Objectives

1. Describe common types of primary headaches
2. Obtain and complete a comprehensive history and assessment in a pediatric patient presenting with headache
3. Identify pharmacologic prophylactic and acute treatments for pediatric headaches
4. Identify complementary therapies for treating headaches in the pediatric population

Epidemiology

- 60% of children report having had headaches over periods of time (ranging from one month to "lifetime")
- By 18 yo >90% of adolescents report having had a headache
- U.S.-20% of children 4 to 18 y.o. report having had notable recurrent headaches (including migraine) in the past 12 months
- Prevalence of recurrent headaches increases with age
  - 4 to <6 years: 4.5%
  - 16 to 18 years: 27.4%
- < 12 y.o.- prevalence of headaches similar among boys and girls (10%)
- > 12 y.o.- prevalence higher in girls (28-36%) vs. 20% in boys.
Pathophysiology

**Vascular Theory**
- Pain due to vasoconstriction followed by vasodilation of blood vessels supplying the brain
- Development of triptan medications based on this theory
  - Successful due to effect on vasoconstriction
  - Likely more due to effects on Serotonin
- This theory is now out of favor but not completely—may still play a role—vasodilation causes the pain in migraine.

**Cortical Spreading Depression Theory “The Wave”**
- Changes in the brain itself causes a pain syndrome
- Slow moving wave of depolarization
- Starts in the basilar areas of the cortex & slowly spreads across the surface of the cortex over 15 minutes

Wave moves down into the Thalamus, down into the brainstem, then up to the sensory cortex

2 things happen:
- 1-Wave travels to the sensory cortex and may cause pain there
- 2-Trigeminal nerve (TGN) branches off fairly close to the thalamus and the trigeminal nerve is then activated
- 3 branches of TGN (Ophthalmic (forehead), Maxillary (Cheek), Mandibular (Jaw))
- Direct stimulation of the TGN from the thalamus—causes pain in the TGN distribution on one side of the head & inflammation of nerves
- Thalamus and TGN become inflamed
- Believed that these processes are the primary cause of pain in migraines
Classification of Headaches

IHS Classification ICHD-3 (2019)

Primary
• Migraine
• Tension type headache
• Trigeminal Autonomic Cephalgias (ie-cluster)
• Other primary headache disorders-(ie)-New Daily Persistent Headache (NDPH), exertional, primary stabbing

Classification of Headaches

Secondary
Headache attributed to:
• Trauma or injury-head +/or neck
• Cranial/cervical vascular disorder (stroke)
• Non-vascular intracranial disorder (IIH-“pseudotumor”)
• A substance or its withdrawal (medication overuse)
• Infection (meningitis)
• Disorder of Homeostasis (Hypothyroidism)
• Disorder of the cranium, neck, eyes, ears, nose, sinuses, teeth, mouth, or other facial or cervical structure –(glaucoma, TMJ)
• Psychiatric Disorder (somatization)

Migraine in Children

• Headache and/or migraine remains under-diagnosed and under-treated in the pediatric population.
• Potential long term consequences with regard to disease progression and disability later in life
• Increasingly being recognized as a significant health problem in children
• Affects school performance, relationship with family and peers
• Early diagnosis and effective treatment are essential to minimize impact on a child’s quality of life and may prevent long term disability
What is Migraine?

• Episodic
• Often debilitating disorder characterized by attacks of severe headache
• Often associated with neurologic and GI symptoms
• Challenging to treat due to the complexity of the condition
• Clinical characteristics that vary among patients and among attacks within a single patient

Evaluation of Headache

• Detailed medical, family, & social history
  • What has been done so far for the headaches?
• Review current and past medications
  • Any past or current prophylactic or acute management meds or other treatments?
• Physical examination & ROS
  • Neurological examination including exam of the optic fundi
  • When was last dilated eye exam?
• Formulate a differential diagnosis
• Laboratory tests and/or imaging if indicated
• Develop management plan
• Follow-up

Questions to ask…

Direct and current symptoms
Frequency, timing, and Duration
Night Awakening?
Reported Intensity Level
Aggravating factors
Measures of relief
Aura?
Associated symptoms
History of previous head trauma/concussion
Triggers

Lifestyle factors
Sleep:
Nutrition:
Hydration:
Caffeine:
Exercise:
Menstrual cycle:
Psychosocial:
School/Extracurricular:
School/Extracurricular activity days missed due to headache
Emergency Room/Urgent Care visits
### Triggers

- Dietary
- Dehydration
- Sleep: deprivation; excess; quality
- Hormonal: menstrual cycle
- Environmental/Sensory: sounds, lights, odors
- Stress/Emotional factors
- Medications: bronchodilators, stimulants, Accutane, SSRI's
- Medication overuse: "rebound headaches"

### Food Triggers

- Fruits and juices: citrus, bananas, raisins and other dried fruits preserved with sulfites
- Raspberries, red plums, papayas, figs, dates and avocados
- Vegetables: onions, sauerkraut, pea pods and certain beans
- Aspartame
- Fresh yeast-risen baked goods
- Caffeine, chocolate, cheese
- Chinese food: monosodium glutamate (MSG)
- Nuts, nitrates
- Vinegar
- Yogurt

### More on MSG

- In many prepared foods
- Different names
- Preservative that helps restore flavor to processed foods
- Considered natural by the USFDA and therefore may be present in foods labeled "all natural!"
- Many foods contain either MSG or ingredient rich in MSG
  - Doritos, KFC, Chik-Fil-A, Campbell's Soup, Flavored Pringles
Potential sources of MSG—READ LABELS!

- Hydrolyzed protein
- Yeast extract
- Natural flavorings
- Broth, stock or bouillon
- Soy protein
- Textured protein
- Whey protein
- Protein fortified items
- Malt extract
- Malted barley

Phases of Migraine

- Premonitory Symptoms & Prodromes
- Aura
- Migraine Attack/Headache Phase
- Post-Headache Phase (Prodrome)
Premonitory Symptoms/Prodrome

• Symptoms can begin a day or two before onset of the headache but usually several hours before.
• Fatigue
• Emotional irritability
• Difficulty with concentration/thinking
• Food cravings
• Sensitivity to light or noise
• Muscle pain (especially head, neck, shoulders)
• Loss of appetite

Aura

• The complex of neurological symptoms that occurs just before or at the onset of migraine headache.
• Occurs 5-20 minutes prior to onset of headache and usually lasts less than 60 minutes.
• Occurs in approximately 20% of patients-more rare in children.
• Although most auras are visual, other symptoms ranging from sensory disturbances to partial paralysis and disorientation can occur.
Migraine Aura Symptoms (Visual)

- Scintillating scotoma
  - Shimmering, pulsating patches, often curved
  - Tunnel vision
- Scotoma
  - Blind/dark spots in field of vision
  - Curtain-like effect over one eye
  - Slowly spreading spots
- Zigzag lines
- Partial loss of sight or blurred vision
- Flashes of light & Color (photopsia)
- Distortions in size/shape of objects

Migraine Aura Symptoms Other sensory disturbances

- Feelings of numbness, typically felt as tingling in one hand, extremity, or face.
- Difficulty with speech or language
- Muscle weakness
- One foot or hand feels bigger than the other
- “Smelling” odors that aren't really there
- Partial paralysis or one side of the body feels heavy or weak
- Difficulty talking or understanding language
- Confusion or Disorientation
- Temporary amnesia

Migraine Attack/Headache Phase

- Most commonly unilateral with throbbing/pulsating quality of pain
- Photophobia/Phonophobia/Osmophobia common
- Gradual onset with duration of 1-72 hours
- Pain increases with physical activity
- Divided into early/late phase—much more treatable in early phase
**Postdrome**

- Lingering symptoms for up to 24-48 hours
- Flu-like/hangover symptoms:
  - Fatigue
  - Sore Muscles
  - Irritability
  - Loss of appetite
  - Mood changes

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**Migraine without Aura**

**Diagnostic criteria:**

- At least five attacks fulfilling criteria B-D

A. Headache attacks lasting 4-72 hr (untreated or unsuccessfully treated)\(^1\)\(^2\)\(^3\)

B. Headache has at least two of the following four characteristics:
  - unilateral location
  - pulsating quality
  - moderate or severe pain intensity
  - aggravation by or causing avoidance of routine physical activity (e.g., walking or climbing stairs)

C. During headache at least one of the following:
  - nausea and/or vomiting
  - photophobia and phonophobia

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

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**Migraine with Aura**

**Diagnostic criteria:**

A. At least two attacks fulfilling criteria B and C

B. One or more of the following fully reversible aura symptoms:
  - visual
  - sensory
  - speech and/or language
  - motor
  - brainstem

C. At least three of the following six characteristics:
  - at least one aura symptom spreads gradually over \(\geq 5\) minutes
  - two or more aura symptoms occur in succession
  - each individual aura symptom lasts 5-60 minutes\(^1\)
  - at least one aura symptom is unilateral\(^2\)
  - at least one aura symptom is positive\(^3\)
  - the aura is accompanied, or followed within 60 minutes, by headache

D. Not better accounted for by another ICHD-3 diagnosis.
New Persistent Daily Headache (Chronic Daily Headache)

- Present for at least 3 months lasting >4 hours/day
- 15 or more headache episodes per month
- Intermittent, continuous, or frequent
- Normal neurological exam
- Impacts school performance and attendance
- Impacts parent work attendance
- No underlying structural/organic etiology
- Headaches began as episodic and changed over time to daily
- Patient can often recall exact date of initial occurrence

Comorbidities

- Medication overuse (OTC analgesics, Triptans)
- Excessive school absences, school avoidance
- Declining academics
- Decreased social/athletic participation
- Fatigue
- Mood disorders (anxiety/depression)
- Abdominal pain
- Arthralgias
- Dizziness/lightheadedness/Syncope
- Obesity

Tension Type Headaches

- Very common with onset between 8-12 years-most common type of headache in general population
- Possibly no family history
- Occurs more often toward end of school day or later at home
- May be intermittent and few or occur daily
- Diffuse, non-pulsating with mild to moderate intensity
- No prodrome, aura, or nausea and vomiting; do not worsen with activity; possible phonophobia or photophobia (usually not both)
- Often described as dull, pressure, fullness, tight cap or band around head or heavy weight on shoulders
- Muscle tenderness in head, neck, or shoulders
- Stress & mental tension-most common
Migraine Variants

- Hemiplegic migraine - episodic headache and attacks of hemiplegia (muscle weakness/temporary paralysis)
- Basilar migraine - vertigo, ataxia, visual disturbance, occipital headache, altered level of consciousness, muscle weakness, drop attacks (can be confused with seizure)
- Ophthalmologic (ocular)migraine - painless vision disturbance or loss lasting less than an hour
  *If headache follows this episode it is considered migraine with aura.

Migraine Variants

- Confusional migraine - aphasia, confusion, combativeness, headache
- Alice-in-Wonderland - visual perceptual distortion, visual hallucinations, headache
- Cyclic vomiting - paroxysmal dysfunction, headache variable

Indications for Neuroimaging

Red Flags

- New, dramatic onset of headache
- Marked increase in headache severity or frequency over time
- Headache exclusively in one location
- Headache that awaken child from sleep, or occur first thing in the morning
- Headache provoked by coughing, straining or sneezing, or headache provoked or aggravated by the Valsalva maneuver
- Headache that is worse when the child is in a horizontal position; this may be a sign of increased intracranial pressure
- Papilledema
- Unilateral weakness or numbness, diplopia, abnormal eye movements or focal motor or sensory changes on neurological exam
- Confusion, incoherent speech, seizure
- Headache caused by exertion along with vomiting, congestion, neck stiffness, vision issues
  - MRI/MRA to rule out vascular abnormalities or other structural causes (subarachnoid hemorrhage, cerebral or cervical arterial dissection)
Management—Begin with the Basics

• Headache Diary/Log (smartphone apps ("migraine buddy")
• Identify & Modify Triggers
• Hydrate!!
• Avoid caffeine
• OTC analgesics no more than 2-3 days/week
• Normalizing schedule—CONTINUE TO GO TO SCHOOL!
• Regular, routine schedule—awaken and go to bed same time each day.
• Sleep—adequate hours and quality of sleep
• Exercise
• Counseling/Meditation

Acute Management—"Abortive therapy"

• OTC Analgesics
  • Pain relief
  • Anti-inflammatory (NSAID)
  • Administration of caffeinated beverage with NSAID increases absorption of the NSAID in the small intestine
• Triptans
  • selective serotonin receptor agonists
  • work by stimulating serotonin, a neurotransmitter found in the brain, to reduce inflammation and constrict blood vessels, thereby stopping the headache or migraine
  • contraindicated in patients with vascular risk factors
• Corticosteroids

Acute Management—"Abortive Therapy"

• Should be limited to 2-3 days per week
• More frequent treatment can cause medication overuse "rebound headaches"
• Many simple analgesics are effective if taken early
Acute management

- **Anti-emetics**
  - Relieves nausea/vomiting associated with migraine attack
  - Promotes normal activity of the gut - can accelerate the absorption of analgesics

- **Anti-histamines**
  - Used to ease migraine symptoms
  - Counteracts the effect of histamine-decreases inflammatory response in the body.

Acute management: OTC analgesics

- Give at onset of headache for best response
- Dose based on weight
- Avoid overuse (no more than 2-3 doses/week)
- “Rebound or medication overuse headaches”
- Most common:
  - Ibuprofen, Naproxen, Acetaminophen, Excedrin Migraine, Excedrin Tension Headache

Acute management: Triptans

**Sumatriptan (Imitrex)**
- Oral-25, 50 100
- Nasal Spray 5 mg 20 mg (quicker, initial relief, bad taste)

**Rizatriptan (Maxalt)**
- 5-10mg (approved ≥ 6 yo)
- Oral/ODT
- Decrease dose with Propranolol use

**Almotriptan (Axert)**
- 6.25, 12.5 mg
- 12-17 yo
Triptan Education

• Give at first sign of migraine
• May repeat dose x 1 in 2 hours if needed
  • MDD-2 tabs Max weekly dose-4 tabs
• Co-administer Triptan with NSAID-more effective

Most common side effects:
• Chest pain or heaviness, tightness/pressure in the chest/throat
• Pounding heartbeat
• Feeling of burning sensation
• Sensation of warmth
• Numbness
• Tingling of the skin

Acute management: Anti-Emetics & Anti-histamines

• Anti-Emetics
  • Prochlorperazine (Compazine)
  • Ondansetron (Zofran)
  • Promethazine (Phenergan)

• Anti-Histamines
  • Diphenhydramine (Benadryl)
  • Hydroxyzine (Atarax)

Acute management

Corticosteroids
• Prednisone-
  • Medrol dose pack-6 day therapy-24 mg, decreasing by 4 mg/day
  • Useful in some cases for brief crises
School Headache Management Letter/Consent

- Obtain ROI to communicate with school/childcare
- Informs school nurse of diagnosis, symptoms, and management plan
- Medication consent allows prompt delivery of analgesic or triptan for better effect
- Include permission to carry a water bottle at school for hydration

Preventive/Prophylactic Management

- Should be considered in patients who have 2 or more attacks per week
- Missing 3 days of school/month or affecting QOL
- Tailor selection of medication to patient
- Consider comorbid conditions (Depression, anxiety, sleep difficulty) and/or lifestyle
- Do not underestimate psychosocial issues

Preventive/Prophylactic Management

- Discuss goals of treatment
- Reduce frequency and/or intensity-not eliminate!
- Better response to acute treatments
- It may take 6-8 weeks before response can be assessed
- Titrate to desired dose over several weeks while attempting to minimize side effects.
- Usually used short term for a period of weeks or months
- Must be taken on a daily basis
- Mechanism of action is unclear-likely raise migraine threshold by blocking one or more neurotransmitters
### Prophylactic Options

- **Antihistamines**
  - Cyproheptadine

- **Tricyclic Antidepressants**
  - Amitriptyline; Nortriptyline

- **Anti-Epileptic Drugs**
  - Topamax (Topiramate), Zonisamide

- **Beta-Blockers**
  - Propranolol, Metoprolol, Atenolol
  - Calcium Channel Blockers (Verapamil)

### Prophylactic Medications

#### Cyproheptadine or Periactin
- *antihistamine with minimal side effects, often used first line in young children and often prescribed by pediatricians*

  Can cause sedation—usually given at bedtime

  - Helpful for management of GI related symptoms with headache (abdominal migraine, cyclic vomiting).

#### Tricyclic antidepressants

- **Nortriptyline, Amitriptyline**

  - Side effects include: dry mouth, sedation, constipation, increased appetite
  - Useful in post-concussive migraine
  - Obtain EKG for increased doses due to possible QT prolongation
Prophylactic Medications

**Anti-epileptics**

*Topamax or Topiramate*

- Side effects include: sedation, cognitive changes, weight loss, and sensory symptoms (paresthesias), decreased perspiration
- Rarely can cause kidney stones and narrow angle glaucoma (reversible)

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Prophylactic Medication

**Beta Blockers**

*Propranolol, Metoprolol, Atenolol*

- Side effects include: fatigue, insomnia, depression, cough, hypotension, bradycardia
- Can be beneficial with comorbid anxiety/panic attacks
- Avoid use in children with history of asthma, depression, diabetes, or exercise intolerance

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Prophylactic Medications

**Calcium channel blockers**

*Verapamil, Diltiazem*

- Side effects include: constipation, hypotension, abdominal discomfort, flushing
- Can be useful for vestibular migraines
CGRP Antagonists
Calcitonin Gene-Related Peptide Antagonist (monoclonal antibodies)
• Specifically developed to bind to CGRP, a substance in the brain that may play a key role in migraine, and block its binding to the receptor.
• Monthly SQ Injections—effects usually within 1 month—decrease migraine frequency
• Adults 18 yo and older
  • Aimovig (Erenumab),
  • Ajovy (Fremanezumab),
  • Emgality (Galcanezumab)

Supplements
• Magnesium—200–400 mg/day
• Riboflavin (Vitamin B2)—200–400 mg/day
• MigreLief
  • OTC supplement
  • Adult & Children’s formula
  • Riboflavin
  • Magnesium
  • Feverfew (helps to relieve smooth muscle spasms)

Complementary & Alternative Therapies
• Acupuncture
• Physical Therapy
• Manual therapies: Massage, Chiropractic Therapy
• Biofeedback
• Aromatherapy
• Reiki
• Yoga, meditation, music
• Hypnotherapy
• Cognitive Behavioral Therapy (CBT)
  • Relaxation training
• Nutritional supplements & Herbal preparations:
  • Riboflavin, Magnesium, Feverfew, Coenzyme Q10, Fish oil,
  • MigRelief, CBD Oil
Exercise

- Regular exercise can reduce the frequency and intensity of headaches and migraines.
- Release of endorphins—body's natural painkillers.
- Exercise reduces stress; helps individuals to sleep at night.
  - 20-30 minutes/day
  - Yoga/Stretching
  - Swimming
  - Walking/Jogging
  - Sports

Summary

- Headaches are very common in children—usually benign
- Early and accurate diagnosis is the key for the best outcomes
- Treatment involves acute & preventative approach along with lifestyles modifications and regular follow up.
- Prompt, acute management is key!

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