Effect of Insomnia on Auditory Evoked Potential in Adult Male Population

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Abstract

Objective: Sleep is essential for optimal health. Induced or perceived lack of sleep is a symptom of insomnia. The most frequently reported consequences of insomnia include impaired attention and memory deficits. Such changes inthe circadian rhythm can lead to deleterious effects on our normal neurophysiological functioning which can be assessed with the help of evoked potentials. The present study is aimed to explore the changes in auditory evoked potential in male individuals suffering from insomnia when compared to normal subjects.

Materials and Methods: The study sample included 50 individuals (21= case group and 29= control group) aged from 25 to 55 years selected from Santosh Medical College and Hospital, Ghaziabad. Level of Insomnia was evaluated with the help of Athens Insomnia Scale. Proper instructions were given and then consent was taken from the participants before recording their auditory evoked potentials.

Results: The study showed no significant ($p<0.05$) changes in latencies auditory evoked potential in case group when compared with control group and no correlation between auditory evoked potential and insomnia.

Conclusion: Insomnia does not have any visible impact on the parameters of auditory evoked potential.

Keywords: Athens Insomnia Scale, Insomnia, Sleep, Auditory evoked potential

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Introduction

Sleep is a naturally recurring state of mind and body, associated with a state of muscle relaxation and reduced perception of environmental stimuli.[1] The National Sleep Foundation recommends 7-9 hours of sleep per night on a regular basis to promote optimal health among adults aged 18 to 60 years.[2] Induced or perceived lack of sleep is called sleep deprivation, which is not a disease but rather a symptom of illnesses such as insomnia.

Insomnia can be labelled as a symptom, a syndrome and a comorbid disorder in which people have trouble sleeping i.e., they may have difficulty falling asleep, or staying asleep as long as desired. [3-5] Overall globally different studies revealed that between 10% to 30% of adults have insomnia at any given point in time and up to 50% -60% have insomnia in a given year. [6-8]

Despite being multidimensional and multifaceted, insomnia is yet evaluated and diagnosed primarily on the basis of clinical history. In medicine, insomnia is commonly measured by using Athens Insomnia Scale (AIS).[9] Now, AIS is considered to be an effective tool in sleep analysis as it is validated in different countries by testing it on local patients. [10-17] A cut-off score of ≥6 on the AIS is used to establish the diagnosis of insomnia.[18]

The most frequently reported consequences of insomnia include tiredness, sleepiness, mood alteration [19], impaired attention, and memory deficits [20] which can lead to deleterious effects on our normal neurophysiological functioning which can be assessed with the help of evoked potentials. [21-24]

The present study is aimed to explore the changes in BAEP wave latencies in male individuals suffering from insomnia when compared to normal subjects. With the help of this study, we will also be assessing insomnia according to results obtained with the use of neurophysiological measures such as evoked potentials.

Material and methods

Materials

a) Athens Insomnia Scale [9]
b) Tuning Fork (256Hz)
c) RMS EMG Salus Machine (RMS Advance Testing Lab, Panchkula, Haryana, India)

Ethical consideration

The present study to evaluate the effect of insomnia on auditory evoked potential in male population followed the guidelines as laid down in the Declaration of Helsinki, and ethical clearance was also obtained from the Institutional Ethical Committee of Santosh Medical College before performance of any tests on human subjects. Before enrolling them into the study a full explanation of the purposes, procedures and potential risks and benefits of the assessments were offered to all participants, and their written consents were acquired.

Experimental design

A case control study conducted at Santosh Medical College and Hospital, Ghaziabad between 2020 and 2022 was performed on 50 male individuals selected from OPD and staff members aged from 25-55yrs. The study sample were classified as control group (29): who do not have insomnia and case group (21): who had complaints of insomnia for past one month after the questionnaire analysis was done using Athens Insomnia Scale (AIS). The auditory evoked potentials were recorded by the RMS EMG Salus Machine (RMS Advance Testing Lab, Panchkula, Haryana, India).

Inclusion Criteria

a) Age= 25-55yrs.
b) Only males with normal hearing
c) Case group = Subjects having Athens Insomnia Scale (AIS) score ≥6
d) Control group = Subjects with Athens Insomnia Scale (AIS) score <6

Exclusion Criteria

a) History of acute/chronic illness, neurological/psychiatric disorders.
b) History of drug intake (eg: CNS stimulants and depressants)
c) Auditory defects (eg: conductive or sensorineural hearing loss)
d) History of smoking/alcoholism/diabetes.
e) Females

Insomnia Analysis

Insomnia was measured by Athens Insomnia Scale (AIS). The AIS is a self-assessment psychometric instrument designed for quantifying sleep difficulty based on the ICD-10 criteria. It is measured on the basis of eight factors out of which initial five factors are related to nocturnal sleep and the last three factors are related to daytime inefficiency. The rating is made on a 0–3 scale. Then the sleep is assessed from the cumulative score of all eight factors and reported as an individual's sleep outcome for the past one month. Individuals with a score of ≥6 on the AIS were included in case group and individuals with a score of <6 on the AIS were included in control group. [25-30]

Preliminary tests

a) Auditory examination: It was done by performing two tests - Weber and Rinne Test.

i) In the Weber test, a vibrating tuning fork (256 Hz) was placed in the middle of the forehead, on top of the head equidistant from the subjects' ears on top of thin skin in contact with the bone. The subject was asked to report in which ear the sound is heard louder. A normal Weber test have a subject reporting the sound heard equally on both sides.

ii) In the Rinne test, a vibrating tuning fork (256 Hz) was placed initially on the mastoid process behind each ear until sound is no longer heard. The fork was then immediately placed just outside the ear and the subject was asked to report when the sound caused by the vibration was no longer heard. A normal or positive Rinne test is when the sound heard outside of the ear (air conduction) is louder than the initial sound heard when the tuning fork end was placed against the skin on top of the mastoid process behind the ear (bone conduction).

Recording of Brainstem Auditory Evoked Potential:

Auditory Evoked Potential was recorded after explaining the participants about the procedure to ensure full co-operation. Subjects were seated in an arm chair comfortably for recordings to be obtained by using the calibrated RMS EMG Salus Machine. For recording purpose, the electrode placement was kept in accordance with 10–20 International System as: ground electrode placed on the forehead, active electrodes placed on both the mastoid processes and the reference electrode placed over the vertex with an electrode conducting paste and cotton balls after abrading and degreasing the respective scalp area. The signals were picked up by these electrodes after the standard click stimuli which was delivered through the headphones producing 2000 click stimuli of 70db intensity above the subject threshold at rate of 10/sec and 0.1msec and recorded.

Statistical analysis

Values were expressed as means ± SD. The data were tested for assumptions of normality using the Shapiro Wilk test. The comparison of means of BAEP wave latencies between the groups was done by a two-tailed analysis using Mann-Whitney test. $P < 0.05$ was considered to indicate statistically significant differences. Data analysis was done by using the statistical program for social sciences (SPSS) version 20.0. To find out the correlation between BAEP latencies and AIS score (insomnia) non-parametric test of Spearman's correlation was applied.

RESULTS

AIS score in male control and case group

Table 1 represent AIS score in male control (n=29) and case (n=21) group. Values are present as mean ± standard deviation.

Table 1: AIS score in male subjects (n=50).

Group	Sample size (n)	AIS Score
		Mean ± SD
Control	29	0.55 ± 1.3
Case	21	8.90 ± 3.86

AIS = Athens Insomnia Scale

Table 1 shows increased mean value of AIS score in male case group (8.90 ± 3.86) as compared to control group (0.55 ± 1.3) that depicts increase in AIS score value in male individuals suffering from insomnia than normal.

BAEP latencies in male control and case group

Table 2 represent BAEP latencies in male control (n=29) and case (n=21) group. Values are present as mean ± standard deviation.

Table 2: BAEP latencies in male subjects (n=50).

Group (Sample size, n)	Wave I	Wave II	Wave III	Wave IV	Wave V	IPL1	IPL2	IPL3
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Control (29)	**1.66 ± 0.07**	**2.80 ± 0.05**	**3.67 ± 0.12**	**5.08 ± 0.33**	**5.47 ± 0.22**	**1.92 ± 0.22**	**1.97 ± 0.34**	**3.93 ± 0.38**
Case (21)	**1.68 ± 0.08**	**2.81 ± 0.04**	**3.65 ± 0.02**	**5.18 ± 0.36**	**5.48 ± 0.34**	**1.95 ± 0.27**	**2.07± 0.21**	**3.94 ± 0.23**

IPL: Interpeak Latency

Table 2 shows no variations in mean value of BAEP wave latencies in male case group and control group that depicts no effect of insomnia on auditory evoked potential in males suffering from insomnia.

Non-parametric Analysis: Mann-Whitney test.

Table 3 represents the Mann-Whitney test analysis to compare the mean latency of BAEP waves between the groups.

Table 3: Mann-Whitney test analysis of BAEP in male control and case group (n=50).

	I	II	III	IV	V	IPL1	IPL2	IPL3
Mann-Whitney U	1203.50	1276.00	1196.50	1273.00	1366.00	1296.50	1394.50	1260.00
Wilcoxon W	2743.50	2816.00	2736.50	2813.00	2906.00	2836.50	2934.50	2800.00
Z	-1.852	-1.418	-1.894	-1.438	-.877	-1.293	-.706	-1.510
Asymp. Sig.(2-tailed)	.064	.156	.058	.150	.381	.196	.480	.131

a. Grouping Variable: AIS

The study showed no statistically significant (p<0.05) difference in the mean latency (ms) of BAEP waves and interpeak latencies between male control and case group.

Non-parametric Correlation Analysis: Spearman's rho correlation test.

Table 4 represents the Spearman's rho correlation test analysis to find out the correlation between BAEP latencies and AIS score (insomnia).

Table 4: Correlation of BAEP with AIS Score (n=50)

Correlations											
			I	II	III	IV	V	IPL1	IPL2	IPL3	AIS2
Spearman's rho	I	Correlation Coefficient	1.000	-.027	.121	-.002	-.169	.089	.031	.077	.154
		Sig. (2-tailed)	.	.780	.208	.985	.078	.354	.748	.424	.109
		N	50	50	50	50	50	50	50	50	50
	II	Correlation Coefficient	-.027	1.000	.088	.223*	.004	.155	-.157	.034	.139
		Sig. (2-tailed)	.780	.	.361	.019	.966	.107	.102	.722	.147

		N	50	50	50	50	50	50	50	50	50
	III	Correlation Coefficient	.121	.088	1.000	-.039	-.055	.130	.020	-.008	.103
		Sig. (2-tailed)	.208	.361	.	.689	.565	.174	.832	.931	.282
		N	50	50	50	50	50	50	50	50	50
	IV	Correlation Coefficient	-.002	.223*	-.039	1.000	.146	-.070	-.007	-.005	.223
		Sig. (2-tailed)	.985	.019	.689	.	.128	.465	.942	.959	.019
		N	50	50	50	50	50	50	50	50	50
	V	Correlation Coefficient	-.169	.004	-.055	.146	1.000	.003	.146	.057	.174
		Sig. (2-tailed)	.078	.966	.565	.128	.	.977	.128	.552	.069
		N	50	50	50	50	50	50	50	50	50
	IPL1	Correlation Coefficient	.089	.155	.130	-.070	.003	1.000	-.021	.051	.161
		Sig. (2-tailed)	.354	.107	.174	.465	.977	.	.831	.598	.092
		N	50	50	50	50	50	50	50	50	50
	IPL2	Correlation Coefficient	.031	-.157	.020	-.007	.146	-.021	1.000	.278	.126
		Sig. (2-tailed)	.748	.102	.832	.942	.128	.831	.	.003	.190
		N	50	50	50	50	50	50	50	50	50
	IPL3	Correlation Coefficient	.077	.034	-.008	-.005	.057	.051	.278	1.000	.140
		Sig. (2-tailed)	.424	.722	.931	.959	.552	.598	.003	.	.146
		N	50	50	50	50	50	50	50	50	50
	AIS2	Correlation Coefficient	.154	.139	.103	.223	.174	.161	.126	.140	1.000
		Sig. (2-tailed)	.109	.147	.282	.019	.069	.092	.190	.146	.
		N	50	50	50	50	50	50	50	50	50

IPL= Interpeak Latency

A non-significant correlation was observed between BAEP and Insomnia at 0.05 level (2-tailed). Thus, showing a no correlation between BAEP and Insomnia.

Discussion

The present study was done on 50 male individuals categorised as twenty-nine normal subjects and twenty-one subjects who were suffering from insomnia for the past one month. After evaluating their degree of insomnia using Athens Insomnia Scale, all participants were subjected for measurement of BAEP by using RMS EMG Salus Machine. The measurements obtained from both the groups were compared if any significant difference exists.

According to Athens Insomnia Scale in this study an increased score value in subjects suffering from insomnia was observed when compared to normal subjects. Moreover, the differences in BAEP wave latencies between the groups depicted no effect of insomnia on the measurements. The results showed no significant prolongation of mean latencies of BAEP in subjects who were suffering from insomnia for the past one month when compared to the normal healthy subjects; as waves I, II, III, IV and V of BAEP showed no variation in mean latency in subjects who were suffering from insomnia for the past one month when compared to the normal healthy subjects. Interpeak latencies between Waves I-III, III-V and I-V also showed no significant increase when compared both the groups. The study results were inconsistent with an experiment done by Harsh et al. showing increase in latency of BAEP waves in sleep deprived individuals compared to the control group.

Similar to other studies our study also had some limitations:

a) Participants may give false information;
b) Institution based case-control study;
c) Less sample size because of the exclusion criteria.

Conclusion

The present study was carried out to understand the effect of insomnia on evoked potentials in Indian male population. It is a novel study that has focused on the state of research on neurophysiological measures while suggesting that on combining with other measures it might be the best avenue offering a more genuine picture of insomnia in Indian population.

In addition, promoting and increasing the use of treatments known to be well effective for insomnia, such as Cognitive behavioural therapy for insomnia (CBT-I), will alleviate greatly the personal burden of this disorder for individuals with insomnia while also decreasing the economic cost for our society. It may be mentioned that every patient should be assessed for sleep pattern, screened for insomnia and should give adequate counselling for the same.

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