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Original Research Article

Effect of Acute Rise of Blood Glucose Level on VEP: A Study

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Abstract

Chronic hyperglycemia is one certain cause of diabetic retinopathy. VEP findings may identify pathology in both early and late stage diabetes. Present study was done to evaluate the effect of acute rise in blood sugar on visual evoked potential in normal subjects. Subjects aged between 17yrs -21yrs of both sexes (n=100) were selected for the study. First recording of VEP done then measurement of capillary blood glucose level done prior to administration of 50 Gm Glucose then repeat measurement done after ½ hour. After rise of capillary blood glucose level recording of VEP was done. Latency of N75 and P100 along with amplitude of N75-P100 has been analysed. Amplitude of N75-P100 has statistical significant difference with p-Value of 0.0054 for right eye and 0.0039 for left eye. Sudden rise of blood sugar level certainly affects result of VEP even in non-diabetic persons. To avoid wrong interpretation of VEP findings every physiologist should consider this post-prandial effect of increased blood sugar while doing VEP in diabetic as well as non-diabetic.

Keywords: N75, P100, amplitude of N75-P100, Capillary blood glucose.

INTRODUCTION

Diabetes Mellitus is one of the fastest growing chronic metabolic diseases in world. In India 31.7 million were affected in year 2000 and expected to reach 79.44million by year 2030 [1]. Metabolic abnormalities in Diabetes Mellitus can involve ganglionic and preganglionic elements in the entire retina and the macular region. In addition, neural conduction may be delayed along post-retinal central visual pathways [2]. In diabetics the most common cause of blindness is retinopathy. Diabetes Mellitus (DM) causes vascular and metabolic abnormalities resulting in visual deficit. Visual evoked potential is effective in detecting retinal dysfunction in diabetics with normal visual acuity. Although diabetic peripheral neuropathy is a common complication of diabetes, the central nervous system seems to be rarely involved. Subclinical abnormalities in the central pathway of diabetic patients have been demonstrated by means of visual, brainstem auditory and somatosensory evoked potentials. Abnormal visual evoked potentials (VEPs) have been found in 6-62.5% of diabetic patients [3].

Diabetic retinopathy is one of the long term micro-vascular complications of diabetes and a major source of morbidity, causing vision impairment and blindness. The electro-physiologic techniques have served to detect early neuro-retinal functional changes that occur in diabetics [4].

Recording visual evoked potentials from scalp is highly sensitive, reliable and reproducible method for diagnosing conduction defects in anterior visual pathways [5]. Chronic hyperglycemia is one certain cause of diabetic retinopathy. VEP findings may identify pathology in both early and late stage diabetes. The sensitivity of neuro-physiological examinations permits the detection of retinal dysfunction, even before clinical manifestations develop and while visual acuity is still normal [6].

Researchers have done all these studies on diabetic patients. Objective of present study is to evaluate the effect of acute rise in blood sugar on visual evoked potential and to find out the change in recording of VEP after glucose administration in normal individuals [7].

MATERIALS AND METHODS

Study was done in Department of Physiology (Neurophysiology laboratory) in L.N. Medical College and Research Center, Bhopal. 100 healthy subjects were enrolled for the study after approval from Institutional

Ethical committee. Subjects were aged between 17yrs - 21yrs of both sexes.

Exclusion criteria for selection of the candidates were:-
History of ophthalomological surgery
Color -blindness.
History of seizures.
Candidates on anti-depressants.
Family history of Diabetes Mellitus.

All subjects were instructed for:

- To make hairs oil free.
- To take good sleep and normal meal.
- To remove contact lenses during procedure.

Device used for recording of VEP was EMG Octopus by Clarity Medical Private Limited ISO9001 & ISO13485.

Technical setting for recording of VEP used was-Channels –

- Active electrode – Mid-Occiput - Oz.
- Reference electrode – Mid Frontal - Fz.
- Ground electrode – On hair line of fore-head - Cz.

Band Pass –

- Low filter = 2Hz.
- High Filter = 200 Hz.

Number of epochs given = 200.
Rate of stimulation was 2Hz.

After fulfilling exclusion criteria written consent were taken from subjects. Each subject was well informed about the procedure. After general examination each candidate was asked to sit on a comfortable chair facing in opposite direction from the recording monitor. Electrodes were placed with the gel over the positions mentioned above as per 10-20 system after cleaning the area before hand. LED goggle has been worn to the candidate and impedance check was done which was maintained below 5KΩ. Recording of VEP done for both the eyes. After first recording of VEP capillary blood glucose has been measured by using ONE TOUCH Select Simple blood glucose monitoring system. 50g glucose with a glass of water was given to the subject and time was noted. After ½ hour of administration of capillary glucose was again measured and rise of sugar has been confirmed and repeat recording of VEP was done. Evaluation of data of VEP (pre and post glucose administration) has been statistically analysed by Graph Pad online calculator (paired t-test) and Microsoft Excel.

Results and Discussion

For all observations N=100

Average pre-test capillary glucose was 106.3044 mg/dl and ½ hour after administration of oral glucose capillary glucose level was 147.6584 mg/dl.

Observations recorded for latencies of N75, latencies of P100 and amplitudes of N75-P100 for both eye.

Table-1: Latency of N75 (ms)

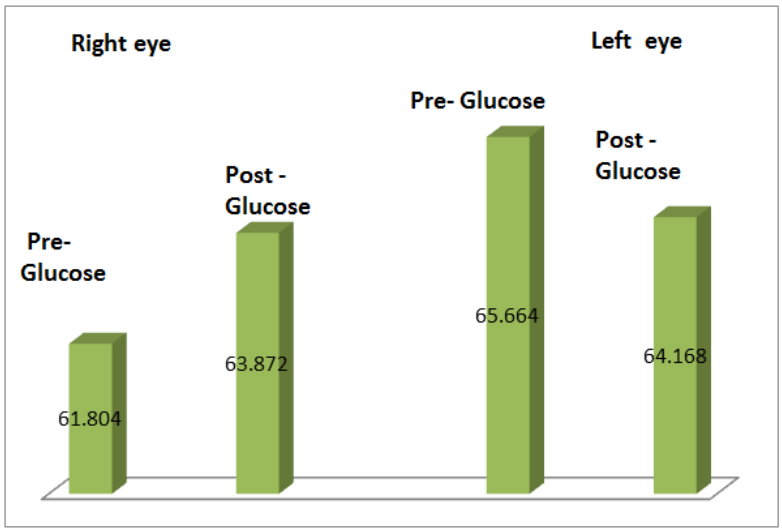
	Right eye		Left eye	
	Pre - Glucose	Post - Glucose	Pre- Glucose	Post - Glucose
Mean	61.804	63.872	65.664	64.168
SD	10.838	10.499	11.278	10.069
p-Value	0.1146		0.3041	

Table-2: Latency P100 (ms)

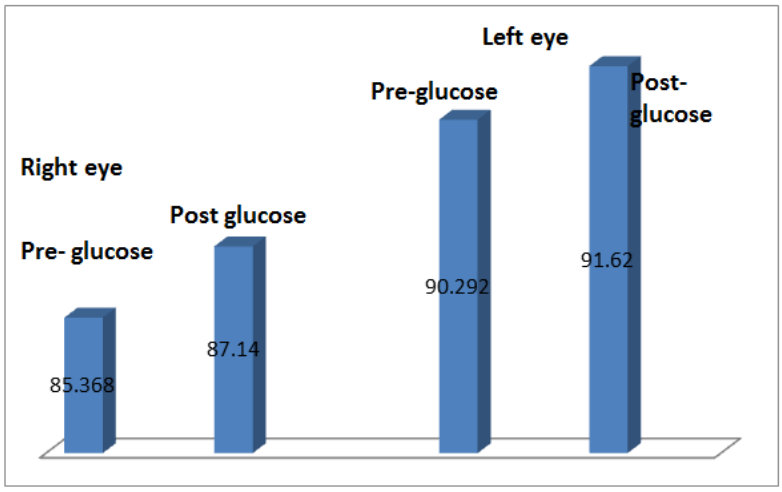
	Right eye		Left eye	
	Pre - Glucose	Post - Glucose	Pre- Glucose	Post - Glucose
Mean	85.368	87.140	90.292	91.620
SD	13.415	22.385	15.743	13.637
p-Value	0.4517		0.4875	

Table-3: Amplitude N75-P100 (µV)

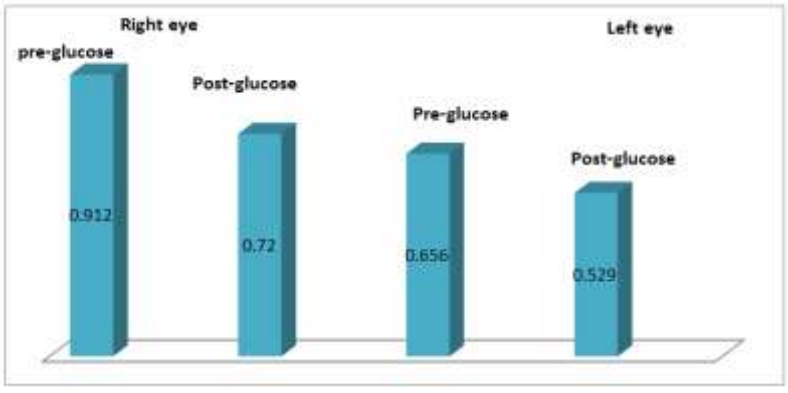
	Right eye		Left eye	
	Pre - Glucose	Post - Glucose	Pre- Glucose	Post - Glucose
Mean	0.912	0.720	0.656	0.529
SD	0.753	0.426	0.394	0.306
p-value	**0.0054**		**0.0039**	



Graph-1: Latency of N75 (ms)



Graph-2: Latency of P100 (ms)



Graph-3: Amplitude of N75-P100

Even though in present study there was not much rise in the level of capillary glucose and there was little difference in latencies in N75 and P100 which is not statistically significant. But there was statistically significant difference in the amplitude of N75- P100. This shows that increase in blood sugar level certainly affect VEP values. Study done by Olivier Ziegler *et al*., supported that short term glucose normalization in poorly controlled uncomplicated diabetic patients is associated with improved P100 latency [3]. Animal studies have shown that acute hyperglycemia is accompanied by a slowing of conduction velocity in the peripheral nervous system [8]. Present result is also supported by Bhanu R *et al*., that in diabetics increased P100 latencies and decreased amplitude could be a manifestation of structural damage at the level of

myelinated optic nerve fibers or retinal ganglion cell damage before development of retinopathy [9].

CONCLUSION

Evoked potentials are simple, sensitive and objective technique for evaluating impulse conduction along the central nervous pathways. Modification of evoked potentials have been observed not only in axonal degeneration and in segmental demyelination processes but also in toxic and metabolic disorders, in which the slowing of nervous conduction may imply either decreased membrane excitability. Conclusion from present study is that physicians/ ophthalmologists/ neurologists who are advising the patients for Visual evoked potential, should instruct the patients about normal sleep and normal food prior to VEP as well as they should be aware of any metabolic derangement of that patient beforehand. High caloric food should not be taken by the patients prior to VEP recording.

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