

## **HEADACHE AS AN ALARM SIGN FOR PEDIATRIC EMERGENCY**

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**Abstract:** Headache is one of the most frequent causes of admission to pediatric emergency department. In childhood, it presents a wide spectrum of etiologies, from benign to clinical conditions with a poor prognosis, such as those secondary to tumors and cerebral vascular malformations. In view of this, this study aims to systematize the factors that make headache in pediatrics a sign of medical emergency, distinguishing it from self-limiting conditions with less potential severity. For that, an integrative review with a qualitative approach was carried out through a literature review in medical textbooks and in Pubmed/Medline, Scielo, BVS and Google Scholar in May 2023. Some red flags cited in the studies were pain that wakes the patient up during the night, or appears soon after awakening, associated vomiting, occipital location, visual distortion, signs abnormal neurological signs and precipitation by the Valsalva maneuver. These findings could be evaluated regarding their association with more severe conditions that require neuroimaging evaluation for specific treatment. Clinical suspicion is commonly guided by warning signs and what tend to be present in the most significant conditions, however, the possible inaccuracy of the report of children and the prevalence of these signs in benign and self-limiting conditions seem to reduce their sensitivity and specificity. Thus, it is imperative that the emergency professional perform a detailed anamnesis, examining the patient carefully in search of warning signs and requesting additional tests, if necessary, to determine the etiologic diagnosis. In addition, more careful management is needed with regard to red flags in headache cases, as well as further studies that correlate the symptomatology with the pathophysiology of potentially life-threatening diseases or poor prognosis.

**Keywords:** children and teenagers, headache, alarm signs, neurological emergencies.

## INTRODUCTION

Headache is one of the most frequent causes of admission to the pediatric emergency department, being the third leading cause of visits in this sector. Headache affects children and adolescents in an increasing projection, and, for this reason, the demand for emergency services has increased exponentially with regard to this condition in childhood. According to studies, the prevalence of headache among children ranges from 5.9% to 37.7%, and increases with advancing age. The incidence in relation to sex also varies, being more frequent in males and before puberty. During adolescence, a predominance of females is notorious (KURT et al, 2020).

The symptom headache during childhood has a wide spectrum of etiologies, from benign, since most children who go to the emergency room for headache are diagnosed with viral diseases or migraines, to clinical conditions with a poor prognosis, such as those secondary to tumors and cerebral vascular malformations. Furthermore, headaches can be divided into primary and secondary, and the most common types within the primary group in childhood are migraine and tension headache. In the vast majority of cases, secondary headaches in pediatrics are of benign etiologies and tend to be self-limiting or resolve with adequate pharmacological treatment, while those derived from serious organic causes are rarely seen when compared to the others (MARQUES et al, 2022).

In this perspective, it is worth noting that the main potentially serious causes of headache that may arrive at the emergency service are intracranial hemorrhage, hydrocephalus, meningitis, encephalitis and head trauma. Life-threatening causes of headache are those that can result in brain injury or death by a variety of mechanisms, including brain tumor, inflammation, increased intracranial pressure (ICP), and/or hypoxia. Children

with life-threatening infections as a cause of headache often have other clinical features of concern, such as altered mental status or focal neurological findings (RAUCCI et al, 2019).

Furthermore, headache interferes with the lifestyle of children and adolescents, as it is one of the main causes of school leave, which negatively affects the patient's school performance and also other daily activities. From this, it can be inferred that headaches are disabling and constantly end up being stress-inducing not only for pediatric patients, but also for their parents (RAUCCI et al, 2019).

Therefore, it is essential when dealing with headaches to elucidate the cause and guide parents about the disease in question. In the emergency setting, rapid clinical assessment and prior identification of life-threatening circumstances are essential. Therefore, the initial care of a child begins with a good medical history followed by a complete physical and neurological examination. Complementary tests are quite varied and include everything from laboratory tests to electroencephalography, cerebrospinal fluid (CSF) examination, computed tomography and magnetic resonance imaging of the skull (KURT et al, 2020). Furthermore, a classification that can be useful in management is temporality, and thus headaches can be divided into four groups: acute, recurrent acute, non-progressive chronic and progressive chronic, with progressive chronic being those at higher risk of being caused by serious diseases (MOURA-RIBEIRO et al, 2018).

Therefore, the diagnosis of headaches in childhood comprises, above all, the patient's clinical condition, as well as complementary tests requested for confirmation, given that the management of headache in pediatric emergency departments depends on its etiology. In view of this, this study aims to systematize the factors that make headache

in pediatrics a medical emergency sign, distinguishing it from self-limiting conditions with less potential severity.

## METHODOLOGY

This is an integrative review article with a qualitative approach through a literature review in online bibliographic databases and medical textbooks. To guide the study, the following guiding question was defined: “What are the factors that make headache in pediatrics a sign of medical emergency, distinguish it from self-limiting conditions with less potential severity and must be considered in the medical approach?”

The research, then, was carried out in Pubmed/Medline (US National Library of Medicine), Scielo (Scientific Electronic Library Online), BVS (Virtual Health Library) and Google Scholar databases, in May 2023. The descriptors used were : “pediatrics”, “headache”, “emergency service” and “red flags”. From this, there was a selection of articles published in the last 10 years (period from 2013 to 2023), in Portuguese and English, which addressed the theme proposed in the abstract or in the descriptors.

Initially, 9, 0, 2 and 97 studies were found in the PubMed/Medline, Scielo, BVS and Google Scholar databases respectively. All 108 articles found were analyzed by the authors, followed by the export of results. After this first analysis, duplicate articles were deleted using the “Rayyan” review manager.

Exclusion criteria were: research related to the adult public, outpatient conduct and those that did not adequately address the proposed theme. Finally, 08 articles were included, whose data were carefully analyzed and integrated with information from textbooks, seeking to list possible “red flags” in headache episodes in children and adolescents that would indicate a worse prognosis in case of inadequately delayed treatment.

## RESULTS AND DISCUSSION

The headache symptom in pediatrics is usually benign and self-limiting. Its incidence associated with risk to life is around 0.3% of children. Therefore, it is perceived that its management is underestimated by health professionals and international societies. However, due to the possibility of serious pathologies with the potential for lethality, such as brain tumors and intracranial hemorrhages, it is important to pay more attention to the management of this situation. Therefore, general and neurological exams make it possible to characterize possible secondary headaches (HSIAO et al, 2014; CONTI et al, 2023; PREZIOSO et al, 2022).

In the study by Rossi et al (2018) there was a slight prevalence of headache in males compared to females, which flattens out with age. Results showed an increase in primary headache compared to secondary headache in pediatric age, suggesting a broader view among emergency service pediatricians. Adolescents were the most represented, in contrast to other analyses, in which school-aged children prevailed, with a higher number of consultations for headache in the emergency room according to a seasonal variation, in months generally associated with greater stress at school.

In a study carried out by Hsiao et al (2014), more than 43,000 visits to the pediatric emergency department were retrospectively evaluated. Among them, 0.9% (409) had headache as their main complaint. Classifying by age group, the majority consisted of children between 6 and 11 years old (40.8%), followed by adolescents between 12 and 17 years old (27.6%) and preschoolers, under 6 years old. of age (30.3%). From this, it was observed that almost 30% of the cases were considered and treated as a primary headache, and the majority as a secondary headache.

Hsiao et al (2014) identified in their

research that the most frequently found causes were viral, respiratory and acute febrile illnesses. 10% of them (40 patients without easily identifiable causes) underwent head computed tomography (CT), of which 6 (15%) had findings of intracranial pathology: three cases with newly diagnosed brain tumors, two intracranial hemorrhages and one hernia transtentorial. The hospital admission rate was 22.7% (93 patients).

Considering the etiological diagnosis of headache in pediatrics difficult, Hsiao et al (2014) demonstrated that neurological symptoms had a great positive predictive value for intracranial pathologies, including papilledema, paralysis, altered mental status, blurred vision and ataxia. Attention must also be given to important differential diagnoses, such as migraine with vomiting associated with headache, as well as increased intracranial pressure. Head CT, despite being expensive and not providing rapid information for acute management, was considered essential for reducing the rate of sudden death. However, its use in all conditions is unfeasible and must be considered with caution, another point in which a well-evaluated clinical neurological condition serves as a guide.

According to the study carried out by Raucci et al (2019), there are four periodic syndromes that may be associated with migraine in childhood. These syndromes are recurrent gastrointestinal disorders in addition to benign paroxysmal vertigo and benign paroxysmal torticollis. The symptomatology of these disorders includes complete well-being between episodes, stereotypes of episodes, and a family history of migraines or headaches. These patients may have migraine with or without aura, or they may develop migraine headaches, as well as nausea or periodic sleep disturbances. Episodic syndromes can be difficult to recognize and treat, which is why, many times, these patients undergo several

diagnostic tests, such as neuroimaging, and constantly require emergency access, as well as hospitalization.

It is important to collect the complete history and physical examination of the patient, in line with other studies discussed. The search for characterizing onset, duration, quality of pain and severity was discussed, as well as precipitating factors such as stress, sleep pattern and changes, mitigating factors, drug use, family history, trauma and systemic diseases, such as sickle cell disease, immunodeficiency, malignancy or congenital heart disease. It is also essential that the neurological examination be carried out in a complete manner, making it possible to assess the severity of the patient's pain, cranial injuries, with special attention to warning signs such as altered vital signs, lowering of the level of consciousness, meningeal signs, visual disturbances, deficits focal neurological disorders, walking and coordination difficulties, hearing and speech difficulties,

Regarding severe headache, despite the analysis presenting a low percentage of these cases, it is important to know that there may be alarm signs, which were more evident in severe headache, such as papilledema, drowsiness, paralysis of the extremities, asymmetrical pupillary response and progressive loss of vision or neurological instability. Visual and sensory changes, fatigue, difficulty speaking, altered mental status, abnormal strength and reflexes, gait incoordination and cranial nerve palsy were serious findings that required imaging. The presence of focal neurological deficit, papilledema, ataxia and lowered level of consciousness has been reported to increase the risk of life-threatening complications in these cases (RAUCCI et al, 2019).

Diffuse headache, vomiting, nocturnal character, visual impairment, pupillary abnormalities, strabismus, nystagmus, ataxia, paresthesia, cranial nerve palsy, weakness,

change in mental status, speech difficulty, and meningism findings were more commonly found in stronger headaches, compared to the rest of the group. Therefore, early detection of dangerous and reversible causes of headache is essential, differentiating primary cases such as migraine and cluster headache or secondary, those due to other causes such as infection and mass injury, with primary headache being more common in girls and children. older children (ROSSI et al, 2018). In contrast, it was found that secondary cause headache was more common in school-aged children, where respiratory tract infections usually occur (RAUCCI et al, 2019, ROSSI et al, 2018; HSIAO et al, 2014).

Most children with severe headache have at least one clinical alert. However, according to the study carried out by the International Headache Society, among the five children without alarm signs, only two do not have any suggestive risk factor in their personal history and general physical examination. Thus, it was verified how important it is to recognize the suggestive characteristics of primary forms and the clinical warning signs for severe illnesses. In cases of children with severe symptoms but no emergency symptoms, it is preferable that they undergo MRI as opposed to CT, due to the risk of leukemia and brain cancer, even though CT is preferred in emergency departments due to its easy access (ROSSI et al, 2018). Pathological findings are rarely reported, so neuroimaging tests must be used with caution, taking into account a broader assessment of the patient's personal and clinical history.

A retrospective study in Singapore evaluated patients seen between 2016 and 2021 with a subsequent diagnosis of cerebrovascular accident (CVA) by neuroimaging. The authors considered that the pre-hospital delay until the emergency room was the biggest barrier in the treatment of stroke. Less than 20% of

the patients were transported by their parents, which indicates that they did not identify an emergency situation. Among all patients, 13.9% had seizures and half had vomiting associated with headache. The clinical suspicion of delayed stroke is associated with postponement of correctly early diagnosis and treatment, which interferes with the prognosis of patients. To this end, greater public health awareness about the knowledge about the symptomatology of childhood stroke among parents and guardians was recommended (TAN et al, 2022).

A study carried out in Italy developed recommendations to guide and facilitate the management of headaches in pediatric care. For that, a group of specialists was selected and submitted to questionnaires, which were evaluated twice to reduce divergences. In agreement with other researches, it was observed that an anamnesis with attention focused on the search for "red flags" is the main basis in the evaluation of children or adolescents with headaches. Some useful points listed during the anamnesis are: onset, duration, location, quality, intensities, prodromes, aura, associated symptoms, triggering, mitigating factors, history of trauma or previous fever, important personal and family history (PREZIOSO et al, 2022).

The recommendations determined by Prezioso et al (2022) include, in addition to the aforementioned search for warning signs, assessment of vital signs, fundoscopy and laboratory tests in case of positive general physical examination for secondary causes. An explanation to family members about lifestyle and behavioral factors was also suggested, given their relationship with the symptom in question. The age of less than 5 years was also considered a "red flag", since, although fever due to upper respiratory tract infections or migraine are the main etiologies in this age group, statistically, the primary forms are

more prevalent in the other classifications. The proposal, then, was that this factor must be taken as a major criterion for hospitalization, even in cases of other negative warning signs, and, if there is a good response to symptomatic therapy, referral to the pediatric neurologist was made within 30 days.

Conti et al (2023) also discussed the challenge of choosing when and to whom to indicate neuroimaging in cases of headache in the pediatric sector. Clinical alerts cited were pain that wakes the patient up during the night, or appears soon after awakening, associated vomiting, occipital location, visual distortion, abnormal neurological signs, precipitation by the Valsalva maneuver, worsening performance at school, changes in behavior, reduced stature, severe or progressively severe acute pattern, absence of primary headache in the family history. The authors therefore sought to determine the incidence of these warning signs in life-threatening cases in the pediatric emergency department. Similar to other studies, the most commonly found etiologies of headache in children were infection and primary headache.

Considering emergency room care obstacles, such as time constraints, emotional pressure and communication problems among professionals, especially during shift changes, red flags were again considered vital to avoid the drastic consequences for patients at risk of life (CONTI et al, 2023). Some important and divergent points with other studies were explained by Conti et al (2023). The authors demonstrated that the signs, although time-honored, do not contain more concrete evidence and are present in almost a third of the patient sample, in contrast to the reduced rate of emerging intracranial abnormalities. Night awakening and morning pattern were not associated with headaches as a life-threatening sign, since they are relatively common according to the studies. The need

for more concrete and more rigorous studies on the relationship between red flags and patient prognosis was reinforced.

Manoyana et al (2022) considered that headache characteristics, especially red flags, may have reliability altered by communication problems among pediatric patients. Furthermore, the use of neuroimaging seems to be unnecessarily high, considering the high prevalence of warning signs and the low prevalence of significant intracranial lesions. The study by Manoyana et al (2022) was a retrospective review of 109 patients over 5 years with non-traumatic headache. Of these, more than 80% underwent CT and another 22%, MRI. Emerging intracranial lesions were identified in 46.8% of the cases, among which the most frequent were brain tumors, intracranial infections and intracranial hemorrhage. However, the most common final diagnoses were migraine, inconclusive diagnosis and tension-type headache, confirming the higher prevalence of primary headaches found in other studies. The acute pattern was more related to significant intracranial lesions. Furthermore, age less than 5 years old, although only found in 6 patients, was a classification with a majority of diagnosis of brain tumor.

In view of the above, the red flags mentioned in the studies could be evaluated in terms of their association with more severe conditions that require imaging evaluation for a more specific treatment. Clinical suspicion is commonly guided by warning signs, which tend to be present in the most significant conditions. However, the possible inaccuracy of reporting by children and the prevalence of these signs in benign and self-limiting conditions seem to reduce the sensitivity and specificity of red flags (PREZIOSO et al, 2022; HSIAO et al, 2014; MANOYANA et al, 2022; CONTI et al., 2023).

## CONCLUSION

Headache is a common complaint in pediatric patients in the medical emergency. In this sense, it is important that health professionals are prepared to assess and treat these children and adolescents, taking into account the etiology of this symptom, as well as the patient's preexisting conditions. Most of the pediatric population undergoing emergency evaluation for non-traumatic headaches have self-limiting conditions, such as a primary headache syndrome, however, a significant minority of previously healthy patients have life-threatening causes that require urgent diagnosis and treatment. Once stabilized, a systematic approach to the emergency evaluation of pediatric headache patients usually identifies the underlying cause.

Thus, it is imperative that the emergency professional perform a detailed anamnesis, examining the patient carefully in search of warning signs and requesting additional tests, if necessary, to determine the etiological diagnosis. Therefore, treatment must be directed at the underlying cause and the individual needs of the patient, given that an adequate assessment is crucial for an individualized and effective approach. Treatment must be directed at the underlying cause, including drug and non-drug options, and prevention of headache recurrence in pediatric patients. In addition, more careful management is needed with regard to red flags in headache cases, as well as further studies that correlate the symptomatology with the pathophysiology of potentially life-threatening diseases or poor prognosis.

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