



Evaluation of Electroencephalogram Changes in Patients with Migraine

KEYWORDS

EEG, hyperventilation, photic stimulation, migraine

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ABSTRACT Migraine is a common disorder that imposes a large personal burden on sufferers and high economic costs on society. The purpose of this study was to evaluate the EEG changes in a clinic-based sample of migraine patients. **Materials and methods:** A total of 50 patients with migraine and 50 age, sex, and race matched controls were included in this study. The EEG was studied in the awake state at rest, during photic stimulation and during hyperventilation. **Results:** Migraine with aura was more common in females than the males. Women were more as likely as men during hyperventilation, but more likely than men during photic stimulation to develop a migraine attack. **Conclusion:** The presence of abnormal EEG patterns in migraine patients may help to initiate further researches to determine the pathogenesis of these EEG changes in migraine as well as the management and prognosis.

Introduction

Headache is one of the humanity's most common afflictions. The utility of EEG in the diagnosis of headache has been controversial. During the past 50 years, a variety of electroencephalographic abnormalities have been reported in patients with migraine, with an incidence ranging from 11% to 74% [1]. Sufferers have a significant level of migraine related disability in all aspects of their daily lives. The International Headache Society published the first set of criteria for the classification of headache disorders in 1988. The introduction of the second edition of the International Classification of Headache Disorders [2] is a major advance in the classification and diagnosis of headache disorders. It is also claimed that EEG is clearly indicated in cases with acute headache attacks, when either epilepsy, basilar migraine, migraine with prolonged aura or alternating hemiplegic migraine is suspected [3], keeping the fact in the mind that the final diagnosis must mainly depend on clinical judgment however. Migraine is associated with a variety of electroencephalographic (EEG) changes. EEG abnormalities in migraine have been reported by a number of authors. Prevalence varies considerably in the older literature. A number of specific rhythms related to drowsiness or hyperventilation have probably been counted as "abnormal" and the reported numbers of definitely abnormal EEG rhythms have been consistently low. In a few controlled and blinded studies, however, slight excess of various EEG rhythms has been found in migraine patients. Similar prevalence of interictal EEG abnormalities has been found in patients with classic and common migraine, but the diagnostic classification may not have been precise enough in some studies [4].

Aims and objectives

The aims and objectives of the study are to evaluate the EEG findings in patients with migraine during hyperventilation and photic stimulation.

Materials and methods

The study was done in the Department of Physiology, in collaboration with the Department of Neurology, IMS and SUM Hospital, Bhubaneswar, Odisha. A total of 50 patients with migraine and 50 age-, sex-, and race-matched controls were included in this study. The patients who fulfill the International Classification of Headache Disorders criteria were included and those who had coexisting tension-type headache, focal neurological deficit, epilepsy, psychiatric disorders, head injuries and diseases of the ear, nose, throat and dental were excluded. Controls were selected from community who had no evidence of migraine. They were subjected to standard scalp electroencephalography. The EEG was studied in the awake state at rest, during photic stimulation and during hyperventilation.

Results

In the migraine group, the median age was 35 years while in the control group the median age was 36 years. The distribution according to gender, ethnic group and education levels are shown in Table No. 1.

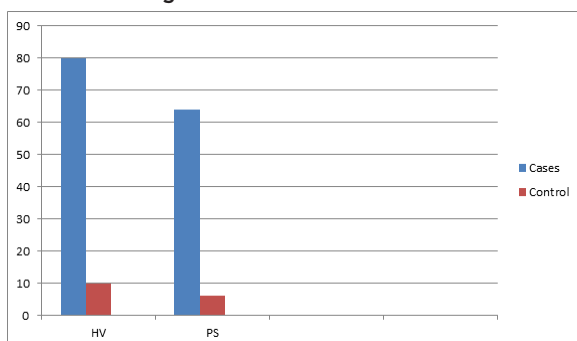
Table No.1: Baseline characteristics of migraine patients and the controls

	Cases n=50	Percent- age%	Control n=50	Percent- age%
Age (years)				
Median	35		36	
Gender				
Female	40	80	40	80
Male	10	20	10	20
Localities				
Rural	12	24	25	50
Urban	38	76	25	50

Education				
Primary	6	12	0	0
Secondary	15	30	10	20
Tertiary	29	58	40	80

The median age for migraine group was 35 years where as the median age for control group was 36 years. Out of the 50 patients, 40 (80%) had migraine with aura. There were 12 (24%) patients who had a family history of migraine. 23 (46%) patients had migraine for more than ten years. Of the 50 migraine patients, 40 had migraine with aura, was more common in females 38(76%) than the males 2(4%). The urban patients had more migraine than rural.

Chart No. 1: Frequency of patients who developed headache during HV and PS



The Chart No: 1 shows that 40 (80%) of the patients developed headache during Hyperventilation(HV) and 32 (64%) of the patients developed headache during photic stimulation(PS). The present study shows that out of 40 (80%) cases who developed headache during hyperventilation (HV), 21 (42%) were males and 19 (38%) were females. Out of 32(64%) of patients who developed headache during photic stimulation (PS), 11(22%) were males and 21(42%) were females.

This study shows that females were more likely to develop headache attacks during PS. The incidence of headache during HV was higher in the migraine patients than control subjects and this observation is consistent with the known fact that HV and PS are predisposing factors for acute migraine attacks.

Table No. 2: Electroencephalographic changes during hyperventilation

	Cases n=50	Control n=50
Theta transients		
Yes	10(20%)	8(16%)
No	40(80%)	42(84%)
Theta activity		
Yes	24(48%)	15(30%)
No	26(52%)	35(70%)
FIRDA		
Yes	07(14%)	02(04%)
No	43(86%)	48(96%)

FIRDA-frontal intermittent rhythmic (delta) activity

The EEG abnormalities that were most commonly observed during hyperventilation were theta and frontal in-

termittent rhythmic (delta) activity (FIRDA). Theta activities and FIRDA were more in cases 07(14%) than the control group 02(04%).

Discussion

Electroencephalography (EEG) has traditionally been considered to be useful adjunct to the clinical evaluation of headache. Weil described paroxysmal high voltage abnormal slow wave activity in a number of patients and proposed the term dysrhythmic migraine for this group [5,6,7]. Dow and Whitty [6] found that relatives of migrainous subjects also had a high incidence of EEG abnormalities providing circumstantial evidence for a constitutional basis for migraine. Since migraine is likely to be a constitutionally determined disorder, it is of interest to know if the EEG of such patients shows characteristic features.

Of the 50 migraine patients, 40 (80%) had migraine with aura, being commoner in females than males. Previous studies reported only about 20% of migraine headaches were associated with aura. Females were more likely to develop headache attacks during PS. The incidence of headache during HV was higher in the migraine than control subjects and this observation is consistent with the known fact that HV and PS are predisposing factors for acute migraine attacks. Unlike previous studies, in our study during PS there were no EEG changes found in both groups. The incidence of EEG abnormalities reported above varies from 13-60% depending on the interpretation during HV in migraineurs the diagnostic standards used and the inclusion of mixed conditions [8,9].

The EEG abnormalities that were most commonly observed during hyperventilation were theta and frontal intermittent rhythmic (delta) activity (FIRDA). The latter which has been described as bisynchronous slow waves at 2-3 Hz/sec, is classically reported with lesions that directly or indirectly involve the mesencephalon, diencephalon, orbital and nasal surfaces of the frontal lobe. It has also been observed in patients who have metabolic, toxic and endocrine encephalopathies involving the subcortical and cortical cerebral grey matter more than the cerebral white matter, hydrocephalus, cerebral edema, increased intracranial pressure, stroke, deep midline lesions, posterior fossa tumors, third ventricle and pituitary tumors. In two previous studies the occurrence of FIRDA has been reported in acute confusional migraine before the publication of ICHD-2 [10,11].

Conclusion

The presence of abnormal EEG patterns in migraine patients may help to initiate further researches to determine the pathogenesis of these EEG changes in migraine as well as the management and prognosis.

References

- Sand T. EEG in migraine: a review of the literature. *Funct Neurol* 1991; 6(1): 7-22.
- Olsen J, Steiner TJ. The international classification of headache disorders, 2nd edition (ICHD-II). *J Neurol Neurosurg Psychiatr* 2004; 75: 808-11.
- Gordon N. Alternating hemiplegia of childhood. *Dev Med Child Neurol* 1995;37: 464-468.
- Mishra T, Mohapatra D, Behera M, Priyadarsini N. EEG changes in migraine patients. *Int J Pharm Bio Sci* 2015 April; 6(2): (B) 830 – 836.
- Selby G, Lance JW. Observations on 500 cases of migraine and allied vascular headache. *J Neurol Neurosurg Psychiatr* 1969; 23: 23-32.
- Dow DJ, Whitty CWM. Electroencephalographic changes in migraine. *Lancet* 1947; 2: 52-4.
- Camp WA and Wolff HG. The EEG changes in migraine. *Archives Neurol*. 1961; 4: 52.
- Slatter KH. Some clinical and EEG findings in patients with migraine. *Brain* 1968; 91: 85-98.

9. Hockaday JM, Whitty CW. Factors determining the electroencephalogram in migraine: a study of 560 patients, according to clinical type of migraine. *Brain* 1969; 92: 769-88.
10. Hoosmand H. The clinical significance of frontal intermittent rhythmic delta activity (FIRDA). *Clin Electroencephalogr* 1983; 14: 135-7.
11. Pietrini V, Terzano MG, D'andrea G, Parrino L, Cananzi AR, Ferro-Milone F. Acute confusional migraine: clinical and electroencephalographic aspects. *Cephalalgia* 1987; 7: 29-37.