

LETTER TO THE EDITOR

**BRAINSTEM AUDITORY EVOKED POTENTIAL IN
DIABETES MELLITUS**

Sir,

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Peripheral and autonomic neuropathy is known to develop in diabetes mellitus but central nervous system involvement in diabetes mellitus has received little attention so far. There are few reports which document central nervous system dysfunction in diabetes mellitus suggesting central neuropathy or derangement of higher nervous functions (1-3). However, experimental evidence in support of this is rather limited, as procedures for early diagnosis of CNS involvement have been lacking.

Some authors have submitted that CNS conduction failure could be detected by monitoring brainstem auditory evoked potentials in diabetic patients (4-7). The present study is an attempt to ascertain the presence of subclinical lesions in the CNS of diabetic patients and to find out their site by evaluating brainstem auditory evoked potentials.

The proposed study was conducted on 40 consecutive diabetic patients attending diabetic clinic of Indira Gandhi Medical College Shimla. Their age ranged from 30 to 60 years with a mean of 48.4 ± 7.68 years. Twenty two patients were male and eighteen were females. Duration of illness ranged from 2 years to 18 years with a mean duration of 9.93 ± 4.8 years. Their diabetic state was controlled with oral

hypoglycaemic agents. Patients were excluded if they suffered from any intercurrent disease which might affect the nervous system such as stroke, seizure, hypertension or uraemia due to nephropathy. No patient in this group was being treated with anticonvulsants, methyldopa, reserpine, nitrofurantoin or any medication which might be expected to interfere with functioning of CNS. Any history of hypoglycaemic episode was ruled out. All reported normal hearing and none was taking any medication which could be expected to affect cortical functioning. Patients having hearing loss and hypoglycaemias were excluded from the study. Neuropathy and pregnancy were also ruled out. Normal hearing in the both the groups was ascertained by clinical evaluation including pure tone audiometry.

Brainstem auditory evoked responses (BEAR): At the time of BAER Recording, hypoglycaemia was ruled out by doing concomitant blood glucose test. The recording of the brainstem auditory evoked responses (BEAR) was conducted in both groups by Nicolet Compact IV 2000 system. The study was carried out in a quite and dimly lit room with the subject in a comfortable supine position. Percutaneous Ag/Ag Cl disc electrodes were applied. Active (+) electrode was placed at vertex (Cz) and reference (-) at ipsilateral mastoid process

and at contralateral mastoid process ground electrode was placed. Stimulus in the form of rarefaction click, at rate of 11.4/sec with intensity of 65 dB above normal hearing threshold, with masking noise of -35 dB HL to non-test ear were given. Evoked potentials detected by far field technique were amplified and a band pass of 150-3000 HZ was used to filter out the undesired frequencies and the responses to 2000 click presentation were averaged for 10 msec sweep time by a computer averager. The averaged evoked responses were displayed on screen and printed on paper by a X-Y plotter. At least two trials were obtained from each side of stimulation to ensure reproducibility of the responses. Absolute peak latencies of wave I, III, V and inter peak latencies of I-III, III-V and I-V were analysed. The various wave morphology were studied.

Statistical evaluation was performed using Student's t-test for unmatched sample and $P < 0.05$ was taken as significant difference between two groups. Coefficients of correlation of latencies and interpeak latencies were found with age, sex, duration of diabetes and blood sugar levels and $P < 0.05$ was considered as significant correlation.

The BAER values obtained from normal controls were compared with available published data (8-10) and were found to be in close agreement with our findings. The table illustrates the comparison (Student's t-test) of absolute latencies of waves I, III, V and interpeak latencies (IPL) I-III, III-V and I-V, obtained from diabetic patients ($n = 40$) and non-diabetic controls ($n = 40$).

Absolute latencies of waves III and V are significantly delayed in diabetic subjects $P < 0.05$ for wave III and $P < 0.001$ for wave V while wave I is not significantly delayed in diabetics. There is significant delay of interpeak latencies III-V and I-V ($P < 0.001$).

Coefficients of correlation of absolute latencies and interpeak latencies showed no correlation with age, blood sugar level and duration of diabetes.

In the present study prolonged interpeak latencies III-V are evidence of the central conduction delay at brainstem from pons-to-mid-brain level. Central conduction delay has been reported earlier by other authors (4-7). Prolongation of absolute latencies of waves III and V implicate delay at higher structure probably at the collicular level. The

TABLE I: Mean latencies and interpeak latencies of brainstem auditory evoked responses in diabetics and controls (\pm SD).

Absolute latency and interpeak latency (ms).	Diabetic patients (n=40)	Non-diabetic controls (n=40)	P-value
Wave - I	1.576 \pm 0.122	1.526+0.194	NS
Wave - III	3.632 \pm 0.172	3.490+0.334	<0.05*
Wave - V	5.821 \pm 0.249	5.291+0.410	<0.001**
IPL - I-III	2.056 \pm 0.146	1.963+0.281	NS
IPL - III-V	2.188 \pm 0.164	1.800+0.236	<0.001**
IPL - I-V	4.245 \pm 0.224	3.765+0.334	<0.001**

* $P < 0.05$ ** $P < 0.001$

relative sparing of wave I (indicative of peripheral transmission time) suggests that the eighth nerve is not greatly involved in diabetes mellitus but Fedele et al (5) observed a delay in wave I latency at various stimulus repetition rates.

The observed delay in central transmission time in diabetes may be related to the pathological observations of Reske-Nielsen and Lundbaek (1). They examined three long term diabetics and found diffuse degeneration of the ganglion cells and nerve fibres of the cerebrum, brainstem and cerebellum. Mc Call (11) reviewed that many physiological abnormalities occur in the brain as a chronic consequence of diabetes. He has attributed these abnormalities to the altered cerebral blood flow, impaired cerebrovascular reactivity, altered neurotransmitter metabolism and altered energy metabolism in poorly controlled diabetes. Various factors have been attributed for brain dysfunction in diabetes but specific mechanism involved in diabetes for altered electrophysiology is unclear. Tandon et al (12) provided an electrophysiological evidence of delayed cognition in poorly controlled NIDDM cases.

No correlations were observed between

wave latencies and fasting and post prandial plasma glucose values. Furthermore no relationship was observed between all the major components of BEAR and duration of diabetes which suggests that brainstem auditory evoked responses are impaired very early in diabetes as has been observed by Pietravalle et al (7).

Our findings therefore suggest diabetic subjects suffer not only from somatic and autonomic neuropathy but also from central nervous system involvement which may be in the form of demyelination or similar focal lesions at lateral lemniscal pathway and probably also at inferior colliculus. Central nervous system involvement in diabetes does not seem to be related to duration of diabetes or to plasma glucose level. BAER recording can represent sensitive and non invasive tool to detect early impairment of CNS pathways in diabetic patients even in absence of specific symptoms.

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