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RESEARCH ARTICLE

GENDER DIFFERENCES IN PATTERN OF VISUAL EVOKED POTENTIAL

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Abstract

Background : A visual evoked potential (VEP) is non- invasive electro physiological test which will record electrical potential difference from the scalp in response to visual stimuli. The VEP tests the functional integrity of the visual pathway from the retina to the occipital cortex. Gender affects various electrophysiological tests VEP is one of them. Aim: to evaluate the pattern difference of VEP between male and female medical student. Materials and methods: The study includes 60 young healthy medical students (30 male and 30 females) of age groups 18 to 25 years. The study design is a cross sectional study. The left and right eyes were tested separately in all subjects by giving mono ocular stimulation. In our study we measured VEP latency of P 100. The statistical analysis was done by Student unpaired't' test. Results: In our study we found that there is any difference in VEP parameters between male and female. P100 peak latency of VEP was significantly (p value < 0.05) shorter in females in comparison to males medical students. Conclusion: Gender has effect on pattern of VEP so gender should include in norms to measure VEP.

Key Words: Gender, Visual evoked potential (VEP)

INTRODUCTION

A visual evoked potential (VEP) is an electrophysiological potential that cause by the electrical activity of brain which examine visual pathway from retina up to visual cortex. It is caused by a visual stimulus, such as an alternating high contrast checkerboard pattern on a computer screen which activates the primary visual cortex [1,2] the area of occipital cortex which involved in receiving and interpreting visual signals [3] and responses are recorded from electrodes that are placed on the head and observed as a reading on a monitor.

Gender is one of the factors which cause interindividual variation in the electrophysiological parameters of the human brain. Many studies have examined gender effects on P-VEPs.[4,5,]Some authors reporting shorter latencies in women [6,8] and others reporting no gender difference.[7,11] Effect of gender on P100 latencies related to the size of the pattern displayed [10] smaller head size and higher core temperature of women , hormonal factors.[9,10]

The VEP can provide important diagnostic information regarding the functional integrity of the visual system. The current standard VEP represents the basic response 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 retrochiasmaldysfunction.VEP peak latency used as the parameter. 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.

MATERIAL & METHODS

In our study we have include 60 young healthy medical students (30 male and 30 female) of age group 18 to 25 years with corrected visual acuity, no color-blindness, no history of physiological or psychological disorders, and no history of drug abuse. We have explained the nature of the study to both the group of subject and their formal consent was obtained prior to the tests.
We have exclude subjects with history of seizures, Glaucoma, Diabetes, Any ocular infections, Brain trauma, if they are currently taking any long-term medication.
We have studied the changes in latency of P100 wave of pattern reversal of VEP

Subjects came before performing the test with:

Washing hair the night before with shampoo and avoiding any hair oils and lotions, ensuring adequate sleep on previous night, any medications that cause drowsiness and affect the size of pupil should be avoided, physical and mental relaxation and corrective lenses, if they worn.

Electrodes Placement

According to the International 10/20 system [12] the silver scalp electrodes placed in relation to bony landmarks. Electrodes were fixed with paste at: Oz active electrode, Fz reference electrode, Cz ground on the vertex. 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.

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).

RESULTS

Table 1

Mean P100 latencies of VEP in Male and Female subjects

P100Latency (milliseconds) (Mean ï S.D.)			P value
	Male (30)	Female (30)	
Right eye	99.6± 5.34	96.1± 5.6	0.0162 (<0.05)
Left eye	99.4± 5.7	96.2 ± 6.1	0.0401 (<0.05)

The P_{100}latency in both the eyes of Male were significantly prolonged ($p<0.05$) in comparison to female i.e. 99.6 ± 5.34 Vs 96.1 ± 5.6 (right eye), 99.4 ± 5.7 Vs 96.2 ± 6.1 (left eye).
Statistical analysis was performed using the unpaired t-test.

DISCUSSION

The present work has been carried out with a view to evaluate the changes in the patterns of visual evoked potential between male and female medical students. All the subjects were thoroughly examined and subjected to VEP tests after a detailed history.

The mean P_{100} latencies in both the eyes of Male subjects were significantly prolonged in comparison to Female subjects.

Most studies have found shorter VEP peak latencies in female. [4,6,13]

Possible explanation for such gender differences may be physical character such as head size [5,6,9],body temperature [14],others are endocrinal factors like sex steroids ,cortisol, y aminobutyricacid affect various brain function.[15,16,17,]

According to some study head size not the sex is responsible for latency changes in female [5]

The mean P100 latencies for all responses were shorter in the pregnant women compared to non pregnant. Pregnancy is a time when serum levels of oestrogen and progestogen are considerably greater than in the non-pregnant state. These observed differences in PRVEP latencies in pregnant and non-pregnant women due to differences in circulating sex steroids, and the effect of gonadal hormones may be the principal reason for latency differences between the sexes[18 ,19]

Shorter people tend to have a smaller brain, and to have shorter VEP latency [14,20], However, Physical conditions such as relaxed state sleep [21] and neuroendocrinological factors such as estrogen [22,23] and progesterone [23] are supposed to affect VEP latency. The consciousness level of the subjects was monitored by EEG to be awake during recording.

The shorter latency of VEP in female is attributed to increase in sensitivity of CNS to cathecholamines due to sex steroids in blood .estrogen tends to shorten visual transmission time by increasing the sensitivity to dopamine and by increasing effects of glutamate via L type voltage –gated calcium channels that are present in CNS and visual pathways [24,25] we cannot explain this changes only on the basis of glutamate.

As estrogen inhibit the synthesis of GABA by inhibiting glutamate decarboxylase enzyme. In contrast to estrogen Progestron& its metabolite antagonize the effect of estrogen [26,27,28]

CONCLUSION

The results of the present study have demonstrated difference in latency of VEP between male and female. Finally, in clinical investigations VEP data should consider gender effect.

REFERENCES

1. Brecelj J, Kakigi R, Koyama S, Hoshiyama M: Visual evoked magnetic responses to central and peripheral stimulation: simultaneous VEP recordings. Brain Topogr1998; 10: 227-237
2. Seki K, Nakasato N, Fujita S, Hatanaka K, Kawamura T, Kanno A, Yoshimoto T: Neuromagnetic evidence that the P100 component of the pattern reversal visual evoked response originates in the bottom of the calcarine fissure. ElectroencephalogrClinNeurophysiol1996; 100: 436-442
3. Adams R, Victor M. Brown R. et al. Special Techniques for Neurologic Diagnosis, Adams and Victor's Principles of Neurology - 8th Ed. The McGraw-Hill Companies, Inc.; 2005
4. Fenwick PB, Brown D, Hennesey J: The visual evoked response to pattern reversal in 'normal' 6-11-year-old children. ElectroencephalogrClinNeurophysiol1981; 51: 49-62
5. Gregori B, Pro S, Bombelle F, La Riccia M, Accornero N: Vep latency: sex and head size. ClinNeurophysiol2006; 117: 1154-1157
6. Malcolm CA, Mcculloch DL, Shepherd AJ: Pattern-reversal visual evoked potentials in infants: gender differences during early visual maturation. Dev Med Child Neurol2002; 44: 345-351
7. Cohn NB, Kircher J, Emmerson RY, Dustman RE: Pattern reversal evoked potentials: age, sex and hemispheric asymmetry. ElectroencephalogrClinNeurophysiol1985; 62: 399-405
8. Emmerson-Hanover R, Shearer DE, Creel DJ, Dustman RE: Pattern reversal evoked potentials: gender differences and age-related changes in amplitude and latency. ElectroencephalogrClinNeurophysiol1994; 92: 93-101
9. Guthkelchan, Bursick D, Sclabassi RJ: The relationship of the latency of the visual P100 wave to gender and head size. ElectroencephalogrClinNeurophysiol1987; 68: 219-222
10. Celesia GG, Kaufman D, Cone S: Effects of age and sex on pattern electroretinograms and visual evoked potentials. ElectroencephalogrClinNeurophysiol1987; 68: 161-171
11. Mitchell KW, Howe JW, Spencer SR: Visual evoked potentials in the older population: age and gender effects. ClinPhysPhysiolMeas1987; 8: 317-324
12. American Encephalographic Society Guideline thirteen: Guidelines for standard electrode position nomenclature. J ClinNeurophysiol 1994; 11: 111–113.
13. Buchsbaum MS, Henkin RI, Christiansen RL:Age and sex differences in averaged evoked responses in a normal population, with observations on patients with gonadal dysgenesis. ElectroencephClinNeurophysio 1974; l37:137-144
14. Kaneda Y, Nakayama H, Kagawa K, Furuta N, Ikuta T:Sex differences in visual evoked potential and electroencephalogram of healthy adults. Tokushima J Exp Med 1996; 43:143-157
15. Sannita WG: Individual variability, end-point effects and possible biases in electrophysiological research. ClinNeurophysiol2006; 117: 2569-2583
16. Hutchison JB, Beyer C, Hutchison RE, Wozniak A: Sexual dimorphism in the developmental regulation of brain aromatase. J Steroid BiochemMolBiol1995; 53: 307-313
17. Krause DN, Duckles SP, Pelligrino DA: Influence of sex steroid hormones on cerebrovascular function. J ApplPhysiol2006; 101: 1252-1261
18. Marsh MS. Smith S. Differences in the pattern visual evoked potential between pregnant and non-pregnan women. ElectroencephalogrClinNeurophysiol 1994;92:102-106.
19.Yilmaz H, Erkin E, Mavioglu H, Sungurtekin U.Visual evoked potentials in pregnancy.Neuro-ophthalmology-1999;21:205-210
20. Allison T, Wood CC, Goff WR:Brain stem auditory, pattern-reversal visual, and short-latency somatosensory evoked potentials:latencies in relation to age, sex, and brain and body size. ElectroencephClinNeurophysio 1983; l55:619-636
21. Ciganek L:The EEG response (evoked potential) to light stimulus in man. ElectroencephClinNeurophysiol 1961; 13:165-172

22. Oshima K, Gorbman A: Effects of sex hormones on photically evoked potentials in frog brain. Gen Comp Endocr 1969; 12:397-404
23. Curry JJ, TimirasPS:Development of evoked potentials in specific brain systems after neonatal administration of estradiol. Exp Neuro 1972 ; l34:129-139
24. Smith SS, Waterhouse BD, Woodward DJ. Sex steroid effects on extrahypothalarnic CNS. I. Estrogen augments neuronal responsiveness to iontophoretically applied glutamate in the cerebellum. Brain Res1987;422:4o-5
25. Zemon V, Kaplan E, Ratcliff F. role of GABA-mediated intracoi inhibition in the generation of vi evoked potentials. In: Cracco R, Bodis-Wollner J, editors. Evoke Potentials. New York: Alan R Li Inc., 1986; 287-295.
26. Backstrom T, Carstensen H, Sodergord R. Concentration of estradiol, testosterone and progesterone in cerebrospinal fluid, compared to plasma unbound and total 17 concentrations. J Steroid Biochem 1974;7:469-472.
27.Datta D, Hurley RI, Naulty JS, Stern P, et al. Plasma and cerebrospinal fluid progesterone concentrations in pregnant and nonpregnant women. Anesth Ana1g 1986;65:950-954.
28. Shearman RP. Endocrine changes during pregnancy. In: Whitfield C, editor. Dewhurst's Textbook of Obstetrics and Gynaecology for Postgraduates. Oxford: Blackwell Scientific Publications, 1986: 125.