Original Research Paper

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Physiology

AUDITORY BRAIN STEM EVOKED RESPONSE IN TYPE 2 DIABETES MELLITUS PATIENTS.

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ABSTRACT **Background** : Detection of central neuropathy at different frequencies using brain Stem Evoked Response Audiometry has rarely been studied

Objectives: Evaluation of central neuropathy in T2DM patients

Material and Methods-Thirty five T2DM patients (age group 30-50 years) of both sexes and age, sex and BMI matched thirty five healthy controls were evaluated for Brain Stem Evoked Response.

Wave latencies(ms) I,III and V and Inter peak latencies(ms) I-III, I-V and III-V at 80 db using 2,4 and 6 KHz frequency was measured by RMS EMG SALUS 2C Electromyogrph. Statistical analysis was performed using SPSS software version 16 and Z-test was used to derive the level of significance.

Results: Wave latencies I,III,V and Interpeak latencies I-III,I-V,III-V is found to be non significant at 2000 and 4000 Hz.Wave latency III in both the ears is found to be highly significant at 6000 Hz. Wave latency V is found to be significant in Left ear and highly significant in Right ear at 6000Hz. Interpeak latency I-III is found to be highly significant in both the ears at 6000Hz.Interpeak latency I-V is significant in both the ears at 6000Hz.Wave latency I and Interpeak latency III-V is found to be non significant in both the ear at 6000Hz.

Conclusion: Increase in wave latency and interpeak latency inT2DM subjects put these patients at a higher risk for central neuropathy.

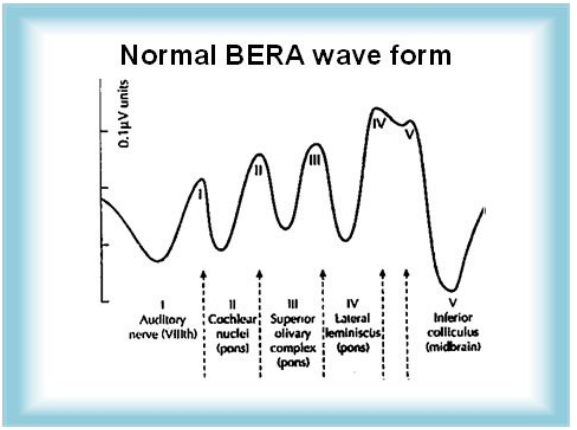
KEYWORDS : T2DM-Type 2 Diabetes Mellitus, BERA-Brain Stem Evoked Response Audiometry and Latency.

INTRODUCTION:

T2DM(type 2 diabetes mellitus) comprises of a group of common metabolic disorders that share the phenotype of hyperglycemia[1]. In addition, it is characterized by abnormal metabolism of fat, protein resulting from insulin deficit or insulin action, or both[2]. T2DM is due to predominantly insulin resistance with relative insulin deficiency called as noninsulin-dependent DM.[3] Since it often has a long asymptomatic period of hyperglycemia, many individuals with T2DM have complications at the time of diagnosis, neuropathy being most frequent. Several reports have shown a bilateral sensorineural hearing loss affecting mainly the high and middle frequencies in patients with diabetes mellitus[2]. Although diabetic neuropathy manifests clinically much later in the course of the disease, yet its physiological evidence can be obtained much earlier with the help of electrophysiological tests.[4] In general the risk of chronic complications increases as a function of the duration of hyperglycemia, they usually become apparent in the second decade of hyperglycemia[5].

BERA is an important noninvasive tool that encompasses diagnosis of lesions ranging from 8th nerve to the auditory cortex[7]. It is based upon the study of electrical potentials generated by the auditory pathway in response to electrical Stimuli[8]. There are seven wave forms traditionally designated with roman numerals from I to VII. Waves I, III, and V are recorded reliably enough to be routinely used in clinical applications[3].

The amplitude of peaks are variable within the subjects, but the latencies of wave peaks are stable[1]. Their latencies are quite specific and their reproducibility is very good.[1] Very distinct advantage of using BERA as a diagnostic modality is that, it is resistant to the effect of sleep, sedation and anesthesia[5].There is also a lack of adequate data on BAEP changes in diabetics in India, because very few studies have been done here[6].



MATERIAL AND METHODS:

The present study was conducted in the Department of Physiology in association with Department of Endocrinology /Medicine, SMS Medical College and Hospital, Jaipur Rajasthan from 1 June 2016 to 31 May 2017 on 35 T2DM patients between the age group 30-50 years, taken from the department of Endocrinology/Medicine ,S.M.S. Hospital Jaipur , 35 age ,sex and BMI matched healthy controls were selected from the attendants of patients .The permission and clearance was obtained by the research review board and ethical committee of the institute.

INCLUSION CRITERIA:

30-50 years Diabetes Mellitus type II patients of both sexes with duration of disease 5-10 years, age, sex and BMI matched healthy control subjects accompanying the patient, cooperative subjects giving written informed consent

EXCLUSION CRITERIA:

Upper airway disease, ear disease, family history of deafness, taking

medication that interfere with auditory functioning, any acute or chronic illness, alcoholics and smokers.

All the Subjects were tested under similar laboratory conditions and allowed to acclimatize themselves to experimental and environmental conditions for 15 minutes so that they were relaxed and rested. The procedure of the test was explained to the cases and controls before conducting the test. A thorough history was taken and general physical examination was done to screen out the subjects.

For assessment of central neuropathy following tests were performed

BERA in the both ears using 80 db at 2,4 & 6 Khz

Statistical analysis was performed using SPSS software version 16 and Z-test was used to derive the level of significance

Observation tables:

Table no. 1

Distribution according to Age and BMI of Case & Control group subjects

Parameters	Case	Control	Significance
Age(years)	43.09±4.49	42.86±4.69	NS
BMI(kg/m²)	23.78±2.29	23.57±2.67	NS

Table no.2

Mean ± SD of BERA Latency (ms) (Right ear) at 2000 Hz of Cases and control group subjects

	BERA at 2000 Hz (Right ear)					
	I	III	V	I-III	I-V	III-V
Case (n=35)	1.63 ±0.17	3.65 ±0.44	5.55 ±0.58	2.17 ±0.67	3.91 ±0.61	1.96 ±0.52
Control (n=35)	1.65 ±0.17	3.75 ±0.23	5.61 ±0.47	2.11 ±0.32	3.97 ±0.57	1.86 ±0.37
p- Value	>.05	>.05	>.05	>.05	>.05	>.05
Significance	NS	NS	NS	NS	NS	NS

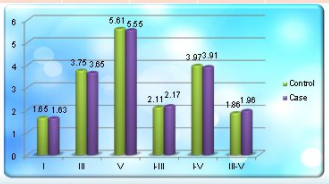


Table no. 3

Mean ± SD of BERA Latency (ms) (Left ear) at 2000 Hz of Cases and control group subjects

	BERA at 2000 Hz (left ear)					
	I	III	V	I-III	I-V	III-V
Case (n=35)	1.56± 0.28	3.75 ± 0.26	5.86 ± 0.38	2.19 ± 0.36	4.29 ± 0.35	2.11 ± 0.47
Control (n=35)	1.49 ± 0.11	3.68 ± 0.22	5.78 ± 0.29	2.16 ± 0.27	4.23 ± 0.41	2.10 ± 0.39
p- Value	>.05	>.05	>.05	>.05	>.05	>.05
Significance	NS	NS	NS	NS	NS	NS

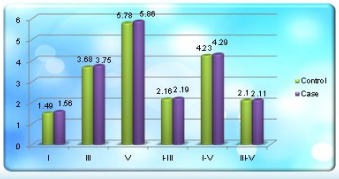


Table No. 4

Mean ± SD of BERA Latency (ms) (Right ear) at 4000 Hz of Cases and control group subjects

	BERA at 4000 Hz (Right ear)					
	I	III	V	I-III	I-V	III-V
Case (n=35)	1.83 ±0.18	3.75 ±0.20	5.71 ±0.34	1.92 ±0.21	3.89 ±0.34	1.97 ±0.40
Control (n=35)	1.83 ±0.15	3.79 ±0.24	5.60 ±0.31	1.97 ±0.25	3.78 ±0.30	1.81 ±0.42
p- Value	>.05	>.05	>.05	>.05	>.05	>.05
Significance	NS	NS	NS	NS	NS	NS

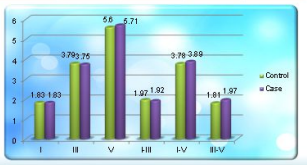


Table no. 5

Mean ± SD of BERA Latency (ms) (Left ear) at 4000 Hz of Cases and control group subjects

	BERA at 4000 Hz (left ear)					
	I	III	V	I-III	I-V	III-V
Case (n=35)	1.77 +0.23	3.76 +0.28	5.68 +0.41	1.98 +0.35	3.83 +0.63	1.87 +0.51
Control (n=35)	1.78 ±0.25	3.69 ±0.32	5.76 ±0.29	1.88 ±0.32	3.97 ±0.44	2.07 ±0.43
p- Value	>.05	>.05	>.05	>.05	>.05	>.05
Significance	NS	NS	NS	NS	NS	NS

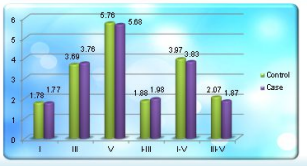


Table no. 6

Mean ± SD of BERA Latency (ms) (Right ear) at 6000 Hz of Cases and control group subjects

	BERA at 6000 Hz (Right ear)					
	I	III	V	I-III	I-V	III-V
Case (n=35)	1.79 ±0.19	3.99 ±0.42	5.93 ±0.47	2.20 ±0.47	4.15 ±0.51	1.94 ± 0.44
Control (n=35)	1.76 ±0.16	3.67 ±0.30	5.67 ±0.40	1.91 ±0.30	3.93 ±0.40	2.01 ±0.35
p- Value	>.05	<.001	<.001	<.001	<.05	>.05
Significance	NS	HS	HS	HS	Sig	NS

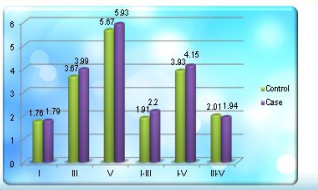
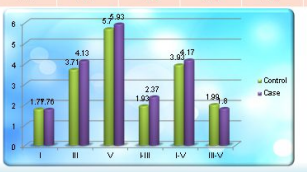


Table no. 7

Mean ± SD of BERA Latency (ms) (Left ear) at 6000 Hz of Cases and control group subjects

	BERA at 6000 Hz (left ear)					
	I	III	V	I-III	I-V	III-V
Case (n=35)	1.76 ± 0.25	4.13 ± 0.13	5.93 ± 0.27	2.37 ± 0.29	4.17 ± 0.38	1.80 ± 0.32
Control (n=35)	1.77 ± 0.19	3.71 ± 0.26	5.70 ± 0.36	1.93 ± 0.26	3.93 ± 0.39	1.99 ± 0.50
p- Value	>.05	<.001	< .01	<.001	<.01	>.05
Significance	NS	HS	Sig	HS	Sig	NS



Results:
Wave latencies I,III,V and Interpeak latencies I-III,I-V,III-V is found to be non significant in both the ears at 2000 and 4000 Hz.

Wave latency III in both the ears is found to be highly significant at 6000 Hz.

Wave latency V is found to be significant in Left ear and highly significant in Right ear at 6000Hz.

Interpeak latency I-III is found to be highly significant in both the ears at 6000Hz.

Interpeak latency I-V is significant in both the ears at 6000Hz.

Wave latency I and Interpeak latency III-V is found to be non significant in both the ears at 6000Hz.

Discussion:
In our study wave latency III in both the ears is found to be highly significant and Wave latency V is found to be significant in Left ear and highly significant in Right ear at 6000 Hz. Interpeak latency I-III is found to be highly significant in both the ears and Interpeak latency I-V is significant in both ears at 6000Hz. Wave latency I and Interpeak latency III-V is found to be non significant in both the ears at 6000Hz . Wave latencies I,III,V and Interpeak latencies I-III,I-V,III-V is found to be non significant in both the ears at 2000 and 4000 Hz.

Hence it can be presumed that there is gradual development of sensorineural hearing defect occuring at higher frequencies in T2DM patients[9,10] because fibers of basilar membrane at the base are affected first than apical fibers , thereby causing earlier hearing loss of high frequency sound.

Several researches revealed hearing loss, sensorineural in most cases, with a predominance of mild to moderate degree and affecting higher frequencies [11]. Hearing loss present at higher frequencies could be explained by the fact that the basal region of the cochlea is more vascularized, which predisposes it to more obvious effects of vascular damage [12]. The hyperglycemia, in turn, could be further present in this region and therefore, its effects would be greater than those observed in other regions of the cochlea [13].

Perhaps, as seen in aging and ototoxic subjects, the basal or high frequency region in the cochlea is susceptible to certain diseases, such as diabetes. Routine clinical tests usually run only in the frequency rangge of speech, when they identifies BERA sensitivity beyond this region (at higher frequencies) i.e., we obtain a more complete picture of cochlear status, which may indicate declining hearing in the high frequencies [14].

Histolopathological finding in the inner ear of these patients show characteristic microangiopathy with Periodic Acid Schiff positive substance in stria vascularis.[1]

Thus assessment of brain stem evoked response can be used as a biomarker for early detection and subsequent management of central neuropathy in T2DM patients,to bring down the morbidity and mortality in these patients.

Conclusion:
Increase in wave latencies and interpeak latencies in both the ears at 6000 Hz indicate beginning of central neuropathy in T2DM subjects, which warrants for a good glycemic control to prevent frank deafness in future.

Early detection and initiation of treatment may improve the disease outcome and overall prognosis.

Limitations and Recommendation:
Large sample size may give more accurate results

Pure Tone Audiometry may also be done for comparison of results obtained.

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