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Diagnostic Value of Brainstem Auditory Evoked Potential (BAEP) in Migraine

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Abstract: Migraine is a common problem which affects almost 10% of general population. No exact and applicable test ever introduced and the diagnosis of migraine is mainly on the basis of history and physical examination. There is an ongoing debate about the study of Brainstem Auditory Evoked Potential (BAEP) as a diagnostic method of migraine. This study aimed at evaluating this method in migraineurs with and without aura. In a case-control setting, 43 migraineurs and 60 healthy people studied. The diagnosis of migraine was according to the criteria of International Headache Society (IHS). Latency and inter-peak latency of the waves were considered as the mainstays of the test. An instrument employed for stimulation (frequency of 14 stimulus/s; up to 2000 stimuli totally). Forty three patients (10 men, 33 women) with the mean age of 34.37±9.97 years as the case group in addition to 60 healthy people (18 men, 42 women) with the mean age of 32.91±11.17 years as the control group was enrolled in the study. Twenty patients (5 men, 15 women) suffered from migraine with aura and the remaining (5 men, 18 women) were affected with migraine without aura. BAEP was abnormal in 24 (55.8%) patients, mainly for the waves III, III-V and I-III on the right side and the wave I-III on the left. Diagnostic of migraine is generally and basically by history. BEAP can be helpful in some patients; however, its changes are not specific.

Key words: Migraine with aura, migraine without aura, brainstem auditory evoked potential

INTRODUCTION

Brainstem Auditory Evoked Potentials (BAEP) have been largely investigated in migraine patients (Brinciotti and Guidetti, 1986; Shibata and Osawa, 1997; Aloisi and Marrelli, 1997; Afra and Proietti, 1998, 2000; Wang and Wang, 1999; Siniatchkin and Kropp, 2000; Hay and Mortimer, 1994). Despite an impressive accumulation of recent scientific data, the pathogenesis of migraine is still unknown. Hyper excitability of the cerebral cortex in migraineurs has been suggested following studies showing hypersensitivity to environmental light and sound stimuli (Hay and Mortimer, 1994; Aurora and Ahmad, 1998; Wilkins and Nimmo-Smith, 1984; Marcus and Sosa, 1989; Spreafico and Frigerio, 2004; Thomas and Sandor, 2002; Ambrosini and Schoenen, 2003; Evers and Bauer, 1997). Sound stimuli can precipitate migraine attacks that suggesting specific involvement of the auditory system in the pathophysiology of migraine. Routine clinical examination and testing of hearing function are normal in migraine, but disorders of function have been recognized by neurophysiological methods for many years (Khalil and Legg, 2000; Bayazit and Yilmaz, 2005). BAEP test has been used for diagnosis of migraine with different results. Several studies report that in the interictal period of migraine increased latency or interpeak latency of the waves of BAEP characterize migraineurs (especially with aura) compared with controls (Brinciotti and Guidetti, 1986; Shibata and Osawa, 1997; Aloisi and Marrelli, 1997; Afra and Proietti, 1998). The auditory evoked potentials of migraineurs have showed differences with healthy controls (Wang and Wang, 1999; Siniatchkin and Kropp, 2000; Afra and Proietti, 2000). The aim of this study is assessment of latency and interpeak latency of BAEP in migraine with and without aura, while comparing it with a healthy control group.

MATERIALS AND METHODS

In a case-control setting, migraine patients referred to Clinic of Neurology in Tabriz, from April 1st 2006 to May 31st 2007 were evaluated (the case group). Diagnosis of migraine was made on the base of criteria of International Headache Society (IHS). Inclusion criteria were: at least one migraine episode per month, at least 6 months, illness duration. Neurological examination had excluded the presence of any neurological disorder.

The patients included in this study were randomly chosen and the objectives of the research made clear to them and they were willing to take part in the study.

Exclusion criteria were: patients with coexisting tension-type headache or other. Patients who reported headache when they arrived to the test were also excluded

from the analysis. The control group included 60 age-matched healthy participants. The enrolled patients were divided into two groups according to presence or absence of aura.

Procedure: The Brainstem Auditory Evoked Potentials (BAEPs) were recorded using 4-channel (Neuroscreen ®Plus Toennies, Germany). Frequency of stimulation was set at 14 per second, a total of 2000 stimulations. The active, reference and ground electrodes were placed on the right mastoid bone, c_z and the left mastoid bone, respectively. Silver-chloride cup electrodes were used. The latency and interpeak latency of waves with 1+Standard Deviation (SD) from the normal values considered as abnormal results. Data were analyzed with the SPSS statistical software package (version 11.5; SPSS Inc, Chicago). Continuous variables were expressed as mean and categorical data were shown as frequency and percent. The contingency table (The Chi square and the Fisher's exact tests where appropriate) and the Independent samples T test employed for comparisons. P values below 0.05 were considered statistically significant.

RESULTS

Forty three patients, 10 (23.3%) men and 33 (76.7%) women, with the mean age of 34.37±9.97 years (13-55 years) were studied. Sixty people, 18(30%) men and 42(70%) women, with the mean age of 32.91±10.17 years (13-60 years) were selected as the control group. Twenty (46.5%) patients (5 men, 15 women) had migraine with aura and 23 (53.5%) patients (5 men, 18 women) suffered from migraine without aura. The mean duration of migraine from the first onset was 8.30±9.46 years (14.00±14.91 years and 6.58±6.47 years in men and women, respectively). It was <5 years in 5 men and 19 women and = 5 years in 5 men and 16 women. The mean duration of headache was 13.62±15.98 h and 17.28±18.93 h in men and women respectively (p = 0.61). The mean frequency of headache episodes was 3.00±1.51 times/month in men and 2.54±1.40 times/month in women (p = 0.41). There were 24(55.81%) patients with abnormal BAEP results in the case group (55% of the migraineur patients with aura and 56.5% in patients without aura respectively; p = 0.92). The most prevalent abnormality in BAEP results was increased latency of the waves III, IV and III-IV. The mean latency of the waves in the case and control groups has been shown in Table 1. The most frequent abnormal waves were III, III-IV and I-III in the right-side and I-III in the left-side (Table 2). The number of abnormal cases as well as the mean of the waves was not significantly different between the migraineur patients with and without aura (Table 3). Duration and location of headache had no significant effect on the results of BAEP (p>0.05). There was a gender-specific difference between the mean of right wave V (p = 0.01), left wave III (p = 0.034) and left wave V (p = 0.027). The mean number of migraine episodes was significantly higher in patients with abnormal results of BAEP comparing with the patients with normal results of the test (2.78±1.41 time/month vs. 1.40±0.54 time/month, p = 0.037). Relation between following factors with the gender of patients, results of BAEP and the type of migraine is shown in Table 4.

Duration of disease according to less and more than of 5 years, duration of episode of headache according to hours (<5h, 5-12 h, = 12 h) and episode of headache (frequency/month).

Table 1: The mean of latency and inter-peak latency (ms) of the waves of BAEP in patients and control group

Wave	I	II	III	IV	V	I-III	III-V
Controls	1.62±0.12	2.70±0.16	3.73±0.14	4.89±0.26	5.56±0.23	2.11±0.13	1.73±0.16
Patients	1.61±0.11	2.73±0.13	3.78±0.18	4.92±0.18	5.56±0.18	2.17±0.22	1.78±0.13

*BAEP: Brainstem Auditory Evoked Potential

Table 2: Normal and abnormal latencies and inter-peak latencies of the waves of BAEP

		I		II		III		IV		V		I-III		III-V	
Wave															
Side		R	L	R	L	R	L	R	L	R	L	R	L	R	L
Normal	Number	34.0	40	36.0	35.0	29.0	41.0	40	40	36.0	41.0	32	30.0	29.0	40
	Percent	79.1	93	83.7	81.4	67.4	95.3	93	93	83.7	95.3	74.4	69.8	67.4	93
Abnormal	Number	9.0	3	7.0	8.0	14.0	2.0	3	3	7.0	2.0	11	13.0	14.0	3
	Percent	20.9	7	16.3	18.6	32.6	4.7	7	7	16.3	4.7	25.6	30.2	32.6	7

R: Right, L: Left, BAEP: Brainstem Auditory Evoked Potential. *Abnormal results considered as normal±1 standard deviation

Table 3: The mean of latency and inter-peak latency of the waves of BAEP in migraineur patients with and without aura

Wave	I	II	III	IV	V	I-III	III-IV
With aura	1.63±0.11	2.72±0.13	3.74±0.14	4.90±0.18	5.59±0.14	2.12±0.16	1.79±0.11
Without aura	1.60±0.11	2.73±0.13	3.81±0.20	4.94±0.19	5.57±0.21	2.22±0.26	1.76±0.15
P value	0.328	0.806	0.295	0.500	0.657	0.166	0.554

* BAEP: Brainstem Auditory Evoked Potential

Table 4: Frequency of duration and number of headache episodes and duration of migraine according to gender, results of BAEP and type of migraine

		Gender		BAEP		Type of migraine	
Variables		Male	Female	Normal	Abnormal	With aura	Without aura
Episode of headache (duration)	<5 h	4	13	2	15	9	8
	5-12 h	2	6	1	6	3	4
	≥5 h	4	16	2	17	8	11
Episode of headache (frequency/month)	<3	5	18	5*	18	10	13
	≥3	5	15	0*	20	10	10
Duration of migraine	<5 years	5	18	2	21	10	13
	≥5 years	5	15	3	17	10	10

BAEP: Brainstem Auditory Evoked Potential. *p<0.05

DISCUSSION

In recent years, numerous electrodiagnostic studies have been proposed for diagnosis of migraine. BAEP studies are among them which have been led to conflicting consequences. In our setting, study on 43 migraineurs yielded a 55.8% of abnormal results of BEAP, with the most prevalence in the latency of waves III, V and inter-peak latency of III-V; however, assessing the two hemispheres separately, the waves III, III-V and I-III on the right and the wave I-III on the left were the most frequent aberrant components. Likewise, this study revealed no significant relation between the type of migraine (with and without aura) and the location or severity of corresponding headache with the results of BEAP, yet the frequency of spells was meaningfully higher in patients with an abnormal BEAP recording. Yang and Li (2000) and Yilmaz and Mumbuc (2005) showed an abnormal result of BAEP in 53% of 30 migraineurs (increased latency in waves I, III and V) and Yilmaz reported the 35% of abnormality in BAEP. In series by Drake and Pakalnis (1990) in the University of Ohio, USA, BAEPs were recorded during the spell of headache and 7 days after. The wave latencies were increased in the first recording and returned to normal a week after (Drake and Pakalnis, 1990). Bayazit and Yilmaz (2005) studied 20 migraineurs and reported an abnormal result of BAEP in 35% of these patients during the inter-ictal phase, emphasizing on the waves I, III, V, I-III and III-V. Schlak and Grotemeyer (1990) reported abnormality in the waves IV and VI. Kochar and Srivastava (2002) reported increased latency and inter-peak latency in migraineurs. Increase latency of the waves III-V and I-V has been reported by Drake and Pakalnis (1990) in patients with migraine, as well. On the other hand, Bank (1991) and Bussone didn't find any significant differences between the migraineurs and healthy ones considering the results of BAEP. Drake and Pakalnis (1990) concluded that the results of BAEP in the migraineurs are only affected in territory of vertebro-basilar artery.

CONCLUSION

In conclusion, as seen earlier many studies have reported a difference between the results of BAEP in patients with migraine and the others (abnormality in 35%-55%). BAEPs were abnormal in 55.8% of patients in our study. There is not a consensus about the type of this abnormality; different waves are reported to be affected in migraine (I, III, V, III-V, I-V). It's apparent that the results of BAEP are somehow abnormal in the patients with migraine; however, it is neither specific nor sensitive indicator of migraine. This has been partly attributed to diverse pathologic and nonpathologic conditions resulting in an abnormal recording of BAEP.

Diagnostic of migraine is generally and basically by history. BEAP can be helpful in some patients; however, its changes are not specific.

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