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Analysis of gender based differences in pattern reversal visual evoked potentials among healthy subjects of north India

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ABSTRACT

Background and Objectives: *Pattern-reversal visual evoked potential (PRVEP) is an objective, sensitive and non-invasive neurophysiological test that can prove to be a useful clinical tool in investigating the physiology and pathophysiology of human visual system. A successful clinical application of the test, however, is not possible without the acquisition of a normative data adjusted to known confounding physiological variables.Therefore, the present study was performed on healthy individuals to investigate the effect of gender on pattern reversal VEP.*

Methods: *PRVEP was recorded in 100 healthy adults in the age-group of 18-25 years, in which there were 50 males and 50 females. VEP was recorded with a PC based, 2 channel, RMS EMG EP mark II machine and standard silver-silver chloride disc electrodes. A VEP monitor displaying checker board was used to give the pattern reversal stimulus.*

Results: *The study demonstrated that the latency of P100 was were significantly longer in males as compared to females. The amplitude of P100 wave was higher in females in both left and right eye as compared to males.*

Conclusion: *Clinical interpretation of PRVEP should be based on gender matched normal subjects besides standardizing the technical parameters of the laboratory. There is a definite gender difference in VEP parameters with females showing shorter P100 latencies and higher amplitudes. This gender difference may be due to genetically determined sex differences in neuro-endocrinological systems.*

KEYWORDS : Pattern reversal, Visual evoked potentials, Gender.

INTRODUCTION

Evoked potentials are noninvasive studies that measure the electrophysiological response of the nervous system to different sensory stimuli including brainstem auditory evoked potentials (BAEP), visual evoked potentials (VEP), short-latency somatosensory evoked potentials (SSEP) [1]. Visual evoked potentials (VEP) are used to assess the visual conduction pathways through the optic nerves and brain. To measure VEP, visual fields are stimulated, usually with a checkerboard visual stimulus, and the evoked response is recorded using surface recording electrodes over the occipital lobe. A unilateral defect in the visual pathway may be missed if both eyes are stimulated simultaneously; therefore, monocular stimulation is usually recommended except for special circumstances like in infants [2]. Three standard stimulus protocols are defined for recording VEP [3]: (a) Pattern-reversal VEP, (b) Pattern onset/offset VEP and (c) Flash VEP. The pattern reversal VEP is the preferred stimulus for most purposes because it has relatively low variability of waveform and peak latency both within a subject and over the normal population [4]. A normal VEP response to a pattern-reversal stimulus is a positive peak that occurs at a mean latency of 100 ms. There are three separate phases in the VEP waveform: an initial negative deflection (N70), a prominent positive deflection (P100), and a later negative deflection (N155). The peak latency and peak to peak amplitudes of these waves are measured [5].

VEP may be affected by variety of physiological factors including age, sex, visual acuity and pupillary size. It may also be affected by measures related to technique including check size, luminance, field size, etc [6]. Gender has been recognized as an important physiological factor which can affect both the amplitude and latency of pattern reversal VEP parameters.Therefore, the present study was performed on healthy individuals to investigate the effect of gender on pattern reversal VEP.

MATERIALS AND METHODS

The study was conducted on 100 healthy individuals in the age group of 18-25years, in which there were 50 males and 50 females.The study was done after approval from the ethical committee of the institute.The subjects selected were having no, medical, neurological and ophthalmic problems. The subjects were not on any medication likely to affect or influence VEPs or drugs affecting moods (antidepressant, tranquilizers).

All subjects selected for the study were subjected to a standardized protocol comprising of history, clinical examination especially ophthalmic and other necessary investigations following which they underwent visual evoked potential (VEP) testing.Correct procedure of the test was explained to all subjects and informed written consent was taken.

Equipment-Visual evoked potential (VEP) was recorded with an RMS EMG EP MK-II equipment equipped with pattern-shift stimulator television screen, signal amplifier with filters, computer system for averaging.

VEP Recording-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 from the pattern-shift screen. Subjects were placed in front of a video monitor displaying black and white checkerboard pattern. The checks of alternate black/white to white/black 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, which were placed on the scalp overlying the occipital and parietal regions with reference electrodes on the midline of frontal region (Fz). The subjects were asked to focus his gaze onto the center of the screen. Each eye was tested separately (monocular testing).

Stimulation Pattern - The visual stimuli were checkerboard patterns (contrast 70%, mean luminance 50 cd/m2) generated on a video monitor and reversed in contrast at the rate of two reversals per second. At the viewing distance of 100 cm, the check edges

subtend a visual angle of 15 minutes with video monitor screen subtending an angle of 12.5°. The refraction of all subjects was corrected for the viewing distance.

Electrodes and Electrode Placement - Surface electrodes were fixed with paste in the following positions: active electrode at Oz, reference electrode at Fz, 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.

RESULTS

Stastistical analysis was done using software SPSS.Values were expressed as Mean±S.D. Comparisons were made between groups by unpaired 't' test. p-values < 0.05, was considered as significant.

The mean latencies (in milliseconds) of wave P100 and peak amplitude of P100 (in microvolts) were noted and compared in both the eyes in the two groups [Table-1, 2].

Table No. 1
Mean P100 latencies and amplitudes with relation to gender of the subjects in right eye.

Parameters	Male	Female	P – value
P_{100}Latency (milli sec) (Mean S.D.)	95.725.71	92.446.61	0.009
P_{100}Amplitude(micro volt) (Mean S.D.)	5.921.76	7.152.21	0.002

Table No. 2
Mean P100 latencies and amplitudes with relation to gender of the subjects in left eye.

Parameters	MALE	FEMALE	
P_{100}Latency (milli sec) (Mean S.D.)	95.585.31	92.176.32	0.004
P_{100}Amplitude(micro volt) (Mean S.D.)	5.961.62	7.222.13	0.001

DISCUSSION

The activation of the primary visual cortex and also due to the discharge of the thalamocortical fibers. N70 reflects the activity of the fovea and the primary visual cortex while N145 reflects the activity of the visual association area. The P100 is a prominent peak that shows relatively little variation between the subjects, minimal within-subject interocular difference, and minimal variation with repeated measurements over time[7]. Therefore, this paper focused more on the values of P100 latency and P100 amplitude among the groups which were examined.

In our study, the mean latency (in milliseconds) of P100 wave in normal female subjects was 92.17 ± 6.32 and 92.44 ± 6.61 in the left and right eye respectively. The mean latency (in milliseconds) of P100 wave in normal male subjects was 95.58 ± 5.31 and 95.72 ± 5.71 in the left and right eye respectively. Another gender variation was exhibited by a statistically significantly higher P100 amplitude in females was 7.22 ± 2.13 and 7.15 ± 2.21 as compared to p100 amplitude in males was 5.96 ± 1.62 and 5.92 ± 1.76 in the left and right eye respectively.In a study done by Shibasaki H and Kuroiwa Y[8], the mean peak latency ofP100 wave in normal subjects was 92.5 ± 4.44. In a previous Indian study of Visual Evoked Potentials in young adults, Tandon OP and Sharma KN[9] reported P100 latency of 95.37 ± 6.85 msec for males and 91.07 ± 49 msec for females. The difference in the values in this study and in past literature may be due to the difference in the recording instruments, which differs from institute to institute, therefore there is need for each institute to have its own parameters according to the device.

Our results showed that the latency of P100 wave was significantly longer in males as compared to females. The amplitude of P100 wave was higher in females in both left and right eye as compared to males. Our results were in agreement with the results of previous studies [10-13] which showed shorter latencies and higher amplitude in females. On the contrary, some studies showed no significant gender difference in VEP latencies [14,15].

The exact cause of this gender difference in VEP parameters is not clear but it may be related to anatomical or endocrinal differences [16]. In a study conducted by Marsh MS et al., [17] They postulated that this endocrine difference may also account for the gender difference in VEP latency. Similarly, Kaneda Y et al., [18] postulated that the sex differences in VEP may be attributed to genetically determined sex differences in neuroendocrinological systems.

CONCLUSION

This study suggest that clinical interpretation of PRVEP should be based on gender matched normal subjects besides standardizing the technical parameters of the laboratory.There is a definite gender difference in PRVEP parameters with females showing shorter P100 latencies and higher amplitudes. This gender difference may be due to genetically determined sex differences in neuro-endocrinological systems.

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