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Physiology

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EFFECTS OF AGE ON VISUAL EVOKED POTENTIAL VALUES

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ABSTRACT

AIM OF THE STUDY: To evaluate the effect of aging on Visual Evoked Potential latencies and wave amplitude.
METHOD AND MATERIALS: The study was conducted in the department of Physiology, MMIMSR, Mullana (Ambala). The study comprised of 100 healthy subjects between the age group of 21-60yrs consisting of both males and females. The subjects were divided into 4 age groups each consisting of 25
SUBJECTS: Group 1. 21-30 years, Group 2. 31-40years, Group 3. 41-50 years and Group 4. 51-60years.The equipment used was Allengers Scorpio EMG EP NCS system provided by Allengers Medical system Limited, Chandigarh. VEP was evaluated by voltage changes generated following application of pattern reversal visual stimulus to the visual system.
RESULTS: From the analysis of data, latency of N75 wave of both right eye and left eye are increasing highly significantly with advancement of age(p value= .0008).Latencies of P100 and N145wave are also increasing significantly in both right and left eyes with increasing age(p value lesser than .0001 and .018 respectively). Amplitude of P100 wave of left eye is decreasing significantly with advancement of age with p value .03 and amplitude of P100 wave of right eye is decreasing non significantly.
CONCLUSION: There is significant effect of aging on VEP latencies and amplitude values in our study. With advancement of age, latencies are prolonged and amplitudes get shorter in our study.

INTRODUCTION:

Evoked potentials are the record of electrical activity produced by groups of neurons with in the spinal cord, brainstem, thalamus or cortical hemispheres following stimulation of one or another system by means of visual, auditory or somatosensory input[1]. The Visual Evoked Potentials (VEPs) result from change of brain activity following application of intermittent visual stimulus to the visual system. They provide a quantitative measure of the functional integrity of the visual pathways [2]. The function measured includes that of the optic nerve through the optic chiasma and the tract, to the lateral geniculate bodies and the geniculocalcarine projection to the visual cortex "area 17"[3].

Vision is appreciated by contrasting the point focussed with the background. This reversal of focus of the object versus background is likely to have an imprint on the Visual Evoked Potentials. This technique of VEP recording is pattern reversal and is the preferred stimulus.[4]

In VEP responses NPN waveform complex is formed. It has 3 components- N75, P100, N145 latencies in msec[5]. Increase in the latency of P100 wave in ms determines diagnosis of various disorders of the visual pathway in the brain.

Visual sensation is affected by aging process due to changes in refractory media of eye and alteration in elasticity of lens. There are degenerative changes in retina as well as degenerative neural changes with advancement of age. In all these cases examination of visual field has been a tool for diagnosis with the induction of electrical voltage studies.

Age has also effect on the VEP values. There is reduction of amplitude and increased latency occur with increase of the age[6]. There is an increase of P100 latency at the rate of 2.5ms after the fifth decade of life[7,8]. It is due to the degenerative changes in the retina and rostral part of the visual system[9] and several optical and mechanical alterations in lens and iris with advancing age. In addition the effect of age on P100 latency is more pronounced with smaller pattern[10] and under conditions of lower luminance. With this study we sought to contribute to the estimation of the age effect on the values of the Visual Evoked Potential(VEP) and to assess the importance of age factor for clinical examinations of individual subjects.

MATERIAL AND METHOD:

The study was conducted in the department of Physiology, MMIMSR, Mullana (Ambala). Institutional ethics committee approval had been taken.

The study comprised of 100 healthy subjects between the age group of 21-60yearrs in an around consisting of both males and females.Subjects were divided into 4 age groups-

1. Group I - 21-30 yrs
2. Group II - 31-40yrs
3. Group III - 41-50 yrs
4. Group IV- 51-60 yrs

Informed written consent was taken from volunteers. Anthropometric data i.e. age, height, weight was noted and they were screened for any history of drug intake or medical illness which are likely to affect the VEP study parameters based on clinical history and physical examinations including detail optic assessment.

INCLUSION CRITERIA:

- Best-corrected visual acuity 6/6 (with or without corrective glasses).
- Full and Normal field of vision
- Normal optic nerve head and retinal nerve fibre layer on clinical examination
- Normal pupillary size (2-4mm) and reactions
- Normal Fundus and optic disc

EXCLUDING CRITERIA:

1. Multiple sclerosis
2. Glaucoma
3. Ischaemic optic neuropathy
4. Optic neuritis
5. HIV infection
6. Vitamin B12 deficiency
7. Nutritional and Toxic optic neuropathy
8. Hereditary and Degenerative diseases
9. Compressive lesions affecting anterior visual pathways
10. Cortical blindness
11. Diabetes mellitus
12. Malingering and Hysteria

Pre-test evaluation:

For obtaining the best result of VEP testing, subjects were advised to come without applying any hair oil or hair chemicals and to put their usual glasses or corrective lenses. Subjects were explained about the test to ensure full cooperation and to avoid subject's

inattention and defocusing during the test procedure.

Recording Procedure:
The equipment used was Allengers Scorpio EMG EP NCS system provided by Allengers Medical system Limited, Chandigarh. VEP was evaluated by voltage changes generated following application of pattern reversal visual stimulus to the visual system.

Skin electrodes (EP disk electrodes) were used. Skin was prepared by cleaning and paste (conduction paste) used to ensure good, stable electrical connection.

The electrodes on scalp were placed relative to bony landmarks as per international 10/20 system. The anterior/posterior midline measurements were based on distance between nasion and inion. For visual evoked potential study, electrode placement was-

1. Reference- placed on frontal bone (Fpz).
2. Ground- placed on vertex(Cz).
3. Active (recording)- placed on 2-4 cm above the inion, on the scalp over visual cortex

Pattern stimuli:
The standard pattern stimulus is high contrast black and white checkerboard. The viewing distance (typically between 50-150 cms) to be adjusted to get a suitable field size and required check sizes. For pattern reversal protocol black and white check changes phase abruptly (black to white and white to black). A reversal rate of a reversal per second was used to elicit standard pattern reversal VEP (each full circle consists of two reversals which equates to a frequency of 1.0 Hz). The stimulus rate, the number of reversals, the mean luminance, the pattern contrast and field size was specified.

- The rate of pattern reversal was 1 Hz.
- The recording sensitivity was kept at 2μV
- The electrode impedance was kept below 5KΩ.

Following parameters were recorded. They were-

1. Latency for P100 wave in ms.
2. Latency for N75 wave in ms.
3. Latency for N145 wave in ms
4. Amplitude of P100 wave in microvolt(μv).

Statistical Method:
The values were statistically analysed and result expressed as mean±SD. The values were correlated in all age groups by using ANOVA.

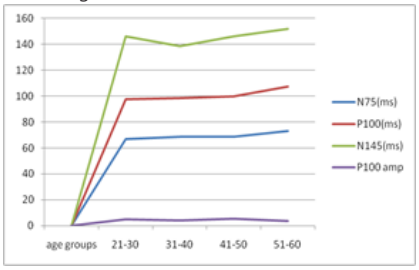
RESULTS AND ANALYSIS
Our study comprised of 100 subjects consisting both males and females in 4 age groups- Group I. 20-30 Group II. 31-40 group III. 41-50 and Group IV. 51-60. Latencies in ms and amplitude in μv of N75, P100 and N145 waves in mean±Sd of left and right eye in different age groups with their p value are shown in table 1.

TABLE 1- Mean± SD of N75, P100, N145 latencies in ms and P100 wave amplitude in μv along with their p value.

	Group I	Group II	Group III	Group IV	P value
N75 left	66.96±4.51	68.64±5.16	68.56±6.28	73.19±8.06	<.001
right	66.55±4.89	69.26±4.74	70.50±5.10	73.31±7.60	<.001
P100 left	97.72±3.80	98.69±3.14	100.09±3.39	107.57±5.65	<.001
Right	99.08±3.63	99.13±3.28	100.42±3.67	108.56±5.33	<.001
N145 left	146.12±15.85	138.51±11.13	146.14±14.47	151.78±16.40	<.05
Right	146.68±16.12	139.42±11.50	144.80±14.19	155.65±15.17	<.05
P100 amp left	4.98±2.11	4.08±1.70	5.57±3.04	3.76±2.43	<.05
Right	4.75±1.99	3.84±1.71	4.86±2.62	3.68±1.82	>.05

In our study, latencies of N75 and P100 waves of both eyes are increasing with advancement of age with high significance. Latency of N145 wave in both eyes is increasing significantly with increasing age. Amplitude of P100 wave is decreasing with advancement of age significantly in left eye and non-significantly in right eye.

DISCUSSION: VEP is the electro-physiologic test that assesses visual cortical activity. In our study, P100 wave latencies are increasing highly significantly in advancing ages beyond 50 years. Our results correlates with the Stockard who agree that the latency of the P100 remains unchanged from the late teens into the late fifties and then increases significantly thereafter[7]. This has been attributed to age-related changes in both retina and the rostral part of visual system. Sokol showed the effect of age on P100 latency is more pronounced with smaller pattern[10] and under conditions of lower luminance.Similar study was done by La March and Synder who Studied age-related changes in amplitude of the P100 component of PREP. They found no significant changes in amplitude over the lifespan[11,12]. Studies done by Allison Truet et al and Tumas et al who found that, in the range of 20 to 59yrs there would be no change in latency, but the changes are more pronounced after age 60.



Graph showing N75, P100, N145 and P100 amplitude Values in different age groups

CONCLUSION:
Our study shows that age is an important physiological factor which affects the various values of Visual Evoked Potential. In our study N75, P100, N145 wave latencies are prolonged significantly beyond 50 and P100 wave amplitude in μv is decreasing significantly in left eye and non-significantly in right eye beyond 50.

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