VOLUME-7, ISSUE-5, MAY-2018 • PRINT ISSN No 2277 - 8160

Original Research Paper

Nursing

A CROSS SECTIONAL STUDY TO FIND OUT IF GLYCEMIC STATUS AND DURATION OF DIABETES AFFECTS LATENCY AND INTERPEAK LATENCY OF BRAIN STEM EVOKED RESPONSE AUDIOMETRY (BERA) WAVES

Dr Manoj Kumar Jain* — MBBS, IIIrd year resident , Department of Physiology, S.M.S. Medical College , Jaipur , Rajasthan *Corresponding author

Dr Jyotsna Shukla — MBBS, MD, PhD , Sr. Professor Department of Physiology, S.M.S. Medical College , Jaipur , Rajasthan

Dr Balram Sharma — Assistant Professor MBBS, MD, DM Endocrinology S.M.S. Medical College and Hospital, Jaipur , Rajasthan

Dr Pooja — Intern, S.M.S. Medical College , Jaipur , Rajasthan

ABSTRACT

Background : Whether glycemic status and duration of Diabetes affects latency and inter peak latency of BERA waves, is not well established

Objectives: To observe whether glycemic status and duration of Diabetes affect latency and interpeak latency of BERA waves in T2DM patients

Material and Methods-Thirty five T2DM patients (age group 30-50 years) of both sexes were evaluated for Brain Stem Evoked Response .They were divided into 2 groups according to duration of diabetes and also according to HbA1C level.

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

Results: Comparison between means of wave latencies I,III,V and Interpeak latencies I-III,I-V,III-V is found to be non significant in both the ears of T2DM patients with disease duration >7 years and those with <7 years.

- Difference in means of wave latency I is found to be significant and interpeak latency I-III highly significant in left ear inT2DM patients of HbA1C >8.5 as compared to HbA1C <8.5.
- Wave latency V and interpeak latency I-V,III-V is found to be significant in right ear inT2DM patients of HbA1C >8.5 as compared to HbA1C <8.5.

Conclusion: Increase in certain wave latencies and interpeak latencies inT2DM subjects with poor glycemic control indicate that these patients may be susceptible for earlier development of central neuropathy.

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

INTRODUCTION

Diabetes Mellitus (DM) is a common metabolic disorder of carbohydrates in which blood glucose levels are abnormally high, abnormal metabolism of fat, protein resulting from insulin deficiency or insulin action, or both. There are two broad categories of DM, type 1 and type 2.Type 2 diabetes is much more common than type 1(Mahallik D[1] et al. 2014), accounts for 80%-90% of all cases of diabetes(Adebola S[2] O 2016). It is typically gradual in onset and occurs mainly in the middle aged and elderly(Gupta R[3] et al. 2010). The type I diabetes mellitus is the most common form among children and adolescents, caused by partial or total destruction of pancreatic beta cells, resulting in progressive inability to produce insulin. India has dubious distinction of being the world leader in diabetic population. Diabetes mellitus is a chronic multi-systemic metabolic disorder(Gupta S[4] et al. 2013), the metabolic dysregulation associated with DM causes secondary patho-physiological changes in multiple organ systems(Gupta R[3] et al. 2010), such as retinopathy, nephropathy, neuropathy, and coronary arterial and peripheral vascular diseases(Cayanu M[5] et al.2014). In general ,the risks of chronic complication increases as a function of the duration of hyperglycemia, they usually become apparent in the second decade of hyperglycemia(Gupta R[3] et al. 2010). It often has a long asymptomatic period of hyperglycemia, many individuals with type-2 diabetes have complications at the time of diagnosis, neuropathy being most frequent (Siddiqi[6] et al. 2015). Peripheral and autonomic neuropathy are more popular than central neuropathy which was considered for the first time in 1965(Forogh[7] et al 2013). The typical hearing impairment described in diabetics is a bilateral sensorineural hearing loss occurring as a result of neuropathy.In diabetes mellitus, there is involvement of the smaller vessels in the inner ear that leads to hypoxia and thus leading to hearing loss (Mahallik D[1] et al.2014). The microangiopathy due to DM can result in loss of blood supply to stria vascularis, atrophy of stria vascularis and damage to outer hair cells; resulting in deterioration of otoacoustic emissions (OAE)(Joshi KD[8] et al. 2017).

The possible mechanisms for diabetic central neuropathy may be microangiopathy at the cochlea, neuropathic brainstem involve ment, metabolic effect of hyperglycemia or hypertriglyc eridemia, hyperviscosity resulting in vascular problems, or a combination of above (Siddiqi[6] et al. 2015).

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 . The electrophysiological testing reflects the bioelectric responses of the nervous system to sensory (somatosensory evoked potentials), auditory (brainstem auditory evoked potentials) or visual stimuli (visual evoked potentials) (Gupta S[4] et al 2013). With the refinement of brainstem evoked response audiometry (BERA), diabetic patients may have an abnormal auditory nerve and brainstem response to an acoustic stimulus and are more prone to develop sensorineural hearing loss . BERA is an important noninvasive tool that may help in the diagnosis of lesions ranging from 8th nerve to the auditory cortex(Siddiqi [6] et al. 2015) . It is based upon the study of electrical potentials generated by the auditory pathway in response to electrical stimuli.

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 patient, age ranging 30-50 years of both sexes, out of which 17 were of disease duration <7years and 18 patients having >7 year duration,18 patients were having HbA1C <8.5 and 17 had HbA1C >8.5 .Patients were taken from the

department of Endocrinology/Medicine ,S.M.S. Hospital Jaipur .The permission and clearance was obtained by the research review board and ethical committee of the institute .

INCLUSION CRITERIA

- Diabetes Mellitus type II patients of age 30-50 years of both sexes with duration of disease 5-10 years
- 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.

MATERIAL AND METHOD

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 all the patients 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 4 Khz
Wave latencies(ms) I,III and V and Inter peak latencies(ms) I-III, I-V and III-V was measured by RMS EMG SALUS 2C Electromyogrph .

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

Observation tables:

Table No.-1

Distribution according to duration of DM of T2DM patients

Parameters	<7yrs(n-17)	>7yrs(n-18)	significance
Mean of Age(years)	43.04±4.42	42.44±4.02	NS
Mean of BMI(Kg/m^2)	23.74±2.44	23.44±2.74	NS

Table No.-2

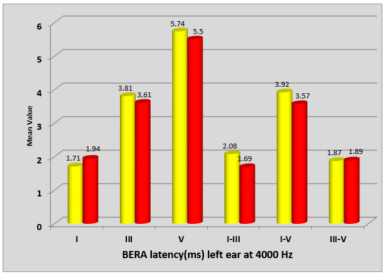
Distribution according to HbA1C of T2DM patients

Parameters	<8.5 (n-18)	>8.5(n-17)	significance
Mean Age(years)	42.04±4.22	42.23±4.12	NS
Mean BMI(Kg/m^2)	23.34±2.24	23.54±2.52	NS

Table No.-3

Mean + SD of BERA Latency and interpeak latency(ms) (left ear) at 4000 Hz of Diabetes patients according to HbA1c

HbA1c	BERA at 4000 Hz Wave Latency(ms) (left ear)					
	I	III	V	I-III	I-V	III-V
< 8.5(n-18)	1.71 ± 0.21	3.81 ± 0.19	5.74 ± 0.28	2.08 ± 0.25	3.92 ± 0.59	1.87 ± 0.44
≥ 8.5(n-17)	1.94 ± 0.19	3.61 ± 0.40	5.50 ± 0.63	1.69± 0.41	3.57 ± 0.67	1.89 ± 0.70
P- Value	<.01	>.05	>.05	<.001	>.05	>.05
Significance	Sig	NS	NS	HS	NS	NS

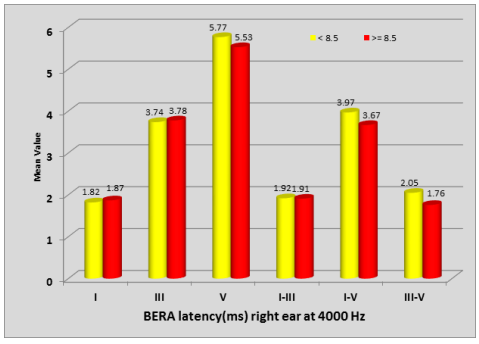


Histogram 3

Table No.-4

Mean + SD of BERA Latency and interpeak latency(ms) (Right ear) at 4000 Hz of Diabetes patients according to HbA1c

HbA1c	BERA at 4000 Hz Wave Latency(ms) (Right ear)					
	I	III	V	I-III	I-V	III-V
< 8.5(n-18)	1.82 ± 0.17	3.74 ± 0.20	5.77 ± 0.34	1.92 ± 0.21	3.97 ± 0.36	2.05 ± 0.41
≥ 8.5(n-17)	1.87 ± 0.20	3.78 ± 0.18	5.53 ± 0.28	1.91 ± 0.22	3.67 ± 0.14	1.76 ± 0.31
P- Value	>.05	>.05	<.05	>.05	<.001	<.05
Significance	NS	NS	Sig	NS	HS	Sig

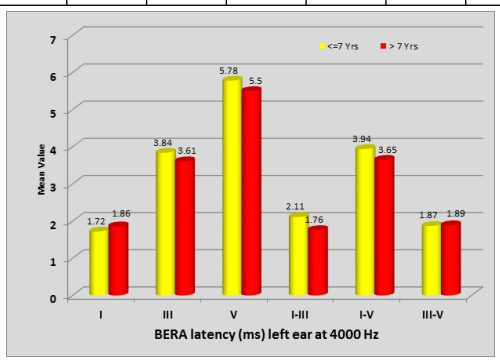


Histogram 4

Table No.-5

Mean + SD of BERA Latency and interpeak latency (ms) (left ear) at 4000 Hz of T2DM patients according to duration of DM

Duration (years)	BERA at 4000 Hz Wave Latency(ms) (left ear)					
	I	III	V	I-III	I-V	III-V
≤ 7(n-17)	1.72 ± 0.21	3.84± 0.17	5.78 ± 0.27	2.11 ± 0.21	3.94 ± 0.62	1.87 ± 0.46
> 7(n-18)	1.86 ± 0.24	3.61 ± 0.35	5.50 ± 0.53	1.76 ± 0.41	3.65 ± 0.60	1.89 ± 0.59
P- Value	>.05	>.05	>.05	>.05	>.05	>.05
Significance	NS	NS	NS	NS	NS	NS

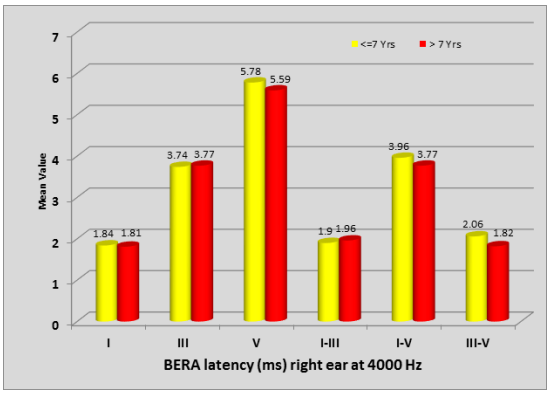


Histogram 5

Table No.-6

Mean + SD` of BERA Latency and interpeak latency (ms) (Right ear) at 4000 Hz of Diabetes patients according to duration of DM

Duration (years)	BERA at 4000 Hz Wave Latency(ms) (Right ear)					
	I	III	V	I-III	I-V	III-V
≤ 7(n=17)	1.84 ± 0.16	3.74 ± 0.20	5.78 ± 0.34	1.90 ± 0.20	3.96 ± 0.38	2.06 ± 0.42
> 7(n=18)	1.81 ± 0.21	3.77 ± 0.19	5.59 ± 0.30	1.96 ± 0.22	3.77 ± 0.21	1.82 ± 0.33
P- Value	>.05	>.05	>.05	>.05	>.05	>.05
Significance	NS	NS	NS	NS	NS	NS



Histogram 6

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 in T2DM patients of duration of disease>7 years as compared to disease duration <7 years .

Wave latency I is found to be significant and interpeak latency I-III is highly significant in left ear inT2DM patients of HbA1C >8.5 as compared to patients with HbA1C <8.5 .

Wave latency V and interpeak latency I-V,III-V is found to be significant in right ear inT2DM patients of HbA1C >8.5 as compared to patients with HbA1C <8.5.

DISCUSSION:
Diabetic angiopathy may occur both directly by interfering with the blood supply to the cochlea by reducing transport through the thickened walls of capillaries, and indirectly by reducing the flow in a narrowed vasculature, or even by secondary degeneration of the eighth cranial nerve (Adebola S O[2] 2016**)**. Several authors have previously suggested that microangiopathy could be responsible for functional changes in the inner ear associated with diabetes mellitus(Adriana C[9] et al. 2015). Angiopathy is slow process that may take many years to develop so comparision with duration is not found to be significant unless very long(Brownlee M[10] et al.2005).

The risk of cochleopathy is proportionately increased with elevated glycated haemoglobin value. The occurrence of diabetic cochleopathy is dependent on the glycemic control, so it is possible to have a prediction about the occurrence of cochleopathy based on the values of glycated haemoglobin .

CONCLUSION:
Increase in wave latencies and interpeak latencies in both the ears with respect to HbA1c indicate beginning of central neuropathy in T2DM subjects, so all the T2DM patients should be advised to undergo BERA studies , so as to detect development of early central neuropathy before sign and symptom of deafness appears.

Early detection may warrant good glycemic control and appropriate treatment may improve 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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