After Today’s Lecture You Will Earn an Orange Belt!
A 4 year old comes in with the complaint of headache. His father asks whether a “brain scan” should be performed. Which of the following characteristics would be the strongest indication for MRI study of this child?

A. Age under 5 years.
B. Detection of a slight limp on examination.
C. Headache that awakens him from sleep.
D. Male gender
E. Unilateral headache
A 12 year old girl presents to your office with a history of frequent HA that sometimes makes her miss school. You are trying to differentiate between migraine and tension headache. Which of the following is true and will help you differentiate?

A. Migraine headaches are more likely to affect boys.
B. Migraine headaches are relieved by exercise.
C. Migraine headache cause a “band-like” pressure on the head.
D. Migraine pain is pulsing and moderate to severe.
A 14 year old girl diagnosed with a migraine. Headaches occur 2x/week and caused her to miss school at least once per month. The family is interested in prophylactic medication and you decide on amitriptyline. Of the following studies which is indicated as part of therapy?

A. Chest radiograph
B. CBC
C. Electrocardiogram
D. Serum alanine aminotransferase
E. Serum creatinine
Learning Objectives

- Describe the evaluation of a child with a headache.
- Review the diagnostic criteria for pediatric migraine.
- Review “red flags” for elevated intracranial pressure in a child with a headache.
- Describe treatment strategies for migraine, tension and chronic headache.
Introduction

- Headache is a frequent complaint in the office base and emergency setting.
- Prevalence increases with age:
  - 3% (age 3 to 7 years)
  - 8% to 23% (age 11 to 15+ years)
- Majority are primary headache disorder.
## Primary vs Secondary Headache Syndromes

<table>
<thead>
<tr>
<th>Primary</th>
<th>Secondary</th>
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<tbody>
<tr>
<td>Migraine (acute and chronic)</td>
<td>Abnormal Intracranial pressure</td>
</tr>
<tr>
<td>Tension type (acute and chronic)</td>
<td>Idiopathic Intracranial hypertension</td>
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<tr>
<td>Trigeminal autonomic cephalgia: cluster</td>
<td>Infection</td>
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<td></td>
<td>Structural disorders</td>
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<td>Vascular disorders</td>
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</table>
Childhood Headache Patterns

- Acute
- Acute Recurrent
- Chronic Progressive
- Chronic Non-Progressive
History

- What is the pattern of your headache?
- How and when did your headache begin?
- How often do they occur and how long do they last?
- Where is the pain located?
- Do you have any other symptoms?
- Does anyone else in your family suffer from headache?
- What do you think may causing the headache?
Miss Fortnite

- 12 yo female with a bilateral, frontal headache lasting 60 min with moderate pain intensity. She has difficulty reading when the pain occurs. She has difficulty describing the quality of the pain. Denies nausea and vomiting and phonophobia. Family history negative for either parent having migraine.
Physical Exam

- Vitals: T: 99 F, HR: 90, RR: 12, BP: 100/70
- Exam: Palpation of the head and neck for sinus, jaw, ocular or temporomandibular joint tenderness, thyromegaly, or nuchal rigidity are normal. Skin is without lesions.
- Normal eye movements, normal optic disc, normal gait, DTR +2 throughout,
CT scan or MRI?

- Routine neuroimaging is not indicated in children with recurrent headaches and normal examination.
Diagnosis

A. Cluster headache
B. Migraine without an aura
C. Migraine with an aura
D. Tension type headache
E. Headache NOS
Miss Alice

- 10 yo female with a unilateral, pulsating temporal headache lasting 30 min with moderate pain intensity. She describes object appearing smaller than they actually are in real life prior to the headache and difficulty with sound. Denies nausea and vomiting and phonophobia. Family history positive for mother having migraine.
Physical Exam

- Vitals: T: 100 F, HR: 90, RR: 12, BP: 100/70
- Exam: Palpation of the head and neck for sinus, jaw, ocular or temporomandibular joint tenderness, thyromegaly, or nuchal rigidity are normal. Skin is without lesions.
- Normal eye movements, normal optic disc, normal gait, DTR +2 throughout,
Red Flags for Considering Neuroimaging

1. Age < 3 years old
2. Early morning pattern
3. Worsening headache while straining, or a Valsalva maneuver
4. Explosive new onset
5. Changes in school performance
6. Underlying neurocutaneous syndrome
7. Progressive frequency and severity
8. Primarily occipital headache
9. Abnormal neurologic exam
MRI vs CT Scan

- MRI: Modality to investigate potential structural abnormalities, infection, inflammation and ischemia.
- CT scan: concern for fracture or hemorrhage
AAN Practice Parameters 2004

- Routine neuroimaging is not indicated in children with recurrent headaches and normal examination.

- However, providers should consider neuroimaging if certain warning signs appear:
  - Recent onset of severe headache
  - Change in headache quality or frequency
  - Abnormal neurologic examination
  - Coexistence of seizures.
Diagnosis

A. Cluster headache
B. Migraine without an aura
C. Migraine with an aura
D. Tension type headache
E. Headache NOS
### ICHD-3 Criteria for Pediatric Migraine

Migraine—Episodic headache with ≥5 attacks lasting 2-72 h that cannot be better explained by another diagnosis or medication overuse, with ≥2 of these characteristics:

- Bilateral location (vs unilateral predilection in adults. Although usually frontotemporal, rare occipital headache in children calls for diagnostic caution.)
- Pulsating quality
- Moderate to severe pain
- Aggravation by routine physical activity

Plus ≥1 of these symptoms:

- Nausea or vomiting
- Photophobia and phonophobia

### ICHD-3 Criteria for Migraine with Aura

Headache fulfilling migraine criteria with ≥1 of these reversible symptoms:

- Visual
- Retinal
- Sensory
- Speech and/or language
- Motor
- Brainstem

Plus ≥3 of these characteristics:

- ≥1 aura symptoms spread over ≥5 minutes
- ≥2 aura symptoms occurring in succession
- Each individual aura symptom lasts 5-60 min
- ≥1 symptom is unilateral
- ≥1 symptom is positive (oscillations, pins, and needles)
- Aura is accompanied or followed within 60 min by headache

### ICHD-3 Criteria for Key Migraine Variants

<table>
<thead>
<tr>
<th>Type of Migraine</th>
<th>Description</th>
<th>Symptoms or Characteristics</th>
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<tbody>
<tr>
<td>Migraine with brainstem aura (formerly basilar migraine)</td>
<td>Migraine with aura symptoms clearly originating from the brainstem, with no motor or retinal symptoms</td>
<td>≥2 of these (reversible) symptoms:</td>
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<tr>
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<td>- Dysarthria</td>
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<td>- Vertigo</td>
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<td>- Tinnitus</td>
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<tr>
<td></td>
<td></td>
<td>- Hypacusis</td>
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<tr>
<td>Chronic migraine</td>
<td>Prolonged migraine that lasts ≥90 d, or very frequent migraine attacks that fulfill the symptoms/characteristics to the right:</td>
<td>Occurring on ≥15 d/mo for ≥3 mo</td>
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<td>≥5 attacks fulfilling migraine or migraine with aura criteria</td>
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<tr>
<td>Status migrainosus</td>
<td>Debilitating migraine with or without aura lasting 72-96 h (migraine persisting ≥90 d becomes chronic migraine)</td>
<td>Pain and/or associated symptoms cause disability.</td>
</tr>
<tr>
<td>Familial hemiplegic migraine (FHM)</td>
<td>Migraine with aura, occurring in patients with ≥1 first- or second-degree relative with history of attacks fulfilling hemiplegic migraine criteria</td>
<td>Both of the following, fully reversible:</td>
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<tr>
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<td>- Motor weakness</td>
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<td>- Visual, sensory and/or speech/language disturbances</td>
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<tr>
<td>Cyclic vomiting syndrome (CVS)</td>
<td>Recurrent episodic attacks of intense nausea and vomiting, usually occurring with:</td>
<td>Additional characteristics:</td>
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<td></td>
<td>- Predictable pattern</td>
<td>- Nausea or vomiting ≥4 times/h</td>
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<td></td>
<td>- Normality between attacks</td>
<td>- Attacks lasting ≥1 h, up to 10 d and ≥1 wk apart</td>
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<tr>
<td></td>
<td>- Self-limiting overall duration</td>
<td></td>
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<tr>
<td>Abdominal migraine</td>
<td>≥5 attacks of abdominal pain lasting 2-72 h when untreated or unsuccessfully treated</td>
<td>Pain has ≥2 of these characteristics:</td>
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<tr>
<td></td>
<td></td>
<td>- Midline or periumbilical location, or poorly localized</td>
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<tr>
<td></td>
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<td>- Dull or sore quality</td>
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<td></td>
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<td>- Moderate to severe intensity</td>
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Pediatric Migraine: Pathophysiology

- Pathophysiology presumed same in children as adults.
- Complex interaction between neural and vascular systems.
- Dysfunction of an ion channel in brainstem nuclei that normally modulates sensory input and regulates the meningeal blood vessels.
- Pathophysiologically, neural abnormalities drive dilation of cranial blood vessels, resulting in further nerve activation and pain.
How are Pediatric Migraine Different than Adult?

- Typically, last only 30-60 minutes.
- Anorexia, nausea and vomiting are common.
- Other symptoms: dizziness, blurry vision
- Difficulty in describing pain.
Mr. Morrissey

- 15 yo male with multiple headaches a month (>15 month) with moderate pain that is bilateral around the temporal area. Pain does not worsen with routine physical activity and is associated with feeling “uneasy.” Doing well in school and on the high school soccer team.
Physical Exam

- **Vitals:** T: 98.6 F, HR: 80, RR: 16, BP: 110/70
- **Exam:** + pain with palpation of the temporal area
  Palpation of the head and neck for sinus, jaw, ocular or temporomandibular joint tenderness, thyromegaly, or nuchal rigidity are normal. Skin is without lesions.
- Normal eye movements, normal optic disc, normal gait, DTR +2 throughout,
CT scan or MRI?

- Routine neuroimaging is not indicated in children with recurrent headaches and normal examination.
Upon further questioning

- You ask the parent to leave the room so you can talk to him alone.

- He shares with you that he thinks he is gay and is not sure how to tell his parents and he is feeling depressed.
Diagnosis

A. Cluster headache
B. Migraine without an aura
C. Migraine with an aura
D. Tension type headache
E. Headache NOS
Mr. Waterworks

- 10 yo male who complains of bouts of attacks that occur twice a day for the last week. Associated with ipsilateral eye redness, nasal congestion and tearing. + Fhx: grandfather with headaches
Physical Exam

- Vitals: T: 98.6 F, HR: 80, RR: 16, BP: 110/70

- Exam: Palpation of the head and neck for sinus, jaw, ocular or temporomandibular joint tenderness, thyromegaly, or nuchal rigidity are normal. Skin is without lesions.

- Normal eye movements, normal optic disc, normal gait, DTR +2 throughout,
CT scan or MRI?

- Routine neuroimaging is not indicated in children with recurrent headaches and normal examination.
- Trigeminal Autonomic Cephalgia (TAC) is rare in children and should consider imaging for secondary causes.
Diagnosis

A. Cluster headache
B. Migraine without an aura
C. Migraine with an aura
D. Tension type headache
E. Headache NOS
Mr. Ball

- 7 yo male who complains of headaches that occur in the morning upon awakening which is occipital and associated with nausea and occasional dizziness.
Physical Exam

- Vitals: T: 98.6 F, HR: 80, RR: 16, BP: 110/70

- Exam: Palpation of the head and neck for sinus, jaw, ocular or temporomandibular joint tenderness, thyromegaly, or nuchal rigidity are normal. Skin is without lesions.

- Nystagmus, normal optic disc, abnormal toe to heel walk, DTR +3 throughout,
Red Flags for Considering Neuroimaging

1. Age < 3 years old
2. Early morning pattern
3. Worsening headache while straining, or a Valsalva maneuver
4. Explosive new onset
5. Changes in school performance
6. Underlying neurocutaneous syndrome
7. Progressive frequency and severity
8. Primarily occipital headache
9. Abnormal neurologic exam
MRI and CT scans of a medulloblastoma in a child
Medulloblastoma

- Most common malignant brain tumor of childhood.
- The peak incidence is in children between five and nine years of age.
- The diagnosis of medulloblastoma requires pathological confirmation at the time of surgical resection.
- Age, extent of disease, histopathologic subtype, and molecular subtype are used to stratify patients with medulloblastoma into risk groups and determine appropriate therapy.
Miss. Pimple

- A 17 year obese girl who has just started to take acne medication presents to your office with poorly localizing daily headaches, blurry vision, and tinnitus.
Physical Exam

- Vitals: T: 98.6 F, HR: 80, RR: 16, BP: 115/70

- Exam: Palpation of the head and neck for sinus, jaw, ocular or temporomandibular joint tenderness, thyromegaly, or nuchal rigidity are normal. Skin is without lesions.

- Normal eye movements, papilledema, normal gait, DTR +2 throughout, noted 6th nerve palsy
Diagnosis

A. Idiopathic intracranial hypertension
B. Migraine headache
C. Medulloblastoma
D. Cluster headache
E. Trigeminal Neuralgia
Secondary Causes of Headache

- Abnormal Intracranial pressure
- Idiopathic Intracranial hypertension
- Infection - Meningitis
- Structural disorders - Chiari
- Vascular disorders – Sickle cell disorders
- Trauma – posttraumatic
- Endocrine - thyroid
Elevated ICP

- Causes
  - Space occupying lesion
  - Blockage of CSF
  - Progressive, worse with Valsalva or exertion.
  - Signs: papilledema, palsies of cranial nerve III and IV.
Infection and Headache

- Acute viral headache
- Meningitis
- Encephalitis
Structural Disorders

- Chiari Malformation: Herniation >5mm below the foramen magnum.
- Occipital Headache, syncope, weakness, sensory disturbance
- Challenges in Diagnosis
Trauma

- Evaluate children who have severe or progressive headache or altered mental status after head injury.
- Indications for CT
- Most posttraumatic HA resolve after 2 weeks
Substances that Can Cause Headache

- Caffeine
- Illicit drug use
- OCP
You are counseling a 16 year old boy who has frequent headaches and would like to know about what strategies to reduce the frequency of the headaches.
Chronic Headache

- > 15 days a month
- Chronic Migraine
- Chronic Tension Type
# Tiered-Treatment Approach to Migraine

## 1st Tier
Lifestyle modifications
- Sleep
  - Good sleep hygiene and habits
  - Age-appropriate duration
- Diet
  - Consistent, well-balanced meals
  - Avoidance of caffeine
- Hydration
- Exercise (hot, sweaty, out-of-breath: 30 min, 3-4 times/week)
- Stress avoidance

## 2nd Tier
Integrative therapies
- Behavioral therapies: cognitive behavioral therapy (CBT), biofeedback, and stress management techniques
- Herbals/supplements: vitamin B2 and magnesium
  - Physical therapies and other complementary treatments

## 3rd Tier
Pharmacologic treatments
- Acute/abortive treatment (in emergency department, hospital, or home)
  - Analgesics
  - Antiemetics (to facilitate absorption of primary drugs)
  - Serotonin agonists/triptans
  - Dihydroergotamine (DHE)
  - Valproate sodium
  - Dopamine antagonists
- Preventive/prophylaxis
  - Antidepressants
  - Antihypertensives:
    - Calcium channel blockers
    - Angiotensin II receptor blockers (ARBs)
    - Beta blockers
    - Flunarizine (not available in United States)
  - Antiepileptics
  - Antihistamines

## 4th Tier
Other treatments
- Onabotulinum toxin A
- Nerve blocks
- Devices (such as nerve stimulators, transcranial magnetic stimulation devices)
- Surgery (although not typically offered)
## Preventative Therapy

### Drugs Used for Migraine Prevention

<table>
<thead>
<tr>
<th>Classification</th>
<th>Examples</th>
</tr>
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</table>
| Antidepressants | TCAs:  
  - Amitriptyline—the most widely used agent for headache prevention in adults, amitriptyline failed to show benefit in a large RCTa  
  - Nortriptyline  
  - SNRIs  
  - Duloxetine  
  - Venlafaxine |
| Antihypertensives | Beta blockers  
  - Propranolol  
  - Timolol  
  - Atenolol  
  - Metoprolol  
  - ARBs (Candesartan)  
  - Calcium channel blockers  
  - Verapamil  
  - Flunarizine (not available in US) |
| Antiepileptics  | Topiramatehc  
  - Valproic acid/divalproexc  
  - Lamotrigine  
  - Gabapentin  
  - Zonisamide |
| Antihistamines  | Cyproheptadine |
| Nutraceuticals  | Magnesium  
  - Riboflavin (B2)  
  - CoQ10  
  - Melatonin  
  - Feverfew  
  - Butterbur rootd  |
| Other           | Onabotulinum toxin Ae |

a Reference to a randomized controlled trial.

c Topiramate is not FDA approved for prevention of migraine.

d Butterbur is a natural compound not FDA approved for prevention of migraine.

e Onabotulinum toxin A is not FDA approved for prevention of migraine.
A 4 year old comes in with the complaint of headache. His father asks whether a “brain scan” should be performed. Which of the following characteristics would be the strongest indication for MRI study of this child?

a) Age under 5 years.

b) Detection of a slight limp on examination.

c) Headache that awakens him from sleep.

d) Male gender

e) Unilateral headache
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b) Migraine headaches are relieved by exercise.

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d) Migraine pain is pulsing and moderate to severe.
A 14 year old girl diagnosed with a migraine. Headaches occur 2x/week and caused her to miss school at least once per month. The family is interested in prophylactic medication and you decide on amitriptyline. Of the following studies which is indicated as part of therapy?

- Chest radiograph
- CBC
- Electrocardiogram
- Serum alanine aminotransferase
- Serum creatinine
Summary

- Most pediatric HA are due to primary headache syndrome.

- Headache are common in childhood. Obtaining a neuroimaging study on a routine basis is not indicated in children recurrent HA and normal neurologic exam.

- Secondary causes of headache should be considered in children with abnormal neurologic findings.
Remember

- Miss Fortnite
- Miss Alice
- Mr. Morrissey
- Mr. Waterworks
- Mr. Ball
- Miss Pimple
- Mr. Long