

“CHANGES IN PATTERN OF VISUAL EVOKED POTENTIAL IN DIFFERENT PHASES OF MENSTRUAL CYCLE.”

*Dr Rahul Mittal ,DrJaishreeTapadia, Dr(Mrs)P.S.Tonpay

Department of Physiology, Sri Aurobindo Medical College & P.G. Institute, Indore, India.

*Corresponding author: Email- rahulisgreat4u@gmail.com

Abstract:

Introduction: A visual evoked potential is electrical potential difference recorded from the scalp in response to visual stimuli. The VEP tests the function of the visual pathway from the retina to the occipital cortex. It is a simple, non-invasive electrophysiological test. The present study was planned to evaluate the changes in pattern of visual evoked potential (VEP) in different phases of menstrual cycle .

Materials and methods: The study included 50 young healthy female medical students of age group 18 to 25 years having regular menstrual cycles. The left and right eye tested separately in all subjects by giving mono ocular stimulation. The important parameters of VEP latency and amplitude of P 100 was measured. The statistical analysis was done by Student unpaired 't' test.

Results: There was statistically significant prolongation of latency P 100 wave and decrease of amplitude of VEP in follicular phase as compare to luteal phase.

Key Words: Visual evoked potential, Menstrual cycle, Follicular phase, Luteal phase.

INTRODUCTION :

A visual evoked potential (VEP) is an electrophysiological potential that can be extracted, as a signal, from the electrical activity of brain which is recorded at the scalp. It is caused by a visual stimulus, such as an alternating checkerboard pattern on a computer screen and responses are recorded from electrodes that are placed on the head and observed as a reading on a monitor. These responses originate from the occipital cortex, the area of the brain involved in receiving and interpreting visual signals.¹ The VEP can provide important diagnostic information regarding the functional integrity of the visual system. The current standard VEP represents the basic responses which is recorded by three recording channel frontal, midline recording channel with an occipital active electrode. Because chiasmal and retrochiasmal diseases may be missed using a single channel, three channels are used to test the patients for chiasmal and

retrochiasmal diseases may be missed using a single channel, three channels are used to test the patients for chiasmal and retrochiasmal dysfunction. VEP peak latency and amplitude are used as the parameters. VEP peak latency refers to the time from stimulus onset to the maximum positive or negative deflection. VEP peak latency may also be referred to as 'time to peak' or peak time.

The menstrual cycle influences various clinical and neurological conditions such as atopic dermatitis, diabetes, asthma, rheumatoid arthritis, pulmonary edema, myasthenia gravis, multiple sclerosis, aneurysms, meningioma, epilepsy, and migraine may be worse during pre-menstrual phase.² EEG also varies during different phases of the menstrual cycle.³ The human menstrual cycle lasts for 28 days and divided into 4 phases: - follicular, ovulatory, luteal and menstrual. Since, during the menstrual cycle, changes in neuronal activity as well as in auditory, olfactory, and taste thresholds have been documented, this study attempts to

investigate variation in VEP parameters during the various phases of menstrual cycle.

MATERIAL & METHOD:

The study group comprised of fifty young healthy female medical students of age group 18 to 25 years having regular menstrual cycles. They were apprised of the nature of the study and their formal consent was obtained prior to the tests.

Inclusion criteria : Females in the age group of 18 to 25 years old with corrected visual acuity, no color-blindness, no history of physiological or psychological disorders, no history of drug abuse and regular menstrual cycles (lasting 25 to 35 days)

Exclusion criteria : History of seizures, Glaucoma, Diabetes, Any ocular infections, Fainting, Brain trauma, If they are currently taking any long-term medication

We studied the changes in latency and the amplitude of P100 wave of pattern reversal of VEP in both the phases of menstrual cycle - Follicular phase and Luteal phase as determine by previous menstrual cycle history and changes in basal body temperature.

Precautions required before performing the test:

Washing hair the night before and avoiding hair chemicals, oils and lotions.

Ensuring adequate sleep on previous night.

Test conducted with corrective lenses, if worn.

Any medications that cause drowsiness and affect the size of pupil should be avoided.

Physical and mental relaxation.

VEP Recording

VEP recorded with RMS equipment. VEP test was performed in a specially equipped electro diagnostic procedure room (darkened, sound attenuated room). Initially, the subjects were made to sit comfortably

approximately 100 cm away in front of the monitor. The visual stimuli were checkerboard patterns (contrast 70%, mean luminance 50 cd/m²) generated on a video monitor. The check edges subtend a visual angle of 15 minutes with video monitor screen subtending an angle of 12.5°.The checks of alternate black/white reversed at a rate of approximately twice per second. Every time the pattern alternates, the subject's visual system generates an electrical response that was detected and recorded by surface electrodes. The subjects were asked to focus his gaze onto the center of the screen. Each eye was tested separately (monocular testing).

Electrodes Placement :The scalp electrodes should be placed relative to bony landmarks, according to the International 10/20 system.⁴Electrodes were fixed with paste in the following positions: active electrode at Oz, reference electrode at Fz, ground on the vertex Cz. The bioelectric signal was amplified (gain 20,000), filtered (band-pass, 1-100 Hz), and 150 events free from artifacts were averaged for every trial.

Observations & Results:

The mean P₁₀₀ latencies in both the eyes of subjects during follicular phase were significantly prolonged (p<0.05) in comparison to luteal phase i.e. 99.2 ± 6.34 Vs 94.5 ± 6.7 (right eye), 100.2 ± 5.8 Vs 95.02 ± 6.2 (left eye).

The P₁₀₀ amplitudes in both the eyes of subjects during follicular phase were significantly lower(p<0.05) in comparison to luteal phase i.e. 5.9 ± 2.8 Vs 8.7 ± 3.4 (right eye), 5.8 ± 2.5 Vs 8.01 ± 3.02 (left eye).

Statistical analysis was performed using the unpaired t-test.

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Table No. 1

Age distribution of subjects

Age (yrs)	Total no. of cases	Percentage
Range		
18-20yr	34	68%
21-25yr	16	32%
Average Mean \pm SD 20 \pm 1.54	50	100%

The study conducted on the 50 subjects. Average mean age for the entire population was 20 \pm 1.54 yrs.

Table No. 2

Mean P100 latencies and amplitudes of VEP in relation to menstrual phase

Menstrual cycle phase	Total no. of cases	P100 Latency (milli sec) (Mean \pm S.D.)		P100 Amplitude (micro volt) (Mean \pm S.D.)	
		Right	Left	Right	Left
Follicular phase	50	99.2 \pm 6.34	100.2 \pm 5.8	5.9 \pm 2.8	5.8 \pm 2.5
Luteal phase	50	94.5 \pm 6.7	95.02 \pm 6.2	8.7 \pm 3.4	8.01 \pm 3.02
Total	50				

DISCUSSION : The present work has been carried out with a view to evaluate the changes in the patterns of visual evoked potential during follicular and luteal phases of menstrual cycle in medical students. All the subjects were thoroughly examined and subjected to VEP tests after a detailed history. The findings are discussed below:-

Correlation of visual evoked potential with phases of menstrual cycle :

The mean P₁₀₀ latencies in both the eyes of subjects during follicular phase were significantly prolonged

in comparison to luteal phase i.e. 99.2 \pm 6.34 Vs 94.5 \pm 6.7 (right eye), 100.2 \pm 5.8 Vs 95.02 \pm 6.2 (left eye) (p<0.05).

The P₁₀₀ amplitudes in both the eyes of subjects during follicular phase were significantly lower in comparison to luteal phase i.e. 5.9 \pm 2.8 Vs 8.7 \pm 3.4 (right eye), 5.8 \pm 2.5 Vs 8.01 \pm 3.02 (left eye) (p<0.05).

In previous study there were also changes in VEP. P₁₀₀ amplitudes increased in luteal phase, significantly (10.44±/-3.15 vs. 8.62±/-3.09 microV, P<0.05) compared with the follicular phase, and reduction in latency in luteal phase significantly (101.29±/-4.42 vs. 104.76±/-5.02 ms, P<0.01).⁵ It is important to point out that the P₁₀₀, N₁₉, and P₂₂ potentials are generated in multisynaptic pathways, and that the observed reduced latencies during the progesterone phase are probably caused by progesterone action on neuronal circuits. The reduction of the progesterone phase latencies generated in multisynaptic circuits provides a neurophysiological basis for understanding the human pre-menstrual syndrome. Shorter people tend to have a smaller brain, and to have shorter VEP latency.^{6,7} However, Physical conditions such as relaxed state sleep⁹ and neuroendocrinological factors such as estrogen^{10,11} and progesterone¹⁰ are supposed to affect VEP latency both at FP and LP. The consciousness level of the subjects was monitored by EEG to be awake during recording. FP is a period when estrogen alone is raised, and LP is a period when both estrogen and progesterone are raised. The effects of estrogen on the CNS are likely to be antagonized by progesterone and its metabolites.^{10,12} In addition, estrogen has been shown to shorten the latency of VEPs in animals^{10,11} whereas progesterone prolongs latency. In their study, VEP amplitudes tended to be larger in LP. Moreover, there was a significantly larger amplitude in LP than in FP after eliminating the effects of body height by ANCOVA (p<0.05). This result is consistent with other studies of VEPs.^{8,13} Physical conditions such as relaxed state⁸, attention, sleep⁹ or body temperature¹⁴, and neuroendocrinological factors such as estrogen^{10,11} and progesterone¹⁰ are supposed to affect VEP amplitude both at FP and LP. The correlation

between increased VEP amplitude at LP which is thought to reflect central adrenergic processes.^{13,15} VEP amplitude has been shown to be increased by estrogen¹⁰ directly and/or indirectly through L-type voltage-dependent calcium channels, acetylcholine, monoamines, γ -aminobutyric acid^{16,17,18} or glutamate¹⁸, and to be inhibited by progesterone¹⁰ directly and/or indirectly through γ -aminobutyric acid or glutamate¹⁸. Therefore, larger VEP amplitude at LP observed in the present and previous studies^{8,13} indicates that VEP amplitude at LP reflects the effect of estrogen more than progesterone.

Conclusion: VEP amplitude at LP probably reflects the effect of estrogen more than progesterone, and that the VEP latency changes at LP reflect the effect of progesterone more than estrogen. We believe that VEP analysis is a useful tool for the study of the actions of gonadal hormones on CNS, not only in animals but also in humans.

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