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Evaluation of Auditory Brainstem Response (ABR) in Vitamin B12 Deficiency

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ABSTRACT

Purpose: Changes in the central nervous system are observed due to vitamin B12 deficiency. The purpose of this study is to assess the effects of vitamin B12 deficiency on the central auditory tracks utilizing ABR.

Material and Method: 30 individuals (16 females, 14 males) with vitamin B12 deficiency and 30 individuals (17 females, 13 males) without any hearing problem and B12 deficiency have participated in the study. The ages of the individuals with vitamin B12 deficiency varied between 18 and 39, with a mean of 28±5.6, The ages of the individuals with normal hearing in the control group were between 18 and 42, with a mean of 30±6.2. The I, III and V. wave latencies and I-III, I-V and III-V inter-wave latencies and amplitudes of the participants with vitamin B12 deficiency and with normal hearing were evaluated using click stimulus.

Results: No statistically significant change was observed between the group with vitamin B12 deficiency and the normal group in the I, III and V. wave latencies and the I-III, I-V and III-V inter-latency values and amplitudes

Conclusion: Although vitamin B12 deficiency effects the central nervous system, normal latencies and amplitudes were obtained in the ABR test. It was especially observed that the brainstem region, where the I, III ve V. Waves originate, is not effected by vitamin B12 deficiency.

Keywords: Vitamin B 12, ABR, Hearing, Medical Treatment.

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INTRODUCTION

Vitamin B12 is a very necessary nutriment for all body cells. At the deficiency of this vitamin, growth of tissues generally depresses. Reason for this is that vitamin B12 is required for DNA synthesis[1,2]. Deficiency of this vitamin causes cell division to lag behind by stopping maturing of nucleus Systems that are most susceptible to B12 vitamin deficiency are hematopoietic and gastrointestinal systems, which have the biggest cell reproduction speed. In addition neurological system gets affected by this deficiency too. Hematologic and neurologic affects are thought to be irrelavant of each other. There is no relation between neural system eclipse and amplitude of anemia. Neurologic findings are determined on more than %25 of the patients who are detected with B12 deficiency, without having anemia. Main reason of neurologic sypmtoms and findings are progressive demyelination at nerve cells[3-5] . ABR is one of the most oftenly used objective methods for evaluation of hearing. ABR is a measurement technique, which evaluates auditory paths' physical function in an non-invasive way. At ABR, after auditory stimulus is conducted, electrical activities are recorded at hearing nerve and brainstem level by utilizing electrodes that are located at head area[6-8] . Achieved wave forms include many peaks. These waves reflect the neural activation from different locations of auditory paths[9,10] .Purpose of this study is; to reveal the effects of vitamin B12 deficiency on auditory system by utilizing ABR test.

METHODS

30 people (16 women, 14 men) who has vitamin B12 deficiency and 30 people (17 women, 13 men) who does not have hearing problem as well as vitamin B12 deficiency have participated this study. Participants' ages, who had B12 deficiency, varied between 18-39 (28±5,6) whereas control group's ages varied between 18-42 (average 30±6,2). Both study and control group participants had their I, III and V. wave latencies, I-III, I-V and III-V inter-latency values and amplitudes measured and evaluated by utilizing click stimulus. Patients with B12 level less than 220 pg/ml are included as study group and patients without any hearing problem as well as with normal B12 levels are included as control group. For diagnosing vitamin B12 deficiency cobas® C 501 device is utilized. Audiometry (Interacoustics Equinox AC 440 Audiometer Assens, Denmark), immitansmetric observation, ipsilateral and contralateral acoustic reflex (Interacoustics AZ26 tympanometer Assens, Denmark) evaluations are conducted on the patients following their Ear Nose Throat examinations. Patients with normal audiologic findings are evaluated by ABR (Interacoustics Eclipse EP25 Assens, Denmark). At ABR test Etymotic Research (ER-3A) insert earphones are utilized. Patients at lying down position ; negative electrodes (invert) are attached to right and left mastoid (M1 & M2), positive (non-invert) electrodes on forehead and groud electrode is attached between two eyebrows (Fpz). ABR parameters are shown at Table 1. Through ABR test by 70 dBnHL amplitude level click stimulus, double trace I, III and V. wave latencies, I-III, I-V and III-V inter-latency values and wave amplitudes evaluated.

Statistical Analysis: For statistical analysis SPSS (IBM Corp; Armonk, New York, ABD) software package program for Windows 16.0 is used. Whilst study data is being evaluated, alongside descriptive statistical methods (averaging, standard deviation, median) on quantitative data comparisons Student T test is utilized comparing parameters showing normal dispersions among groups, Mann Whitney U test is utilized comparing parameters showing abnormal dispersions among groups. Results are evaluated in a confidence interval and signifance at $p<0.05$ level Table 2.

DISCUSSION

Vitamin B12, which is found an in animal origin nutriments, is an important cofactor of metabolic reactions that are

Table 1. ABR Parameter

Analysis Time : 20 msec
Stimulus Amplitude Level : 70 dBnHL
Filtering : HP: 33 Hz, LP: 1500 Hz
Channel Quantity : 2
Averaging : 2000 sweep
Stimulus repetition rate : 21.1 pps
Electrode mounting : Non-invert electrode (+) on forehead (Fz), ground electrode between two eyebrows (Fpz), invert (reference) electrodes on left (M1) and right (M2) mastoids.

Table 2 : Right ear wave latency and inter-latency and inter-latency averages of control group and group with B12 deficiency

	Control Group Average Wave Latencies (msec)	Average Wave Latencies of Group with Vitamin B 12 Deficiency (msec)	p value
I. wave average latency	1,72±0,25	1,61±0,23	,540
III. wave average latency	3,80±0,29	3,51±0,24	.320
V. wave average latency	5,67±0,19	5,40±0,26	,230
I-III. inter-wave latencies	2,07±0,28	1,90±0,17	,861
III-V. inter-wave latencies	1,87±0,17	1,89±0,20	,420
I-V. inter-wave latencies	3,95±0,24	3,79±0,27	,502

Table 3: Left ear wave latency and inter-latency and inter-latency averages of control group and group with B12 deficiency.

	Control Group Average Wave Latencies (msec)	Average Wave Latencies of Group with Vitamin B 12 Deficiency (msec)	p value
I. wave average latency	1,61±0,17	1,59±0,22	,254
III. wave average latency	3,69±0,25	3,50±0,23	,329
V. wave average latency	5,53±0,22	5,38±0,27	,420
I-III inter-wave latencies	2,08±0,15	1,91±0,25	,488
III-V inter-wave latencies	1,84±0,25	1,88±0,26	,363
I-V inter-wave latencies	3,73±0,27	3,79±0,29	,247

related to DNA sythesis. Vitamin B12 deficiency is a serious health problem especially in developing countries and its incidence is designated approximately around 40percent [11.12] . Hematologic and neurologic variations may also be added to clinic findings of B12 deficiency. Moost common hematologic event is megaloblastic anemia. B12 is an important vitamin, which is affective on neural system in addition to hematologic events. Neurologic events may well develop independently from hematologic anomalies[13]. Cobalamin deficiency may lead to myelopathy. Relevant or irrelevant with neuropathy, may lead to anxiety, fatigue, low blood pressure, attention disorders, deep tendon reflex losses, activity malfunctions, paralysis attacks, lack of interest, developmental and mental disorders, coma at babies and kids.[14,15]. Schenk and friends working on 24 cases with B12 deficiency in 1997, who had mental and motor developmental retarding ; after remediation 16 cases have totally recovered, however 6 cases could not complete full neurologic improvement despite their physical developments were back to normal, reason being late diagnosis[16]. Vitamin B12 deficiency may cause cochlear pathology by affecting cell metabolism, nerve and muscle functions[17]. At the absence of vitamin B12, cochelar nerve's myelination may get damaged and blood circulation to cochelar may be adversely affected[18-22] studies are reported on hearing functions got affected due to vitamin B12 deficiency on adults. At some other studies no results to support this relation are obtained [23,24]. Houston and friends in 1999, showed that there may be relevance between hearing loss and vitamin B12 deficiency on 55 healthy females. In the study, it is found that women with hearing loss have %38 less vitamin B12 than the healthy ones. Lasisi and friends in 2010, could not find any relevance between hearing loss due to elderliness and vitamin B12 levels. Similarly, through another study conducted on 50+ year old patients no relation has been found between hearing loss and vitamin B12 levels [24]. Shemesh and friends through the study they have conducted on military personnel in 1993, they have determined subjects, who has tinnutus complaint, had % 47 lower B12 levels. In addition, he has reported auditory developments on patients following B12 replacement, who previously had B12 deficiency and hearing loss. In 1981, Krumholz and friends have examined 20 individuals' auditory brainstem responds who has B12 deficiency. According to this study, abnormal ABR (extended I-V interpeak latencies) are achieved at 3 out of these 20 individuals in Table 3. These 3 individuals were held subject to re-testing following B12 remediation and 2 out of 3 turned around with normal ABR results. Through this study, due to not having a control group as well as the subject group being so small, no thorough knowledge could be obtained on the effects of B12 deficiency on ABR responds[25].

CONCLUSION

At our study, in comparing griup with B12 deficiency and the control group, nno deviation has been observed between wave latencies and inter-wave latency values.

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