Evaluation of visual evoked potentials in children with headache

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Headache is a common problem in childhood. Visual evoked potential (VEP) P100 latencies were recorded in children with headache. Sixty-four patients, aged 10.7±1.2 years, met the criteria of the International Headache Society for the diagnosis of migraine. Fifty-eight patients, aged 10.2±1.3 years, with tension headache and 56 healthy subjects, aged 10.3±1.3 years, as the control group were also studied. Patients with migraine had slightly longer P100 latencies than the other two groups. We conclude that VEP latency recording is a valuable test in the diagnosis of migraine, and can be safely used in children.

Key words: visual evoked potentials, headache, child.

Symptoms of visual and auditory dysfunction such as photophobia and phonophobia are frequently encountered in patients with migraine. Precipitation of migraine attacks mostly by visual stimulants and the predominance of visual ones in migraine aurae suggest a possible role of the visual system in the pathophysiology of migraine[1,2]. Lower threshold for disturbance to light and voice and migraine physiopathology associated with photophobia have not yet been completely understood. However, increase in sensitivity to light and voice in the central nervous system may have a role in the pathophysiology[3]. "Variations" in many parameters and abnormalities in visual evoked potentials (VEP) have been reported in migraine patients[4-6]. In this study we aimed to determine whether recording of VEP has a role in the differential diagnosis of migraine in patients with headache.

Material and Methods

The study included 64 patients (46 female, 18 male) diagnosed to have migraine according to the classification of the International Headache Society[7], 58 patients (32 female, 26 male) with tension headache and 56 healthy controls (34 female, 22 male). "Controls" and the patients had a mean age of 10.4±1.3 (6.8-14.2) years (Table I). Cases with any neurologic disease or visual problems were not included in the study. Patient groups were "constituted" from the cases who had had no attack in the previous week and who were not on any prophylactic treatment. All patients described at least one pain attack in a month, and family history was positive in 62 (54%) of the cases. There was aura in 12 of the cases.

Table I. Characteristics of the Groups

Group	n	Female/Male	Age (year)*
Migraine	64	46/18	10.7±1.2
Tension headache	58	32/26	10.2±1.3
Control	56	34/22	10.3±1.3
p value	–	–	>0.05

*: Values are given as mean±SD.

Visual evoked potential responses were recorded using four channel Eosate Biomedica System (Florence, Italy). During VEP response evaluation, subjects were placed 90 cm away from the TV monitor (Philips video monitor 15-04) so that visual stimulus could be seen. VEPs were performed by checker-board pattern reversal. Stimuli was presented as a checker-board pattern of black and white squares changing every 20 milliseconds (msec) on the TV monitor. In order to keep subjects visually fixated, a plus sign was placed in the middle of the monitor. The monitor was connected to a visual stimulator (Eosate Pattern Stimulator). The monitor was at a 23° angle and the square was at a 1° angle. VEP was done monocularly and pattern reversal stimuli was 1.5 stimuli/sec. In VEP, active electrode was inserted into

the scalp in the midline over the occipital region 5 cm above the inion (Oz). The reference electrode was over the frontal region and the ground electrode was placed on the forearm. Frequency limits were between 0.5-100 Hz and analysis time was 500 msec. A repeat trial to verify reproducibility of the test was performed. A division was selected as a 5 microvolt (μV).

Statistical analysis was performed by one way analysis of variance (ANOVA). If ANOVA test was significant, Tamhane test was used in post-hoc analyses. Results are expressed as mean±SD. Differences with p values less than 0.05 were considered significant.

Results

Visual evoked potential P100 latency values were slightly higher in the migraine group when compared to the tension headache and control groups (p=0.03) (Table II) (Fig. 1).

Table II. P100 Latency and Amplitude Values of the Groups

Group	Latency (msec)*	Amplitude (mV)*
Migraine	103.85±4.73	11.8±1.2
Tension headache	100.98±3.42	10.6±1.2
Control	100.71±3.55	10.5±0.8
p value	<0.05**	<0.05**

* Values are given as mean±SD.
** Significant differences between the migraine and other two groups, p<0.05.

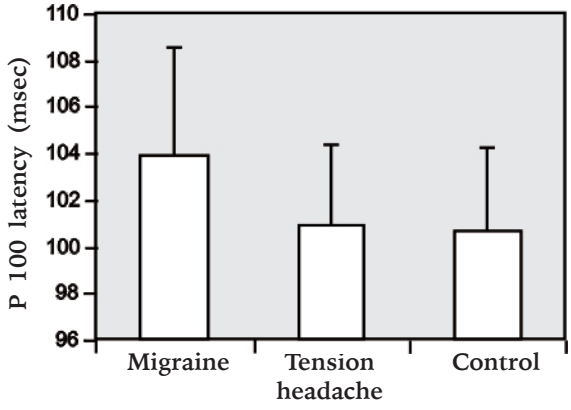

Fig. 1. P100 latency values of the groups.

Visual evoked potential P100 amplitude values were also slightly higher in the migraine group than in the tension headache and control groups (p=0.02). There were no significant differences between the amplitude values of the tension headache and control groups (p=0.85) (Table II).

Discussion

Higher VEP P100 latencies and amplitudes have been reported in a few studies of adult and pediatric patients with migraine[4,5,8,9]. In our study we also found delayed P100 latencies and higher amplitudes in patients with migraine. Abnormalities in VEPs suggest the presence of cerebral hyperexcitability in these patients. Increased sensitivity to light and other stimulants resulting from neuronal hyperexcitability has been shown to cause light intolerance in even painless periods[10]. Chronicle and Mulleners[11] have explained the cause of hyperexcitability as loss of interneuron in the visual cortex resulting from migraine attacks or drugs used in the treatment of migraine. The state of hyperexcitability also detected electrophysiologically may explain the physiopathological basis of VEP abnormalities observed in patients with migraine who are sensitive to, and whose pain is increased by light, noise and smell[12].

There are conflicting results regarding VEP latencies in the studies performed on pediatric migraine patients. Lahat et al.[6] determined VEP abnormalities in migraine patients under five years of age, and proposed that VEP latencies be used in the differential diagnosis of migraine. In another study, Lahat et al.[4] reported significantly greater P100 amplitudes in patients with migraine when compared to patients with headache but without migraine (19.8 μv vs 13.1 μv), and sensitivity and specificity values of 67% and 83% respectively, of VEP 100 amplitude in the diagnosis of migraine. Rossi et al.[13] also reported similar results and emphasized the importance of VEP recording as a diagnostic test in the evaluation of migraine. In another study, higher P100 amplitudes and lower serum magnesium levels have been reported in patients with migraine, and the authors have commented on these findings as cases of lower threshold levels of migraine attacks and as reflecting neuronal hyperexcitability[14]. However, in some studies similar VEP latencies were found in patients with migraine[15,16].

Demyelination precipitated by recurrent cerebral edema and ischemia has also been advocated as the cause of longer P100 latencies in migraine patients[17]. The higher incidence of stroke in patients with migraine when compared to the normal population supports the hypothesis that ischemia may have a role in the etiology[18].

We found slightly increased VEP P100 latencies in children with migraine when compared to the control group. In light of the other studies with similar findings, we conclude that VEP latency recording is a valuable test in the diagnosis of migraine, and can be safely used in children.

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