Volume : 5 | Issue : 5 | May 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

Research Paper

A Study of Changes in Choice Reaction Times (Visual And Auditory) in Uncomplicated Type II Diabetes Mellitus

Medical Science

KEYWORDS : Choice Reaction time, Diabetes mellitus

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ABSTRACT

Background: Reaction time is the time from the onset of a stimulus to the initiation of a response. It is an indicator of processing of sensory stimulus by central nervous system and it's execution in the form of a motor response. This study was taken up to see combined effects of age, gender and diabetes on the processing of signals. Aim: Effect of Type II uncomplicated Diabetes mellitus on choice reaction times (visual and auditory). Method: The study group consisted of 100 cases of Type II uncomplicated diabetes mellitus (58 males and 42 females, aged between 30 to 80 years) from Diabetic OPD. Control group consisted of age matched 100 asymptomatic volunteers. Result: There was a statistically significant increase of reaction times in diabetics as determined by the Students unpaired "t" test (p=0.02). Conclusion: Findings suggests that the diabetes increases the audiovisual reaction time.

INTRODUCTION:

Reaction time is a simple and non- invasive test for measuring neuronal function. It is an indirect index of processing capability of the CNS (speed and accuracy) and sensory motor association. With the growth of cognitive psychology, reaction time has become conceptualized as a measure of speed of information processing and is extensively used to study mental activities in both normal and neurologically impaired populations[1]. Reaction time measures are common in research for two primary reasons:

(i)Measures are components of real life tasks- sports, traffic navigation.

(ii)They measure the time taken for mental events such as stimulus processing, decision making and response programming[2].

It has been studied in various conditions like premenstrual stress, alcoholics, smokers, schizophrenics, diabetes mellitus, Parkinson's disease etc. Impairment of conduction velocity in peripheral motor and sensory nerve fibers is known to occur in diabetes[3,10].

An attempt has been made to find out if reaction time measurements might be useful in studying the neurological deficit in diabetic patients.

AIM: Effect of Uncomplicated Type II Diabetes Mellitus on choice reaction times (visual and auditory).

MATERIAL & METHODS:

The study was conducted in tertiary care teaching hospital with approval from the institutional ethics committee. The study group comprised of 100 patients(58males and 42 females aged between 30 to 80 years) of uncomplicated Type II Diabetes Mellitus(DM) visiting diabetic OPD with duration of diabetes from 1to 27 years.

The control group comprised of age matched 100 (47 males and 53 females) asymptomatic volunteers with normal blood sugar levels. Choice reaction times(visual and auditory) was performed on all the participants with reaction time apparatus(RTM-608). The tests were carried out in a secluded room under similar conditions in a sitting position. An informed written consent was taken from all the subjects.

To record visual reaction time (VRT), 2 stimuli green and red light were used. The subjects were not aware of the colour of the light being switched on by the examiner. The examiner switched on the lights randomly and the lights glowed on the subject's side of the panel. The subjects responded by quickly pressing the corresponding button in front of the light. The reaction time was directly read from the digital display in seconds. The average of three values was taken.

To record the auditory reaction time (ART), subjects were trained to differentiate between high and low frequency sounds by placing earphones. Procedure similar to the recording of VRT was followed.

RESULTS:

The statistical significance was determined by the Students unpaired "t" test with p=0.02.

Table no.1: VRT (Green and Red) in Females – Comparison between Controls and diabetics

AGE GROUP (years)	VRT (Green)							VRT (Red)						
	CONTROL			DIABETIC				CONTROL			DIABETIC			
	No.	Mean	SD	No	Mean	SD	Res.	No.	Mean	SD	No.	Mean	SD	Res
30-39	11	0.3807	0.0089	11	0.5913	0.0834	S	11	0.3753	0.0157	11	0.5970	0.0844	HS
40-49	14	0.4164	0.0155	11	0.6694	0.0834	S	14	0.4153	0.0143	11	0.6896	0.0916	HS
50-59	11	0.4515	0.0152	5	0.8096	0.2101	S	11	0.4632	0.0179	5	0.8078	0.1380	HS
60-69	12	0.4746	0.0109	8	0.8550	0.0979	S	12	0.4871	0.0164	8	0.8419	0.1118	HS
70-79	5	0.5500	0.0129	7	1.1616	0.3010	S	5	0.5334	0.0154	7	0.9006	0.1816	HS

S- Significant, HS- Highly Significant

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Table no.2: ART (High frequencies and low frequencies) in Females – Comparison between Controls and Diabetics

AGE GROUP (years)	ART(High frequencies)							ART(Low frequencies)						
	CONTROL			DIABETIC				CONTROL			DIABETIC			
	No.	Mean	SD	No	Mean	SD	Res.	No.	Mean	SD	No.	Mean	SD	Res
30-39	11	0.3638	0.0141	11	0.5820	0.0874	HS	11	0.3618	0.0121	11	0.5863	0.0886	HS
40-49	14	0.3979	0.0132	11	0.6693	0.0931	HS	14	0.3964	0.0133	11	0.6698	0.0893	HS
50-59	11	0.4418	0.0221	5	0.7932	0.1366	HS	11	0.4437	0.0177	5	0.7919	0.1371	HS
60-69	12	0.4696	0.0151	8	0.8272	0.1079	HS	12	0.4709	0.0197	8	0.8282	0.1110	HS
70-79	5	0.5141	0.0133	7	0.8576	0.1597	HS	5	0.5193	0.0126	7	0.8616	0.1549	HS

HS- Highly Significant

Table no3: VRT (Green and Red) in Males – Comparison between Controls and Diabetics

AGE GROUP (years)	VRT(Green)							VRT(Red)						
	CONTROL			DIABETIC				CONTROL			DIABETIC			
	No.	Mean	SD	No.	Mean	SD	Res.	No.	Mean	SD	No.	Mean	SD	Res
30-39	12	0.3918	0.0222	11	0.6046	0.0655	HS	12	0.3768	0.0216	11	0.5886	0.0624	HS
40-49	10	0.4162	0.0226	13	0.7727	0.0822	HS	10	0.3998	0.0227	13	0.7579	0.0813	HS
50-59	10	0.4572	0.0147	19	0.8420	0.1726	HS	10	0.4388	0.0135	19	0.8154	0.1468	HS
60-69	7	0.4844	0.0225	8	0.8779	0.1319	HS	7	0.4677	0.0231	8	0.8552	0.1304	HS
70-79	8	0.5472	0.0158	7	0.9385	0.1810	HS	8	0.5322	0.0163	7	0.8956	0.1223	HS

HS- Highly Significant.

Table no.4: ART (High frequencies and low frequencies)) in Males – Comparison between Controls and Diabetics

AGE GROUP (years)	ART (High frequencies)							ART (Low frequencies)						
	CONTROL			DIABETIC				CONTROL			DIABETIC			
	No.	Mean	SD	No.	Mean	SD	Res.	No.	Mean	SD	No.	Mean	SD	Res
30-39	12	0.3605	0.0246	11	0.5575	0.0777	HS	12	0.3626	0.0255	11	0.5957	0.0869	HS
40-49	10	0.3836	0.0245	13	0.7259	0.0732	HS	10	0.3817	0.0202	13	0.7422	0.0849	HS
50-59	10	0.4194	0.0146	19	0.7663	0.1176	HS	10	0.4178	0.0170	19	0.7887	0.1238	HS
60-69	7	0.4497	0.0232	8	0.8356	0.1668	HS	7	0.4487	0.0287	8	0.7987	0.1399	HS
70-79	8	0.5172	0.0149	7	0.8558	0.1048	HS	8	0.5170	0.0131	7	0.8675	0.0984	HS

HS- Highly Significant.

DISCUSSION:

The choice reaction times (visual and auditory) showed a significant increase with age. The findings of this study correlated well with the findings of many others. From a study of reaction time by Hodgkins(1962), it is seen that simple and choice reaction time shorten from childhood through adolescence to the twenties. Thereafter they tend to lengthen slowly until the fifties or sixties. The increase is more rapid after this age into the seventies and beyond. The most rapid change for the worse is in the seventh decade of life[4].

Wright RE has also opined that performance of both young and old adults declined as task difficulty increased, with the decline being greater and more rapid for older subjects[5]. Similar results were obtained by Wilkinson,et al[6](5325 subjects), Shah et al[7] and Fozard et al,[8](1265 subjects ranging from 17-96 years). Most of the slowing of performance with age can be attributed to a fall of signal to noise ratio in the brain. This could indirectly impair ability to prepare reactions, hold states of readiness or formulate expectations. Both Simple and Choice reaction times definitely increase with age due to several factors such as degenerative changes in the sense organs leading to a deterioration of signal to noise ratio, poorer cerebral circulation and a change in the behavioral aspects of a response.

On comparison of ART and VRT between males and females in the control group, no significant difference was found. This correlates well with findings of Shah AH, et al. However according to Fozard et al,[8] males show a shorter reaction time than females. In a study conducted by Shenvi, et al [9]the reaction was found to be higher in boys than in girls. The above mentioned comparisons imply that gender differences do not contribute to the changes in reaction time and deterioration processes have affected the overall visual and auditory processes. Hence age is the contributory factor in this study which is associated with an increase in reaction time.

In our study there was a significant deterioration of reaction times in diabetes in all age groups. No significant difference was noted between VRT for green and red light. Similarly no significant difference was found between ART for high and low frequency sound in control and study group. These observations coincides with the work on Madan Mohan et al[10].Diabetics have significantly accelerated levels of oxidative stress which accounts for most of the diabetic complications: neuropathic, cardiovascular, retinal, renal etc. Segmental demyelination is the basic pathological lesion present in the diabetic nerve. This change results in delayed electrical conduction and therefore, a reduction in the motor conduction velocity [11] .Diabetes Mellitus affects peripheral nerves in the somatosensory and auditory system [12], slows psychomotor responses and has cognitive effects on those individuals who do not have a proper metabolic control .Similar study was done by Parekh ,et al [13] who observed a delayed reaction time for auditory and visual stimuli in patients of diabetes mellitus.

CONCLUSION:

Comparison of the control and diabetics for the same age group with all the parameters being the same showed a definitely significant increase of reaction times in diabetics in every age group. Thus, the cognitive domains which were the most adversely affected in patients of Type II DM were information processing speed and working memory. Delayed reaction time in diabetics without clinical neuropathy can be taken as a non- invasive, low cost, sensitive indicator of early nerve damage without clinical signs or symptoms and can be performed as an outdoor procedure.

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