Original Research Article

An Electrophysiological Comparative of Auditory and Visual Reaction time among Diabetics and Non-Diabetics- A Case Control Study

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Abstract

Background: Type 2 diabetes is a pandemic; visual and auditory reaction time were used as tools to detect neuropathy a common complication of diabetes so that we could prevent further damage to nerves. **Objectives:** To measure and compare visual and auditory reaction time between Type -2 diabetics on oral medication and non-diabetics. **Material and Methods**: A case control study was done and they were enrolled based on detailed questionnaire and informed consent was obtained .The study was conducted in the month of July 2019 which included 40 Type 2 diabetic subjects from a tertiary care hospital. Visual Reaction time and Auditory reaction time were measured. PC1000Hz reaction timer was used to measure auditory and visual reaction time SPSS software (trial version 22.0) was used for analysis. **Results:**The mean age of type 2 diabetic subjects was 49.6 years and that of control 44.4 years cases and controls were age matched. The visual reaction times was significant with p value = .001 and for auditory reaction time p value =.001. **Conclusion:**Auditory and visual reaction was prolonged in type 2 diabetics on oral medication when compared with non-diabetics of same age group. This can be due to neuropathic changes in diabetes.

Keywords: Case- control study, matching, diabetes mellitus, diabetic neuropathy, oral hypoglycemic drugs, auditory reaction time, visual reaction time.

Introduction

Type 2 diabetes has become a worldwide epidemic and created a need to reduce the morbidity and mortality due to it from various causes like visual and auditory disturbances.Need has ascended to perceive neuropathy earlier before it is clinically visible. One of the micro vascular complications of diabetes, include neuropathy is a major contributor to morbidity and mortality.

Neuropathy severity is linked to duration and degree of glycemic control.

Neuropathy development favourably affecting nerve fiber subtypes may clarify some clinical heterogeneity, but dissimilar neurophysiologic tests are required to identify dysfunction of different nerve in diabetes[1,2]. Auditory and visual reaction time is reflected as an ideal tool for gauging sensory motor association[3,4].

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Reaction time (RT), is the elapsed time amid the presentation of a stimulus which can be of any modes of sensory input like visual, auditory, pain, touch or temperature and the successive behavioural response to occur. It is an index of speed of processing. The behavioural answer is characteristically a button press but can also be an eye movement, Avocal reply, or some other observable behavior[5]. It is dependent on several factors starting from nerve conduction to coordinating system in our body including long term, and recent memory,learning ability,criticism, perception and visual - auditory skills.

It shows to be an important parameter for evaluating the factors which are affecting the reaction time. This study was done to measure and compare visual and auditory reaction time between type -2 diabetics on oral medication and non-diabetics.

Materials and Methods

A case control study was conducted in the month of July 2019 for 1 year in tertiary care hospital. Written

informed consent was given by all participants. Information details about family history (Diabetes, Hypertension), alcohol consumption, cigarette smoking, drug intake, diet history, visual and auditory disturbances, occupational history, and history of recent illness were obtained by astructured questionnaire.

Cases- 40 Type 2 diabetic subjects were selected from tertiary care hospital (fasting blood sugar < 100mg %, duration of diabetes less than 10 years).

Inclusion criteria: Type 2 diabetics on oral medication.

Exclusion criteria: subjects on insulin, cases of diabetes with complication,alcoholics, smokers, subjects with visual and auditory disturbances and subjects with any illness are excluded.

PC 1000 HZ Reaction Timer: We used an in-house build add on device called PC 1000[6], to Account auditory and visual reaction time. PC 1000 is a1000 hertz square wave oscillator which has a soft key for start and stop function. PC 1000 Reaction timer instrument has two mechanisms (A &B)connected to each other. First component (A) has a start button, and it is handled by the inspector only.Second component (B) has a stop button which will be handled by the subject alone and it has a small red LED and headphone (1000 hertz's tone) which receives the visual and auditory stimulus respectively. Red light is designated for the experiment as it continues for a long time in retina. Component A and component B is in turn connected to a personal computer which has audacity software installed in it. Audacity city software accounts the reaction time in 0.001sec correctness in wave set-up.

Controls: 40 healthy volunteers with no history of diabetes (fasting blood sugar <100mg %), hypertension, visual and auditory disturbances, alcohol intake, and no history of recent illness from any diseases were taken as controls after suitable matching.

For measurement of Visual Reaction Time (VRT) Auditor presses the START key in first component(A) which will be out of the view of the subject .Subject is instructed to press the STOP switch in second component (B) as soon as he/she sees the red light in the instrument. Reaction time is noted in audacity software. For measurement Auditory reaction time Inspector presses the start button (A) which will be out of the view of the subject and the subject is instructed to press the stop button (B) as soon as he/she hears the sound (1000 hertz's tone) through the headphone connected to it. Reaction time is verified in audacity software. Three trials each were given to measure both VRT and ART.

Statistical Analysis

Recorded observations were transferred into Microsoft excel. SPSS software was used for analysis. Paired t-test applied between two groups (type 2 diabetics and controls) for significance difference. P-value <0.05 is considered statistically significant.

Results

Table 1:Distribution of Cases and Controls Depending on Age

Subjects	Age (mean±SD)	p-value
Diabetics	49.6±5.4	0.11
Non- diabetics	44.4±8.6	0.16

As per table 1 The mean age of type 2 diabetic subjects was 49.6 years and that of control 44.4 years. But age has no significant role. (p>0.05).

Table 2:Description of Visual Reaction time (VRT) and Auditory Reaction time (ART) among the study participants

Subjects	VRT	ART	P-value
Diabetics	254.46±80.6	246.36±78.38	0.0001*
Non- diabetics	210.28±44.6	188.42±32.4	0.001*

*p<0.05 is considered statistically significant.

As per table 2 Mean values of both visual reaction time (VRT) and Auditory reaction time (ART) in type 2 diabetic group were greater than controls and the difference was statistically significant (p<0.05). This signifies neuropathic changes are the main reason to change the significant reaction time.

Discussion

Reaction time is a measure of function of sensory motor association [7] and performance of an individual [8]. It has physiological significance and is a simple and non-invasive test for peripheral as well as central neural structures[9]. In the present study we found that visual reaction time is longer than auditory reaction time.

Most likely cause of visual reaction time being greater than auditory reaction time is due to the fact that the visual reaction time involves chemical changes in its occurrence. Also,the visual pathway involves many collateral pathways to various association areas and hence a greater delay in comprehension of visual stimulus as it is interpreted in a more complex and elaborate fashion. In our study that patients with near-normal blood glucose control were recruited and they exhibited slowed simple attention, whether information presentation is visual or aural. Subjects with type II diabetes on oral medication all had mild, but measurable peripheral neuropathies Diabetes has also been shown to affect peripheral nerves in the somato sensory [10] and auditory system[11] ,slows psychomotor responses and has cognitive effects, all of which may affect reaction time.

Assessment of 16 young men who were diabetic and insulin dependent diabetes mellitus with neuro-physiological measures of attention,decision making, and motor tasks demonstrated decreased attention on visual and auditory reaction time tasks[12]. Holmes Showed that attention and fine motor skills are disrupted at altered glucose concentrations. By using a visual reaction time as paradigm we sought to determine if disruption of relative responding (choice reaction time) would occur in response to blood glucose level deviations [12].They have shown that performance impairment occurred independently of disease duration and control and without documented neuropathy understanding the sensitivity of some cognitive skills to acute glucose fluctuations[13].

Suzuki et al have recognised the central and peripheral somatosensory conduction in patients with diabetes as irregular. The central conduction abnormality is present in diabetes[14].

Toppish demonstrated that patients with diabetes mellitus had a significant reduction in attention. Attention deficit occurs maximally in hypoglycaemia [15].

Celiker demonstrated that there are possible neurological abnormalities even in the absence of neuropathy symptoms considering electrophysiological abnormalities for e.g. motor and central nerve conduction abnormalities. There are significant associations between electrophysiological parameters and metabolic control [16]. Alexander demonstrated that there is a subclinical involvement of auditory pathway in diabetic patients with normal hearing[17].

Conclusion

It is concluded from the present study that, for subjects with Type -2 diabetic on oral medication visual and auditory reaction time is prolonged compared to normal individuals. Since diabetes involves both central and peripheral nerves, clinicians can apply this simple non-invasive test in their daily practice to detect neuropathy and supplement them with neurotropic agents to prevent further damage to nerves and monitor their prognosis with treatment.

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