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RESEARCH ARTICLE

VISUAL EVOKED POTENTIAL CHANGES IN DIFFERENT PHASES OF MENSTRUAL CYCLE IN YOUNG FEMALES

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ABSTRACT

Background: Visual evoked potential (VEP) is a convenient and non-invasive tool for assessing the functional integrity of visual system. Apart from age and gender visual evoked potential can also be influenced by the varying levels of ovarian hormones in the different phases of menstrual cycle. **Aim of the study**: To observe the changes of visual evoked potentials in the follicular phase and luteal phase of the menstrual cycle in healthy young women. **Materials & Methods:** Study group of thirty females between the age group of 18 to 22 years having regular menstrual cycle of 28 days were included in the study. The females with irregular menstrual cycles, Polycystic ovarian diseases(PCOD), refractive error and who were on hormonal pills were excluded from the study. Pattern reversal VEP was recorded by using Neuroperfect EMG 2000 system with installed software during follicular and luteal phases of the same menstrual cycle. Peak P100, N75 and N145 latencies were recorded. **Results:** Statistical analysis was done by using student 't'test. In the present study, mean P100 wave latency (95.55 ±7.11) and mean N145 wave latency(137.98 ±11.44) were reduced in follicular phase, whereas mean P100 wave latency (104.42 ± 5.67) and mean N145 wave latency (146.21 ± 9.01) were increased in luteal phase of menstrual cycle and these changes are statistically significant (P value <0.05) . **Conclusion:** From this study it was found that, In females during follicular phase, PRVEP latencies were shortened and VEP latencies were prolonged during luteal phase of menstrual cycle. So in case of females, before going for any diagnostic conclusion of diseases affecting visual system, the normal variations of PRVEP latencies should be considered.

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INTRODUCTION

Evoked potentials are an electrophysiological potentials that can be extracted as a signal from the electrical activity of the brain which is recorded at the scalp. Visual evoked potential (VEP) is a graphical recording of cerebral electrical potentials generated by the occipital cortex in response to a defined visual stimulus. Pattern reversal visual evoked potential (PRVEP) are generated in the cortical and subcortical visual areas when the retina is stimulated with alternating checker board pattern. VEP can provide important diagnostic information regarding the functional integrity of the visual system. PRVEP is a very important non-invasive, and highly objective tool in detecting the abnormalities of visual system (Rahul Mittal, 2013; Kothari *et al*., 2012)

Wave forms in VEP are

P100 wave: It is generated in the striate and peri-striate occipital cortex due to the activation of primary visual cortex and also due to the discharge of impulses in the thalamocortical fibers.

N75 wave: It reflects the activity of fovea and the primary visual cortex (area 17).

N145 wave: It reflects the activity of visual association cortex (area 18) (Odom *et al*., 2009).

Factors affecting VEP are (Azarmina *et al*., 2011)

- Technical - Electrode position, Type of stimulus
- Anatomical variations
- Physiological factors - Pupil diameter, Refractive error, Age, Sex, and Ovarian hormones.
- Ovarian steroid hormones have widespread effects throughout the central nervous system including the sensory information processing in the brain.

Hormonal changes in menstrual cycle (Puja Dullo, 2008**)**: Menstrual cycle in female human beings is a complex process involving the interaction between hypothalamus, the anterior pituitary, the ovaries and the uterus. The average duration is about 28 days.

Follicular or proliferative phase of menstrual cycle (8-14 days) is otherwise called as oestrogen dominated phase whereas secretory or luteal phase (15-28 days) is associated with increase in progesterone secretion. Hormonal changes during this cyclical process not only responsible for oocyte maturation and uterine changes including endometrial and vaginal changes but can also have an effect on other physiological phenomenon like processing of visual information in the brain. So purpose of this study was to observe the changes in PRVEP during follicular (high oestrogen levels) and luteal (high progesterone levels) phases of menstrual cycle.

Aim and objectives

To evaluate the changes in latency of P100, N75 and N145 wave forms during follicular phase and luteal phase of menstrual cycle.

MATERIALS AND METHODOS

Study group includes 30 female subjects of age between 18-22 years with regular menstrual cycle of 28 days duration. This prospective type of study was conducted at research lab, department of Physiology, Coimbatore medical college. Informed written consent was obtained from the subjects. Approval from the institutional ethics committee was obtained. After obtaining menstrual history, thorough clinical examination was done to rule out the neurological illness and any other diseases affecting the menstrual cycle.

Exclusion criteria (Rahul Mittal, 2013)

Persons with known history of,

- Seizures
- Glaucoma
- Ocular infections
- Drug abuse
- Miotic pupil
- Refractive error - myopia, hypermetropia, astigmatism
- Neurological diseases
- Polycystic ovarian disease
- Oral contraceptive pills
- Diabetes mellitus, Systemic hypertension

Electrode placement: The standard silver-silver chloride disc electrodes should be placed over the scalp according to the international 10/20 system.

- Active electrode (Oz) – Occiput
- Reference electrode (Fz) – Forehead
- Ground electrode (Cz) - Vertex

Procedure: Visual evoked potential was recorded during follicular and luteal phases of menstrual cycle in each female by using Neuroperfect EMG 2000 system with installed VEP software. The visual stimuli were checker board patterns (Alternate black and white squares) generated on a video moniter. The pattern stimulus luminance was 59 cd/sq.m with 80% contrast between black and white squares.

The rate of pattern reversal was 1Hz
The recording sensitivity was kept at 2μv
The analysis time (sweep duration) - 300msec.

Everytime the pattern alternates, the subjects visual system generates an electrical response that was detected and recorded by surface electrodes. The subjects were asked to fix their gaze on the fixation point (red square) which was positioned at the centre of the checker board pattern. The electrode impedance was kept below 5kohms. Responses to 150 stimuli free from artefacts were recorded and averaged for both eyes.

Statistical analysis: By using paired student 't' test, latency of P100, N145 and N75 wave forms of PRVEP were analysed between follicular and luteal phases of menstrual cycle.

RESULTS

In the present study, significant difference was observed in mean P100 wave latency and mean N145 wave latency when compared between follicular phase and luteal phase of menstrual cycle. Mean N75 wave latency also shown variations in follicular and luteal phase but statistically insignificant.

WAVE FORMS	LATENCY (m sec)		p VALUE
	FOLLICULAR PHASE	LUTEAL PHASE	
P 100	95.55 ±7.11	104.42 ± 5.67	<0.0001*
N145	137.98 ±11.44	146.21 ± 9.01	0.0088*
N75	73.68 ± 4.85	77.58 ± 9.69	0.0733

DISCUSSION

The menstrual cycle is a most extensively studied rhythm in women. The hormonal changes during the normal menstrual cycle are well established and these hormonal changes are commonly associated with fluctuations in the state of physiological functions including processing of visual information. In the present study, mean PRVEP wave latencies were decreased during follicular phase and it was consistent with the study results of Yelmaz *et al*. (2000) Azarmina *et al*[4], Sangeeta *et al*. (2013) and Kaneda *et al*. (1997) Yelmaz *et al*. (2000) studied the PRVEP changes in 30 healthy women during different phases of menstrual cycle and observed the significantly decreased mean P100 latency during follicular phase with p value of <0.05. During this phase oestrogen level rises to 3-5 times that of other phases without increase in progesterone level. Significant decrease in PRVEP latency was thought to be due to facilitating effect of estrogen on the neural transmission of visual pathways (Odom, 2009). Mohsen Azarmina *et al*[4] found significantly decreased PRVEP latency during follicular phase of menstrual cycle (100.8msec) when compared to VEP latency during maximum bleeding day (119.6msec) and it was statistically significant (Puja Dullo, 2008). Sangeeta Gupta *et al*. (2013) observed that, mean P100 PRVEP latency was shorter in follicular phase with statistically difference (p<0.0001) when compared to luteal phase. The significant reduction in VEP latency can be attributed to the facilitating effect of estrogen. Kaneda *et al*. (1997) showed increased latency on flash VEPs associated with low estrogen and high progesterone level. Parducz *et al*. (1993) suggested that, physiological levels of estradiol may induce a remodelling of GABAergic neurons and reduce their impulse transmission in the adult rat hypothalamus. Kawakami *et al*[10] observed that, elevated levels of progesterone increases the brain thresholds in the rabbit.

Conclusion

In females during follicular phase of menstrual cycle, PRVEP latencies were shortened and it may due to the facilitating effect of estrogen on neural transmission. Estrogen increases the conduction velocity of optic nerve pathway by influencing the remodelling of GAB Aergic neurons. Prolonged VEP latencies during luteal phase might be due to the antagonising action of progesterone on oestrogen and by increasing brain threshold. So in case of females, before going for any diagnostic conclusion of diseases affecting visual system, the normal variations of PRVEP latencies which occur during menstrual cycle may be considered.

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