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Visual Evoked Potentials in Patients with Classic Migraine

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Abstract

***Background*:** Migraine is considered as a chronic disease. Ocular symptoms and sensitivity to light stimuli are common in the patients with such disease. There are some evident that visual system function in the patients with migraine is impaired even between the attacks as compared with health people. In this study, we examine Visual Evoked Potential in 30 patients suffered from migraine before, during and after aura.

***Materials and Methods*:** 30 patients suffered from classic migraine and with visual aura were evaluated in terms of visual stimulatory potentials before, during and after aura. P-100 latency and amplitude were evaluation criteria in our study. The results of this investigation were evaluated by χ^2 test.

***Results*:** Abnormal amplitude frequency was occurred in 17 cases before aura, in 27 cases during aura and in 20 cases, it occurred after aura. Reduction of the amplitude wave p-100 during and after aura was significantly more in both eyes (p<0.05). Ten cases had abnormal P-100 latency during aura and the other two cases had it after aura. There is a significant difference in the P-100 latency during aura (p<0.05). There is no difference between the changes in visual stimulatory potentials with gender.

Conclusion: Some changes were found in the parameters in the visual stimulatory potentials in the patients with classic migraine before, during and after aura.

Introduction

The migraine is one of the most common reasons of headaches which mostly appear as associated with episodes of moderate to severe one-sided throbbing headaches along with nausea, vomiting, sensitivity to sound or light. In some other investigations, migraine prevalence has been estimated up to 20% in women and up to 6% in men [1]. One type of migraine as associated with aura is called classic migraine. Aura may appear as impairment in vision, sensation, movement and/or speech [2]. Fifteen percent of the patients with migraine have aura; however, it is not occurred in each attack [3]. The most common aura is visual one called as Scintillating scotoma (teichopsia) which includes about 80 to 90 percent of aura cases [4]. Due to frequent occurrence of visual symptoms, a great share of studies on migraine have been oriented toward the evaluation of Visual Evoked Potential (VEP) of such patients especially those with classic migraine, which is a simple and noninvasive approach. The main purpose of these researches is to determine the type and frequency VEP changes as well as their value in the patients suffered from migraine. Despite various studies have been conducted, the results are different and the changes in latency of P-100 amplitude have been reported just in some of these studies [5-9]. It seems that VEP changes are dependent of the impact of the duration of the disease and it has been occurred in both new cases of migraine and the chronic migraine [10] and it is possible to make use of it to classify various types of migraine [11, 12]. Taking into consideration the above issues and increasing value of this approach for the patients with migraine and with regard to the lack of an investigation which would have been conducted on the evaluation of such changes in three stages including before, during and after visual aura in the patients suffered from classic migraine, the present study was carried out in Kerman city.

Materials and Methods

This investigation is conducted in Kerman by a cross-sectional method on 30 patients suffered from classic migraine with visual aura. Diagnosis was established according to IHS (International Headache Society) criteria. All the patients had visual acuity as normal or modified by glasses. All other examinations performed by an ophthalmologist appeared normal and the patients were healthy in terms of systematic and neurologic examinations and had no history of disease and were not under any drug therapy. The patients had no anti-migraine treatment for two weeks before the test is conducted.

A VEP test taken on the patients without headache or aura symptoms and they were asked to refer immediately to us once the aura is started. In case it is continued, another VEP test will be performed; 15 minutes after the aura is stopped and during headache stage, the patient will give another VEP test. The reason to select such a time for test was to be able to initiate preventive treatments for headache attacks of the patient in the minimum possible time. The present study was conducted using Toennies

system version-3 assembled in Iran. VEP test was performed by Pattern Reversal method on a 15×12 TV Monitor from a distance of 60 cm. Stimulation reversal rate was 2 times per second with full visual field stimulation.

Active electrode was placed on O_2 area (according to international 10-20 system) and reference electrode was placed on F_2 area and finally ground electrode was put on the patient's hand. Electrode resistance was less than 5 KΩ. Simulation was in full field form. An average was calculated of 200 stimulation and P-100 latency and amplitude was estimated. In this investigation, a P-100 latency of higher than 118 ms was considered as abnormal. Furthermore, the level of confidence in this study was 95% and the sample size was measured by α 5% and investigation potential of 80% as 30 persons. Statistical analysis was made using SPSS-17 and χ^2 statistical test. The $p \leq 0.05$ was considered as statistically valuable. The subjects participated in the study with full consent and the committee of ethics at the University of Kerman has approved it to be conducted.

Results

The subjects participating in this research consisted of 12 men (43%) and the remaining were women. The age average was 23±2.8 for men and 25±1.9 for women was. The total age average of all patients was 24±3.2 and they were in an age range of 12-40 years old. No cases of abnormal P-100 latency were seen in the stage before the aura. Ten cases had abnormal P-100 latency during aura and two cases had it after the aura.

The cases of abnormal P-100 latency during the aura was significantly more than those after the aura (p=0.034). There was no significant difference between P-100 latency in different phases in both genders (Table 1). Meanwhile, P-100 latency difference between two eyes in the patients with normal latency P-100 was calculated in which no abnormal case was found before, during and after aura. Abnormal amplitude frequency has been measured in 17 cases at a time before aura and in 27 cases during aura and in 20 other cases after it. The abnormal amplitude frequency during aura (p=0.038) was significantly higher than that before aura (p=0.027). There was no significant statistical difference of abnormal amplitude frequencies at times before, during and after aura between both genders. Additionally, there were significant differences between the cases of amplitude reduction in the right eye during and before aura (p=0.04), between the cases of amplitude reduction in the left eye before and during aura (p=0.03) and between the cases of amplitude reduction in the right eye before aura compared to that during (p=0.02) and after (p=0.004) aura.

Table 1. Abnormal P-100 latency frequency at different times for each eye by gender

Time	Eye	Male	Female	All	*p*-Value
During aura	Right	0	2	2	0.866
	Left	3	5	8	
After aura	Right	0	0	0	0.765
	Left	1	1	2	

Table 2. Abnormal amplitude frequency at different times for each eye by gender

Time	Eye	Male	Female	All	*p*-Value
Before aura	Right	4	2	6	0.136
	Left	5	6	11	
During aura	Right	5	8	13	0.654
	Left	5	9	14	
After aura	Right	2	6	8	0.543
	Left	4	8	12	

Discussion

A prominent feature that characterizes our study is to investigate VEP changes during visual aura of classic migraine and to make a comparison between it with that before and after aura. Our most key findings was a significant reduction of P-100 amplitude during and after aura compared to that before aura as well as a significant reduction of P-100 amplitude in both eyes during and after aura as compared to that before aura. There has been conducted some studies on electrophysiological alterations and VEP in particular in the patients suffered from migraine, some results of which are in contradiction to each other [13-18]. In these investigations, the patients with migraine as classified into two groups including classic migraine and typical migraine were studied with P-100 amplitude and latency as examined during headache attack and afterwards and then it has been compared to the control group. However, in none of them, such changes have not been examined specifically during visual aura of classic migraine. Considering the results of the present study suggesting the same changes in both eyes, it may be concluded that pathology is in Retro Chiasmatic. As we know, two-sided VEP changes may be caused by two-sided damage to optic nerve or chiasma; however, since the patients have already undergone a full neurologically and visual examination, this case is not true with them. It seems that significant reduction of amplitude during and after aura as compared to that before aura which is coincident with migraine headache is verification for Spreading Depression Theory of Leao. Since hypoperfusion wave is continued until 4-6 hours [19], such amplitude reduction may be expectedly occurred after the aura; an issue that has been already suggested to in some other studies [13, 16, 20, 21]. We have not found a similar investigation by which we would compare VEP changes during aura with other researches. However, the changes we recorded before and after aura, are similar to those found in many other studies. Boylu et al. reported the same results as ours in their evaluation of VEP changes in 41 patients suffered from migraine including ones in both P-100 amplitude and latency [22]. Also, Unay found in his evaluation of 37 patients with migraine within an interval between the headaches that P-100 latency in such patients is significantly more than those in patients with tension headaches [6]. Like us, Sand concluded that there is a direct relationship between such changes and disease duration, too [5]. Bohotin et al reported P-100 latency in all the patients under their study on the evaluation of the patients suffered from migraine

with and without aura [20]. The researchers conducted by Afra, Kocher, Bockowski et al showed like our investigation that there are P-100 amplitude changes within the phases between headache attacks [23-26]. Unlike the results of our study and above-mentioned articles, some investigations have achieved quite the opposite results. Zaletel et al have found in their work no significant difference between P-100 latency and amplitude changes [21]. Tagliati in Italy and van Dijk in Netherlands have not reached to any valuable findings in their evaluation of VEP changes in the patients with migraine [27, 28]. It seems that VEP changes in the patients with migraine in our study and other similar investigations as explained above, before and after aura is firstly due to a reduction of cortical blood circulation. Such changes are not seen in the patients with migraine; some other areas such as brainstem and trigeminal nucleus might be involved, a result that is verified by Cerebrovascular Doppler Ultrasound [21]. Any disorder in cortical information processing and synaptic delay have been mentioned in some investigations as a cause for such impairments [8, 29]. Parts of changes in the time between headache attacks might be resulted from abnormal excitability of cerebral cortex in such patients [9, 19, 20]. It is likely the changes we found in our study to be happened due to aforesaid cases. The previous studies suggest that those changes are independent of age factor and it has been found in children too [8, 6] and is emerged by flash stimulation technique [30]. Furthermore, such changes appeared not to be related to the headache area and the number of its attack [8, 10]. In the present study, though frequency difference of amplitude disorders in both eyes was not significant during and after aura, the existence of such a little difference is also indicative of this point that optic nerve may have disorders to some extent during migraine attacks. Although all the studies emphasize the necessity for further investigation to be conducted on how the migraine affects the patients as well as VEP efficiency in them [31], our findings shows like Boylu et al that VEP changes are considered as an adequate and reliable means in migraine disease evaluation [22]. Though this investigation underlines classic migraine cases, lack of the subjects suffered from classic migraine with non-visual auras is among limitation of this study. In general, the results we achieved in this research show that VEP changes may not only occur in phases after aura and between the headaches attacks, but it would happen during aura. This finding is an emphasis on VEP value and the necessity for further studies on evaluation of patients suffered from migraine through this method.

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Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

No conflict.

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