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Research Article

VEP's in Hypertension

Effect of Visual Evoked Potentials in Patients with Primary Hypertension

Jalsi Joseph[1], Danti Joseph[2]*, and Abraham Sam Jefferson Bennet[3]

[1]*Assistant Surgeon, P&T Colony UPHC, Madathur, Tuticorin- 628008*

[2]*Assistant Professor, Department of Physiology, Sree Balaji Medical College and Hospital, Chrompet, Chennai- 600044*

[3]*Junior Medical Officer, Bethany Health Care Centre, CMCT building, Mukta Gardens, Chetpet, Chennai- 600031*

Abstract: Hypertension can cause vascular endothelial changes which can lead to hyalinization and demyelination. It also causes hypertensive retinopathy and retinal artery atrophy in chronic hypertensive patients. Retinal artery atrophy can lead to demyelination changes in the optic nerve. Visual evoked potentials (VEPs) can be used as a sensitive method for documenting the abnormalities in the visual pathways. VEPs are electrical potential differences recorded from the scalp to the visual stimuli. The demyelination changes of optic nerve in early stages of primary hypertension were not studied much. Hence, this study was aimed to assess the effect of VEP in primary hypertension. The main objective of this study was to correlate the latency and amplitude of VEPs in normal individuals and primary hypertensive patients. This is a comparative study which was done between two groups. Group A was a control group with 60 normal participants and group B was a study group that had 60 primary hypertensive patients. Pattern reversal VEP (Parameters – N_{75}, P_{100} & N_{145} latencies and amplitude of P_{100}) was recorded in both groups. The variables were correlated between group A and group B. In the result of this study, the VEP latencies of N_{75} and P_{100} waves was increased (duration delayed) significantly in both right eye and left eye of participants in Group B than Group A. Amplitude of P100 wave was decreased in both eye, but it is not statistically significant in left eye. VEP parameters can be used for routine screening and diagnostic tests for visual impairment and hypertensive retinopathy even in earlier stages of hypertensive patients.

Key words: Visual Evoked Potential, Primary Hypertension, Visual Impairment.

***Corresponding Author**

Danti Joseph , Assistant Professor, Department of Physiology, Sree Balaji Medical College and Hospital, Chrompet, Chennai- 600044

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1. INTRODUCTION

Hypertension defined as chronic elevation in systemic arterial blood pressure (BP>140/90 mmHg).[1] Hypertension due to unknown origin is known as primary hypertension. Primary hypertension, also called "essential hypertension", is one of the major public health problems. The individuals with systolic blood pressure ranging from 120 to 139 mmHg and diastolic blood pressure of 80 to 90 mmHg are classified as pre hypertensive. Severe chronic hypertension may lead to lot of complications in many organ systems in the body.[2,3] Involvement of cerebral vascular endothelial changes in the central nervous system majorly contribute to more morbidity and mortality[4,5]. This cerebral vascular endothelial change includes, retinal artery atrophy and hyalinization that leads to demyelination in optic nerve and infarction of retinal artery.[6] The vascular endothelial changes like hyalinization can lead to demyelination which would seriously affect the integrity of the sensory impulses in sensory nerve pathways of brain. The integrity of sensory pathways in the brain was not well documented in primary hypertension. The demyelination changes can be evaluated in early stages by Sensory Evoked Potentials. They find the functional integrity of the sensory pathways. They also help in assessing the neurological functions of adjacent structures. The Sensory Evoked Potential includes Visual Evoked Potentials (VEPs), Brainstem Auditory Evoked Potential (BAEP) and Somatosensory Evoked Potential (SSEP)[7].Visual Evoked Potentials (VEPs) are electrical potential differences recorded from the scalp in response to the visual stimuli. It represents the mass response of the cortical and sub cortical areas to the visual stimuli. It provides the sensitive method for documenting the abnormalities in the visual pathways[4,5]. Hypertensive retinopathy in chronic hypertension is a proved complication in hypertensive patient, but retinal artery endothelial changes which lead to retinal artery atrophy can cause demyelination in optic nerve even in early stages of primary hypertension and it can also be the reason for visual disturbances.[6] The optic nerve is one of the sensory nerve which can be affected by retinal artery atrophy due to hypertension even in early stages of primary hypertension. Hence this present study was aimed to evaluate the changes in visual pathway of hypertensive individuals by Visual Evoked Potential. The main objective of this study was to measure the latency and amplitude of VEP in normal individuals (control group), to measure the latency and amplitude of VEP in primary hypertensive patients (study group) and to correlate the measured latency and amplitude of VEP between control group and study group

2. MATERIALS AND METHODS

The institutional research ethics committee approval was taken to conduct the study in the Electrophysiology Research Laboratory of the Department of Physiology, Sri Manakula Vinayagar Medical College and Hospital (SMVMCH), Pondicherry (Ref. No. SMVMCH-EC/DDO/AL/213/2016). It was a hospital based cross-sectional analytical study. Based on previous study, the sample size was calculated to be 120.[8] The participants were separated into two groups: Group 'A' (control group) with 60 normal individuals and Group 'B' (study group) 60 individuals with primary hypertension[9-11]. The study group was selected from the patients attending the medicine OPD. The purpose and procedure of the study was explained to all the study participants. The consent form was made available to the subjects in their native language, and written consent was taken from the study participants in prescribed format. After obtaining medical history, a thorough physical examination was performed on all the participants. The subjects of both gender, age group between 40 to 70 years with newly diagnosed primary hypertension and who initiated their treatment within 2 months are included in this study. Individuals with refractive errors, secondary hypertension, diabetes, taking any long term medical treatments, smokers, and alcoholics were excluded from the study[12-16]. After obtaining informed consent, relevant medical and surgical history was collected from the participants in data collecting performa. Anthropometric measurements like height, weight and d Body mass index (BMI) were measured. VEP measurements were recorded using EMG EP MK II equipment (Electromyography, Evoked potential machine, MK II model, Recorders and Medicare System Private Ltd. Chandigarh, India).[11]

3. STATISTICAL ANALYSIS

The data collected were analysed using Microsoft office excel 2007 and by using statistical software – SPSS (Software Package for the Social Science) version 24. The level of significance was tested between group A and group B using the student's t-test. The 'p' value < 0.05 was considered statistically significant.[8]

4. RESULTS

The pattern reversal visual evoked potential was recorded in 120 participants. In that, 60 participants in group A were normal persons (considered as a control group). Other 60 participants in group B (considered as study group) were diagnosed as primary hypertension when they attended the general medicine OPD. Table 1A showed the average mean value of (Mean ± Standard Deviation) height, weight, systolic and diastolic BP of participants in both groups. Table 1B showed both group's (Group A- Control group and Group B- Study group) gender difference in percentage.

Table 1A- The Average Height, Weight, Systolic and Diastolic BP of participants in both groups (Group A- Control group and Group B- Study group)

S. No.	Variables	Group A	Group B
1.	Height (cm)	158.2 ± 7.69	161.46 ± 9.45
2.	Weight (kg)	67.3 ± 13.33	60.8 ± 10.12
3.	Systolic BP (mmHg)	116.6 ± 2.66	146.4 ± 6.24
4.	Diastolic BP (mmHg)	82.24 ± 3.98	94.4 ± 4.76

Values expressed as Mean ± Standard Deviation, cm- centimeter, kg- kilogram, mmHg- millimeter of mercury. p value < 0.05

Table 1B- Gender Difference in both groups		
Gender	**Group A (%)**	**Group B (%)**
Female	40	33.3
Male	60	66.7

Values expressed in percentage (%)

Table 2 showed the Mean ± SD of latencies N_{75} and P_{100} waves of both groups. The latency of N_{75} and P_{100} waves were increased (duration delayed) significantly in both right eye and left eye of participants in Group B than the individuals in Group A. Other VEP parameters like N_{145} wave latency were increased in both eyes, but not statistically significant. The amplitude of the P100 wave was decreased in both eyes, but it is also not statistically significant in the left eye. This showed that, primary hypertension can cause significant delay in the conduction of nerve impulses in the optic nerve pathway.

Table 2- The VEP parameters (Latency of N_{75}, P_{100} and N_{145} waves, Amplitude of P_{100} wave) of Right and Left eye of participants in both groups. The Values are expressed as mean ± Standard Deviation (SD).

VEP Parameters	Group A (Normal) (n=50) (Mean ± SD)		Group B (Cataract) (n=50) (Mean ± SD)		'p' value (<0.05 = significance)	
	Right Eye	Left Eye	Right Eye	Left Eye	Right Eye	Left Eye
Latency of N_{75} (ms)	77.16 ± 2.67	71.75± 7.42	79.04 ± 7.95	74.48 ± 2.64	0.006	0.02
Latency of P_{100} (ms)	103.16 ± 1.69	108.37 ± 1.95	104.97 ± 8.34	109.45 ± 8.34	0.0001	0.0004
Latency of N_{145} (ms)	146.15 ± 7.94	147 ± 8.71	149.47 ± 8.42	150.03 ± 14.69	0.2	0.2
AmplitudeP_{100}-N_{145}(1V)	9.38 ± 1.99	5.04 ± 1.85	5.31 ± 2.35	4.95 ± 2.35	0.01	0.5

5. DISCUSSION

Even though the fact that, the primary hypertension can lead to hypertensive retinopathy is confirmed, the sensory changes in the optic nerve pathway remain unclear. Potential investigations are sensitive in determining the intactness of the sensory pathway. The latency delay in sensory evoked potentials is found in metabolic diseases and central demyelinating diseases.[6] Also many previous studies showed finding of significant change in VEP with normal fluctuation in demyelinating diseases like multiple sclerosis and changes in VEP parameters were recorded in iron deficiency anemia, hypertension and cardiac fluctuations in carotid pressure and heart rate[14-16]. This study was done to find out the changes in VEP parameters in primary hypertensive patients. The study results showed that the latencies of VEP parameters N_{75}, P_{100} and N_{145} were prolonged in group B. Also there was reduction in amplitude of P_{100} wave which was not statistically significant in this present study. This indicates that there is conduction delay in the optic nerve due to primary hypertension[8]. In 1994 Marsh et al., conducted a study to find the effects of preeclampsia in visual evoked potential. They documented the delay in P_{100} wave latency of VEP in preeclampsia patients.[11] In 1997 Tandon et al., documented prolongation in P_{100} wave latency in VEP of hypertensive individuals in their study.[12] The same results were documented in this present study which confirmed the impairment in sensory conduction of visual pathway in primary hypertension. This pathological change in sensory conduction of visual pathways in hypertension may be due the arterial spasm of blood vessels in the central nervous system. Smoog I, Lernfelt B et al., done a study on "15-year longitudinal study of blood pressure and dementia". In which, they explained the importance of how long a person had blood pressure before developing dementia. They reported that, the increased BP may increase the risk for dementia by causing small vessel diseases and white matter lesions. This confirmed, that the present study result may be because of changes in retinal artery which can be the reason for conduction delay in the optic nerve[17]. This present study also has limitations like less sample size, and the stage of demyelination in the patients could not be evaluated in this study.

6. CONCLUSION

The VEP evaluation showed the involvement of anterior visual pathway in individuals with primary hypertension before development of hypertensive retinopathy. Based on the study findings, we conclude that, the impairment in visual sensory conduction in primary hypertensive patients was significant and thus signifies the need for early diagnosis and treatment in hypertension. And it also emphasizes the importance of maintaining the blood pressure within the normal range. VEP parameters can be used for routine screening and diagnostic tests for hypertensive retinopathy in earlier stages of hypertensive patients.

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8. AUTHORS CONTRIBUTION STATEMENT

Dr Jalsi Joseph have contributed by giving the concept and idea for this study. Dr Danti Joseph gathered the data and analyzed the data for this study. Dr Abraham Sam Jeferson Bennet gave inputs in designing this study.

9. CONFLICT OF INTEREST

Conflict of interest declared none.

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