

Original Research Article

Evaluation of effect of brainstem evoked response audiometry in hyperlipidemic patients

Shivakumar Senniappan*, Gowri Paramasivam

Department of ENT, Vinayaka Missions Kirupanandavariyar Medical College and Hospitals, Salem, Tamil Nadu, India

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*Correspondence:

Dr. Shivakumar Senniappan,
E-mail: drshiva73@gmail.com

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ABSTRACT

Background: Brain stem evoked response audiometry (BERA) is a useful objective assessment of hearing. The major advantage of this procedure is its ability to test even infants in whom conventional audiometry may not be useful. This investigation can be used as a screening test for deafness at high risk. This study is to correlate changes in brainstem evoked response audiometry parameters concerning lipid profile.

Methods: The study was conducted between January 2019 to June 2020 on 50 patients attending ENT OPD in Vinayaka Mission's Kirupanandha Variyar Medical College and Hospital, Salem. All patients with auditory and/or vestibular complaints were seen at the otorhinolaryngology OPD and underwent an otorhinolaryngological examination, audiological studies (pure tone audiometry) and an electrophysiological assessment BERA.

Results: The results of BERA was considered. A total of 5 waveforms and 3 interpeak latency waves were calculated. It was recorded from both the ears. There was a significant increase in the values of absolute waves II, III, IV, and V and interpeak latency wave values I-II and I-V.

Conclusions: Early identification of hyperlipidemic patients is useful in preventing disease progression and associated morbidity and mortality. BERA is a non-invasive method which can help us to detect central auditory pathway dysfunction at early stages in hyperlipidemic patients even before the patient's experience symptomatic hearing loss.

Keywords: Hyperlipidemia, Brain stem evoked response audiometry, Deafness

INTRODUCTION

Brain stem evoked response audiometry (BERA) is an objective, non-invasive, and effectual electrophysiological technique of hearing evaluation.¹ It aids in evaluating the auditory pathways emerging from the auditory nerve extending to the brainstem.² Also BERA calculates how our brain can exercise the sounds we hear. BERA documents the replies to clicks or other audio tones that are played which are generated by the brainwaves.³ It helps to identify hearing loss and changes in the central nervous system in both symptomatic and asymptomatic patients with hearing loss. It is contemplated as a short

latency potential, the reason being it takes place at the earliest 10 milliseconds following a sound stimulus.⁴ Hyperlipidemia is distinguished by abnormally elevated measures of lipids (fats) i.e. cholesterol, elevated TG, or both.⁵ Fats take part in an essential role in the body's metabolic activities; nevertheless, when their levels are increased it displays several diseases like coronary artery disease atherosclerosis, stroke, heart attack, renal failure, etc. Hyperlipidemia may conduct in auditory dysfunction.⁶ It has been suggested that microvascular complications influence the hearing of hyperlipidemic individuals. Hyperviscosity of the blood serum, vascular obstruction, or increased vulnerability to noise is perhaps

the cause for auditory dysfunction which arises in hyperlipidemia.⁷ Microscopic examinations have exhibited injury and destruction to the inner ear nerves and vessels of the individuals suffering from hyperlipidemia, which in turn have been speculated as a salient causative component for neuronal deterioration in the auditory system.⁸

METHODS

The study was conducted between January 2019–June 2020 on 50 patients attending ENT OPD in Vinayaka Mission’s Kirupanandha Variyar Medical College and Hospital, Salem. All patients with auditory and/or vestibular complaints were seen at the otorhinolaryngology unit and underwent an otorhinolaryngological exam, audiological studies, and an electrophysiological assessment BERA.

Inclusion criteria

Inclusion criteria were patients below 50 years of age–male and female with normal hearing with total cholesterol>200 mg/dl, high density lipoprotein<40 mg/dl, low density lipoprotein>130-190 mg/dl, very low-density lipoprotein>30, LDL/ HDL ratio>3, patients with normal hearing.

Exclusion criteria

Exclusion criteria were 1) other diseases related to CNS. 2) diseases like diabetes mellitus, hypertension, hepatic disease, renal disease, anemia, and similar illnesses that are likely to affect hearing. 3) chronic alcoholism. 4) patients with presbycusis (50 years and above). 5) pregnancy 50 patients who were newly diagnosed with hyperlipidemia fulfilling inclusion/exclusion criteria, who gave informed consent were subjected to detailed history taking, physical, systemic, and complete ENT examinations including tuning fork tests and pure tone audiometry. Selected patients were subjected BERA.

Statistical analysis

Student’s T-test for single independent samples was applied for the analysis of absolute value and latency period means. Levene’s test was applied for analyzing the equality of variances. Statistically significant values were those below p<0.05. The SPSS 15.0 software was used for these tests. This study was designed to detect a 0.05 ms difference among absolute latency measures and wave interpeak intervals; the statistical power was 80% and the significance level was 5%.

RESULTS

Here, in our study (Table 1), which includes 50 patients, only 1 patient belonged to the age group 11-20 years, 4 patients belonged to the age group 21-30 years, 13

patients belonged to the age group 31-40 years and 32 patients belonged to age group 41-50 years.

Table 1: Age distribution.

Age distribution (years)	No. of Patients
0-10	0
11-20	1
21-30	4
31-40	13
41-50	32

Table 2 in our study, the average values of the Total Cholesterol, HDL, LDL, VLDL, and LDL/HDL ratio are given below. The mean values in terms of mg/dl are as follows: 1) total cholesterol-205.5 (normal<200) 2) HDL– 37.13 (normal>40) 3) LDL– 142.64 (normal<130) 4) VLDL– 35 (normal<30) 5) LDL/HDL ratio– 3.2 (normal<3).

Table 2: Lipid profile.

Lipid profile	Normal value (mg/dl)	Mean value (mg/dl)
Total cholesterol	<200	205.57
HDL	40-60	37.13
VLDL	<30	34.998
LDL	<130	142.64
LDL/HDL ratio	<3	3.24738

Figure 1 total of 5 waveforms and 3 interpeak latency waves were calculated. It was recorded from both the ears. It was found that in wave-I the mean values in both right (1.51 ms) and left (1.53 ms) ears were not statistically significant. The mean values of wave-II in the right ear were 2.96 ms and in the left ear, it was 3.05 ms. In wave-III the mean values in the right ear were 4.27ms and in the left ear, it was 3.98ms. In wave-IV the means values were 5.28 ms and 5.17 ms respectively in right and left ears. Wave-V showed mean values 5.60ms and 5.72ms in the right and left ears. The interpeak latency I-III in the right ear showed 4.28ms and in the left ear 4.13 ms. The IPL III-V for the right ear was 1.92 ms and 1.89ms in the left ear. IPL I-V was 4.41 for the right ear and 4.28 for the left ear.

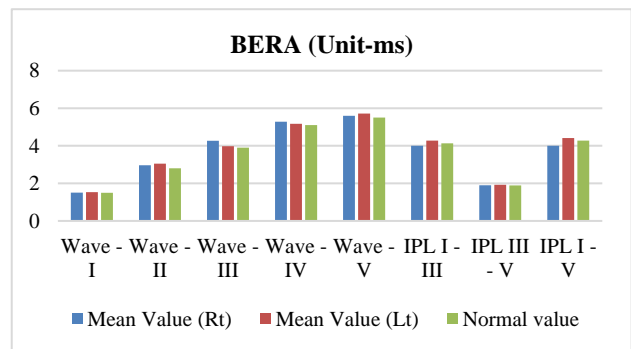


Figure 1: BERA wave.

DISCUSSION

BERA helps us in the gauging of the auditory nerve, brainstem, and subcortical structures after auditory stimulation.⁹ The main aim of our study was to determine the relationship between BERA to that of cholesterol and lipids.¹⁰ It is believed that cholesterol is an essential constituent of a cell membrane because it balances them and harmonizes lipid transportation beyond the membrane.¹¹ As far as cochlea is concerned the lipid configuration, fluctuation, and firmness of the outer hair cell's membrane are suggested to be vital for its electro motile purpose and cochlear amplification.¹² This information suggests that outer hair cell function may be distinctly delicate to hyperlipidemic circumstances as stated by Oghalai et al.¹³ Pillsbury et al from his study said that males were more affected than females. The interpretation of BERA waves is as follows; 1) wave I—peripheral nervous system involvement. 2) wave II—central nervous system involvement.¹⁴ Our study reveals no significant change in the absolute latency of wave-I in hyperlipidemic patients in both ears suggestive of no peripheral involvement. It shows the absence of peripheral hearing impairment in hyperlipidemic patients.¹⁵ Whereas when other waveforms were concerned there was a significant increase in the values of absolute waves II, III, IV, and V and interpeak latency wave values I-II and I-V. There was no change in wave-I and in interpeak latency waves III-V. The above findings were supported by the studies performed by Rosen et al In another study which was done by Rosenhall et al concluded that there were notable changes in the IPL waves I-III and I-V which further aided our study.¹⁶ Among all the variables in the lipid profile, it was found that there was a statistically significant relationship between low-density lipoproteins and many waveforms in the hyperlipidaemic group. Thus, low-density lipoproteins may be of prime importance in auditory dysfunction. However, there are not many studies done to prove or support our study.¹⁷ Ruth et al believed that diet is a primal factor for averting coronary artery disease and hearing loss. Central auditory pathway dysfunctions at early stages in hyperlipidemic patients even before the patient experiences symptomatic hearing loss.¹⁸ Thus early identification, lifestyle modifications, and early treatment can prevent auditory dysfunction and hearing loss in hyperlipidemic patients.^{19,20}

CONCLUSION

Hearing status in newly diagnosed hyperlipidemic patients by using BERA highlights the functional integrity of the central auditory pathway. This pathway is affected in these patients showing an increase in the latencies of BERA waves II, III, IV, and V in both ears and interpeak waves I-III and I-V. Hyperlipidemia is an important etiological factor causing hearing loss particularly presbycusis and progressive sensorineural hearing loss which is already well established. It is also evident that as lipid levels reduced, the progression of

hearing loss also stopped. It is proved that hyperlipidemia may cause ischemic changes in both large and small blood vessels leading to vascular compromise. Many investigators who have analyzed the possible correlation between hearing loss and high serum cholesterol levels have found that hearing appears to be influenced by high blood lipids.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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