

# PEDIATRIC HEADACHES

*Pediatric Pain PRN  
Curriculum*

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The  
**MAYDAY**  
Fund



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## Objectives

- Identify the common types of headache and the factors to consider in evaluating a pediatric patient who presents with headache.
- Describe the different types of migraine and the differences in approach in treatment of acute migraine and status migrainous.
- Describe the features of other primary and secondary headache disorders.



# Pediatric Headaches



# Pediatric headache: prevalence & classification

*60% of children experience a headache in a 3 month period*

*17% reporting severe headache in the last year*



## Prevalence increases with age

- 4% of preschoolers
- 10% of school-aged children (girls 1:1 boys)
- >16% of adolescents (more girls 3:1 boys)

Most children who have headache have a family history of headache.

## Headache classification

<b>Primary headache</b>	Accounts for 90% of all headaches. include migraine and tension-type headaches
<b>Secondary headache</b>	Associated with underlying conditions such as head trauma, infection, and tumor. Head pain can also result from syndromes involving the eyes, ears, neck, teeth, or sinuses.

The etiology of the headache should dictate the treatment plan. If headache of unknown cause, treatment goal is pain relief or reduction to minimize associated functional disability.



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# Headache evaluation

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## In addition to obtaining a thorough comprehensive pain history, determine:

- Is this the first evaluation even though the headaches have been occurring for sometime?
- Has the child already been diagnosed with migraines but there had been a sudden change in character of the headache or behavior of the child?
- Is the child able to play during the headache or does the child seek a dark and quiet place?
- Is the headache getting less responsive to treatment (possible analgesic overuse)?
- Are there any known triggers of headache such as certain foods, chemical exposures or stressors?
- Are there associated symptoms? Aura? Night waking? Vomiting? visual changes, sensory and motor changes, cognitive impairment, others?





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# Headache evaluation



## *Red flags: when to worry*

- Awakens child
- Onset: sudden, abrupt, split-second (thunderclap)
- Neurologic symptoms or abnormal findings
- Worse when lying down, coughing, Valsalva
- Recurrent, localized
- Lasting more than 6 months
- Systemic symptoms (fever, weight loss)
- Previous headache history or headache progression



## **Does the patient awaken with the headache?**

This may point to migraine, hypertension, sleep apnea, space occupying lesions or other causes.

## **Is this the child's first headache and they are presenting for evaluation because it is so severe?**

Such a headache may be indicative of a subarachnoid hemorrhage (sentinel headache).



## **Is the headache getting progressively worse** (suggesting brain neoplasm)?

A headache that gets worse when the patient lies flat or is worsening over time might indicate increased intracranial pressure

Most patients with headache are completely intact neurologically. If a patient has ataxia or weakness; nuchal rigidity, signs of trauma or skin lesions it is time to worry.



**How will you assess Marla's headache symptoms?**

# Marla

*Marla is a 10-year-old girl who presents today to the Emergency Department (ED) with what she reports as the worst headache ever.*

*Her mother states that Marla has had headaches in the past. Her daughter has done well with ibuprofen and rest in a quiet, dark place. This time the headache did not get better.*

*They deny recent injury or changes in environment or school. Several kids at school have been ill.*



# Migraine



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# Migraine



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**An inherited, chronic disorder with episodic attacks**

- *Children 3-7 years (1-3%)*
- *Adolescents (8-23%)*
- *More common in girls than in boys*

Focus treatment on prevention to reduce frequency and severity of headaches



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# Migraine etiology theories

*Twitchy blood vessels?*

*Complex & inheritable*

*Mediated by neurochemicals*

*Hyper-excitable cerebral cortex*

*Lowered electrical threshold*

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## Migraine susceptibility genes have been identified.

- There may be genetic mutations in ion channels and/or a potentiation of the action of excitatory neurotransmitters such as glutamate.
- It is thought that migraine is a sensory processing disorder in which brainstem structures are dysfunctional in modulating the nociceptive system and that there may be a migraine generator in the dorsal midbrain and pons.
- The pathophysiology is presumed to be the same in children as adults.
- There is also evidence that migraine is a progressive disorder which means that significant emphasis should be placed on preventive therapies.

It used to be believed that migraines were due to blood vessels that constrict then dilate producing aura followed by head pain but now we know that it is much more complex than that. Currently, it is thought to be a cascade of events that include intracranial and extracranial changes.

Changes in blood flow, imbalance in activity between the brainstem nuclei regulating anti-nociception and vascular control are precipitating events. In other words, chemical activity and firing of nociceptors becomes dysregulated resulting in pain. Aura is attributed to cortical spreading depression. This is a self-propagating wave of depolarization. These lower electrical thresholds permits a variety of internal and external factors to trigger attacks.



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# Status Migrainous

*Defined by the  
International Headache Society*



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## A debilitating migraine that lasts for 72 hours or longer is:

- Children that present to the ED for migraine are more often teenagers (mean age of 12.1-13.6 and median of 14 years).
- Most of the patient (up to 71%) have failed their outpatient abortive treatment plan, and have had headache for a mean duration of 72 hours.
- Expect the patient and family to be very anxious and desperate for relief as the child has been suffering for several days by the time they present to the hospital.



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# Migraine *without* Aura

*Some children do not experience headache but just have severe vertigo or vomiting, making diagnosis difficult.*

*For migraine without aura to be the diagnosis then the headache cannot be attributed to any other disorder.*

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## Diagnostic criteria for migraine without aura.

- At least 5 attacks, lasting 1-72 hours
- Headache has at least 2 of the following: (PUMA)
  - Pulsating quality (throbbing)
  - Unilateral, bilateral, frontotemporal (not occipital- An occipital location is a symptom that requires further work-up)
  - Moderate or severe pain intensity
  - Aggravated by routine physical activity
- At least 1 of the following
  - These symptoms may be assumed when a child is avoiding light or sound.*
  - Nausea and/or vomiting.
  - Photophobia and phonophobia
  - May be inferred from child's behavior
  - Not attributed to another disorder



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# Migraine with Aura

*Migraine with aura is uncommon in children*



*15%-30% kids report visual disturbances, distortions, or obscuration, before or as headache begins*

- Starts gradual, lasts several minutes (typical aura)
- Binocular visual impairment with scotoma (77%)
- Distortion or hallucinations (16%)
- Monocular visual impairment or scotoma (7%)
- Formed illusions (spots, balloons, colors, rainbows)
- Bizarre visual distortions (Alice in Wonderland syndrome) may infrequently be described

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**Visual disruptions, hemiparesis, & aphasia: regional neuronal depolarization & oligemia caused by cortical spreading depression**

Often children who have aura do not have headache.

Visual symptoms can include fortification spectra (zig-zag bands of light), sparks, or stars. Some children will experience "Alice in Wonderland Syndrome" in which objects appear larger or smaller than they actually are. Strangely children are not startled by this and can often give good descriptions of what they are seeing.

Aura usually occurs less than 30 minutes before the headache. An aura can be visual, physical or involve speech. Physical symptoms can include numbness, tingling, confusion, weakness or difficulty speaking. These symptoms usually last less than 30 minutes but can be quite alarming. If they persist and the patient does not experience headache the child should receive a full evaluation. Hemiplegic migraine is rare and can be identified by genetic testing if it is familial.

The aura caused by cortical spreading depression.

## Groups

- Typical Aura with migraine headache
- Typical Aura with non-migraine headache
- Typical Aura without headache
- Familial hemiplegic migraine
- Sporadic hemiplegic migraine
- Basilar-type migraine



# Treatment



# Triggers

- *Stress*
- *Fatigue*
- *Illness*
- *Fasting*
- *Dehydration*
- *Food*



Like adults, children can have triggers for their migraines but theirs can be a little different. Stress or "let-up" from stress, poor sleep, fatigue, skipping meals and low fluid intake can set off a migraine.

Food triggers are unusual in children but some do identify certain offending foods. caffeine is a common one.



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# Pharmacologic treatment: abortive



## *Acute/Abortive treatment*

*NSAIDs*

*Triptans*

*Opioids*

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**It is essential to develop a treatment and rescue plan. Abortive therapy is essential for management of an acute attack**

Although many migraine duration in children is often very limited and may last only an hour.

Due to the short duration of an attack and the finding that 50% of children are strong placebo responders evaluation of efficacy of acute pharmacologic intervention is difficult to assess. Also, end-points vary from study to study.

The first-line treatment for children is to use OTC NSAIDs in weight-based dosing to relieve migraine headache pain. It is most effective if taken at the first sign of migraine followed by a short rest period while awaiting the medication to work. For severe headaches a small amount of caffeine can be added, such as a caffeine containing soda. Care must be taken as caffeine can be a trigger itself.

Some children will need to use a escalate pharmacologic treatment and utilize a triptan. The only triptan that is FDA approved for children 6 to 17 years of age is rizatriptan as studies showed efficacy in reduction of pain from both forms available, tablet and dissolving tablet. Almotriptan is approved for children 12 and older. Sumatriptan has been studied in children as young as 5 years old in all three of its forms, nasal, subcutaneous and oral with varying results but nasal and subcutaneous forms showed some efficacy.

Opioids are discouraged for migraine headache management due to prevalence of rebound headaches.

If acute or abortive treatments are needed more than 9 days per month then a preventative medication may be indicated.



# Pharmacologic treatment: preventative



## *Preventive medicines*

### *Cyproheptadine*

### *Antiepileptics*

- *Topiramate*
- *Valproic acid*

### *Tricyclic antidepressants*

**Cyproheptadine** which is in the class of antihistamine is often used in young children as a preventative agent but can cause dry mouth, sedation and weight gain.

**Topiramate** and **amitriptyline** have been used for prevention of migraine for many years based on adult studies.

- A recent randomized, double-blind, placebo-controlled trial by Powers et al showed no significant difference between these drugs and placebo in reducing the number of headaches experienced in a month.
- Both of the medications can have side effects of sedation and mood changes, as well as many others their use is under scrutiny.

**Valproic acid** has been used as a treatment but it is teratogenic so may not be a good choice for teenage girls.





# Neutraceuticals



There are few randomized controlled trials in pediatrics of supplements for the management of headaches so the use of these treatments have been extrapolated from studies in adults and limited studies in children. Generally, these are thought to have a low risk of causing harm.

Butterbur, though, must be prepared correctly or it can contain toxins that cause liver failure or be carcinogenic. It is necessary to use a source that is "PA" free.

- Riboflavin/vitamin B2
- Melatonin
- Magnesium oxide
- Coenzyme Q10 (CoQ10)
- Migralief (B2/magnesium/feverfew)
- Butterbur extract





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# Migraine in the ED

*Hydration*

*IV ketorolac*

*Triptans*

*Dopamine receptor antagonist*

*Low dose propofol*

*Opioids*

As nausea and vomiting are part of the symptomology of migraine, hydration is often the first line of treatment for the pediatric patient who present with status migrainous

Ketorolac given intravenously is effective over 50% of the time.

Triptans are most effective when used early in the onset of a migraine and so efficacy may be diminished in status migrainous although they are still utilized in oral, nasal and injection for in these patients with some effect.

Chlorpromazine and prochlorperazine and metoclopramide have the dual effect of being antiemetic and relieving pain. Although metaclopramide has a track record of been used more frequently, evidence for prochlorperazine is somewhat stronger.

In a retrospective study of pediatric patients with a discharge diagnosis of migraine found that the 7 who were treated with sub-anesthetic doses of propofol had a significantly different reduction in pain scores from the time admission to the time of discharge compared to the 35 patients who received standard abortive therapies. There was not significant difference in length of stay. This is a small study which shows promise for future treatment possibilities.



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# Inpatient treatment of migraine

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*Valproate*  
*Dihydroergotomine (DHE)*

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One treatment utilized in the inpatient setting for chronic migraine is valproate.

It is essential that the headache pain is assessed before and after the trial dose. If there is a decrease in the pain after the first dose then treatment will continue at a lower dose every 6 hours until the pain is gone. This treatment does not come without a potential down side. Patients are often very sleepy, can have some nausea. Valproic acid has caused hepatotoxicity and pancreatitis but this is usually with chronic use. It can cause birth defects and so is not given to pregnant women and girls.

It works by increasing GABA which is a pain inhibitor. Meaning that the pain threshold will be higher and pain will be decreased. Decreasing the sensitivity caused by central sensitization.

If the patient fails the trial dose of valproic, meaning that there was no improvement in their headache symptoms, then dihydroergotomine may be tried.

Since this drug is a potent vasoconstrictor the patient must received an ECG prior to starting this treatment regimen. DHE also causes nausea and vomiting so an antiemetic is required prior to the dose. During infusion blood pressures and pulse oximetry must be watched closely.

Headache pain is again assessed before and after infusion. This cannot be given to anyone who is pregnant, has uncontrolled hypertension or ischemic heart disease.

Along with the vasoconstrictive properties of DHE it is also a serotonin receptor agonist which helps inhibit pain signals again decreasing central sensitization.



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# Tension-type headache

*Headache lasting 30 min to 7 days*

***May be episodic or chronic***

- Not accompanied by nausea, vomiting, photophobia or phonophobia
- Headache has at least 2 of the following characteristics:
  - Mild or moderate intensity
  - Bilateral location
  - Not aggravated by routine physical activity

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## The most common type of primary headache.

The occurrence of this headache type also increases with age. The pathophysiology is obscure although it is believed that this type of headache is neurobiological in origin and may be related to central sensitization. Nociception from myofascial tissues is also considered important.

Children with tension-type headache have been found to have pressure hypersensitivity over trigeminal and non-trigeminal nerves compared to unaffected children, supporting the thought that these children have central nervous system hyperexcitability.

The management of tension headaches involves good headache hygiene, NSAIDs and acetaminophen as well as utilization of mind-body modalities.





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# Chronic daily headache

## Four types

- Chronic migraine
- Chronic tension type headache
- New daily persistent headache
- Hemicrania continua

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New daily persistent headaches have a sudden onset and thus patients that present with this disorder should receive a full evaluation for secondary causes.

- *Primary HA  $\geq 15$  days per month lasting  $>4$  hours*
- *Prevalence in adults is 4%*
- *Prevalence in children unknown*





# Management



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# Long-term goals



Once the primary headache is under control it is important that the patient and their family focus on prevention. Having a good life balance will help prevent migraines. This means regular eating habits and sleeping hygiene. It also means getting frequent exercise. Patients may be told to avoid certain foods such as caffeine, chocolate, aged cheese, cured meats or citrus.

*Reduce frequency*

*Reduce reliance on ineffective acute medications*

*Improve quality of life*

## **Balance biobehavioral with pharmacology**

Biobehavioral treatments include:

- Stress management
- Sleep hygiene
- Exercise
- Dietary modifications



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# SMART headache management

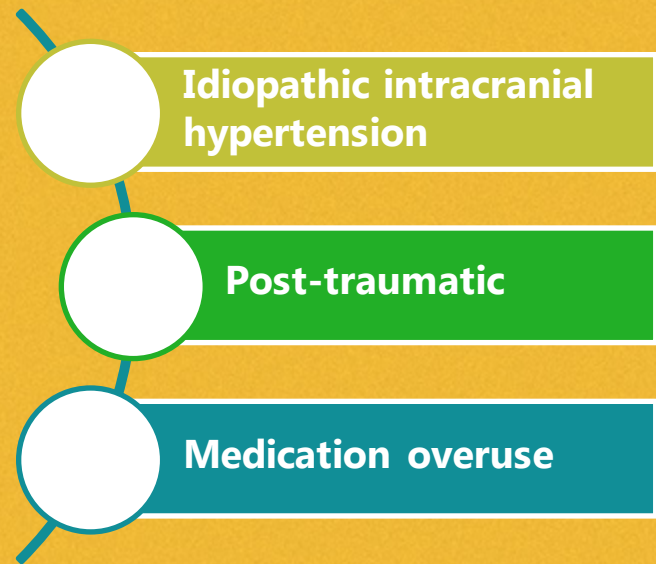


Good headache hygiene requires regular sleep, meals and exercise. Reduction of stress through yoga or relaxation exercises is helpful. Of course, avoiding triggers is essential. This mnemonic will help you remember the components of good headache hygiene.

<b>S</b>	Regular and sufficient sleep
<b>M</b>	Regular and sufficient meals and hydration
<b>A</b>	Regular aerobic exercise
<b>R</b>	Relaxation and stress reduction
<b>T</b>	Trigger avoidance



# Secondary Headaches





# Idiopathic intracranial hypertension

## Idiopathic intracranial hypertension



- **AKA Pseudotumor Cerebri**
- **Rare**
- **Increased ICP without evidence of a secondary cause**
- **Secondary cause more common in children**
- **Present with complaint of Headache**

Diagnostic criteria in children are still being defined because children can have an increased lumbar puncture opening pressure without papilla edema. Presenting symptoms can include nausea and vomiting, visual changes and neck pain but 90% will present with the complaint of headache. IIH in children is different than in adults as there is often a secondary cause that must be addressed. Some examples of these causes include head trauma, bacterial and viral diseases and drug related increase in intracranial pressure. The mainstay of treatment is to reduce ICP usually by decreasing the production of cerebral spinal fluid with medication therapy. If the patient is obese, weight loss will also be helpful.



# Post-traumatic headache

## Post-traumatic

*The occurrence of mild traumatic brain injury amongst children in the US is 692 in 100,000 of children <15 years presenting to the emergency department.*

*16% of children have had at least one head injury by age 10.*

*Post-traumatic headache usually develops within a week and subsides within 2 weeks of injury .*

- **Mild traumatic brain injury is common**
- **Post-traumatic syndrome can include headache**
- **Most headache symptoms resolve after 2 weeks**
- **Some children have prolonged symptoms**
- **Slow return to school/work**

An epidemiological study of post-concussion syndrome, found that 13% of almost 500 school age children studied had symptoms at 3 months post-injury and 1% of those complained of headache (Barlow).

It is more common for children with a mild TBI to suffer from chronic headache than children who suffer external head trauma.

Not all children with mild head trauma need imaging studies.

Children who had no loss of consciousness, headache, mental status changes or basilar skull fracture and did not have a severe mechanism of injury have low probability of having serious intracranial processes.

It is important that children have a slow return to school work and sports waiting until each increase activity level does not worsen headache.

Just thinking, like doing school work can worsen headache so the recommendation is a slow return to school with active supports and accommodations.

Post-concussive headache is difficult to treat and if a child is experiencing prolonged symptoms they should be seen by a specialist.



# Medication-overuse headaches

(aka Rebound Headaches)

## Medication overuse

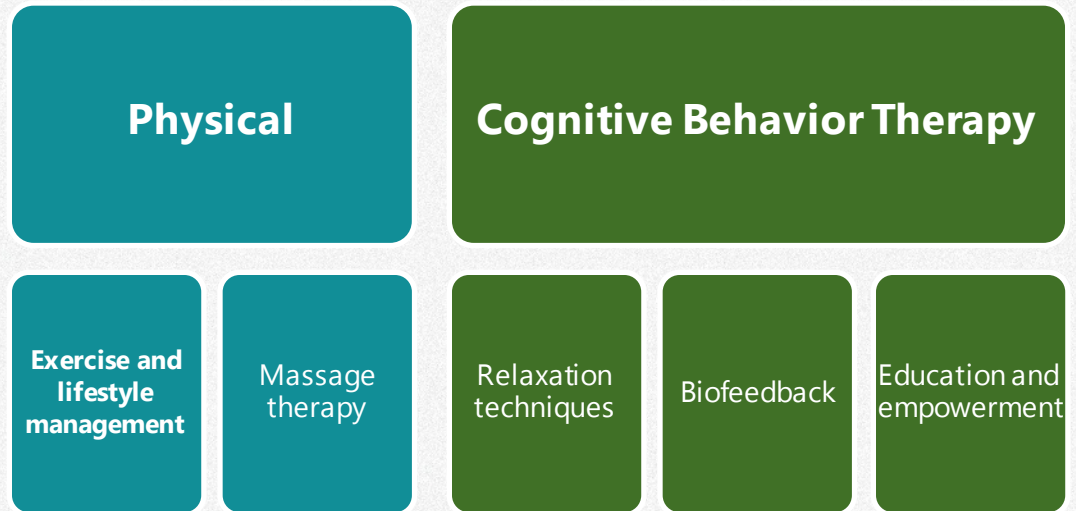
Medication-overuse headaches may occur with as few as 8-10 days of treatment/month and with many types of medications including NSAIDs and acetaminophen.

- *May feel like dull tension-type headache or more severe migraine*
- *Greatest risk with opioids, triptans, ergots and combination analgesics with butalbital or caffeine and perhaps NSAIDs*
- **>2 days a week for >3-4 weeks**
- *Requires cessation of analgesic use and a 6-8 week washout period; steroids may be useful*





# Biobehavioral headache management



Although there are limited studies in pediatric patients biobehavioral treatment of headaches is considered critical. Engaging a pain psychologist for cognitive behavioral therapy, enrolling in a wellness program, participating in physical therapy with a structured exercise program, and improving sleep hygiene may be beneficial.



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**What questions do you need to ask in order to develop an appropriate treatment plan?**

# Marla

*You find that the headache started early this morning waking Marla from sleep. This is the first time she has been awoken with a headache. She began vomiting shortly after waking and has not been able to take more than a few sips.*

*She keeps her head covered with a blanket during the visit and she asks you to turn the lights out when you leave. She states feeling weird before she went to bed last night but does not describe any visual symptoms. The headache gets worse with movement and is worse with lying down.*

*Her mother reports that Marla has been doing very well in her advanced math class and so she has been allowed a "fru-fru" coffee drink after school this week.*



# Marla

## ***Marla's treatment plan:***

- ***Workup***
- ***Triggers***
- ***Rescue plan***

*Work-up including blood, imaging and an LP were negative. Patient received hydration and a dose of ketorolac and improved.*

*You discuss that caffeine can be a trigger for migraines and suggest they find a different way to reward her for her school achievements.*

*You also review the rescue plan which will include naproxen and rizatriptan, and discuss SMART headache management (regular sleep, meals and activity and avoidance of triggers).*

*You share this video with them.*

*Migraine: How it works and how to get it under control (7:30)*



**In  
Summary...**



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# Key Points



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*Headaches are classified as primary or secondary.*

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*The etiology of the headache dictates the treatment.*

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Factors to consider in evaluating a pediatric patient who presents with headache include how long the headaches have been occurring, whether this is a first evaluation or the child was previously diagnosed with migraines, if the child can play during headache, if the headache is getting less responsive to treatment, whether there are known triggers, and the associated symptoms.

Status migrainous is a debilitating migraine that lasts for 72 hours or more. Migraines can occur with or without aura.

Treatment includes identifying (and avoiding) triggers like stress, fatigue, illness, fasting, dehydration, and certain foods.

- Abortive therapy is essential for management of an acute attack (NSAIDs, triptans, opioids).
- Preventative pharmacologic treatment includes cyproheptadine, antiepileptics, and tricyclic antidepressants.

Secondary headaches include idiopathic intracranial hypertension, post-traumatic, and medication overuse.

Biobehavioral techniques, such as exercise, massage therapy, relaxation, biofeedback and empowerment, may be beneficial in managing headaches.



# Appendix



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