Primary Care Pediatric Headache 
Focus on Evaluation

Jennifer Bickel, MD
Co-Director Comprehensive Headache Clinic
Department of Neurology

Disclosure

• I have no actual or potential conflict of interest in relation to this program

Objectives

• Increase awareness regarding recent changes in the theories of headache pathophysiology
• Enable the provider to better distinguish between primary and secondary headaches using the patient’s history and physical
• Improve upon the provider’s ability to provide treatment for headache prevention and abortive therapy

Headaches In Children
(Lewis 2002)

• Migraine Prevalence:
  – 1.2% to 3.2% in 3 to 7 year olds
  – 4% to 11% in 7 to 11 year olds
  – 8% to 23% in 11-15 year olds
• Prevalence of any type of headache:
  – 37% to 51% in 7 year olds
  – 57 to 82% by age 15

Headache Disability

Pathophysiology of Migraine

Wolff's Vascular Theory of Migraine
- Vasoconstriction of cranial vessels causes aura.
- Vasodilatation of meningeal vessels leads to activation of the trigeminal nerve fibers resulting in pain.

Neurovascular Theory
- Cortical Spreading Depression
- Reactive blood vessel changes
- Increased plasma protein leakage
- Subsequent activation of trigeminal nucleus with central sensitization (allodynia)

Cortical Spreading Depression
- A wave of short lasting neuronal excitation, followed by prolonged depression of cortical neuronal activity

Leao's Observations
- First described by Leao in 1940's
- Confirmed by functional imaging in 1990's by Olesen
Cortical Spreading Depression

- A wave of short lasting neuronal excitation, followed by prolonged depression of cortical neuronal activity
- First described by Leao in 1940’s
- Confirmed by functional imaging in 1990’s by Ølesen
- Does not follow vascular pattern

CSD Stimulates Trigeminal Sensory Fibers (TSF)

Trigeminal nerve fibers in the meningeal vessels

Release of CGRP, substance P & Inflammatory Cytokines

Activation of Nociceptors

- The inflammation and edema activate peripheral meningeal pain receptors called nociceptors

Trigeminal Nerve Pathways

Prolonged TNC Stimulation May Lead to Central Sensitization
Symptoms of Central Sensitization

<table>
<thead>
<tr>
<th>Patients often avoid 1 or more of the following activities because of cutaneous allodynia</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Combing hair</td>
</tr>
<tr>
<td>• Pulling hair back (ponytail)</td>
</tr>
<tr>
<td>• Shaving</td>
</tr>
<tr>
<td>• Wearing eyeglasses</td>
</tr>
<tr>
<td>• Wearing contact lenses</td>
</tr>
<tr>
<td>• Wearing jewelry</td>
</tr>
<tr>
<td>• Wearing snug clothing</td>
</tr>
<tr>
<td>• Using a heavy blanket in bed</td>
</tr>
</tbody>
</table>


Cranial Parasympathetic Activation

• Activated TNC can stimulate superior salivatory nucleus causing parasympathetic activation
• Parasympathetic activation can cause sinus-like symptoms during a migraine attack

Why does CSD start?

• Cortical Hyper-excitability Inter-ictally
  – Lower threshold for phosphene generation with transcranial magnetic stimulation of the visual cortex
  – Increased aversion to noxious visual patterns
  – MEG and fMRI-BOLD indicate cortical spreading depression with visual stimuli

Etiology for Hyper-excitability

• Likely heterogeneous neuronal dysfunctions
  – Mitochondrial Dysfunction
  – Channelopathy
  – Upregulation of CGRP
  – Increase vulnerability to oxidative stress

Chronic Migraine

• Iron deposition in the periaqueductal grey matter

Moskowitz 2004

Moskowitz 2004
Secondary Headaches

Does my child have a brain tumor?

Secondary Headaches: Cerebral Tumors
- 2.4 per 100,000 children under 15 years of age
- 62% of children with a brain tumor will have a headache
- Less than 1% will present with headache alone
- More than half of children with brain tumors will have five or more neurological deficits


Secondary Headaches: Ocular
- Controversial
- Children frequently are referred to eye clinics for headaches
- Pain is typically behind eyes, absent in the morning, mild in nature, relieved with eye rest
- Proper correction will improve headaches in over 70% of headaches related to refractive errors


Secondary Headaches: Hypertension
- Cause or association?
- Most often related to underlying renal disease
- May become more common as metabolic syndrome increases in prevalence
- Headache qualities similar to migraines

Primary Headaches
Primary Headaches in Children

- Migraines with and without aura
- Tension Type Headaches
- New Daily Persistent Headache
- Chronic Daily Headache
- Childhood periodic syndromes that are commonly precursors of migraine (migraine variants)

Primary Headaches in Children

- Migraines with and without aura
- Tension Type Headaches
- New Daily Persistent Headache
- Chronic Daily Headache
- Childhood periodic syndromes that are commonly precursors of migraine (migraine variants)

Primary Headaches in Children

- Migraines with and without aura
- Tension Type Headaches
- New Daily Persistent Headache
- Chronic Daily Headache
- Childhood periodic syndromes that are commonly precursors of migraine (migraine variants)

IHS-II

**Adult Classification Of Migraine**

- Lasts 4 or more hours if untreated
- Moderate to severe headache
- Worse with movement
- Throbbing
- Unilateral
**IHS-II Adult Classification Of Migraine**
- Lasts 4 or more hours if untreated
- Moderate to severe headache
- Worse with movement
- Throbbing
- Unilateral
- Photophobia and phonophobia
- Nausea and/or vomiting

**IHS-II Classification: The Pediatric Accommodations**
- In children, attacks may last 1-72 hours (although the evidence for untreated durations of less than 2 hours in children requires corroboration by prospective diary studies).
- Migraine headache is commonly bilateral in young children; an adult pattern of unilateral pain usually emerges in late adolescence or early adult life.
- Migraine headache is usually frontotemporal. Occipital headache in children, whether unilateral or bilateral, is rare and calls for diagnostic caution; many cases are attributable to structural lesions.
- In young children, photophobia and phonophobia may be inferred from their behavior.

**Diagnosis Of Migraine**
- Only 15% associated with auras
- Often preceded by neck pain
- Associated with allodynia
Pediatric Migraine Co-Morbidities

- Allergic Rhinitis
- Epilepsy
- Recurrent Epistaxis
- Motion Sickness
- Snoring
- Parasomnias (sleep-walking)
- Obesity?
- Not cervical disc disease

Psychiatric Co-Morbidities in Adolescent Chronic Daily Headache

- 21% Major Depression
- 19% Panic Disorder
- 20% Current High Suicide Risk
- Most correlated to migraine with aura

Key points from the history:
Looking for secondary causes

- Associated neurological changes
- Occipital location (in children under 6)
- Underlying systemic illness

Key points from the history:
Looking for secondary causes

- Associated neurological changes
- Occipital location (in children under 6)
- Underlying systemic illness
- Morning/positional headaches

Key points from the history:
Looking for secondary causes

- Associated neurological changes
- Occipital location (in children under 6)
- Underlying systemic illness
- Morning/positional headaches

Key points from the history:
Looking for secondary causes

- Associated neurological changes
- Occipital location (in children under 6)
- Underlying systemic illness
- Morning/positional headaches
Key points from the history: Looking for secondary causes

• Associated neurological changes
• Occipital location (in children under 6)
• Underlying systemic illness
• Morning/positional headaches
• Family history of headaches

“Does anything strange happen to you?”

Key points from the history: Lifestyle patterns

• Sleep patterns
• Caffeine intake
• Water intake
• Favorite foods
• Meal times
• Missed school
• Extracurricular activities
• Relationship to menstruation

Key points from the history: Psychiatric

• Recent stressors
• Sleep problems
• Crying spells
• Anger outbursts
• School performance
• Coping skills
• Family dynamics “who lives in the home?”

Physical Examination

• Fundoscopic examination
• Eye movements
• Symmetry
• Gait
• Reflexes
• Plantars

Neuroimaging in Pediatric Headaches
AAN 2002 Practice Parameter:
Evaluation of children and adolescents with recurrent headaches

- Six studies in which 605 of 1,275 children underwent neuro-imaging
- 16% had abnormalities but only 3% had a significant lesion which required intervention

- All 14 children with a surgically significant abnormality had an abnormal neurological exam

- Often reveals non-significant, clinically confusing findings:
  - Chiari malformation
  - Arachnoid cyst without mass effect
  - Pineal cyst
  - Paranasal sinus disease
  - White matter lesions
  - Occult vascular malformations

- Variables which predict presence of a space occupying lesion:
  - Headache of less than one month
  - Absence of family history of migraine
  - Abnormal neurological finding
  - Gait abnormalities
  - Occurrence of seizures

AAN 2002 Practice Parameter:
Evaluation of children and adolescents with recurrent headaches

- Obtaining a neuroimaging study on a routine basis is not indicated in children with recurrent headaches and a normal neurological examination.

- Neuroimaging should be considered in children with an abnormal neurological examination or the coexistence of seizures
AAN 2002 Practice Parameter:
Evaluation of children and adolescents with recurrent headaches

- Neuroimaging should be considered in children in whom there are historical features to suggest the recent onset of severe headache, change in the type of headache or if there are any associated features that suggest neurological dysfunction.