Diagnostic criteria of pediatric migraine without aura

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The objectives of this study were to assess the validity of the International Classification of Headache Disorders-I (ICHD-I) and the International Headache Society-Revised (IHS-R) criteria and to evaluate the other headache features that are not included in these criteria for migraine without aura in the pediatric population. One hundred and thirty-two children who referred to our clinic with the complaint of chronic or recurrent headache were evaluated. Clinical diagnosis of the pediatric neurologist was used as the gold standard in evaluating the validity of ICHD-I and IHS-R criteria and the other headache features. After eliminating patients with other migraine types, secondary headache, and missing data, 92 patients were included in the study according to their records. Sixty-one children (66.3%) were diagnosed as migraine without aura. Using the clinical diagnosis as the gold standard, the specificity of ICHD-I criteria was detected as 93.5%, while the sensitivity was detected as 36.1%. IHS-R criteria had 90.3% specificity and 78.7% sensitivity. Relief of headache with sleeping or lying down in a dark, quiet room was found to be the highest specific and sensitive factor of the other headache features not included in these criteria. IHS-R criteria were found to be more valid in the diagnosis of migraine without aura than ICHD-I criteria. IHS-R criteria are recommended both in clinical practice and in the studies requiring migraine without aura case definitions in the pediatric population.

Key words: childhood headache, migraine, International Classification of Headache.

There are various diagnostic criteria for childhood migraine. The earliest among them are Vahlquist, Bille, Ad Hoc Committee, and Prensky and Sommer criteria[1-4]. In view of the lower sensitivity of these earlier criteria, the International Headache Society published the first edition of the International Classification of Headache Disorders-I diagnostic criteria (ICHD-I) in 1988. The ICHD-I have been fundamentally proven to be sensitive for adults; however, the only amendment for migraine in individuals under 15 years of age has been limited to 2-48 hours of attack duration instead of 4-72 hours[5]. Despite providing an essential development in the diagnosis of migraine in the pediatric population, the studies on the application of ICHD-I in children have shown a need for revision of the criteria for children to increase their sensitivity in diagnosis. Some of these studies have also provided new definitions or suggestions for new criteria[6-16]. Winner et al.[17] suggested the International Headache Society-Revised criteria (IHS-R). The second edition of the International Classification of Headache Disorders criteria (ICHD-II) was published in 2004. The diagnostic criteria for migraine without aura did not differ from ICHD-I, with both requiring at least five attacks, lasting 4-72 hours, with at least two of four pain features and at least one of two sets of associated symptoms. In children, criteria were slightly modified. Attacks which are commonly bilateral and usually frontotemporal may be shorter, 1 to 72 hours. In young children, photophobia and phonophobia may be inferred from behavior[18].

In the International Headache Society (IHS) system, primary headache diagnosis is established considering the characteristics and accompanying symptoms of headaches only after secondary causes of headache are ruled

out. In most of the studies, clinical diagnosis has been recognized as the most valuable (gold) standard and there have been efforts to define new criteria[12,13,16,17]. The determination of criteria for migraine diagnosis will be both beneficial in clinical diagnosis and treatment and essential for epidemiological researches. Therefore, there are ongoing efforts to define migraine diagnostic criteria.

The aim of this study was to evaluate the validity of ICHD-I and IHS-R diagnostic criteria for migraine without aura in the pediatric population regarding the clinical diagnosis of a pediatric neurologist as gold standard. Additionally, we investigated whether there are features of headaches which have high specificity and sensitivity and are not included in these criteria.

Material and Methods

The children and adolescents referred to our clinic with chronic or recurrent headaches between February 2001 and March 2002 were prospectively evaluated. They were questioned for both headaches and their additional complaints. Upon physical and neurological examinations, they were asked to complete a questionnaire about the characteristics of their headaches with the help of a family member. This questionnaire included questions on the date of onset, frequency in recent times, number of headache attacks, duration of headaches, pain features, triggering and ending factors of headaches, and accompanying symptoms, which also involved ICHD-I (Table I) and IHS-R (Table II) criteria and some additional information. To evaluate the intensity of pain, the Visual Analog Scale (VAS) and, for those who could not use VAS, Facial Analog Scale (FAS) were applied. For those who used FAS, the resulting point was completed to 10 and then recorded[19,20]. The questionnaire was re-evaluated by the child himself and the family in order to ensure that the questions were throughly understood. Upon the physical and neurological examinations, any additional studies required were conducted. The patients were asked to keep diaries, and the families were enlightened on the steps to follow. The characteristics derived from the diaries were evaluated.

Table I. International Classification of Headache Disorders-I Criteria for Pediatric Migraine without Aura

A) At least five attacks fulfilling B-D
B) Headache attack lasting 2-48 hours
C) Headache has at least two of the following: 1. Unilateral location 2. Pulsating quality 3. Moderate to severe intensity 4. Aggravation by routine physical activity
D) During headache, at least one of the following: 1. Nausea and/or vomiting 2. Photophobia and phonophobia

Table II: International Headache Society-Revised Criteria for Pediatric Migraine without Aura

A) At least five attacks fulfilling B-D
B) Headache attack lasting 1-48 hours
C) Headache has at least two of the following: 1. Bilateral location (frontal/temporal) or unilateral location 2. Pulsating quality 3. Moderate to severe intensity 4. Aggravation by routine physical activity
D) During headache, at least one of the following: 1. Nausea and/or vomiting 2. Photophobia and/or phonophobia

All the patients who were examined by the first or the third author were re-evaluated by the second author. If needed they were consulted to the fourth and the fifth author. Finally, the diagnosis was established depending on the clinical diagnosis of the second author, who is an experienced pediatric neurologist, according to IHS-based criteria in the light of the history, examination, headache questionnaire, diary, and follow-up.

Among 132 children and adolescents to whom the questionnaire was applied within a year period, those with secondary headache (n=3), complicated migraine (n=2), or incomplete information (n=11) were excluded from the study. The remaining 116 patients with complaint of primary headache were taken into first evaluation. However, the patients with the diagnosis of migraine with aura (n=24) were also excluded. The study was conducted on the remaining patients (n=92).

Ninety-two patients were divided into two groups with regard to their clinical diagnosis as those with migraine without aura and those with other types of headache. The characteristics which are compatible and incompatible with ICHD-I and IHS-R criteria

were determined. Clinical diagnosis was taken as the gold standard. The specificity, sensitivity and the positive predictive value (PPV) of ICHD-I and IHS-R criteria for migraine without aura were calculated. The same method was used to determine the values in migraine diagnostic criteria for the symptoms listed in the criteria, accompanying symptoms, the characteristics of headache, and the triggering and relieving factors of headaches. The answers "lying in a quiet, peaceful place with my eyes closed" and "lying in a dark, quiet room and/or sleep" given to questions, "What do you do when your headache starts?" and "What do you do to relieve your headache?", respectively, were evaluated under the same category.

Table III. Calculation of the Sensitivity, Specificity and Positive Predictive Value

		Clinical Diagnosis	
		Migraine	Nonmigraine
Other Criteria	Migraine	True Positive (TP)	False Positive (FP)
	Nonmigraine	False Negative (FN)	True Negative (TN)

Sensitivity: TP/(TP+FN)
Specificity: TN/(TN+FP)
Positive Predictive Value: TP/(TP+FP)

Statistical Analysis

SPSS 10.0 program was used to analyze patient information. The sensitivity, specificity and the PPV were calculated considering the clinical diagnosis of the pediatric neurologist as the gold standard. True positive refers to the number of patients who were diagnosed as migraine without aura based on both the clinical diagnosis and the definition used. True negative reflects the number of patients who were not diagnosed as migraine without aura based on both the clinical diagnosis and the definition used. While false positive refers to the number of patients with a diagnosis of migraine without aura based on the definition, but with headaches other than migraine based on the clinical diagnosis, false negative refers to the number of patients with headaches other than migraine based on the definition used, but having migraine without aura according to the clinical diagnosis. Sensitivity is the probability of positivity of a test based on the gold standard set. The higher the sensitivity of a test, the lower the false positivity. Specificity shows the probability of a test being negative based on the gold standard. The higher the specificity of a test, the lower the false positivity. PPV is the probability of a test providing the accurate results.

Table III presents the calculation of sensitivity, specificity, and PPV of ICHD-I and IHS-R criteria 21.

Results

The mean age of the 92 children and adolescents (46 females, 46 males) was 10.8 years (range: 4-16, SD 2.6 years). The mean period of headaches was 23.7 months (range: 2-120, SD 21.7 months). All patients experienced at least five headache attacks with the same characteristics at various times. Some of the patients had daily headache attacks whereas the others had only one attack in two or three months. The headache attack duration was less than one hour in 20.7% and under two hours in 52.2% of the patients.

Based on the clinical diagnosis, 61 patients (66.3%) were diagnosed as having migraine without aura, while 31 patients (33.7%) were diagnosed as suffering from headaches other than migraine. Table IV presents the results of the calculation (evaluation) of sensitivity, specificity, and PPV of ICHD-I and IHS-R criteria.

Clinical diagnosis (gold standard), evaluation of headache characteristics, accompanying symptoms, and triggering and relieving factors of headache are shown in Table V.

Table IV. Evaluation of International Classification of Headache Disorders-I and International Headache Society-Revised Criteria for Migraine without Aura

Number of cases	True positive	True negative	False positive	False negative	Sensitivity (%)	Specificity (%)	Positive predictive value (%)
International Classification of Headache Disorders-I criteria	22	29	2	39	36.1	93.5	91.7
International Headache Society-Revised criteria	48	28	3	13	78.7	90.3	94.1

Table V. Evaluation of the Headache Characteristics

Symptoms	Clinical migraine (n = 61)	Clinical nonmigraine (n = 31)	Sensitivity (%)	Specificity (%)	Positive predictive value (%)
Duration: 2-48 hours	28	14	45.9	54.8	66.7
Duration: 1-48 hours	52	19	85.2	38.7	73.2
Headache intensity ≥5	45	14	73.8	54.8	76.3
Aggravation of activity	43	14	70.5	54.8	75.4
Unilateral pain	19	9	31.1	71.1	67.9
Throbbing quality	44	22	72.1	71.0	83.0
Nausea	33	5	86.8	83.9	86.8
Vomiting	21	2	34.4	83.5	91.3
Photophobia	36	8	59.0	74.2	81.8
Phonophobia	51	19	83.6	38.7	72.9
Triggering factors	48	26	78.7	16.1	64.9
Accompanying symptoms	43	16	70.5	48.4	72.9
Relief of headache with sleeping/lying in dark quiet room	45	8	73.8	74.2	84.9
Familial history of migraine	36	14	72.0	54.8	72.0

When the conditions relieving the headache were evaluated, 12 patients had both essay type responses and circled choices. However, the remaining questions were answered in multiple-choice fashion. Of the patients with the clinical diagnosis of migraine without aura, 37 (60.6%) marked "sleeping"; and 8 (13.1%) "sleeping in a dark, quiet room". The triggering causes and the accompanying symptoms of the patients with migraine without aura and other types of headaches are shown in Figures 1 and 2.

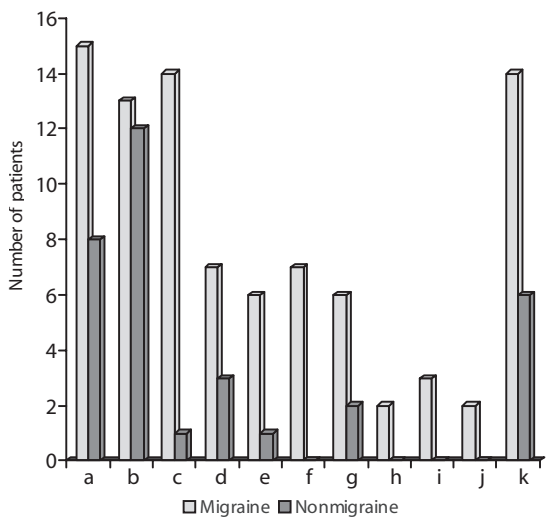

Fig. 1. The triggering causes of headache in migraine without aura and other types of headache. a) Fatigue, b) Stress, c) Hunger, d) Sleeplessness or too much sleep, e) Noise, f) Light, g) Television/computer, h) Riding in vehicle, i) Certain foods, j) Smell, k) None.

Discussion

When the clinical diagnosis was considered as the gold standard, the sensitivity of ICHD-I criteria was 36.1% and specificity 92.3% in the diagnosis of migraine without aura. While the specificity was considerably high, the sensitivity was very low. In other words, in the light of ICHD-I criteria, among those

patients suspected of having migraine without aura by the pediatric neurologist, only one out of three could be diagnosed as migraine without aura.

In evaluating IHS criteria, a better approach would be evaluating only the migraine without aura, in which the clinical diagnosis is the gold standard, because the diagnosis of migraine with aura is easier. To date, Maytal et al.[13] have

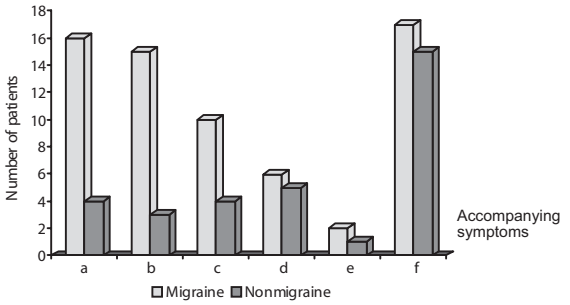

Fig. 2. The accompanying symptoms of headache in migraine without aura and other types of headache. a) Facial pallor/redness, b) Dizziness, c) Congestion in nose, d) Tearing/conjunctival injection, e) Abdominal pain, f) None.

evaluated ICHD-I criteria through specificity, sensitivity, and PPV in a study including only the patients with migraine without aura, and the clinical diagnosis was considered as the gold standard. The sensitivity and the specificity of IHS criteria in their study were 27.3% and 92.4%, respectively. Our results were similar to theirs. However, other studies on all migraine patients showed a 26.9-66% rate of diagnostic capability of ICHD-I criteria[7,9,12,14,15].

In our study, based on the clinical diagnosis as the gold standard, the sensitivity and the specificity of IHS-R criteria in the diagnosis of migraine without aura were 78.7% and 90.3%, respectively. Both the specificity and the sensitivity of IHS-R criteria in the diagnosis of migraine without aura were high. To our knowledge, there is no similar study on IHS-R criteria.

In the evaluation of the criteria based on ICHD-I for migraine in childhood, the most important item leading to incompatibility with these criteria has been stated as the duration. The duration of headache in 11-81% of the children with clinical diagnosis of migraine has been shown to be less than two hours, whereas in 28-35%, the duration has been under one hour[8-10,12]. Nearly half of the patients enrolled in the study had headache which lasted less than two hours. We also found that when the minimum headache attack duration was one hour, the sensitivity was higher than with an attack of two hours' duration; however, there was a slight decrease in the specificity. This was in conformity with the results of other studies[13]. ICHD-II reported "In children, attacks may last 1-72 hours (although the evidence for untreated duration of less than 2 hours requires corroboration by prospective diary studies"[18]. We determined the attack duration by diary in this study.

A 20-67% ratio of unilateral migraine has been reported in the pediatric population[5-9]. According to the results of this study, the sensitivity and the specificity of unilateral pain were low. Bilateral frontotemporal location was included in IHS-R criteria. It is reported in ICHD-II criteria that "Migraine headache is commonly bilateral in young children, is usually frontotemporal, but is rarely occipital in children"[18].

The sensitivity, specificity, and the PPV of vomiting, nausea, photophobia, and phonophobia were the highest among migraine diagnostic criteria. This was in conformity with other studies recommending their inclusion into the diagnostic criteria[11,12-17]. As with IHS-R criteria, this study has also included at least one of these findings as a diagnostic criterion. In ICHD-II criteria, it was accepted that "In young children, photophobia and phonophobia may be inferred from their behavior"[18].

The specificity of the existence of a triggering cause of headache was very low in our results. The causes such as hunger, smell, and noise, which are known to be migraine specific, were more capable of leading to migraine headaches without aura than to other types of headaches. The incidence of the onset of headaches in the children with migraine without any causal factor was high, and was not different from other types of headaches. To sum up, the factors such as light, smell, and food, which are known to be causal for migraine headaches, are contributory to the diagnosis of migraine. In cases with no such triggering factor, diagnosis of migraine should not be underestimated; however, their inclusion in the diagnostic criteria will not increase the sensitivity.

The symptoms accompanying headache, i.e. flushing of the face and tearing, in the diagnostic criteria were not thought to be

contributory to increase the sensitivity and this was consistent with the results of Maytal et al.[13] The most significant symptoms accompanying migraine headache were flushing of the face and vertigo. In fact, vertigo was a more pronounced complaint than headache in some patients. In recent studies, migrainous vertigo has also been defined in adults[22]. Despite the studies reporting the accompaniment of vertigo in children with migraine headache, the need for further studies has been emphasized[23]. Some studies recommend the use of familial history as a diagnostic criterion[1,3,4,6,16]. In the present study, the PPV of positive familial history was 72%. The familial history of the patients whose members of the family were diagnosed as migraine by a specialist was considered positive in this study. Although a history of migraine in the family may seem to be a contributory factor in increasing the sensitivity, it is a criterion that should be carefully evaluated, especially in our country, considering those who have not been precisely diagnosed.

Migraine attacks have been shown to improve with sleep especially in the children under eight years of age[24]. Prensky and Sommer[4] and Gladstein et al.[6] suggested that relief of headache with sleep should be involved in the migraine criteria. In recent studies, the need for further studies to evaluate the behavior in resolving pain as diagnostic criteria has been emphasized[13,15]. The children and the families were asked to respond to the question regarding how their headache resolved in both essay and multiple-choice form. In clinical diagnosis, most of those who were diagnosed as migraine without aura responded with "sleeping". The sensitivity, specificity, and PPV of relief of headache with sleep or lying in a dark quiet room were high in this study. This condition is not included in ICHD-II criteria.

In conclusion, in the case of a need to use diagnostic criteria for migraine without aura in the pediatric population, IHS-R criteria are more valid than ICHD-I criteria. However, further studies are needed to confirm the validity of IHS-R criteria and the criteria for migraine without aura suggested by this study in pediatric neurology clinics, general pediatric outpatient clinics, and migraine prevalence studies. IHS-R criteria are similar to ICHD-II criteria. In this study, relief of headache with sleep or lying in a dark quiet room, which is not included in these criteria, was detected to be a highly specific and sensitive headache feature for children with migraine without aura.

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