

Study of Auditory and Visual Reaction Time in Chronic Alcoholics

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Research Article

Abstract: Background and objective: Alcoholism is common and serious problem. Alcohol most commonly consumed in the form of ethanol. The effects of alcohol are mainly caused by altering the function of membrane proteins in many different cell types especially cells of GIT, urinary tract, cardiovascular and nervous system. Alcohol also causes alcoholic peripheral neuropathy. Reaction time has physiological significance and is simple and non invasive test to see the functions of peripheral as well as central neural structures. The reaction time is an indirect index of processing capability of central nervous system and also a simple means for sensory and motor performance for early diagnosis of alcoholic neuropathy. Hence we want to investigate the audiovisual reaction time in alcoholic subjects. **Material and Methods:** The study was conducted in the department of physiology MR Medical College Gulbarga. The study was conducted in chronic alcoholic's subject and there age matched control and in three groups of 30 subjects in each groups. Group I – Normal healthy control, Group II – chronic alcoholic without neuropathy, Group III – chronic alcoholic with neuropathy Audiovisual reaction time was determine by using an instrument “ Reaction time apparatus” designed by Anand agencies Pune. The data was statistically analyses by using student unpaired ‘t’ test. **Result:** auditory and visual reaction time was compared with chronic alcoholic and healthy aged matched controls. The reaction time was significantly increased in chronic alcoholic without neuropathy and with neuropathy. **Conclusion:** From our study we conclude that alcohol addiction has adverse effect on the audiovisual reaction time. Thus helps in early diagnosis as well as prognosis of alcoholic neuropathy **Keywords:** Chronic alcoholism, reaction time, neuropathy.

1. Introduction

Alcoholism is common and serious problem. The word “Alcohol” is derived from Arabian term ‘al-kuhul’ which means finely divided spirit. There are several types of alcohol amyl, butyl, isopropyl, methyl, ethyl alcohol or ethanol. Alcohol most commonly consumed in the form of ethanol. It is consumed in different forms containing different concentration eg – Beer (4% - 12%), wine (10 % - 15 %), Rum (37.5 % - 75.5 %), Whisky (40 % - 55%).(1) Ethanol has wide spread effects on the organ system of the body. The effects of alcohol are mainly caused by altering the function of membrane proteins in many different cell types especially cells of GIT, urinary tract, cardiovascular and nervous system.(2) Chronic

alcoholism is a pathological condition resulting from the habitual use of alcohol in excessive amounts. Scientist suggested that a minimum of 100ml of ethyl alcohol per day for 5 years will precipitate the adverse effects.(3) National family health survey (NFHS- 3) showed that about 32% of total population is chronic user of alcohol. The effect of alcohol on brain can occur by both direct & indirect means.(4) Alcohol causes sleep disturbances, numbness& legs, wernicke's syndrome and korsakoffs syndrome which can occur due to the low thiamine (Vit-B) levels. Korsakoffs syndrome affects memory and prevents new learning from taking place. Alcohol also causes alcoholic peripheral neuropathy.(5,6) These might be due to the consequences of axon loss in chronic alcoholism.(7) Alcoholic neuropathy also renders patient susceptible to compression of peripheral nerves at common sites of compartment including median nerve at carpel tunnel, ulnar nerve at elbow and peroneal nerve at fibular head (8). Reaction time has physiological significance and is simple and non invasive test to see the functions of peripheral as well as central neural structures. We are going to study auditory and visual reaction time.(9) The reaction time is an indirect index of processing capability of central nervous system and also a simple means for sensory and motor performance for early diagnosis of alcoholic neuropathy.

2. Material and Methods

The study was conducted in the department of physiology MR Medical College Gulbarga. The study was conducted in chronic alcoholic's subject and there age matched control and in three groups of 30 subjects in each groups. Group I – Normal healthy control, Group II – chronic alcoholic without neuropathy, Group III – chronic alcoholic with neuropathy. The age group of subjects was between 40 – 60 years. A detailed case history was taken for both control and alcoholic subject. Inclusion criteria for chronic alcoholic was alcohol consumption of more than 100ml daily for more than 10 years and without any

other diseases causing neuropathy as well as any abnormality of vision or hearing.

Methodology

After obtaining approval from research and ethical committees of MRMC Gulbarga and written informed consent was taken from the subjects. The producer was explained and a proper trial was given before taking the readings. Audiovisual reaction time was determined by using an instrument "Reaction time apparatus" designed by Anand agencies Pune. All the tests were done in a quiet room at room temperature of 26 – 32°C. For auditory reaction time the stimulus was given in the form of beep tone and click while for visual reaction time the stimulus was in the form of red and green light. A built digital chronoscope is present on the examiner's side measures the reaction time in milliseconds. An average of 3 readings was taken. The data was statistically analysed by using student unpaired 't' test.

3. Observation and Results

Table 1: Showing Mean value and SD of auditory reaction time (msec) with right hand.

Stimulus	Group	Mean ± SD	Comparison	'P' significance
Tone	I	137.1 ± 9.1	I&II	< 0.001 S
	II	148.8 ± 10	I&II	< 0.001 S
	III	152.2 ± 10	II&III	< 0.05 S
Click	I	135.4 ± 10	I&II	< 0.001 S
	II	147.7 ± 12	I&III	< 0.001 S
	III	156.5 ± 10	II&III	< 0.05 S

Table 2: Showing Mean value and SD of visual reaction time (msec) with right hand.

Stimulus	Group	Mean ± SD	Comparison	'P' significance
Red	I	141.2 ± 10	I&II	< 0.001 S
	II	147.2 ± 9	I&III	< 0.001 S
	III	155 ± 10	II&III	< 0.05 S
Green	I	140 ± 10	I&II	< 0.001 S
	II	154 ± 12	I&III	< 0.001 S
	III	160 ± 10	II& III	< 0.05 S

4. Discussion

Reaction time is the interval between presentation of stimulus and the initiation of response. Reaction time relates to but is different from reflex time, movement time and response time. Reflex time is shorter than reaction time because of elimination of central processing. In a reflex the impulse travels through the afferent, center and efferent (reflex arc). Measurement of

reaction time includes latency in sensory neural code traversing the peripheral and central pathway, cognitive processing and a motor signal again traversing both central & peripheral pathways. In our study auditory and visual reaction time was compared with chronic alcoholic and healthy aged matched controls. The reaction time was significantly increased in chronic alcoholic without neuropathy and with neuropathy. Our finding matched with the findings observed by Robert D.Hienz, Danielle A.Bowers 1992. (10), Patterson B.W and Williams H.L. 1987(11), Ivashchenko O.L and Vazhnova(12) .T.N 1988(13), Ford J .M and White P.M 1989(14), Lukasiwicz M 2005(15), Latha Rajendra Kumar 2008(16).

The significant increase in audio-visual reaction time in alcoholics can be explained as :

1. Alcohol causes central or peripheral neuropathy causing reduced motor and sensory nerve conduction velocity, which prolongs reaction time. Alcohol causes increased lipid permeability of membrane of astrocytes and oligodendrocytes. Ethanol is known to modulate ion channels and receptors especially the K⁺ channels on astrocytes. This causes increased leakage of an action potential current down the axon(4).

2. Chronic alcoholic with polyneuropathy usually have some degree of nutritional deficiency mainly the deficiency of vitamin B1 either due to less intake or improper digestion & intestinal absorption.(17). Lack of thiamine prevents neuron from maintaining ATP levels as a result of impaired glycolysis, which will further affect nerve function. Neural tissue depends on the process of energy, leading to disappearance of myelin on peripheral nerve. These altogether causes increase in current leakage and slow signal transmission.

3. Acetaldehyde formed during ethanol metabolism as toxic effect on peripheral nerve if it is not metabolized quickly.(18).

4. Alcohol affects somatosensory and auditory system. It slows psychomotor responses and has cognitive effects such as slowing of mental speed and diminished mental flexibility, which in turn prolongs reaction time.

5. There is evidence of skeletal muscle myopathy due to prolonged use of ethanol as in chronic alcoholic leading to delayed reaction time.(19,20)

The reaction time is an indirect index of the processing capability of central nervous system and also a simple means of determining sensory and motor performances. Thus reaction time measurement is a simple test to assess effect of alcohol on body & in early diagnosis as well as prognosis of alcoholic neuropathy before the appearance of signs & symptoms.

5. Summary and Conclusion

- The present study was conducted to study audiovisual reaction time in chronic alcoholics and healthy controls.
- There was significant increase in audiovisual reaction time when compared between controls and alcoholics without neuropathy & with neuropathy.
- The study helps in early diagnosis as well as prognosis of alcoholic neuropathy.

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