine	<i>Less than 6 years:</i> 0.125 mg/kg bid or tid; dose should not exceed 12 mg/d <i>6–14 years:</i> 4 mg bid or tid; dose should not exceed 16 mg/d
Propranolol	1 to 4 mg/kg per day; start at low dose and increase slowly
Riboflavin	400 mg/day as a single dose

external stresses include problems at home, educational difficulties, and problems with friendships, including bullying and teasing. Parents often are reluctant to discuss problems occurring at home and commonly fail to appreciate the effects of marital disharmony on children. It is important to discuss these issues with the parents and the child separately.

A variety of biobehavioral measures have been studied in the management of migraine. There is some evidence that biofeedback, relaxation therapy, cognitive-behavioral therapy, and hypnosis may be of value in some patients, but very few well-designed studies in children have been reported.

Prophylactic medication should be considered only when the headaches are interfering with the child's ability to function normally, such as missing significant time from school

or sports activities. There are few well-designed studies of prophylactic medications in children. Consequently, most treatments are based on adult practice or on anecdotal reports of success. The drugs most commonly used include propranolol, amitriptyline, cyproheptadine, and calcium channel blockers (Table 5). Riboflavin has been demonstrated recently to be effective in the prevention of migraine headaches and may be more attractive to some families. Valproic acid has been effective in adults for prophylaxis of migraine headaches. The risk of serious hepatotoxicity and teratogenicity and the association with hyperandrogenism and polycystic ovaries limit the usefulness of valproate as first-line treatment in the prevention of migraine, particularly in young children and in females.

CLUSTER HEADACHE

Methysergide, lithium, and corticosteroids are effective in preventing cluster headache. Methysergide, a serotonin agonist, should be used only for periods of up to 6 months because of the risk of retroperitoneal fibrosis. Acute attacks can be treated with sumatriptan or by inhalation of 100% oxygen at a rate of 8 to 10 L/min.

TENSION HEADACHE

An acute tension headache due to fatigue or stress is managed best with simple analgesia, rest, and removal of the stress. Once a more chronic pattern has been established, nonpharmacologic approaches are more likely to be effective. Assessment should be directed toward identifying the predisposing, precipitating, and perpetuating factors in the child's home and school.

Evaluation of nonpharmacologic treatments of tension headache, including relaxation techniques (eg, biofeedback and imagery), massage therapy, and acupuncture, has been limited. Patients who have tension headaches often have received many different drugs, and analgesic rebound headaches may complicate the picture. Amitriptyline can be helpful in these patients at an initial dose of 10 to 25 mg at bedtime.

Drug-induced Refractory Headache ("Analgesic Abuse Headache")

Analgesic headache is well recognized in adult practice, particularly among those who have migraine headaches, but it is probably under-recognized in children. The headache is the paradoxical consequence of regular, frequent analgesic use. It is important to appreciate that analgesic headaches do not occur only with opiate use; long-term ergotamine, NSAID, or acetaminophen use also can cause the phenomenon.

Treatment involves education of the patient regarding the nature of the problem and an alteration in the pattern of analgesic use. Patients should be encouraged to use a large dose of a simple analgesic infre-

quently. Migraine prophylaxis may be helpful. In severe cases, the child may require admission to the hospital for treatment with intravenous dihydroergotamine and metoclopramide and a planned analgesic withdrawal.

SUGGESTED READING

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PIR QUIZ

Quiz also available online at www.pedsinreview.org.

1. A 10-year-old boy has had headaches for 3 months that usually occur at night and wake him up from sleep. His mother has noticed that his speech has become somewhat slurred in the last month. The boy also complains of difficulty in swallowing. Examination reveals weakness of the right side of his entire face. Which of the following is the most appropriate initial evaluation?
 - A. Computed tomography of head.
 - B. Electroencephalography.
 - C. Lumbar puncture.
 - D. Nuclear brain scan.
 - E. Reassurance of the parents and follow-up in 1 month.
2. A 13-year-old girl has had recurrent headaches over the past year. The headaches occur at any time and usually are preceded by the sensation of flashing lights. They are described as throbbing, occur mostly in the right frontal area, and usually are relieved by sleep. The patient's mother suffers from hypertension and has had similar headaches in the past. Findings on physical examination are normal. Of the following, the most likely diagnosis is
 - A. Brain tumor.
 - B. Cerebrovascular aneurysm.
 - C. Cluster headache.
 - D. Migraine.
 - E. Pseudotumor cerebri.
3. A 15-year-old girl complains of recurrent headaches over the past year. The pain is episodic and occurs in the right frontoparietal region. Of the following, the features that best support the diagnosis of migraine are
 - A. Awakening from sleep because of pain.
 - B. Hypertension and bradycardia.
 - C. Pain worsened in supine position.
 - D. Papilledema after the episode of headache.
 - E. Throbbing or pulsatile character to pain.
4. A 14-year-old boy reports repeated episodes of pain in and around the right eye that he describes as deep, dull, and constant during the attacks. The pain episodes occur unpredictably 2 to 3 times a month, and they always involve the right eye. Examination during one of these episodes reveals the right eye to be slightly swollen and watery, and the face appears flushed. Of the following, the most likely diagnosis is
 - A. Amblyopia.
 - B. Cluster headache.
 - C. Migraine.
 - D. Optic glioma.
 - E. Pseudotumor cerebri.

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