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RESEARCH ARTICLE

VISUAL EVOKED POTENTIALS IN DIABETES MELLITUS

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ABSTRACT

Introduction: Diabetes mellitus is a heterogenous group of metabolic disorders characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both.

Materials and Methods: This is a combined cross sectional and case control study. This study was carried out in the Research laboratory of the department of physiology, Coimbatore medical college, Coimbatore. The approval of the ethical committee was obtained prior to the commencement of the study. A total of 80 subjects were included in the study of which 40 were diabetic patients, both type 1 and type 2 and 40 were control groups. They were of 30 – 70 years of age group. Group I includes 40 controls of age and sex matched healthy individuals. Group II includes 40 diabetic patients. Group II $_A$ includes 20 type I diabetic patients. Group II $_B$ includes 20 type 2 diabetic patients. Neuroperfect EMG 2000 system and Autoanalyser are the materials used for the study. Pattern–shift visual evoked potential test was performed in a specially equipped electrodiagnostic procedure room.

Results: One way ANOVA & Student 't' test were used to assess the statistical significance. The mean value of the P_{100} latency was significantly delayed in Group II $_A$ and Group II $_B$ patients as compared to that in Group I subjects.

Conclusion: The delay in P_{100} latency was observed in diabetic patients before the development of overt retinopathty.

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INTRODUCTION

Diabetes mellitus is a heterogenous group of metabolic disorders characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. Diabetes are of two types which are type I and type II diabetes. Type I diabetes is the form of disease primarily due to beta cell destruction which require insulin for survival. Type II diabetes is the form of disease primarily have insulin resistance rather than absolute insulin deficiency (Joslin's 14th edition). Diabetic retinopathy is characterized by sight threatening chronic microvascular complication that eventually affects all patients with diabetes mellitus (Renu jogi 3rd edition). visual evoked potentials are evoked potentials in response to visual stimuli. Visual evoked potentials are useful for investigating the physiology and pathophysiology of human visual system including visual pathways and visual cortex. They can be used effectively to study both normal and abnormal functions in the field of research.

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MATERIALS AND METHODS

This is a combined cross sectional and case control study. This study was carried out in the Research laboratory of the department of physiology, Coimbatore medical college, Coimbatore. The approval of the ethical committee was obtained prior to the commencement of the study. A total of 80 subjects were included in the study of which 40 were diabetic patients, both type 1 and type 2 and 40 were control groups. They were of 30 – 70 years of age group. All the cases of diabetic mellitus were taken from diabetic clinic of Coimbatore medical college hospital and the controls were taken from the general population. The study subjects of both sexes were divided in to two groups. Group I includes 40 controls of age and sex matched healthy individuals. Group II includes 40 diabetic patients. Group II $_A$ includes 20 type I diabetic patients. Group II $_B$ includes 20 type 2 diabetic patients. Patients with history of hypertension, retinopathy, glaucoma and cataract were excluded. Neuroperfect EMG 2000 system and Autoanalyser are the materials used for the study. Pattern–shift visual evoked potential test was performed in a specially equipped electrodiagnostic procedure room.

Table 1. P_{100}, N_{75} and N_{145} latencies and $N_{75} - P_{100}$ amplitude in Group I, Group IIA and Group II B

VEP Parameters	Group I		Group II A		Group II B		P value	
	Right eye Mean ± SD	Left eye Mean ± SD	Right eye Mean ± SD	Left eye Mean ± SD	Right eye Mean ± SD	Left eye Mean ± SD	Right eye Mean ± SD	Left eye Mean ± SD
P100 ≤ 100	97.9 ± 1.93	98.13± 1.59	98.37±1..81	97.97±1.88	96.25±2.86	96.42±2.78	0.075	0.57
P100 >100	100.7± 0.41	100.87±0.47	105.69±3.95	106.85±2.82	105.5±3.63	104.34±3.34	0.030	0.007
N75 ≤ 75	71.13±3.20	70.32±3.09	71.20±4.09	71.16 ±3.74	69.43±4.62	67.83± 3.07	0.330	0.028
N75 > 75	76.42± 0.30	75.08±1.20	76.58±3.22	77.45±1.6	76.87±388	76.28±4.45	0.149	0.089
N 145 ≤ 145	135.19±3.06	133.15±6.19	136.09±5.64	134.34± 7.41	134.34±7.41	133.65±7.64	0.076	0.080
N 145 > 145	145.98±3.06	145.48±3.55	146.33±5.62	146.12±5.67	146.12±5.67	146.25±3.25	0.862	0.741
N75– p100 ≤ 5	4.98±0.43	4.93±0.43	4.97±0.25	4.91±0.27	4.90±0.17	4.88±0.16	0.091	0.093
N75– p100 > 5	5.25± 0.14	5.34±0.16	5.29±1.10	5.23±0.14	5.42±0.22	5.41±0.22	0.055	0.086

Table 2. Comparison of VEP responses in group II A and group II Bpatients

Vep Parameters	Group I		Group II A		Group IIB		P value	
	Right eye Mean ± SD	Left eye Mean ± SD	Right eye Mean ± SD	Left eye Mean ± SD	Right eye Mean ± SD	Left eye Mean ± SD	Right eye Mean ± SD	Left eye Mean ± SD
P100 ≤ 100	97.9 ± 1.93	98.13± 1.59	98.37±1..81	97.97±1.88	96.25±2.86	96.42±2.78	0.075	0.57
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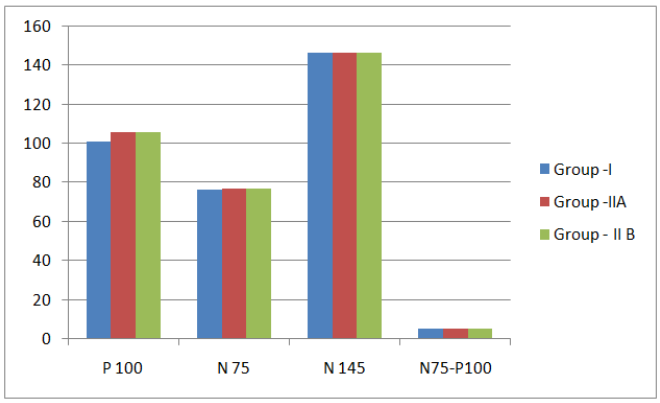

Fig. 1. P_{100}, N_{75} and N_{145} latencies and $N_{75} - P_{100}$ amplitude in Group I, Group IIA and Group II B of Right eye

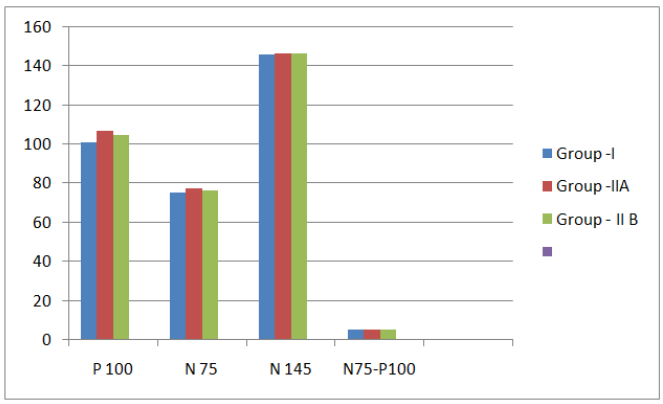

Fig. 2. P_{100}, N_{75} and N_{145} latencies and $N_{75} - P_{100}$ amplitude in Group I, Group IIA and Group II B left eye

The patients were explained about the test and should avoid hair spray or oil before the test. The patients were seated comfortably one meter away from the pattern – shift screen. Subjects were placed in front of a black and white checker board pattern displayed on a video monitor. Subjects were placed in front of a black and white checker board pattern displayed on a video monitor. Standard silver chloride electrodes were used. The electrodes were applied to the scalp using conduction jelly after thoroughly cleaning the area. Recording electrode was placed at Oz position, reference electrode was placed at Fz and the ground electrode at M1 position using conduction jelly. The pattern- shift screen checks changes alternatively black/ white to white / black at a rate of approximately twice per second. Every time the pattern changes, patient's visual system generates an electrical response which was detected and recorded by surface electrodes. The patient was asked to focus his gaze on to the center of the screen. Each eye was tested separately, while the other eye was being covered with an opaque patch.

RESULTS

One way ANOVA & Student 't' test were used to assess the statistical significance. The mean value of the P_{100} latency was significantly delayed in Group II $_A$ and Group II $_B$ patients as compared to that in Group I subjects. There was no significant prolongation of N_{75} and N_{145} latencies in Group II $_A$ and Group II $_B$ as compared to Group I subjects (Table – 1/ Fig:1,2). The mean value of $N_{75} - P_{100}$ amplitude was not significantly decreased in Group II $_A$ and Group II $_B$ as compared to Group I subjects. (Table–1/ Fig:1,2). Comparison of VEP responses was done between Group II $_A$ and Group II $_B$. (Table – 2/ Fig:3,4). There was no statistically significant difference found between these two groups. (Table -2 /Fig:3, 4).

DISCUSSION

The present study was done on 40 diabetics and 40 controls in the age group of 30 – 70 years. The P_{100} latencies of VEP were significantly delayed in Group II A and Group II B patients as compared to Group I subjects. This finding was consistent with the observations of Varkonyi *et al*. (2002), Dolu *et al*. (2003), Azal *et al*. (1998), Szabela *et al*. (2005), Li *et al*. (2001) , Fierro *et al*. (1996), Parisi *et al*. (1994) who reported similar changes in their study. The N_{75} and N_{145} latencies were not significantly

delayed in Group II A and Group II B patients as compared to Group I subjects. VEP responses were compared between Group II A and Group II B patients. No significant difference was found between these two groups. This finding was consistent with the observations of Pozesserse *et al*. (1988). The P_{100} waveform is generated in striate and peri striate occipital cortex due to activation of primary visual cortex. N_{75} reflects the activity of fovea and primary visual cortex, while N 145 reflects the activity of visual association area. Our findings signify that there is a definite neurological deficit in diabetes mellitus. The possible mechanisms for the development of optic nerve dysfunction are polyol pathway and vessel ischaemia. The polyol pathway refers to the intracellular mechanisms responsible for changing the number of hydroxyl units on a glucose molecule. In the sorbitol pathway, glucose is first transformed to sorbitol and then to fructose. Although Glucose is converted readily to sorbitol, the rate at which sorbitol can be converted to fructose and then metabolized is limited. Increased sorbitol is also associated with a decrease in myoinositol and reduced ATP ase activity in axons. The reduction of these compounds may contribute to the pathogenesis of optic nerve fibre loss. Thickening of the walls of nutrient vessels that supply the nerve leads to vessel ischemia may contribute to the development of segmental demyelination. This process is accompanied by a slowing of nerve conduction. Therefore VEP should be considered as a valid method for detecting prediabetic retinopathy, which could contribute greatly to the prevention of diabetic retinopathy and its complications.

Conclusion

The delay in P_{100} latency was observed in diabetic patients before the development of overt retinopathty. So, VEP measurement which is a highly sensitive, reliable, non invasive and reproducible method for detecting the early alterations in the central optic pathways in diabetics. It should be added to the list of screening tools for a complete and early assessment of neurological involvement of the diabetic patients to advise them for an early and proper management of the disease.

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Conflict of interest- Nil

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