What is a seizure?

- A seizure is a neurologic (brain) event
- Single seizure does not mean one has epilepsy
- The seizure is due to a surge of electrical activity in the brain

Types of Seizures

- Febrile Seizures
  - Common under age of 6 years
  - No treatment unless needs abortive medication (such as Diastat)
- Infantile Spasms
  - Serious epilepsy of infancy; frequently causing developmental delays
  - Known for type of seizure and hypsarrhythmia

Types of Seizures

- Febrile Seizures
- Infantile Spasms
- Focal Seizures
- Generalized Seizures

Current Issues and Updates for Seizure Medications, VNS, and Ketogenic Diet

Pat Berry, ARNP
Seattle Children’s Hospital
Department of Neurology
March 8, 2011

Focal Seizures

- Focal seizure
  - Involves part of the brain, may or may not include loss of consciousness.
  - Symptoms relate to the part of the brain affected
Focal Seizures

- Simple focal
  - Finger/arm numbness
  - Left arm and leg shaking
  - Hearing sounds, clicking
  - Smelling things not there
- Complex focal
  - Seizure but may be aware
- Focal secondarily generalizes
  - May only be known by EEG or seeing the beginning of the seizure

Generalized Seizures

- Generalized seizure
  - Involves whole brain and loss of consciousness

Examples of generalized seizures:
- GTCS
- Absence
- Tonic
- Atonic
- Myoclonic

Recognise common symptoms

- Blank staring
- Chewing
- Fumbling
- Wandering
- Shaking
- Confused speech

What should I do during a seizure?

- Stay calm and track time
- Do not restrain but help avoid hazards
  - Protect head, remove glasses, loosen neckwear
  - Move anything hard or sharp out of the way
  - Turn onto side
- Stay until aware and help reorient
- Call ambulance if seizure lasts > 5 minutes or if clusters of seizures > 60 minutes

What happens after a seizure?

- Person may be back to normal.
- Person may need to sleep.
- Allow person to rest as needed.
Seizure emergencies

• > 5 minutes or
• Clusters where not recovering in-between seizures
  – Another seizure begins before person has regained consciousness
• Becomes injured
• Recovers slowly
• Does not resume normal breathing

Prolonged Seizures

• Rescue Medications
  – Diastat (diazepam)
    • Given per rectum
    • Onset 2-10 minutes
  – Midazolam (Versed)
    • Given via atomizer into nares
    • Onset within 5 minutes
  – Ativan (lorazepam)
    • Given bucally
    • Onset ~10 minutes

• Issue for Diastat and Midazolam is that they cannot be delegated as they are not oral medications.
  – Midazolam
    • Drawn up from vial; needle removed and nasal applicator applied
    • Half dose to each nostril

Risks that might increase seizures

• Missed medication
• Sleep deprivation
• Flashing lights may be a problem. This will be identified on the child's EEG.
• Alcohol or recreational drugs
• Stress
• Illness, particularly vomiting, diarrhea, fever
• Hormones, menstrual cycles
• Missing meals

Not everything that looks like a seizure is a seizure.

• We call these Non-epileptic events
• They may include events such as
  – Fainting
  – Breath holding spells
  – Behaviors, especially if child has other developmental issues or spasticity problems
  – Behaviors that can appear similar to seizures but do not have an EEG correlate.
• Treatment is treating the underlying problem and may include:
  – Good psychotherapy,
  – Sometimes medications for anxiety or depression;
  – Stress management
  – Evaluation by a cardiologist

What is epilepsy?

• Epilepsy is more than one unprovoked seizure
  – A seizure may be provoked by many things.
  Examples might be: fever, an illness or a head injury.
What causes epilepsy

- Idiopathic (we do not know the reason), 70% of people with epilepsy cause is unknown.
- Of the other 30% causes are:
  - Head trauma
  - Brain tumor and stroke
  - Lead poisoning
  - Infection of the brain tissue
  - Heredity
  - Prenatal disturbance of brain development

What happens if it is epilepsy?

- Treatment of epilepsy goals
  - Eliminate seizures without producing side effects
  - Help person with epilepsy lead full and productive life

What preventative medication should we use?

- Made on a child by child basis. Considerations include:
  - Seizure type or the reason for the seizures
  - Family and child
    - Side effects of the medication
    - Which dosing types work best: liquid vs. chewable vs. tablet
    - How many times a day required to take the medication?

Management of Epilepsy

- Medications
  - Preventative
  - Abortive
- Surgery
  - Resective
  - VNS
- Diet
  - Atkins
  - Ketogenic

Management of epilepsy.

- Medications
  - Taking regularly, not missing doses
    - Using technology to help; alarms on cell phones
- Changing medications
  - Can take months; need to get new medication up to a therapeutic dose before can wean old medication off
- Generally side effects fall into two categories:
  1. Slowing things down: sleepiness, trouble walking, dizziness, blurry vision
  2. Revving things up: irritability, hyperactivity

Management of epilepsy.

- Medications
  - Antiepileptic drugs
    - Changing medications
    - Can take months to bring a new medication on and take an old medication off
  - Abortive medications
    - Diastat
    - Midazolam
Management of epilepsy

- Surgery
  - Needless to say brain surgery is complicated.
  - May require multiple hospitalizations prior to the decision to determine if child is a candidate.
  - Then which surgery would be appropriate and most effective.
  - This may mean weeks hospitalized while this is figured out between the neurosurgery and neurology team members.

Management of epilepsy

- Surgery
  - If there is a focal reason for the seizures; sometimes resection is an option

Vagus Nerve Stimulator

1. Place magnet over chest area where generator is implanted.
2. Hold magnet over generator for at least two seconds.
3. Remove the magnet, which will start an extra dose of stimulation.

Management of epilepsy

- Dietary or nonpharmacologic treatment
  - Atkins diet
    - When considering the diet as a treatment, we may use this as a first option in school aged children; more choices and less restrictive
    - Still requires strict adherence.
  - Ketogenic diet
    - High fat; low protein/carbohydrate diet
    - EVERYTHING that goes into or onto the child is evaluated; including all foods, sunscreen, shampoos, toothpaste, etc.
    - Communication with families to help with diets at school is critical

Vagus Nerve Stimulator

- School Implications
  - Magnet needs to be close to child at all times
  - Magnet can wipe out credit cards; computer discs
  - Magnet can be used to “prevent” a seizure if known what triggers them.
  - It generally goes off for a minute; so if seizure is longer – could use a second time
Ketogenic Diet

- School Implications:
  - Teachers/staff need to be aware so that no “sneaking” is done.
  - If snacks are planned in advance, something similar might be able to be arranged for child on diet.
  - 3 day emergency or field trips need to have special planning

Adolescents Beyond Seizures

- Great social immaturity and psychiatric comorbidity
- Completes less elementary education
- More severe learning disorders or mental retardation
- 27% do not graduate from high school
- If they do get vocational training twice as likely to be unemployed

Adolescents Beyond Seizures

- More often unmarried, living alone or with parents
- High rates of social problems, even if neurologically and intellectually normal.
- Those with mental retardation do less well
- And even with remission there is ongoing need for support

School support

- 504 or IEP is almost always needed
- Counseling
- Peer and/or family supports (Epilepsy Foundation)
- Awareness of social problems: unplanned pregnancy, alcohol use, psychiatric problems

Invisible disability

- Sleep: not only seizure may affect sleep and provoke seizures
- Dating, anxiety
- Weight gain
- Disruptions in family life (regular activities might need to be rearranged or discontinued)
- Income: loss of income if one parent stops working; cost of medical care; therefore decrease of extra money options

Seizure Action Plan

- Seizure Action Plan aka Health Care Plan or whatever your district calls it.
- We are working to complete one for every child who has a seizure that is going to school.
Seizure Action Plan

Student name
DOB: 07/18/2007
MR #:
DATE OF PLAN: 04/29/2011

PARENT/GUARDIAN EMERGENCY CONTACT INFORMATION:
Provider Name Phone number
Primary Care Provider
Neurology Specialist
Hospital Preference:

IMPORTANT MEDICAL HISTORY TO KNOW (including hospital stays, surgeries, etc):
Mikey has a history of intractable seizures which can cluster for long periods of time.

ALLERGIES, SPECIAL CONSIDERATIONS AND SAFETY CONCERNS (for activities, sports, trips, etc):
He has an allergy to adhesive tape.

WHAT MY CHILD'S SEIZURES LOOK LIKE:
• 1. Nonresponsive, vacant look with eyes rolled up in head. He begins to have a twitching of his eyes. His head drops down and this lasts for approximately 30 seconds. He generally has anywhere between 4 and 10 of these a day.
• 2. Generalized tonic-clonic. It starts with his lip curling up, generally the right upper lip. The jaw then makes a contortion. His eyes then make a horizontal movement and his legs become stiff with his toes curling in. This lasts anywhere from 10 seconds to 4-5 minutes. He generally has anywhere between 0 and 8 of them in a day. These can progress into shaking of all extremities which can last up to 10 minutes.
• 3. Arms extend out like Superman, where they hold there and then drop back down, lasting for approximately 10 seconds. These generally occur in clusters of around 7 to a cluster and he will generally have 0-1 of these clusters in a day.

DURING A SEIZURE, MY CHILD NEEDS:
• Basic Seizure First Aid: Stay calm & track time, keep my child safe, do not restrain my child, do not put anything in my child's mouth, turn my child on his side, stay with my child until he is fully awake, record seizure in log.
• For tonic-clonic (grand mal) seizure: Protect the head, keep airway open, watch breathing, turn my child on his side.

AFTER A SEIZURE MY CHILD NEEDS:
A place to lie down, and notify parents or emergency contact.

DAILY MEDICATIONS:
• Medication Dose & time of day Common Side Effects
  – valproate acid 250mg in am; 125mg afternoon; 250mg in pm
  – Hair loss, liver toxicity, nausea, tremor and weight gain

EMERGENCY MEDICINES
• Name of Medication How to give How much
  – Diastat 10 mg. rectal gel
• When to give
  – Give for a generalized tonic clonic seizure lasting over 5 minutes, or a luster of 3 generalized tonic clonic seizures within 1 hour
• Special Instructions
  – 911 to be called if Mikey does not stop seizing within 10 minutes of administering diastat. Diastat can be repeated in 24 hours if necessary.
• Common Side Effects
  – drowsiness, behavior changes, poor coordination and unsteadiness

TREAT MY CHILD'S SEIZURE AS AN EMERGENCY IF:
A convulsive (tonic-clonic) seizure lasts longer than 5 minutes. Michael has many seizures in a row without waking up, or is injured. Michael has breathing difficulties. Michael has a seizure in water.

FOR A SEIZURE EMERGENCY:
1. Call 911 to transport Michael to the nearest hospital.
2. Notify Parent or Emergency Contacts above.
3. Notify Patricia Berry, ARNP (OR whoever family wants listed here) at 206-987-2078.
4. Administer emergency medicines as indicated above.
This form is active from 01/31/2011 to 6/30/2012.
Seizure Action Plan

Electronically authenticated by: Patricia Berry ARNP, Neurology


cc:
With parents consent could put school here.

Can you live a long and happy life with seizures?

• Absolutely!

Websites

• [http://www.cdc.gov/epilepsy/toolkit/parents_guide.htm](http://www.cdc.gov/epilepsy/toolkit/parents_guide.htm)
• [www.charliefoundation.org](http://www.charliefoundation.org)
• [www.cyberonics.com](http://www.cyberonics.com)
• [www.epilepsy.com](http://www.epilepsy.com)
• [www.epilepsyfoundation.org](http://www.epilepsyfoundation.org)
• [www.seattlechildrens.org](http://www.seattlechildrens.org)

References

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• Camfield, CS, Camfield, PR, Long-term social outcomes for children with epilepsy, Epilepsia 48 Supplement, 9:3-5; 2007
• Camfield, CS, Camfield, PR, Problems for people with epilepsy beyond seizures, Epilepsia 48 Supplement, 9:1-2; 2007

Center for Children with Special Health Care Needs

[www.cshcn.org](http://www.cshcn.org)
School Nurse Role for Students with Complex Neurological Conditions

Cheryl Sampson, RN, BSN, MN, NCSN
School Nurse Specialist
Central Valley School District

May 11, 2011
School Nurse Experiences

Communication

- Parents
- Health Care Providers
- Hospital discharge planning

Care Plans

- Basic Emergency Care Plans (ECPs)
- Individualized Health Care Plans (IHPs)

The Five Rights of Delegation

- **Right Task**
  One that is delegable for a specific patient.
- **Right Circumstances**
  Appropriate patient setting, available resources, and other relevant factors considered.
- **Right Person**
  Right person is delegating the right task to the right person to be performed on the right person.
- **Right Direction/Communication**
  Clear, concise description of the task, including its objective, limits and expectations.
- **Right Supervision**
  Appropriate monitoring, evaluation, intervention, as needed, and feedback.

Section 504 Issues

- Requires any school receiving federal funds to provide persons with disabilities an opportunity to be fully integrated into the mainstream to the greatest extent possible (FAPE)
- IHPs can be used for 504 plans if so designated and all steps followed

504 Plan requirements

- Have a mental or health condition that limits one or more major life activities (diagnosed and/or regarded as having an impairment)
- 504 Accommodation Plan developed with parents/guardians, teachers, and school personnel involved
- Rights and responsibilities given to the parents/guardians
Questions?
Headache Following Pediatric Traumatic Brain Injury

Neurological Case Reviews: Planning Complex Care Across the Medical and School Continuum
K-20 Statewide Nursing Seminar

May 11, 2011 Heidi Blume, MD, MPH
Div. Pediatric Neurology
Seattle Children's Hospital & Research Institute
Seattle, WA

Post Traumatic Headache

- Definition
- Epidemiology
- Cases
- Evaluation
- Management
- Summary

Adult Posttraumatic Headache

Post Traumatic Headache
- Headache that develops within 7 days of head trauma or regaining consciousness
- Criteria are based on severity of injury, latency from injury and duration of the headache.
- No description of headache localization, characterization or accompanying features are used

Adult Posttraumatic Headache

- Headache is one of the most common complaints following traumatic brain injury (TBI)
  - > 90% report headache acutely after mild TBI/concussion
  - Headaches may be more common following mild TBI than moderate or severe TBI.
  - Women have higher risk of chronic headache after mild TBI than men
  - 18-46% of those with TBI report headaches 1 year following the injury

Pediatric Posttraumatic Headaches

500,000 children are evaluated in hospitals for TBI annually

Mild TBI
- High school athletes take longer to recover than college athletes
- 1 month after injury 32-58% reported headache
- At 3 months 14% of school aged children remained symptomatic
- 2.3% were symptomatic 1 year after the initial injury
- 1.3% had chronic posttraumatic headache 12 months after injury
- Association between sex and recovery from concussion is not clear

Moderate-Severe TBI
- Few studies on headache in children

<table>
<thead>
<tr>
<th>Headache after Moderate/Severe TBI</th>
<th>Lucas et al. 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>% with HA</td>
<td>Baseline</td>
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<tr>
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<td>----------</td>
</tr>
<tr>
<td></td>
<td>18%</td>
</tr>
</tbody>
</table>

- Risk Factors for Chronic Headache
  - Pre-Injury Headache: 48% vs. 23%
  - Female Sex: 40% of men and 60% of women had headache after injury
  - ~ 50% Classified as migraine
  - These results differ from studies that found lower risk of chronic headaches after moderate/severe TBI ~ 20%

500,000 children are evaluated in hospitals for TBI annually
CHAI Study

Child Health After Injury Study

- Large, prospective, population-based CDC funded study of function of children and families after pediatric TBI compared to children with an arm injury
- Fred Rivara et al. at Harborview Injury Prevention & Research Center
- Children age 5–17 years at the time of injury: n=649
  - Mild TBI: n=441
  - Moderate/Severe TBI: n=71
  - Orthopedic Arm Injury: n=137
- Analysis of data obtained at baseline, 3 and 12 months

CHAI Study: Mild TBI & Headache

Headache 3 months after Injury

- mTBI is associated with headache overall compared to children with arm injury
  - 43% vs. 26%, RR 1.7 (95% C.I:1.2-2.3)
- This effect is most notable in girls and teens
  - Girls: 59% vs. 24%, RR: 2.4 (95% C.I:1.4-4.2)
  - Teens: 46% vs. 25%, RR: 1.8 (95% C.I:1.1-3.1)
  - Teen Girls w/ ≥ 5/10 HA: 55% vs. 23%, RR: 2.5 (1.0-6.5)
- Risk of headache after mTBI appears to increase with age in girls but not boys

Girls with Headache 3 months After Injury

<table>
<thead>
<tr>
<th>Age, years</th>
<th>% TBI</th>
<th>% Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-13</td>
<td></td>
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</tr>
<tr>
<td>14-17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHAI Study: Mild TBI & Headache

Headache 12 months after Injury

- Association between mTBI and headache 12 months after injury is suggested in girls but not boys
  - Girls: 26% vs. 10% with ≥ 5/10 headache
    RR: 2.2 (95% C.I.:0.9-5.6)
  - Particularly in teenaged girls
    • 44% vs. 14%, RR: 3.1 (0.8-11.9)

CHAI Study Mod./Severe TBI & Headache

3 months After Injury

- Moderate/Severe TBI associated with headache in younger children
  - 60% vs. 27%, RR: 2.0 (95% C.I:1.2-3.4)
- Headache is not increased overall or for teens
- Results are limited by smaller numbers in mod/severe TBI group (n=60)

CHAI Study Mod./Severe TBI & Headache

12 months After Injury

- Headache not significantly associated with pediatric moderate/severe TBI
  - Trend for teen girls to report more headache at 12 months following moderate/severe TBI than girls with arm injury
    - Teen Girls “Bothered a lot by headache”:
      42% vs. 7%, RR: 5.8 (95% C.I.: 0.9-38.2)
  - BUT

Diagrams and graphs are included for visual representation of data.
Activation of the TNC May Result in Referred Pain that Could be Perceived Anywhere along the Trigeminocervical Network

Migraine Targets

Case: Sports Concussion - Soccer

14 yo girl with no history of headache
- Was asked to head balls from a machine for photo op
  - Machine set too high, after 10, crying with posterior headache, recovered in time for the games...
- Hours later, during tournament game, ball kicked into the side of her head, immediate pain, dizziness, nausea, vomiting
- Recovered in @ 10 days
- 3 weeks later, bonked heads with her sister
- Next day sister elbowed her head while getting into the car – severe headache, dizziness etc.

Case: Sports Concussion - Football

16 yo lineman
- Initial concussion recovered in 1-2 weeks
- 2 yrs later helmet-helmet with 90 sec headache, returned to game
  - 2nd hit, same game: horse-collared, head & neck trauma, immediate headache, stopped play
- 3 months after injury, headache 4-5 days/wk
- Out of school, HA worse with cognitive or physical activity
- Significant sleep dysregulation, balance problems
- Mom with headaches after MVA

Case: Severe TBI

14 yo boy struck by a car on the way to school
- GCS:7, ICH, limb fractures, intubated x 3 days, hosp at HMC x 2 weeks
- Rehab at SCH for 6 weeks
- Developed headaches around time of discharge from rehab
- Other problems included sleep disturbance, cognitive changes, tics, photophobia, limb fractures, poor balance
- Mother and brother with occasional migraines

Evaluation

- History
  - Pre-Injury
  - Injury
  - Post-injury
  - Family history
  - Social history
- Exam
  - Cervical
  - Shoulder
  - Face, skull
- Neurological Exam
  - Cranial Nerves
  - Fundoscopic
  - Coordination
  - Balance
  - Speech
  - Memory
  - Cognition
Evaluation

Imaging
• Indications for imaging
  • Severe New Headache
  • Focal neurological findings
  • Repeated emesis
  • Altered mental status
  • CT to rule out hemorrhage and fracture
  • MRI if suspicious for stroke, vascular dissection or lesion

AAP Clinical Report, 2010

Evaluation

• Other causes of headache
  • Venous thrombosis, stroke, vascular dissection, seizure
  • Migraine
  • Other secondary headache
• If the history/exam isn’t typical consider
  • Hemorrhage, stroke …
  • Fracture, C-Spine Injury
  • Infection
  • Evidence of other underlying disease
    • Thyroid disease, eating disorder, depression, inflammatory disease…
  • Effect of drugs/alcohol

Acute Headache Management

• Rule out neurological emergency, intracranial hemorrhage, and other acute injury
• No NSAIDs until evident there is no bleed
• Rest, acetaminophen, cool packs to head, heat to neck
• Avoid exacerbating factors
• Hydration
• Then NSAIDs, possibly triptans, hydration, rest

Management of Headache

No Data

• Manage headache based on the patients headache and other symptoms
• Physical Therapy/Massage
• Supplements: Magnesium, B2/Riboflavin, CoQ10
• Medications
• Counseling
• Autonomic symptoms
• Acupuncture, biofeedback
• Avoid Medication overuse

Management of Headache

• Sleep
• Meals & hydration
• Activity
• Relaxation/rest
• Trigger avoidance

School Accommodations

• Modified school expectations after concussion
  • Most will recover within 2 weeks
  • Physical & cognitive rest, avoid further head trauma
  • Provision of notes, homework
  • Modified Class schedule
  • Modified homework expectations
  • Physician may consider low impact, sub-threshold exercise if symptoms become chronic
Management of Headache

• Medications used Acute post-traumatic headaches
  • Acetaminophen
  • Ibuprofen
  • Naproxen
  • Sumatriptan
  • Ketorolac
  • IV Fluids
  • Depakote
  • IV Magnesium

Avoid medication overuse

Management of Headache

• Medications used for chronic post-traumatic headaches
  • Amitriptyline
  • Topiramate
  • Propranolol
  • Depakote
  • Magnesium
  • Gabapentin
  • SSRIs
  • Steroids.....

Case: Sports Concussion - Soccer

14 yo female soccer player
• Seen in local ER, recovered over 2-3 weeks
• Stopped soccer
• Headaches and other symptoms resolved after about 2-3 weeks
• 4 months later cleared for gymnastics
  • OK for 3-4 practices
• Severe migrainous headache after one practice w/o obvious head trauma
  • ER, headache resolved with IV meds
• No further headaches or symptoms at rest or with activity in gymnastics, exam normal

Case: Sports Concussion - Soccer

14 yo female soccer player
• Common migraine emerging or migraine triggered by concussion?
  • Maternal Aunt with migraine, but no one else
• Should she go back to soccer?
  • Advised early treatment of any future migrainous headaches with ibuprofen (if no evidence of ICH), +/- caffeine, and/or sumatriptan

Case: Sports Concussion - Football

16 yo lineman with chronic headaches
• Sleep problems continued
• No exercise, + depression
• Tried Amitriptyline for sleep and headaches
  • He stopped Elavil
• Advised:
  • Physical therapy
  • Topiramate
  • Counseling
  • Referral to pain clinic

Case: Sports Concussion - Football

16 yo lineman with chronic headaches
• School Accommodations, late start, 504 plan
• Acupuncture
• Started exercising
• Function & school attendance much improved
• Headaches improved
  • Naproxen and sumatriptan help with episodic headaches
Case: Severe TBI

14 yo boy struck by a car
- Amitriptyline for headache and sleep
- Guanfacine for tics
  - Amitriptyline made tics and drooling worse
- Started propranolol
- Headaches improved within a few weeks
- 1 year after injury
  - No significant headaches for months
  - Occasional mild headaches
  - Photophobia improved

Acute Headaches after Pediatric TBI

Summary
- Headaches are common after TBI
- Evaluate to ensure there is no life threatening or progressive injury or other secondary cause of headache
- Manage with rest, hydration, acetaminophen or NSAIDs, and conservative measures if possible
- Severe headaches should be treated to try to prevent conversion to chronic headache and to minimize disability
- Follow Return to Play guidelines
- Most headaches will resolve within 1-2 weeks

Chronic Headaches after Pediatric TBI

Summary
- Chronic headaches affect a minority of children with TBI
- Risk factors may include: female sex, prior TBI/concussion, prior headaches, family history of migraine, age
- Unfortunately given the common nature of TBI/concussion, each year thousands of children are affected by chronic post-traumatic headaches

Headaches after Pediatric TBI

Summary
- Management
  - Assess for underlying disorder
  - Multidisciplinary approach for chronic headaches
    - Physical therapy/massage
    - Medications/Supplements
    - Counseling
    - Complementary therapies
    - School accommodations, 504 plan, if necessary
    - Sub-threshold exercise

Thank You

CHAI Study Group

Frederick Rivara, Principle investigator
Jin Wang
Nancy Tempkin
Tom Koepsell
Monica Vavilala
Ken Jaffe
Daniel Durbin
Dorsch
### Headache Medications

**Table 10. Acute treatment for childhood migraines**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaminophen*</td>
<td>10-15 mg/kg/dose</td>
<td>Tabs 80, 160, 325 mg</td>
</tr>
<tr>
<td>Ibuprofen*</td>
<td>10 mg/kg/dose</td>
<td>Tabs 100 chewable, 200, 400, 600, 800</td>
</tr>
<tr>
<td>Naproxen sodium</td>
<td>2.5-5 mg/kg</td>
<td>Tab 220 (OTC), 250, 375, 500 mg</td>
</tr>
<tr>
<td>Combination preparations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butalbital, aspirin/acetaminophen, caffeine</td>
<td>1.2 g</td>
<td></td>
</tr>
<tr>
<td>Isometheptane, acetaminophen, dichlorphenazine</td>
<td>1.2 capsules, rodot hourly, ≤5 cap/d</td>
<td></td>
</tr>
<tr>
<td>(Midam)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-HT agonist:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sumatriptan†</td>
<td></td>
<td>25 mg, 50 mg, 100 mg tabs</td>
</tr>
<tr>
<td>Zolmitriptan†</td>
<td></td>
<td>6 mg subcutaneous injection</td>
</tr>
<tr>
<td>Rizatriptan†</td>
<td></td>
<td>5 mg, 5 mg nasal spray*</td>
</tr>
<tr>
<td>*Strong supporting efficacy and safety data in adolescents.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>†Not approved for pediatric use.</td>
<td></td>
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</tr>
</tbody>
</table>

**Table 18. Preventive medications for pediatric migraines**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Available</th>
<th>Toxicity</th>
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<tbody>
<tr>
<td>Antihistamines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyproheptadine</td>
<td>0.25-1.5 mg/kg</td>
<td>Syrup 2 mg/tsp</td>
<td>Sedation, weight gain</td>
</tr>
<tr>
<td>Antidepressants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amitriptyline</td>
<td>5-25 mg qhs</td>
<td>Tabs 10, 25, 50 mg</td>
<td>Sedation, weight gain</td>
</tr>
<tr>
<td>Nortriptyline</td>
<td>10-75 mg qhs</td>
<td>Tabs 10, 25, 50, 75 mg</td>
<td></td>
</tr>
<tr>
<td>Anticonvulsants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topiramate</td>
<td>1-30 mg/kg/day</td>
<td>Sprinkles 15, 25 mg, Tablets 25, 100</td>
<td>Sedation, paresthesia, weight loss, glaucoma, kidney stones, weight gain, bruising, hair loss, hepatotoxicity, ovarian cysts, fatigue, alaxia, tinnitus, trinitus</td>
</tr>
<tr>
<td>Valproic acid</td>
<td>20-40 mg/kg/day</td>
<td>Syrup 250 mg/tsp, Sprinkles 125 mg, Tablets 250, 500, ERT 250, 500</td>
<td></td>
</tr>
<tr>
<td>Gabapentin</td>
<td>10-40 mg/kg/day</td>
<td>Syrup 250 mg/tsp, Tablets 600, 800 mg, Capsules 100, 300, 400 mg</td>
<td></td>
</tr>
<tr>
<td>Antihypertensive agents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta-blockers*</td>
<td>2-4 mg/kg/day</td>
<td>10, 20, 40, 60, 80 mg, LA cap 60, 80, 120, 160 mg</td>
<td>Hypotension, sleep disorder, decreased stamina, depression, same</td>
</tr>
<tr>
<td>Metoprolol</td>
<td>2-6 mg/kg/day</td>
<td>Tab 50, 100</td>
<td>Same</td>
</tr>
<tr>
<td>Nifedipine</td>
<td>0.5-2.5 mg/kg/day</td>
<td>Tab 20, 40, 80 mg</td>
<td>Same</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verapamil</td>
<td>4-10 mg/kg/day tid</td>
<td>Tab 40, 80, 120 mg, SR tab 120, 180, 240 mg</td>
<td>Hypotension, nausea, AV block, weight gain</td>
</tr>
<tr>
<td>Nonsteroidal anti-inflammatory agents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>naproxen sodium</td>
<td>250-500 mg</td>
<td>Tab 220, 250, 375, 500 mg</td>
<td>Gastro upset</td>
</tr>
</tbody>
</table>

*Avoid when: asthma, diabetes, ERT
†Extended release, once daily preparation.