

## A STUDY ON EEG ABNORMALITIES IN CHILDREN WITH MIGRAINE

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### ABSTRACT

#### BACKGROUND

Migraine is one of the common causes of headache in children. Migraine and epilepsy are both common episodic neurological disorders. The comorbidity of these two conditions is well known. Many researcher have pointed out that neuronal hyperexcitability is the initiating event for occurrence of migraine attack. The aim of the paper was to evaluate the EEG in children with migraine.

#### MATERIALS AND METHODS

We retrospectively analysed records of children who attended our paediatric outpatient department with diagnoses as suffering from migraine based on International Headache Society (IHS) diagnostic criteria. Apart from detailed clinical history, EEG of every patient was collected and analysed. EEG was performed interictally at least 24 hours after the last episode of headache attack in all the cases.

#### RESULTS

56 children (age range, 4-14 years) constituted our study group. 64.3% children had migraine without aura (common type) and in 23.2% cases had migraine with aura (classic type) other were with migraine variants. Abnormal EEG was reported in 30.3% children. 17% of children with migraine without history of seizure had abnormal EEG. Sixty one percent of patients with aura had abnormal EEG. History of either febrile fits or afebrile fits was present in total 17.1% of cases. The type of paroxysmal discharges we came across was- a) Sharp waves, b) Spikes and c) Spike and slow wave complexes. Abnormal paroxysmal sharp and spike-wave complexes (also called spike-and-slow-wave complexes) were the most common EEG abnormality.

#### CONCLUSION

EEG abnormality was found in significant number of children with migraine both with and without history of seizure in our study. This indicates neuronal hyperexcitability during episodes of migraine. So, EEG should be considered in patients with clinical diagnoses of migraine to exclude association of any seizure activity.

#### KEYWORDS

Migraine, EEG, Seizure, Aura.

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#### BACKGROUND

Migraine is characterised by acute, recurrent episodes of paroxysmal headache, which is often accompanied by nausea, vomiting and abdominal pain and relieved after sleep.<sup>1</sup> It is one of the common causes of headache in children. Many researcher have pointed out that neuronal hyperexcitability is the initiating event for occurrence of migraine attack.<sup>2,3</sup> Some antiepileptic drugs are effective in prevention of migraine headache. Herein, we report the study results of association of EEG abnormalities in children with migraine.

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#### AIMS AND OBJECTIVES

Aim of the study was to find whether there was any significant association of EEG abnormality in children with migraine.

#### MATERIALS AND METHODS

This study was conducted in a tertiary care teaching hospital. We retrospectively analysed records of children who attended our paediatric outpatient department between January 2014 and July 2016 of our institution and was diagnosed as suffering from migraine based on International Headache Society Diagnostic Criteria.<sup>4</sup> This study was approved by the Hospital Ethical Committee. Data was collected from record section of our institution. Detailed history like age of onset, presence of aura, frequency, duration of illness, familial history, triggering factors, clinical findings of neurological examination and imaging study results, EEG, etc. of every patient was collected and analysed. EEG was performed interictally at least 24 hours after the last episode of headache attack in

all the cases. Children with concomitant organic disease or structural abnormality of brain were excluded from the study. The data collected was analysed statistically using descriptive statistics. Appropriate test of significance was used to analyse the data.

### Inclusion Criteria

Migraine was diagnosed as per International Headache Society Diagnostic Criteria.<sup>4</sup> Those who fulfilled the diagnostic criteria mentioned below were included in the study.

### Diagnostic Criteria for Migraine without Aura

- a. At least five headache attacks lasting 4-72 hours (untreated or unsuccessfully treated), which have at least two of the four following characteristics-
  1. Unilateral location.
  2. Pulsating quality.
  3. Moderate or severe intensity (inhibits daily activities).
  4. Aggravated by walking stairs or similar routine physical activity.
- b. During headache, at least one of the two following symptoms occur.
  1. Phonophobia and photophobia.
  2. Nausea and/or vomiting.

### Migraine with Aura (MA) Diagnostic Criteria

- A. At least two attacks fulfilling with at least three of the following-
  1. One or more fully reversible aura symptoms indicating focal, cerebral, cortical and/or brain stem functions.
  2. At least one aura symptom develops gradually over more than four minutes or two or more symptoms occur in succession.
  3. No aura symptom lasts more than 60 minutes; if more than one aura symptom is present, accepted duration is proportionally increased.
  4. Headache follows aura with free interval of at least 60 minutes (it may also simultaneously begin with the aura).
- B. At least one of the following aura features establishes a diagnosis of migraine with typical aura-
  1. Homonymous visual disturbance.
  2. Unilateral paraesthesias and/or numbness.
  3. Unilateral weakness.
  4. Aphasia or unclassifiable speech difficulty.

### Exclusion Criteria

Those patients who did not fulfil the diagnostic criteria of International Headache Society were not included in the study.<sup>4</sup> Those children with any structural abnormality of the brain were also excluded from the study.

### RESULTS

From the records, 85 children were found to be diagnosed as suffering from migraine during the study period. In 56

children, EEG study was done. So, these 56 children (age range, 4-14 years) were enrolled for statistical analysis. 5 (8.9%) were under 5 years old, 34 (60.7%) were of 5-12 years, 17 (30.3%) were above 12 years. 36 (64.3%) of the cases were girls and 20 (35.7%) were boys.

In 36 (64.3%) of the cases had migraine without aura (common type) and in 13 (23.2%) cases had migraine with aura (classic type). Cyclical vomiting, one of the migraine variant was present in 4 children and paroxysmal vertigo in 2 children. Retinal migraine was diagnosed in one child.

Nineteen (33.9%) children had bilateral front otemporal headache. Unilateral headache was present in 30 (53.6%) children. Duration of headache was reported to be less than 1 hour in 6 children, 1 to 4 hour in 9 children and more than 4 hour in 41 children.

Nausea was present in 49 (87.5%) patients. Vomiting was reported in twenty three (41%) patients. Sensitivity to light and/or sound was reported in 28 (50%) patients. Vertigo was present in 5 (8.9%) patients. Aura in the form of visual disturbance was present in 9 (16%) children. Combination of the symptoms was present in twenty (35.7%) children.

Family history of migraine was present in 49 (87.5%) of the children. History of febrile fits was present in 4 (7.1%) children and afebrile fits were reported in 5 (8.9%) patients. Family history of seizure disorder either febrile or afebrile was present in fourteen (25%) patients. All the children had normal imaging study.

There was a significant association of EEG abnormality in patients with migraine ( $P < 0.01$ ). Abnormal EEG was reported in 17 (30.3%) children. All the children with either febrile or afebrile seizure had abnormal EEG. 17% of children (8 out of 47) with migraine without history of seizure had abnormal EEG. 61% of patients with aura (8 out of 13) had abnormal EEG. In 6 records, paroxysmal discharges were seen along with disturbances in background activity. In 8 records, paroxysmal discharges alone were seen. The type of paroxysmal discharges we came across was- a) Sharp waves, b) Spikes and c) Spike and slow wave complexes. Paroxysmal discharges were both symmetrical and asymmetrical. 3 Hz per second spikes and slow waves were found in 2 children with absence seizure. Abnormal temporal lobe discharge was reported in the child with CPS. Abnormal paroxysmal sharp and spike-wave complexes (also called spike-and-slow-wave complexes) were the most common EEG abnormalities. Difference of EEG abnormalities in different types of aura was significant.

### DISCUSSION

Migraine is the most common cause of recurrent headaches in children and accounts for more than half of the cases.<sup>5</sup> In children, migraine without aura is more common than with aura. Those who present with aura, most common is visual aura. In our study, 36 (64.3%) of the cases had migraine without aura (common type) and in 13 (23.2%) cases had migraine with aura (classic type).

Migraine and epilepsy are both common episodic neurological disorders, although migraine is more frequent. In 1906, the British neurologist, Sir William R. Gowers pointed out the resemblance between migraine and epilepsy.<sup>6</sup> Migraine and epilepsy, both disorders share many clinical features and underlying pathophysiological mechanisms. The comorbidity of these two conditions is well known.<sup>7</sup> Four types of association between headache and epileptic seizure are recognised- preictal headache, headache as the expression of an epileptic manifestation, postictal headache and interictal headache.<sup>8</sup> In our study, we found significant association of seizure either febrile or afebrile in children with migraine. Incidence of seizure in the family members of migraine patients were also more than that of general population.

The diagnosis of migraine as per International Headache Society (IHS, Table 1) diagnostic criteria depend largely, if not entirely, upon the patient's description of symptoms. Investigations has limited role in diagnosis of an otherwise uncomplicated case of migraine. EEG is considered as the mirror of brain activity. EEG is an important tool in diagnosis of seizure disorder. EEG is not routinely recommended in the evaluation of a child with recurrent headaches as it is less likely to provide an aetiology, improve diagnostic yield or distinguish migraine.<sup>9</sup> But, EEG provides a vast potential for exploring the pathophysiology of migraine. EEG abnormalities are present in upto 10% of children with migraine of different types, regardless of the diagnosis,<sup>10</sup> of which hemiplegic migraine has shown the most definite abnormal EEGs with a wide variety of patterns. During the ictus, severe unilateral or focal disturbances including delta activity, theta-delta activity, theta activity or alpha-reduction are often described. In most of the cases, abnormal EEG changes subside in a few days and return to normal.<sup>11,12</sup>

In different studies, EEG changes associated with migraine headache in children were reported. A study by P. Karimzadeh disclosed migraine as a common problem in children with EEG abnormalities present in approximately 20% of the patients.<sup>13</sup> In a study performed by Holguin and Fenichel,<sup>14</sup> EEG abnormalities associated with childhood migraine were reported as 27%. In a study by Kramer and colleagues, epileptic form EEG abnormalities were found in 11% of patients with both migraine and tension headache.<sup>15</sup> In our study, abnormal EEG was present in 30.3% of cases. EEG was abnormal in all the cases with history of either febrile or afebrile seizures. 17% of children (8 out of 47 cases) with migraine without history of any seizure had abnormal EEG. Patients with aura had abnormal EEG in 61% cases. Most common EEG abnormalities were abnormal paroxysmal sharp and spike-wave complexes (also called spike-and-slow-wave complexes). Difference of EEG abnormalities in different types of aura was significant.<sup>16</sup>

EEG abnormality was found in significant number of children with migraine both with and without history of seizure in our study. This indicates neuronal

hyperexcitability during episodes of migraine. So, EEG should be considered in patients with clinical diagnoses of migraine to exclude association of any seizure activity.

## CONCLUSION

EEG abnormality was found in significant number of children with migraine both with and without history of seizure in our study. This indicates neuronal hyperexcitability during episodes of migraine. So, EEG should be considered in patients with clinical diagnoses of migraine to exclude association of any seizure activity.

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