

## Mini Review

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Volume 2 : Issue 3

Article Ref. #: 1000PNNOJ2116

### Article History

Received: March 15<sup>th</sup>, 2016

Accepted: March 22<sup>nd</sup>, 2016

Published: March 24<sup>th</sup>, 2016

### Citation

Blanco-Baudrit DA, Blanco-Baudrit LF, Yock-Corrales A. Pediatric headache in the emergency department. *Pediatr Neonatal Nurs Open J.* 2016; 2(3): 99-103. doi: [10.17140/PNNOJ-2-116](https://doi.org/10.17140/PNNOJ-2-116)

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# Pediatric Headache in the Emergency Department

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## ABSTRACT

Headache is defined as a somatic complaint. Incidence has increased in the last years probably due to children's lifestyle changes. Headaches have a wide variety of causes, either primary or secondary ones. While the majority of headaches are self-limited and benign, headaches occasionally herald a life-threatening illness such as a brain tumor, intracranial hemorrhage or meningitis. The emergency department physician has to distinguish between "benign" and "serious" headaches and therefore must have an organized approach to the evaluation of these patients. Obtaining neuroimaging studies on a routine basis are not indicated in children with recurrent headaches. An extensive history and physical examination are crucial and must guide the differential diagnosis. Management in the ED must be addressed to establish an accurate diagnosis, ruling out secondary causes, by giving an effective treatment and by providing a discharge plan that includes treatment and follow up with their primary care physician.

**KEYWORDS:** Headache; Children; Emergency department; Migraine.

## INTRODUCTION

Headache is a common complaint in children and the prevalence of childhood headache is reported to be as high as 75% in school-age and adolescent children.<sup>1</sup> Headaches have been reported to occur in 10.6% of children aged between 5 to 15 years, and even more frequently in older children (28% in 15 to 19 year-old).<sup>2</sup> The median age of children with headache is around 9.4 years.<sup>3</sup> Literature shows that headaches increase throughout childhood, reaching a peak at about 11-13 years of age in both sexes.<sup>4,5</sup>

Headache is one of the top three causes of referrals to a pediatric Emergency Department (ED). It is unusual as an isolated complaint and most often it is associated with other symptoms. The most common type of recurrent headache in childhood is migraine and tension headaches are in adolescence.<sup>6</sup> Males are affected more frequently than females at preschool age, and in junior-high school age females have higher incidence.<sup>5,7</sup> Several studies describing differential diagnosis of headache in the pediatric ED reported a varied number of causes as viral infections, sinusitis, migraine and post-traumatic headaches as the most common diagnoses.<sup>8,9</sup> Burton et al described viral illness, sinusitis and pharyngitis in more than 60% of patients.<sup>10</sup>

The importance of this topic is that primary headache is under diagnosed in children, partly due to different clinical characteristics compared with the adult population. Secondary causes of headache can be associated with high mortality and morbidity and health personnel should be aware of the differential diagnosis (Table 1).

Stressful life events in childhood have an impact on the course of migraine and tension type headaches because they increase the possibility of a combined headache. Headache with an onset early in life increases the risk of an unfavorable clinical course. Genetic factors play an important role in the phenotypic expression of the disease.<sup>8</sup>

Common causes of headache
<i>Vascular:</i> Febrile illness, migraine
<i>Inflammatory:</i> Upper respiratory tract infections, Dental infections
<i>Muscle contraction:</i> Tension-type headache
<i>Posttraumatic headache</i>
<i>Psychogenic headache</i>

**Table 1:** Common Causes of Headache in the Pediatric Population (Adapted from Fleisher & Ludwig's Textbook of Pediatric Emergency Medicine).<sup>11</sup>

## **PATHOPHYSIOLOGY**

The major pain-sensitive structures inside the skull are the blood vessels, dura mater and meninges. The brain parenchyma and ependymal lining are insensitive to pain. The periosteum adjacent to the sinuses and the teeth is pain sensitive. Muscles attached to the skull can be a source of pain, usually secondary to prolonged contraction. The upper cervical and cranial nerves produce pain when injured, inflamed, or displaced by mechanical traction.

Pain originating from the cranial circulation as well as the intracranial structures above the tentorium travels primarily *via* the trigeminal nerve and is referred to the front of the head. Pain originating in the posterior fossa structures travels mainly *via* the first 3 cervical nerves and results in pain in the back of the head and neck. However, complex nerve relationships and unpredictable displacement of structures by mass lesions can cause unexpected paths of pain referral.

The extraocular muscles can cause pain in the orbits after an extended period of contraction; however, eyestrain or refractory error has not been reported as a significant cause of headaches in children.

## **CLASSIFICATION OF HEADACHES**

The International Headache Society (IHS) published a standardized classification system that includes the following headache types: primary headaches, secondary headaches and cranial neuralgias, central and primary facial pain, and other headaches.<sup>12</sup>

Primary headaches include migraine, tension-type headache, cluster headache, other autonomic cephalgias and other primary headache disorders. Migraine is described as a group of heterogeneous disorders with variations in pain intensity, duration, pattern of associated features, and frequency of occurrence of the attacks.<sup>8</sup> A modification of the ICHD-II criteria was made to improve sensitivity to 84.4% in the diagnosis. This modified criteria included bilateral headache, duration of 1-72 hours, nausea and/or vomiting plus two of five other associated symptoms (photophobia, phonophobia, difficulty in thinking, lightheadedness or fatigue), in addition to the usual description of moderate to severe pain of a throbbing or pulsating nature worsening or limiting physical activity.<sup>13</sup> Some triggers have been described for primary headache like sleep deprivation, fatigue, hunger, weather changes and some foods.<sup>14</sup>

## **MIGRAINE HEADACHE**

Literature refers to migraine as the most common cause of primary headache.<sup>15</sup> Pediatric migraines are characterized by bilateral head pain and often of shorter duration than in adults. Headaches tend to last from 4 to 72 hours with at least 2 of the following: unilateral location, pulsating quality, moderate to severe pain, aggravation with physical activity; and at least one of the following: nausea/vomiting, photo or phonophobia.<sup>16</sup> Martinez et al in their study described 127 children with migraine and found unilateral location in 44.4% of the patients, photophobia in 74.5% and aura in 14.3% with sensory and visual symptoms.<sup>3</sup>

Migraines can be with or without aura. Some rare migraine variants are found in childhood. These include ophthalmoplegic migraine and alternating hemiplegic migraine. Ophthalmoplegic migraine may involve the 3<sup>rd</sup>, 4<sup>th</sup> and/or 6<sup>th</sup> cranial nerves and generally presents with transient migraine-like headaches with associated neuropathy, such as diplopia.<sup>17</sup> Alternating hemiplegic migraine (or alternating hemiplegia of childhood) is a rare syndrome of episodic hemiplegia lasting minutes to days, with accompanying dystonia, nystagmus, oculomotor abnormalities and cognitive impairment.<sup>18</sup> "Alice in wonderland" syndrome is referred to visual illusions and spatial distortions before the headache.<sup>19</sup> Acute confusional migraine is associated with an altered conscious state and focal neurological abnormalities like aphasia, anisocoria and memory deficits that will last up to 24 hours.<sup>20</sup> There are other migraine equivalents in children like cyclic vomiting, abdominal migraine, benign paroxysmal vertigo and torticollis; which are exclusion diagnosis. These ailments and their associated neurologic deficits may present a diagnostic challenge in the emergency department.

## **TENSION TYPE HEADACHE**

Tension-type headaches are common in children. They tend to be mild compared to migraines, and patients may not seek medical attention. Pain is usually bilateral, localized in the neck and occiput; and is normally associated with stressful episodes at home or school. They last from 30 minutes to 7 days.<sup>16</sup> Pressure or tightness that waxes and wanes is the common complaint, with no other symptoms associated. These headaches often become worse as the day progresses and may last for days.

## **CLUSTER HEADACHE**

This type of primary headache is uncommon in children. Patients can have one or more headaches per day, lasting about 30 to 90 minutes at a time. The pain is unilateral, severe,

often around the eye, and usually accompanied by autonomic symptoms such as lacrimation, facial flushing, or nasal stuffiness on the same side as the headache.

**SECONDARY HEADACHES**

According to the International Headache Society (IHS), a new onset headache occurring with another disorder recognised to be capable of causing it is always diagnosed as secondary. Secondary headaches due to non-life-threatening diseases are the most frequently seen in the pediatric population (Table 2). In particular, respiratory tract infections and minor head trauma represent the majority of the cases.<sup>9</sup> In a small minority of patients, headache is secondary to serious life-threatening intracranial disorders. Meningitis is the most common cause of headache due to a serious neurological condition.<sup>21</sup>

Life-threatening causes of headache
<ul style="list-style-type: none"> <li>• Hypertension</li> <li>• Coarctation of aorta</li> <li>• Central nervous system infections</li> <li>• VP shunt failure or infection</li> <li>• Brain tumor</li> <li>• Stroke</li> <li>• Hydrocephalus</li> <li>• Carbon monoxide poisoning</li> </ul>

**Table 2:** Life-threatening causes of secondary headache in Children (Adapted from Fleisher & Ludwig's Textbook of Pediatric Emergency Medicine).<sup>11</sup>

In the literature, patients with headache associated with increased intracranial pressure were associated with pain that wake up the patient at night, and early onset pain in the morning. However, 25% of children with migraine episodes wake up the child at night, but usually the pain started before the child go to sleep.<sup>8</sup> Migraine pain is located frontally in more than 50%, and it may have a hemicranial distribution. Occipital pain is frequently found in brain tumors.<sup>4,13</sup>

In several studies children with serious underlying conditions had demonstrable objective finding on neurological examination. The importance of a good history and thorough physical examination cannot be overemphasized.<sup>22</sup>

**INTRACRANIAL MASSES**

Usually the headache of a tumor or mass is associated with symptoms of increased intracranial pressure. Some distinguishing historical features of intracranial masses include severe occipital headache or headache that is exacerbated by sneezing, coughing, a Valsalva maneuver or a change in head position. Pain awakens the patient from sleep or is worse in the morning. Projectile vomiting could be associated with the headache especially if it happens in early morning.<sup>23,24</sup>

**EVALUATION OF HEADACHE**

The evaluation of a pediatric patient with headache begins with a thorough medical history followed by a complete

physical examination looking for neurological signs, with measurement of vital signs and blood pressure. Ancillary tests usually are not necessary in the majority of the patients. Diagnosis of a primary headache disorder is based mainly on clinical criteria given by the IHS. Rapid recognition of secondary headaches is vital in the ED.

**HISTORY**

The emergency physician should ask about a description of the headache (sudden first headache, frequency, severity, pattern over time, mode of onset, duration), warning signs (Table 3), location and quality of pain (pounding, squeezing, stabbing), triggers and exacerbating factors (stress, sleep changes, posture), alleviating factors (treatments already used with dose and frequency), associated symptoms (nausea or vomiting, weakness, visual symptoms, sensory changes, lacrimation or rhinorrhea) and family history.<sup>25</sup>

Warning signs
<ul style="list-style-type: none"> <li>• Sudden onset of headache (first or worse ever)</li> <li>• Increase in severity or characteristics of the headache</li> <li>• Changes in mood or personality over days or weeks</li> <li>• Awakening from sleep</li> <li>• Related to severe vomiting, especially in early morning</li> <li>• Worsening of pain with cough or Valsalva maneuver</li> <li>• Poor response to conventional treatment</li> <li>• Altered conscious state</li> <li>• Papilledema</li> <li>• Focal neurologic deficit or meningismus</li> <li>• Seizures or fever</li> <li>• High-risk population (patients with sickle cell anemia, malignancy, recent head trauma, VP shunt, others)</li> </ul>

**Table 3:** Warning signs in children with headache (red flags).<sup>8,9,21</sup>

**PHYSICAL EXAMINATION**

In most patients with primary headache the physical examination is normal. The first step is to assess patient's appearance and determine how sick they look and severity of pain, because this may indicate a more serious underlying condition. Vital signs are important because an abnormality can raise suspicion of a life-threatening illness. A complete physical examination including a detailed neurologic examination is essential. In the neurologic examination, the clinician should look for mental status, cranial nerves, signs of intracranial pressure, integrity of the brainstem, motor and sensory evaluation, deep tendon reflexes, coordination problems and gait abnormalities.<sup>25</sup>

**DIAGNOSTIC TESTING**

For few children who need further evaluation, the work-up should be directed at the underlying suspected etiology. Diagnostic testing are varied, including routine laboratory testing, Cerebral Spinal Fluid (CSF) examination, Electroencephalography (EEG), and neuroimaging with Computed Tomography (CT) or Magnetic Resonance Imaging (MRI). Routine neuroim-

aging is not indicated in children with recurrent headache and a normal neurologic examination. Guidelines recommend that this test must be ordered for children presenting with abnormal neurologic exam and a history of CNS disease.<sup>7,22</sup> Lumbar puncture is not recommended in the evaluation of primary headache. It should be done when there's suspicion of CNS infection, low pressure headaches, idiopathic intracranial hypertension and subarachnoid hemorrhage.<sup>26</sup>

Neuroimaging should be considered in children with chronic progressive headaches, abnormal neurologic examination, worst headache of life (sudden, thunderclap headache), significant head trauma, presence of VP shunt, meningeal signs and focal findings/altered mental status. It should be considered, if the headache is associated with vomiting on awakening, unvarying location of headache (especially occipital), persistent headache with no family history of migraine, neurocutaneous syndromes and age less than 3 years old (limited verbalization skills).

In primary headaches the imaging modality recommended is an MRI, in secondary headaches – especially in the ED setting – the most appropriate imaging modality will be a head CT scan, specifically to rule out hemorrhage.<sup>27</sup> EEG is not helpful in the evaluation of pediatric headache.

## TREATMENT

The mainstay of ED management is to exclude secondary causes of headache and to initiate an appropriate treatment.<sup>28</sup> There are many treatment options available for pediatric headaches, but the goal is to recognize and avoid triggers and to diagnose somatic/psychiatric comorbidities as well as educating the family and the patient about therapy. The clinician has to promote stress reduction techniques and encourage regular exercise and a good sleep. After that, an explanation should be given regarding the pharmacologic treatment.<sup>4</sup>

Medical treatment should focus on abortive analgesics to alleviate the pain. Opioids and benzodiazepines have no role in the management of primary headaches. Clinicians often consider ibuprofen to be more effective than acetaminophen in the management of pain. It has been proven in several studies that Ibuprofen is safe and effective, although one investigation comparing acetaminophen (15 mg/kg) and ibuprofen (10 mg/kg) found no difference in pain relief.<sup>15</sup> As an initial strategy, over the counter medications should be administered and if they result to be ineffective or not completely effective, migraine-specific therapy is often required. In this case, triptans may be added to the treatment plan.

Several authors have concluded that oral triptans are not as effective in children as in adults. However, nasal sumatriptan is promising. Most studies evaluating oral sumatriptan, oral rizatriptan and oral zolmitriptan found no effectiveness of these medications for pain relief in children.<sup>15</sup>

Headaches can be increased in frequency in some patients and might produce some disability. When this happened, preventive therapy plan must be started. Some prophylactic medication apart from behavioral management is: antidepressant medications, especially the tricyclic antidepressants; antisero-nergic medications; and antihypertensive medications, including both beta-blockers and calcium channel-blockers. The initial goals of the preventive treatment are reduction of headache frequency and improvement of headache disability.<sup>29,30</sup> Patients discharged from the ED should have an appropriate follow-up plan with their primary physician. Some of the patients will require admission to the hospital for further evaluation and treatment.

**FINANCIAL DISCLOSURE:** None.

## CONFLICTS OF INTEREST

There are no conflicts of interest to declare.

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