

Research Submission

The Child With Headache in a Pediatric Emergency Department

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Objectives.—To investigate clinical features of a pediatric population presenting with headache to a pediatric emergency department (ED) and to identify headache characteristics which are more likely associated with serious, life-threatening conditions in distinction from headaches due to more benign processes.

Background.—Although headache is a common problem in children visiting a pediatric ED, a few studies thus far have attempted to identify the clinical characteristics most likely associated with suspected life-threatening disease.

Methods.—A retrospective chart review of all consecutive patients who presented with a chief complaint of headache at ED over a 1-year period was conducted. Etiologies were classified according to the International Headache Society diagnostic criteria 2nd edition.

Results.—Four hundred and thirty-two children (0.8% of the total number of visits) aged from 2 to 18 years (mean age 8.9 years) were enrolled in our study. There were 228 boys (53%) and 204 girls (47%). School-age group was the most represented (66%). The most common cause of headache was upper respiratory tract infections (19.2%). The remaining majority of non-life-threatening headache included migraine (18.5%), posttraumatic headache (5.5%), tension-type headache (4.6%). Serious life-threatening intracranial disorders (4.1%) included meningitis (1.6%), acute hydrocephalus (0.9%), tumors (0.7%). We found several clinical clues which demonstrated a statistically significant correlation with dangerous conditions: pre-school age, recent onset of pain, occipital location, and child's inability to describe the quality of pain and objective neurological signs.

Conclusions.—Differential diagnosis between primary and secondary headaches can be very difficult, especially in an ED setting. The majority of headaches are secondary to respiratory infectious diseases and minor head trauma. Our data allowed us to identify clinical features useful to recognize intracranial life-threatening conditions.

Key words: headache, child, emergency department

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INTRODUCTION

Headache is a common complaint in children and adolescents. Headache prevalence rates among children range from 5.9% to 37.7% and increase in school-age (40-50%) and adolescent children (80%).¹ An attack of severe headache can produce anxiety in both parent and child; it represents one of the most common reasons for a visit to a pediatric emergency department (ED). In a pediatric ED, the primary objective is to recognize the serious life-threatening

Conflict of Interest: None

conditions requiring immediate medical care among the wide spectrum of headache diagnoses. Moreover, in less severe headache types, appropriate evaluation and investigation may prevent unnecessary hospitalization.

In the previous literature, there are few data regarding the evaluation of headache in the pediatric ED.²⁻⁷ Therefore, the aims of our retrospective study were: (1) to investigate the clinical characteristics of the pediatric patients presenting with headache to our ED during one year; and (2) to identify the clinical headache characteristics which may lead to suspect serious life-threatening diseases.

SUBJECTS AND METHODS

Patients.—A total of 432 consecutive patients who presented with a chief complaint of headache to our ED between January 1, 2004 and December 31, 2004 were reviewed retrospectively. Patients with headache associated with a moderate-severe cranial trauma were not included. Children with mild head trauma, according to the Canadian Pediatric Society (1990), were included in our sample. According to these guidelines, the criteria to define a head trauma as mild are: (1) asymptomatic; (2) mild headache; (3) 3 or fewer episodes of vomiting; (4) Glasgow Coma Scale score of 15; (5) loss of consciousness for less than 5 minutes.⁸ During the period of the study, 55,273 children attended the pediatric ED. Headache-related cases represented around 0.8% of all visits.

The study was approved by the local ethical committee.

The following data were recorded from each ED chart: patient age, sex, family history and detailed history of headache, subjective characteristics of headache, associated symptoms, physical examination, radiological and laboratory tests, previous treatment sought, and diagnosis and treatment. Our patients were divided in groups according to 2 different criteria: (1) the patient's age; (2) the time interval from the onset of the headache attacks. These divisions are, of course, arbitrary, but they show the advantage to allow the possible identification of groups, related to age or headache onset, in which potentially life-threatening headaches may be more frequent.

1. According to a previous study on pediatric headaches in ED,⁴ patients were divided into 3 groups based on their age: (1) pre-school children (2-5 years); (2) school-age group (6-12 years); (3) adolescent group (13-18 years).
2. Headaches were arbitrarily separated into 3 types on the basis of the time interval from the onset of the headache attacks: (1) recent-onset headaches, in which the attacks first occurred within 2 months before the ED visit; (2) medium-onset headaches, in which the attacks began from 2 to 8 months before; (3) late-onset headaches, in which patients had complained of attacks for a longer time than 8 months before ED consultation.

Headache features, determined from patient descriptions of pain, included: the location of pain (bilateral or unilateral, and frontal, temporal, or occipital) and the quality of pain (pulsating or constrictive). Pain intensity (slight, medium, and severe) was estimated based upon impact on daily activities. We considered that slight pain (grade 1) allowed all daily activities to be accomplished, while medium pain (grade 2) limited the daily activities and severe pain (grade 3) obliged the child to abandon any activity.⁹ In order to assess a complete spectrum of diagnosis, charts of inpatient and outpatients, referred to the Department of Neurology for hospitalization, were examined. Headaches were classified according to the International Headache Society (IHS) diagnostic criteria 2nd edition.¹⁰

Statistical Analysis.—Statistical analysis was performed in order to investigate the clinical factors that enabled the prediction of the occurrence of benign or life-threatening headache. Based on etiological criteria, headaches were divided in 4 groups (see later). The possible correlation between the headache group and some clinical characteristics, such as patient age, time interval from onset, pain location, and neurological signs, was tested by means of the chi-square test. Significance levels were set at .05. All statistical analyses were performed using SPSS (version 13.0) software.

RESULTS

Clinical Characteristics.—In total, 432 headache patients were studied ranging from 2 to 18 years of

age with a mean of 8.9 years. The study group included 228 boys (53%) and 204 girls (47%). Patients were classed by age-related groups: 83 pre-school children (19%), 285 school-age children (66%), and 64 adolescents (15%).

Dividing patients according to the onset of the headache attacks, 404 patients (93%) reported a recent onset of headache, while only 3% and 4% of all patients presented with a medium and late onset headache.

As far as the pain location is concerned, only 119 patients (27.5% of all patients) could identify a precise location. Among this subgroup, 101 children (85%) indicated a bilateral, frontal or temporal, pain location, while one-sided headache or bilateral occipital pain was present in 15 (12.5%) children. Only 3 patients (2.5%) reported pain at the vertex. A description of the quality of pain could be obtained only from 35 patients (8% of all our patients). Pain was described as pulsating or constrictive in 23 (66%) and 12 (34%) patients, respectively. As for the pain intensity, it could be described only by 36 patients (8.3% of all our patients). Ten children (28%) referred slight pain, a medium pain was reported in 3 cases (8%), whereas most patients (23-64%) presented with a severe headache.

Associated symptoms were reported in 189 patients (44% of all our patients) and included vomiting, fever, motor/sensitive/visual troubles, abdominal pain, vertigo, and behavioral/consciousness impairment.

At the physical examination, 95 children (22% of all our patients) showed focal and/or general findings and, in particular 21 children (4.8% of all our patients) had focal neurological signs. Four children showed hypertension (0.9% of all our patients). Five children (1% of all our patients) showed papilloedema.

Diagnostic Examinations.—Laboratory and radiological tests (sinus series, blood studies, chest X-ray, electrocardiogram [EKG], head computed tomography [CT], abdominal ultrasound [US], lumbar puncture) were performed in 46 patients (11%). Although no brain magnetic resonance imaging (MRI) was performed in the ED, some children subsequently had this examination when moved to hospitalization units. Sinus series were the most common test (42%)

in patients with suspected sinusitis. It confirmed the clinical hypothesis only in 7 patients.

Five patients (10.6%) had CT scan of the head. Two patients had abnormal findings: one child showed ventriculo-peritoneal (V-P) shunt malfunction and the other an ethmoid sinusitis.

Outcome After ED Consultation.—A total of 299 patients (69%) were discharged, while 126 children (29%) were hospitalized. Seven patients (2%) refused the hospitalization. A specific diagnosis was reached in 277 patients (64% of all our patients). The final diagnosis could be reached during either the ED consultation or the hospitalization.

1. Headache attributed to non-life-threatening diseases included in IHS criteria:¹⁰ 134 patients (49%) (Table 1). The most common cause of headache was upper respiratory tract infections (URI) (30.8%) including pharyngitis, tonsillitis, pneumonia, sinusitis, otitis, and adenoiditis. One patient (0.3%) had a serious anemia possibly provoking headache. Post-traumatic headache was included in the non-life-threatening headache group according to IHS criteria of acute and chronic headache

Table 1.—Headache Attributed to Non-Life-Threatening Diseases

| Headache attributed to non-life-threatening diseases (ICHD-II codes ¹⁰) | N | % |
|---|-----|------|
| 1. Respiratory tract infections (9.2) | 37 | 14 |
| 2. Sinusitis (11.5), otitis (11.4), adenoiditis (11.8) | 46 | 16.8 |
| 3. Viral infections (9.2.2) | 4 | 1.4 |
| 4. Chronic medication (8.3) | 5 | 1.8 |
| 5. Dehydration (10.5) | 3 | 1.3 |
| 6. Anemia (10.5) | 1 | 0.3 |
| 7. Posttraumatic headache (5.1) | 24 | 8.6 |
| 8. Chronic postcraniotomy headache (5.7.2) | 2 | 0.7 |
| 9. Arterial hypertension (10.3) | 4 | 1.4 |
| 10. Refractive errors (11.3.2)/heterophoria (11.3.3) | 6 | 2 |
| 11. Teeth disorders (11.6) | 2 | 0.7 |
| Total | 134 | 49 |

ICHD-II = International Classification of Headache Disorders, 2nd edition.

Table 2.—Primary Headache

| Primary headache (ICHD-II codes ¹⁰) | N | % |
|---|-----|------|
| 1. Cluster headache (3.1) | 2 | 0.7 |
| 2. Tension-type headache (2.1) | 20 | 7 |
| 3. Migraine without aura (1.1) | 67 | 24.1 |
| 4. Migraine with aura (1.2) | 13 | 4.6 |
| 6. Chronic headache (1.5.1) | 3 | 1.3 |
| 7. Migraine-triggered seizure (1.5.5) | 1 | 0.3 |
| Total | 106 | 38 |

ICHD-II = International Classification of Headache Disorders, 2nd edition.

attributed to mild head injury.¹⁰ In fact, all these patients had a normal neurological examination and only 25% were admitted and performed CT.

2. Primary headache: 106 patients (38%) (Table 2). Migraine represented the most common type (73.5%) and in particular, migraine without aura was found in 61% of children. Tension headache, chronic migraine, and cluster headache were diagnosed in 20%, 3%, and 2% of our patients, respectively.
3. Headache comorbidity: headache coexisting with diseases without a demonstrated causality relationship (unclassified in IHS criteria): 19 patients (7%). The most frequent comorbid conditions were epilepsy, vertigo, syncope, and urticaria.
4. Headache attributed to serious life-threatening intracranial disorders: 18 patients (6%) (Table 3). These children showed brain tumors, viral meningitis, V-P shunt malfunctions, pseudotumor cerebri, and brain malformations. The most common cause of secondary neurological headache was meningitis (39%).

In summary, among the 277 patients who had a final diagnosis, 259 children (94%) showed a benign headache, while 18 patients (6%) had a life-threatening headache.

Headaches in the Different Patient Groups.—Age-Related Groups.—The cause of the headache varied with age group. Secondary non-life-threatening head-

aches represented 49.4% of pre-school children headaches, whereas only 12.5% adolescent patients showed this headache type ($P < .001$). Secondary neurological headaches were diagnosed in 7.2% of pre-school children, in 9.4% of adolescents and in 2.1% of the school-age patients. Primary headaches were observed in 29.8% of school-age children and in 37.5% of adolescents ($P < .001$).

Time Interval From the Onset of the Headache Attacks.—The time interval from the onset of the headache attacks was not significantly correlated with the occurrence of benign or life-threatening headache ($P = .483$). However, 17 of 18 children with a serious neurological disease (94.5%) had headache attacks for less than 2 months. On the contrary, primary headaches represented 43.8% and 38.5% of the medium and late onset headaches, respectively.

Headaches Features and Associated Symptoms and Signs: Their Relationship With the Occurrence of Benign or Life-Threatening Headache.—Among headache features, location and quality of pain proved to be useful in secondary neurological headache diagnosis. Indeed, patients with intracranial diseases were either unable to indicate the location of pain (15/18 patients) or they had an occipital headache (3/18 patients). Primary headaches represented 73.3% of one-sided headaches ($P < .001$). All patients with primary headaches could describe the quality of pain (66% pulsating, and 34% constrictive). Only 8.3% of children with serious underlying illness described the pain as constrictive ($P < .001$). Also the

Table 3.—Headache Attributed to Dangerous Intracranial Diseases

| Dangerous intracranial diseases (ICHD-II codes ¹⁰) | N | % |
|--|----|-----|
| 1. Brain malformation (Chiari type I, Dandy-Walker) (7.7, 7.9) | 2 | 0.7 |
| 2. Brain tumors (7.4) | 3 | 1.3 |
| 3. Viral meningitis (9.1.2) | 7 | 1.9 |
| 4. Pseudotumor cerebri (7.1.1) | 2 | 0.7 |
| 5. Ventriculo-peritoneal shunt malfunction (7.1.3) | 4 | 1.4 |
| Total | 18 | 6 |

ICHD-II = International Classification of Headache Disorders, 2nd edition.

assessment of pain intensity could help in discriminating the occurrence of benign or life-threatening headache. The intensity of pain was reported as slight in 32.3% of children with a secondary nonneurological headache, while among patients who described a severe pain, 82.6% had a primary headache and 17.4% had a secondary nonneurological or neurological headache. All patients with a life-threatening secondary headache referred a very intense pain ($P < .001$).

Associated symptoms were not statistically associated with the occurrence of benign or life-threatening headache ($P = .071$). Vomiting was the most common and it was reported in primary and secondary headaches with the same rate (30%). In 67% of cases, secondary neurological headaches had other associated symptoms, including fever, focal neurological deficits, and behavioral disturbances. All children with a serious underlying neurological condition had objective neurological signs, including papilloedema (5/18 patients), ataxia (5/18 patients), hemiparesis (4/18 patients), abnormal eye movements (6/18 patients). Primary headaches were associated in 70.6% of cases to phonophobia and photophobia.

COMMENTS

There are only a few studies dealing with pediatric headaches in an ED.²⁻⁷ In our study, the frequency of children with headache was 0.8%, similar to previously reported data (0.6-1.3%).^{4,6} There was no significant difference between sexes, but school-age children recorded greater frequency (66%). Headaches of recent onset (2 months or less, prior to ED visit) represented the largest proportion (93%), as compared with those begun from 2 to 8 months or longer than 8 months before the ED visit. We chose to also consider the longer lasting headaches since they are observed, although much more rarely, in ED.

Among the secondary headaches, the ones due to non-life-threatening diseases were the most frequent. In particular, respiratory tract infections could be considered the etiologic factor of 30.8% of all the examined headaches, thus confirming previous results.^{2,4,6} When the primary headaches are considered, migraine was far the more common type.

According to literature,^{4,6,7} meningitis was the most common cause of a headache due to a serious neurological condition. These patients did not constitute a diagnostic problem, however, as they had clear systemic and neurological signs of intracranial hypertension.

In our patients, some clinical elements were shown to correlate with the occurrence of benign or life-threatening headache. Looking at the patient's age, primary headaches were most common in school-age children and in the adolescent group while headaches associated with serious intracranial diseases occurred more frequently in pre-school children and adolescents. In pre-school children, special attention should be paid to performing a thorough neurological examination. Considering the onset of the headache attacks, 94.5% of patients with dangerous neurological disease experienced headache with an onset not earlier than 2 months before the ED visit, whereas most of the medium- and late-onset headaches were diagnosed as primary headaches (82%).

Some headache clinical characteristics can suggest secondary headache. In particular, children with serious neurological conditions either were unable to localize pain or referred an occipital headache; moreover, they could not readily describe the quality of pain. This result confirms previous findings (Table 4). In secondary non-life-threatening headaches, pain was located especially in the bilateral frontal or temporal region, whereas about 74% of unilateral headaches were classified as primary headaches.

In our study, vomiting did not prove to be useful for the differential diagnosis of headache, it being associated to all different etiologies. However, other associated symptoms, such as decreased consciousness, focal findings, vomiting, and fever, were very common in patients with headache attributed to a neurological disorder.

Primary headaches were more often associated with visual disturbances, sensitive troubles (migraine with aura, 26%), and phono-photophobia (22%). All patients with an intracranial disorder had neurological objective signs of the underlying condition, such as papilloedema, ataxia, hemiparesis, and abnormal eye movements.

Table 4.—Comparison of the Present Study With the Previous Ones

| | Kan et al ⁴ | Lewis and Qureshi ^{2†} | Leon-Diaz et al ⁶ | Present study |
|--|------------------------|---------------------------------|------------------------------|---------------|
| Number of patients | 130 | 150 | 185 | 432 |
| Age (years) | <18 | <18 | 2-15 | 2-18 |
| Secondary benign headaches (%) | 63.2 | 59.6 | 60.6 | 35.4 |
| Secondary life-threatening headaches (%) | 15.3 | 14.9 | 4.3 | 4.1 |
| Primary headaches (%) | 10 | 18 | 24.3 | 24.5 |
| Unclassified (%) | 11.5 | 7 | 10.8 | 36 |

†In this article (see Table 1, page 202), the total amount of headache type percentages is 99.5%.

Among the diagnostic tests performed in the ED, the most frequently used examination was the sinus series for suspected sinusitis. The sinus series, whose diagnostic value in this disease is still controversial,^{11,12} showed sinusitis only in 7/20 patients, thus suggesting the low usefulness of this examination.

In our study, only 5 patients (1.5%) had a CT scan in the ED, as their clinical state was unclear. In 2 patients (40%), a neurological underlying disease was found. Patients with a life-threatening intracranial condition were immediately hospitalized and underwent more sophisticated diagnostic examinations later. Kan et al reported that 10% of their children had CT scans and that brain abnormalities were found in 10% of patients. The authors suggested that emergency CT scans should be limited to patients with secondary neurological headaches including head trauma and V-P shunt complications or should be considered in patients with a high risk of develop-

ing intracranial complication and in patients with a abrupt onset of headache without a clear specific etiology.⁴ We cannot make a direct comparison with these previous data, because some patients in this study received a brain CT or MRI during hospitalization. This may explain a difference in the rate of performed neuroimaging studies between Kan et al's patients and our headache children.

In conclusion, the majority of the headaches in the pediatric ED were secondary to concurrent acute respiratory illness and minor head trauma. In a small minority of patients, headaches were secondary to serious life-threatening intracranial disorders. As shown in Table 5, several clinical features such as pre-school age, recent onset of headache attacks, occipital location, patient's inability to describe headache characteristics, and neurological signs are useful to identify headaches secondary to underlying brain processes.

Table 5.—Factors Associated With the Occurrence of Benign or Life-Threatening Headache

| | Benign | Life-threatening |
|--------------------------------|--|---|
| Age* | School | Pre-school |
| Onset of headache attacks | >2 months | <2 months |
| Pain location* | Unilateral/bilateral, frontal or temporal region | Unable to describe or occipital region |
| Pain quality* | Able to describe or pulsating | Unable to describe or constrictive |
| Pain intensity* | From slight to intense | Very intense |
| Associated neurological signs* | None | Focal neurological deficits, papilloedema, ataxia, consciousness disturbances |

*Statistically significant associations ($P < .05$).

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