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Study of Audio - Visual Reaction Time in Chronic Smokers and Alcoholic Males

Physiology

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ABSTRACT

The consumption of alcohol and cigarette smoking is most common and serious problem, worldwide. Apart from various factors such as age, sex, left v/s right hand practice, number of stimuli, reaction time is also affected by smoking and alcohol consumption. The aim of the present study is to measure and compare Auditory & Visual reaction time between study groups (smoker, alcoholic, smoker with alcoholic) and control group. Methods: The present study involved 360 subjects in the age group of 30-60 years, both smoker and alcoholic, recruited from medicine OPD from S.M.S Hospital, Jaipur (Rajasthan). Out of total 360 subjects: - 90 were smoker, 90 were alcoholic, 90 were smoker with alcoholic and 90 were control subjects. Data were statistically analyzed by student's unpaired't' test, one way ANOVA and post hoc tukey test. Results: In this study, visual reaction time (sec.) (VRT) with left hand (red and green light) increased significantly ($p < 0.05$) in alcoholics and smoker with alcoholics when compared with controls while with right hand, visual reaction time increased significantly in smoker with alcoholics and smokers. On Post hoc analysis, smoking was found to be main factor affecting VRT (red and green light) for right hand while for left hand it was alcoholism. Results of auditory reaction time (sec.) (low and high pitch) were statistically non-significant with both left and right hand. Conclusion: VRT (red and green light) was highest in smoker with alcoholics indicating delayed response in smoker and alcoholic group which get further aggravated in smoker with alcoholic subjects.

KEYWORDS:

Visual reaction time (VRT); Auditory reaction time (sec.) (ART)

Introduction

The time that a person takes to react to a stimulus is known as reaction time. It is determined by autonomous response to external stimulus[1]. The sensori-motor relation, efficacy of an individual and, the processing capability of central nervous system can be measured by the reaction time [2].

In adults most of diseases and deaths occurs due to smoking tobacco. Due to smoking every year more than 6,00,000 people die in the age group of 25-69 years, in India [3]. Risk of many types of cancers, heart disease, strokes and emphysema has increased in smokers [4].

Moreover, the consumption of alcohol is also a most common and serious problem, worldwide. It is consumed mostly in the form of ethanol but it is consumed in different forms also, containing different concentrations of alcohol such as – Beer (4% - 12%), Wine (10% - 15%), Rum (37.5% - 75%), and Whisky (40% - 55%) [5].

Major health risks are caused by alcohol and tobacco whenever used alone or together [6]. There are several diseases which are related to consumption of alcohol, such as chronic liver disease, cancers, cardiovascular diseases, alcohol syndrome in foetus and acute alcohol poisoning [7].

There is presence of adverse effects on different types of cognitive/ psychological functions due to tobacco smoking [8]. Processing capability of brain is involved in intellectual functions that can be tested by numerous tests like neuro-physiological and / or neuro-cognitive tests [9].

The aim of the present study was to measure and compare Auditory & Visual reaction time between study groups (smoker, alcoholic, smoker with alcoholic) and control group.

Material and methods

The present study was carried out in Upgraded Department of Physiology, S.M.S Medical College & Hospital, Jaipur. The present study involves 360 males attendants (30-60 years) of patients recruited from medicine OPD from S.M.S Hospital, Jaipur. Subjects were divided into 4 groups and each group contains 90 males:-

Group (A) – control (non-alcoholic and non-smoker)
Group (B) - smoker
Group (C) - alcoholic
Group (D) - alcoholic with smoker

Statistical analysis: The mean values of all variables of audio-visual reaction time were compared by using one way ANOVA and post hoc tukey test. Results were presented as Mean ± SD. All the statistical analysis was performed using SPSS Version 23 and Microsoft Excel 2007, using appropriate software, p value < 0.05 was taken as significant.

The subject (group – B, C, D) smokers (in terms of pack years) and alcoholic (according to safe units of alcohol consumption) for more than 10 years were selected for the study. All the parameters were measured after 24 hours of drinking alcohol [10].

Institutional ethical committee clearance and informed consent from all the subjects was obtained before starting the study.

Subjects suffering from any acute and chronic illness, fasting, practicing meditation or yoga therapy or on placebo treatment and having any visual or auditory problem were excluded from the study.

Each group was evaluated for different parameters such as - Height (cm) and weight (kg), blood pressure (mmHg)- by sphygmomano meter, Auditory reaction time (seconds) and Visual reaction time (seconds).

Reaction time was recorded with the help of "Audio-Visual reaction time apparatus" by medisystems. It had a resolution of 0.1 second and display accuracy of 100% being the pizeo electric crystal used for 100% accuracy of time. The apparatus has two modes of stimulus: - Auditory and visual.

Auditory reaction time (sec.) was recorded for low and high pitch (frequency) sound stimuli and Visual reaction time was recorded for red and green light with both hands (Right & Left). As soon as the stimulus was perceived by the subject, he responded by pressing the response key or switch by the index finger as quickly as possible. The display indicated the response time in seconds.

Results:

In the present study the Mean±SD values of age (years) were 43.03±9.42 and 43.1±10.76, BMI (kg/m^2):23.78±3.98 and 23.47±3.75, SBP (mmHg) 123.96±6.86 and 125.11±7.64, DBP (mmHg): 84.49±6.04 and 85.24±7.15 and MBP (mmHg): 97.64±5.9 and 98.53±6.94 for control group and study groups, respectively. All the values were within normal range and no statistical difference was

observed in control and study group by students unpaired 't' test, thereby showing proper matching of control and study group subjects.

Table 1: Comparison of Audio-Visual reaction time [sec.] (with right and left hand) in control and study groups subjects:

Parameters	Groups	N	Mean	Std. deviation	p value	Parameters	Groups	N	Mean	Std. deviation	p value
VRT (sec.) for red light with left hand	Control	90	0.23	0.04	0.00*	VRT (sec.) for red light with right hand	Control	90	0.21	0.04	0.00*
	Smoker	90	0.24	0.04			Smoker	90	0.23	0.04	
	Alcoholic	90	0.31	0.04			Alcoholic	90	0.21	0.04	
	Smoker with alcoholic	90	0.4	0.06			Smoker with alcoholic	90	0.23	0.04	
VRT (sec.) for green light with left hand	Control	90	0.23	0.04	0.00*	VRT (sec.) for green light with right hand	Control	90	0.2	0.04	0.00*
	Smoker	90	0.24	0.04			Smoker	90	0.22	0.04	
	Alcoholic	90	0.31	0.04			Alcoholic	90	0.21	0.04	
	Smoker with alcoholic	90	0.4	0.06			Smoker with alcoholic	90	0.22	0.04	
ART (sec.) for low pitch with left hand	Control	90	0.16	0.04	0.05	ART (sec.) for low pitch with right hand	Control	90	0.17	0.04	0.08
	Smoker	90	0.16	0.04			Smoker	90	0.17	0.03	
	Alcoholic	90	0.17	0.04			Alcoholic	90	0.16	0.04	
	Smoker with alcoholic	90	0.17	0.04			Smoker with alcoholic	90	0.17	0.04	
ART (sec.) for high pitch with left hand	Control	90	0.17	0.04	0.17	ART (sec.) for high pitch with right hand	Control	90	0.17	0.03	0.21
	Smoker	90	0.18	0.04			Smoker	90	0.18	0.04	
	Alcoholic	90	0.17	0.04			Alcoholic	90	0.17	0.04	
	Smoker with alcoholic	90	0.18	0.08			Smoker with alcoholic	90	0.17	0.04	

(N= no. of subjects) ($p<0.05$ significant)*

Table 1 shows that Mean±SD values of VRT (sec.) for red light and green light with both left and right hand in control group (A) and study groups and the difference in the mean value between the groups was statistically significant, by using One-way ANOVA. After applying Post hoc tukey test statistically significant difference was observed for red and green light with left hand between group A & C, A & D, B & C, B & D and C & D and with right hand between group A & B, A & D, B & C and C & D. By using One-way ANOVA, statistically non-significant difference was observed in mean values of ART (sec.) for low and high pitch with both left and right hand.

Discussion

Reaction time is an easy method and can be used as an index of cortical arousal, also important for efficient response to environment [11]. In the marine, aviation and road transport, visual stimuli like flashing are used as a signal coding method and in industrial environment, auditory modality is used. These input or output modalities are also found in many industrial application systems (to provide alertness) like design of driving vehicle, military communication, smoke detector alarm and light control system [12].

In this study, results of VRT (sec.) for red and green light with both left and right hand were found to be statistically significant ($p<0.05$) in study and control group. VRT (sec.) for red and green light with left hand increased significantly in alcoholics and smoker with alcoholics when compared with controls and, with right hand VRT (sec.) for red and green light increased in smokers and smoker with alcoholics.

The result of the present study further revealed that ART (sec.) for low and high pitch with left and right hand were statistically non-significant.

So, the results of this study for VRT (red and green light) are in accordance with the findings observed by Phatale SR and Boramma S (2014) [13], Kumar LR and Shenoyk C (2009) [14], Katherine T and Stough C (2000) [15], Maylor EA and Rabbitt PMA (1987) [16], with respect to VRT in alcoholic and Vallath A et al (2015) [17], Jadhao P et al (2013) [18] and Turen U et al (2013) [19] with respect to VRT in smoker subjects.

Present results do not corroborates (for VRT) with the findings of Afshan A et al (2012) [20], Ichapuria RB et al (1991) [21], Morgan SF and Pickens RW (1982) [22].

The possible reason for increase in VRT in alcoholics may be that, sensory and motor both pathways are involved in reaction time. The sensory pathway includes the input of both visual and auditory signals which are sensed by the sensory receptors and carried by the optic and auditory nerve and information processing takes place in the brain. Motor pathway includes the cranial nerves and the nerves which supply the muscles of hand. In person with good reflexes, the processing of information is shorter, so reaction time is shorter. Both autonomic and peripheral nerves damage occur in alcoholics. Thus, decrease speed of the impulse conduction leads to increase in reaction time [14].

The possible reason for increase in VRT due to smoking may be as follows: In smokers along with reduction in small airways function, PaO_2 and $PaCO_2$ also decrease [23]. Cerebral blood flow decreases due to hypocapnia (as CO_2 is most potent cerebral vasodilator). Cigarette smoke contains one harmful and neurotoxic substance carbon monoxide, so chronic smokers develop increased carboxy-haemoglobin levels that affect oxygen transport and its utilization, in this way it might cause impairment of function of central nervous system. Thus, cognitive dysfunction and perceptual-motor delay occurs in habitual smokers, due to decreased cerebral blood flow and hypoxic impairment of central nervous system [24].

Conclusion

VRT (red and green light) was highest in smoker with alcoholics indicating delayed response in smoker and alcoholic group which get further aggravated in smoker with alcoholic subjects. On Post hoc analysis, smoking was found to be main factor affecting VRT (red and green light) for right hand while for left hand it was alcoholism.

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