

Spectrum of Diagnosis of Children with Headache in a Tertiary Pediatric Emergency Department

Maria José Montealegre-Sauma¹,
Sabrina Sequeira-Sequeira²,
Alfonso Gutierrez-Mata^{3,4} and
Adriana Yock-Corrales³

Abstract

Background: Headache is a common complaint in children. The study aim was to describe the clinical characteristics on the presentation of patients with headache in the Emergency Department.

Methods: A retrospective longitudinal study of children who presented with headache to a tertiary pediatric hospital in Costa Rica. It was conducted in a two-year period. We included children from 2 years to 18 years. Data was abstracted from electronic ED records, admission and progress note.

Results: Eighty-eight patients were included in the study. 60% were known to be healthy and 40% had a positive past medical history; 33% had a previous history of migraine or chronic non-specific headache. Forty-one (46, 5%) were diagnosed with primary headache and 47 (53, 5%) with secondary headache. The median time from onset of symptoms to the ED presentation was 120 hours (IQR 24-1440) for patients with primary headache and 72 hours (IQR 24-192) for secondary headache. The median time of duration of headache was 60 minutes in both groups. Patients with primary headache had less neurologic symptoms 4 (9.7%) compared with 8 (17%) in secondary headache. Universal headache was the most frequent location in secondary headache patients (60%). In patients with primary headache, frontal location was more common (46%) followed by universal location (26%). A normal physical examination was noted in 38 (92.6%) of the patients with primary headache in comparison with 27 (57.4%) of secondary headache. The principal diagnosis of patients with primary headache was migraine and in secondary headache a viral infection. CT scans were performed in 76% of the patients; and only 12 (13.6%) were reported as abnormal. 37 (42%) of the patients received medical management.

Conclusions: Routine neuroimaging is not indicated in children with recurrent headache and a normal neurologic examination. Management in the ED must be addressed to establish an accurate diagnosis, excluding secondary causes, using an effective treatment and providing the patients and parents a discharge plan that includes treatment and follow up discharge.

Keywords: Headache; Emergency department; Pediatric; Children; Migraine

- 1 Pediatric Department, Hospital San Rafael de Alajuela, San Jose, Costa Rica
- 2 Pediatric Department, Hospital Maximiliano Peralta, Cartago, Costa Rica
- 3 Neurology Department, Hospital Nacional de Niños and University of Costa Rica, San José, Costa Rica

Corresponding Author:

Adriana Yock-Corrales

✉ adriyock@gmail.com

Servicio de Emergencias Pediátricas,
Hospital Nacional de Niños "Dr. Carlos Sáenz
Herrera", Avenida Paseo Colón, PO Box
1654-1000, San José, Costa Rica

Tel: 506 8390-0516

Fax: 506 2222-9769

Citation: Sauma MJM, Sequeira SS, Mata A G, et al. Spectrum of Diagnosis of Children with Headache in a Tertiary Pediatric Emergency Department. *Pediatr Emerg Care Med Open Access*. 2016, 1:1.

Received: March 14, 2016; **Accepted:** April 26, 2016; **Published:** May 02, 2016

Introduction

Headache is a common complaint in children and the prevalence in the pediatric population is reported to be as high as 75% in school-age and adolescent children [1]. By age 3, headache is presented in 3 to 8% of children; at age 5 in 19.5% of children and by age 7 in 37 to 51.5% [2,3]. Headache is the third leading cause

of referral to a pediatric emergency department (ED). The most common type of recurrent headache in childhood is migraine. In the adolescence, tension headaches are the most common type [4]. Males are affected more frequently than females at preschool age, and these changes in junior-high school age were females have a higher incidence [3,5,6].

The International Headache Society (IHS) published a standardized classification system that consists of these headache types: primary headaches, secondary headaches and cranial neuralgias, central and primary facial pain, and other headaches [4,7].

Primary headaches include migraine, tension-type headache, cluster headache, other autonomic cephalgias and other primary headache disorders. Migraine is characterized as heterogeneous disorders where attacks vary in pain intensity, duration, pattern of associated features, and frequency of occurrence [7]. A modification of the ICHD-II criteria needed to be done to improve sensitivity to 84.4% in the diagnosis. This modified criteria included bilateral headache, duration of 1-72 hours, and nausea and/or vomiting plus two of five other associated symptoms (photophobia, photophobia, difficulty 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 [7,8].

Secondary headaches due to non-life-threatening diseases are the most frequent in the pediatric population. In particular, respiratory tract infections and minor head trauma constitute the majority of the cases [9]. In a small minority, headache is secondary to serious life-threatening intracranial disorders. Meningitis is the most common cause of headache due to a serious neurological condition [9,10]. Red flags include sudden onset of symptoms or recent recurrent severe headache for a few weeks, change in character over weeks or days, headache suggesting raised intracranial pressure (early morning headache, vomiting in morning, pain disturbing sleep, headache worse with cough or valsalva), associated symptoms of personality changes, weakness, seizures or fever, underlying history of neurocutaneous syndrome, history of systemic illness (malignancy with possible metastases, hypercoagulopathy) and young age (less than 3 years of age) [7,9,10].

The evaluation of a child with headache begins with a thorough medical history. It is important to determine a diagnosis of both primary and secondary headaches, followed by a complete physical examination with measurement of vital signs, particularly blood pressure, and a complete neurologic examination including an optic fundus. Several studies have shown that children with headaches related to acute critical illness had neurologic signs on consultation [3,11].

There is a lack of consensus concerning the role of diagnostic testing including routine laboratory testing, cerebral spinal fluid (CSF) examination, electroencephalography (EEG), and neuroimaging with computerised tomography (CT) or magnetic resonance (MRI). Obtaining neuroimaging study on a routine basis is not appropriate in children with recurrent headaches and a normal neurologic examination [3]. Neuroimaging should be considered in children in whom there are clinical features to suggest: a recent onset of severe headache; change in the type of headache; neurologic dysfunction; or concerning associated symptoms that accompany the headache. These recommendations are proposed by the American Academy of Neurology (AAN) [12].

The mainstay of ED management is to exclude secondary causes of

headache and to initiate an appropriate treatment [13]. Clinicians often think ibuprofen to be more effective than acetaminophen in the management of pain [14,15]. Several authors have concluded that oral triptans are not as effective in children as they are in adults. However, nasal sumatriptan may be effective. Most of the studies that evaluated oral sumatriptan, oral rizatriptan and oral zolmitriptan found that these medications were not effective for pain relief in children [15].

Reports about pediatric headache in the emergency department in Latin American children are scarce, and the real burden of the disease is not known. Most of the literature refer to the adult population and in Central America the information about this topic is non-existing. Our aim was to describe the clinical characteristics on the presentation of patients with headache, spectrum of diagnosis, need of neuroimaging use and management for this pathology in the ED.

Materials and Methods

This was a retrospective longitudinal descriptive study of children who presented with a chief complaint of headache to the ED of the National Children's Hospital "Dr. Carlos Sáenz Herrera" in San José, Costa Rica (nation's population of 4.5 million habitants). This is the only tertiary referral and teaching pediatric center in the country, with 350 beds and around 125 000 annual emergency department consultations. The study was approved by the hospital Institutional Review Board, and permission was obtained to review clinical charts.

We included all children aged 2 years to 18 years presenting to a single-center tertiary ED between January 2010 and December 2012. Patients who had incomplete data on their clinical charts were removed from the current analysis. Identification of patients with headache was based on discharged diagnosis from the hospital information system using the Classification of Diseases 10th revision (ICD-10) codes.

Headache was assigned as primary or secondary. The HIS criteria were not used because of the absence of some variables to classify the headache, because of the retrospective nature of the study. Furthermore, we divided headache in four basic Rothner patterns: acute, recurrent acute, chronic progressive and chronic non-progressive.

A standard data collection form was utilized to obtain information from clinical charts. Data was abstracted from electronic ED records, admission and progress notes as well laboratory and radiology reports. Data collected included demographics, age, past medical history, onset of symptoms, presenting signs and symptoms, imaging, investigations, interventions and complications.

A statistical analysis was performed using SPSS statistics 20. Presenting symptoms and signs were analyzed descriptively. Continuous variables were presented as mean and SD (normal distribution) or median and inter-quartile range (IQR). Dichotomy variables were presented as percentages and confidence intervals (CI) of 95%. Univariate analysis was performed using T student for categorical variables and Chi-square for non-categorical variables.

Results

Search by ICD 10 identified 90 patients during the 2-year study period. Two patients were not included in the final analysis because of incomplete records. A total of 88 patients were enrolled in the study.

Demographic characteristics are detailed in **Table 1**. Of the patients admitted to the ED 60% were known to be healthy. Forty percent of patients had a positive past medical history and, of these 33% had a previous history of migraine or chronic non-specific headache diagnosis. Eight percent had a ventriculoperitoneal (VP) shunt and 7% head trauma. A positive family history of migraine was presented in 26% of the patients (**Table 1**).

From the total of the patients, 41(46.5%) were diagnosed with a primary headache and 47 (53.5%) with a secondary headache. The median time from onset of symptoms to the ED presentation was 120 hours (IQR 24-1440) for patients with primary headache and 72 hours (IQR 24-192) for secondary headache. In regards to the duration of the acute headache the median time was 60 minutes (IQR 30-300) in primary headache and 60 minutes (IQR 3-180) in patients with secondary headache.

Primary headache was associated with neurologic symptoms in 4 (9.7%) of the patients in comparison with 8 (17%) of the patients with secondary headache. Fifty-six percent of patients with primary headache had an early onset of symptoms compare with 21.2% with secondary headache. Fifty-three percent of patients with primary headache had worsening of their symptoms versus 30% of the patients with secondary headache. Triggers were presented in 6 (14.6%) of the primary headaches in contrast with 2 (4.2%) of secondary headaches. This triggers included stress, chocolate, sunlight and noise).

Secondary headache had an acute presentation in 36 (76.5%) of the patients versus 14 (34.1%) of patients with primary headaches. Chronic non-progressive headache was found only in patients with primary headache type.

Early morning pattern headache was the most frequent presentation in both types, 35 (85%) in primary headache and 27 (57.4) in secondary headache. Night symptoms were noted in 51% of the primary headache patients versus 9% of secondary headaches. Headache associated aura and in relation with some activity was discovered only in patients with primary headache.

Universal headache was the most frequent location in secondary headache patients (60%). In patients with primary headache, frontal location was more frequent (46%) followed by universal location (26%).

Signs and symptoms are presented in **Table 2**. The more frequent associated symptoms were vomiting, followed by fever, and visual disturbances. Focal neurologic signs were more prevalent in secondary headaches like walking abnormality and ataxia. Only the secondary headache group presented speech disturbances (5%) and paresthesia (7%). A normal physical examination was found in 38 (92.6%) of the patients with primary headache in comparison with 27 (57.4%) of secondary headache patients. Visual disturbances were registered in 8 (19.5%) of patients with primary headache versus 2 (4.5%) of secondary headache. Limb

weakness and cranial nerve disturbances were found in both groups (**Table 2**).

Final diagnoses of patients with primary and secondary headache are shown in **Table 3**. The main diagnosis of patients with primary headache was migraine and in patients with secondary headache was a viral infection.

The main symptoms that were reported on admission with the three patients that were diagnosed with a brain tumor were nausea, vomiting and walking abnormality. The final diagnosis on these patients was medulloblastoma in two patients and craneopharyngeoma in one.

In regards with laboratory and neuroimaging investigations, CT of the head was performed in 76% of the patients; and only 12 patients (13.6%) were reported as abnormal. Three patients had brain tumors, two patients a VP shunt malfunction, five patients with sinusitis and one patient with a previous diagnosis of neurocysticercosis that presented with ataxia and had a diagnosis of phenobarbital intoxication; the last one with small hygromas. Lumbar puncture was done in 14 (15.9%) of the patients and 50% of them were abnormal. All patients had a final diagnosis of meningitis.

Thirty-seven (42%) of the patients received medical management. The most preferred drug was a non-steroidal anti-inflammatory drug like ibuprofen in 13% of patients and acetaminophen in 11%. Opioids and metoclopramide was given in 9% of the patients. Steroids were used in 6% of the patients. Only 27% of the patients reported improvement of their pain during the stay in the emergency room. Pain scales were applied only in 13% of the patients.

Discussion

This is the first study in Latin America to report the epidemiology of pediatric headaches in the emergency department. Headaches are common complaints in children and there is a 75% of prevalence in scholar children and adolescents [1]. In our study, the majority of the patients were males (60%). Primary headache is more frequent in boys at scholar age, however when they get closer to the adolescent this change and girls are more affected [5].

The median age of our patients was 8,5 years with a range between 2-14.5 years. Martinez et al. reported 127 children with a median age of 9,4 years and Kan found a median age of 9,3 years [1,16].

Table 1 Demographic Characteristics of Patients with headache in the Emergency Department.

Variable	Total N= 88	
	n	%
Age in years, mean (Range)	8.5 (2-14.5)	
Male sex	53	60
Inter-hospital transfer	18	19
Mean days of hospitalization, mean (Range)	1.03 (1-3)	
Past medical History		
Healthy	53	60
Chronic Headache	16	18
Migraine	13	15
Ventriculo-Peritoneal Shunt	7	8
Head Trauma	6	7

Table 2 Presenting signs and symptoms of patients with primary and secondary headache in the emergency department.

	Primary Headache N: 41	Secondary Headache N: 47	OR	95% CI	p-value
Presenting Symptoms	n (%)	n (%)			
Vomits	29 (70.7)	31 (65.9)	1.2	0.36-3.4	0.63
Fever	15 (36.5)	29 (61.7)	0.35	0.13-0.92	0.01
Focal Numbness	-	3 (6.3)	-	-	0.09
Dizziness	12 (29.2)	9 (20.4)	1.7	0.58-5.3	0.26
Seizures	2 (4.8)	3 (6.3)	0.75	0.06-7	0.76
Altered mental status	1 (2.4)	6 (12.7)	0.17	0.003-1.5	0.07
Visual Disturbances	13 (31.7)	5 (10.6)	3.9	1.1-15	0.01
Speech Disturbances	-	2 (4.2)	-	-	0.18
Limb weakness	1 (2.4)	-	-	-	0.28
Walking Abnormality	4 (9.7)	12 (25.5)	0.31	0.06-1.1	0.05
Presenting Signs					
Normal	38 (92.6)	27 (57.4)	9.3	2.3-52	0.0002
Cranial Nerve dysfunction	2 (4.8)	2 (4.2)	1.15	0.08-6.5	0.88
Limb weakness	2 (4.8)	1 (2.1)	2.3	0.11-145	0.47
Walking abnormality	1 (2.4)	8 (17)	0.12	0.002-0.99	0.02
Slurred Speech	2 (4.8)	-	-	-	0.12
Visual Disturbances	8 (19.5)	2 (4.2)	5.45	0.98-55	0.02
Sensory loss	-	-	-	-	-
Altered level of consciousness	-	1 (2.1)	-	-	0.28

Table 3 Final diagnosis of patients with headache in the emergency department.

Diagnoses	N	%
Primary Headache		
Migraine	24	27.2
Complicated Migraine	8	9
Chronic headache	9	10.2
Secondary Headache	-	-
Viral Infections	21	23.8
Sinusitis	6	6.8
VP shunt malfunction	5	5.6
Viral Meningitis	4	4.5
Seizures	3	3.4
Bacterial Meningitis	3	3.4
Brain tumor	3	3.4
Stroke	1	1.1
Post Head Trauma	1	1.1
Total	88	100

Literature shows that headaches increase throughout childhood, reaching a peak at about 11-13 years of age in both sexes [4,5,7].

Of the patients who were admitted, 60% were known to be healthy children, 40% had comorbidities, of these 8% had VP shunt malfunction, 7% had head trauma and 33% had a previous diagnosis of migraine or non specific chronic headache. The difference with studies in other latitudes is that in our hospital patients with a trauma are evaluated by the pediatric trauma team and patients that had head trauma and headache might not have headache as discharged diagnosis. This will explain the low frequency. The minority of our patients, as reported in other series had serious neurological conditions [1,7,9].

Lewis and Qureshi studied 150 children with headache in the

ED and identified 27 (18%) patients with serious underlying neurologic pathology, all of who had clear neurologic signs [11]. In our study only 18% of patients with secondary headache and 9% of patients with primary headache had positive neurologic signs on physical examination.

In our study primary headaches presented with morning symptoms in 53% of the patients compared with 23% of patients with secondary headache. In the literature, patients with headache associated with an increase of intracranial pressure were associated with patients that wake up at night with pain and if the onset is in early morning. However, 25% of children with migraine episodes can make the child to wake up at night, but generally the pain has a preceding onset before the child sleeps [7,11].

Also we documented the presence of triggers in 14% of patients with primary headache in contrast with 5% of the patients with secondary headache. It has been described as triggers for primary headache: sleep deprivation, fatigued, hunger, climate changes and some foods [11]. Our study found noise, stress, sunlight and chocolates have triggered for headaches. All have been described previously.

Universal location is more common in secondary headache (60%) in comparison with primary headache (26%). Frontal location is presented in 46% of patients with primary headache in contrast with 30% of secondary headache. Studies reported for migraine more than 50% bifrontal location and hemi cranial distribution [4,7,8,11]. Occipital pain is frequently found in brain tumors. In our research this location was described in 5% of the patients with secondary headache.

The most frequently symptoms reported in primary headache were vomiting, fever and visual disturbances. Patients with secondary headache diagnosis were more likely to have vomiting

(65.9%), fever (61.7%) and walking abnormality (25.5%) Other symptoms were dizziness and seizures. This finding correlate with published case series, describing vomiting and fever as the predominant symptoms in secondary headache [4,7,16].

Our univariate analysis found that primary headache presented more frequently with morning symptoms, visual disturbance and normal neurologic examination. 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 [16]. All associated with the findings in our study. The more significant variables for secondary headache were fever, altered consciousness and ataxia. The central nervous system pathology should be suspected if it has association with altered conscious state, visual abnormalities, motor or sensitive asymmetry and other neurologic deficits [7,9].

Of the patients admitted to the hospital for the final diagnosis of primary headache: 27.2% had migraine. Literature refers to migraine as the most common cause of primary headache [15]. Viral infections were the main cause of secondary headache (23.8%). Several studies describing differential diagnosis of headache in the pediatric ED reported viral infections, sinusitis, and migraine and post head trauma as the more common diagnoses [7,10]. Diagnoses reported in our study are similar to previous reports. Burton et al described viral illness, sinusitis and pharyngitis in more than 60%, of the patients [17].

Routine neuroimaging is not indicated in children with recurrent headache and a normal neurologic examination. The pediatric health care professional must decide whether a CT examination is necessary, and be able to provide summary information to the families of the risks surrounding low-level radiation. One recent research correlates that CT scans during childhood and adolescence are followed by an increase risk in cancer incidence for all cancer types and for many individual types of cancer like brain cancer, leukemias, myelodiplasias, and others) [18,19]. Guidelines recommended that this test must be only for children

presenting with abnormal neurologic exam and history related to CNS disease.(6) Our study reported that 76% of the patients underwent CT, of these 13.6% had abnormalities. There was one case of primary headache (migraine) with CT abnormality, being an incidental finding of bilateral small hygromas. These findings are consistent with several studies in which brain imaging has very limited value in evaluating headaches in pediatric patients without clinical evidence of underlying structural lesions [3,4,7,11].

It has been proven in several studies that Ibuprofen is an effective and secure treatment [14,15,20]. One investigation compared Acetaminophen (15 mg/kg) and Ibuprofen (10 mg/kg) without any difference between both medications [15]. Our study reported 42% of patients with medical treatment. NSAIDs were the main treatment used in 13%, 11% with acetaminophen, 9% opioids and metoclopramide and 6% steroids. Twenty seven percent of the patients reported relief with the medical treatment during a hospital stay.

It is important in headache evaluation the history and physical examination, both are necessary to make an accurate diagnosis. Management in the ED must be addressed to establish an accurate diagnosis, excluding secondary causes, using an effective treatment and providing the patients and parents discharge plans that include treatment and follow up discharge.

We acknowledge three potential limitations to our study. Its retrospective nature did not allow us to find some useful information from the clinical charts, and therefore, we excluded some patients for that reason. This study should be prospective to identify the patients at the moment they arrived at the ED, for accurate data and symptoms record. Our sample is small compared with other series, and we analyzed information from a single center. Finally, we found that pain scales are not used in the ED in all the patients, so the symptoms relief was not objectively recorded.

References

- 1 Kan L, Nagelberg J, Maytal J (2000) Headaches in a pediatric emergency department: etiology, imaging and treatment. *Headache* 40: 25-29.
- 2 Hsiao HJ, Huang JL, Hsia SH, Lin JJ, Huang IA, et al. (2014) Headache in the pediatric emergency service: a medical center experience. *Pediatr Neonatol* 55: 208-212.
- 3 Lewis DW, Ashwal S, Dahl G, Dorbad D, Hirtz D, et al. (2002) Practice parameter: evaluation of children and adolescents with recurrent headaches: report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society. *Neurology* 59: 490-498.
- 4 Alfonzo MJ, Bechtel K, Babineau S (2013) Management of Headache In The Pediatric Emergency Department. *Pediatr Emerg Med Pract* 10: 1-25.
- 5 Scheller JM (1995) The history epidemiology and classification of headaches in childhood. *Semin Pediatr Neurol* 2: 102-108.
- 6 Jacobs H, Gladstein J (2012) Pediatric headache: a clinical review. *Headache* 52: 333-339.
- 7 Ozge A, Termine C, Antonaci F, Natriashvili S, Guidetti V, et al. (2011) Overview of diagnosis and management of paediatric headache. Part I: diagnosis. *J Headache Pain* 12: 13-23.
- 8 Winner P (2008) Classification of pediatric headache. *Curr Pain Headache Rep* 12: 357-360.
- 9 Celle ME, Carelli V, Fornarino S (2010) Secondary headache in children. *Neurol Sci* 31 Suppl 1: S81-82.
- 10 Ahad R, Kossoff EH (2008) Secondary intracranial causes for headaches in children. *Curr Pain Headache Rep* 12: 373-378.
- 11 Brna PM, Dooley JM (2006) Headaches in the pediatric population. *Semin Pediatr Neurol* 13: 222-230.
- 12 Brenner M, Oakley C, Lewis D (2008) The evaluation of children and adolescents with headache. *Curr Pain Headache Rep* 12: 361-366.
- 13 Friedman BW, Grosberg BM (2009) Diagnosis and management of the primary headache disorders in the emergency department setting. *Emerg Med Clin North Am* 27: 71-87.
- 14 Manzano S, Doyon-Trottier E, Bailey B (2010) Myth: Ibuprofen is superior to acetaminophen for the treatment of benign headaches in children and adults. *CJEM* 12: 220-222.
- 15 Bailey B, McManus BC (2008) Treatment of children with migraine in the emergency department: a qualitative systematic review. *Pediatr Emerg Care* 24: 321-330.
- 16 Martinez BPA (2006) La jaqueca en la infancia: Una patologia banal. *Rev Neurol* 42: 643-646.
- 17 Burton LJ, Quinn B, Pratt-Cheney JL, Pourani M (1997) Headache etiology in a pediatric emergency department. *Pediatr Emerg Care* 13: 1-4.
- 18 Brody AS, Frush DP, Huda W, Brent RL (2007) American Academy of Pediatrics Section on R. Radiation risk to children from computed tomography. *Pediatrics* 120: 677-682.
- 19 Mathews JD, Forsythe AV, Brady Z, Butler MW, Goergen SK, et al. (2013) Cancer risk in 680,000 people exposed to computed tomography scans in childhood or adolescence: data linkage study of 11 million Australians. *BMJ* 346: f2360.
- 20 Lewis DW (2001) Headache in the pediatric emergency department. *Semin Pediatr Neurol* 8: 46-51.