Original Article

The study of auditory and visual reaction time in patients of Type-1 diabetes mellitus as compared to healthy individuals

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Abstract

Introduction: The measurement of reaction time has been used to evaluate the processing speed of central nervous system and co-ordination between sensory and motor system. Diabetes mellitus affects peripheral nerves in the somatosensory and auditory system, slows psychomotor responses all of which may affect reaction time. **Aim:** To highlight the role of audiovisual reaction time in routine examination of diabetic patients for early detection of neuropathic changes. **Objectives:** 1. To determine the audio-visual reaction time in patients of type 1 diabetes mellitus and age and sex matched healthy controls. 2. To compare and correlate reaction time tasks in patients of type 1 diabetes mellitus with age and sex matched healthy controls. **Material and Methods:** The present study was conducted in civil hospital, Latur. The study group consisted of 60 cases of diagnosed type 1 diabetes mellitus who were taking regular treatment in age group of 18-25 yrs and 60 age and sex matched nondiabetic healthy individuals. The reaction time was recorded for auditory and visual stimuli by reaction time apparatus. **Results:** Statistical analysis done by using unpaired t-test revealed significant prolongation of visual and auditory reaction time in type 1 diabetics as compared to healthy individuals($p<0.001$). Delayed reaction time without clinical signs and symptoms can be taken as sensitive indicator of early nerve damage.

Keywords: Diabetes mellitus, Reaction time, Diabetic neuropathy.

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Received Date: 14/09/2016 Revised Date: 07/10/2016 Accepted Date: 10/11/2016

Access this article online

Quick Response Code:

Website: www.medpulse.in

DOI: 14 November 2016

INTRODUCTION

Diabetes Mellitus (DM) is a common metabolic disorder which occurs either due to relative or absolute insulin deficiency and affects many organ systems within the body. The diabetic population is constantly on rise[1]. It is also associated with many complications like diabetic neuropathy, diabetic retinopathy, cerebrovascular disease, etc. Various studies have showed that there is decrease in conduction velocity of motor and sensory nerve fibres in diabetic neuropathy which may affect reaction time[2]. Reaction time is the interval of time between the presentation of the stimulus and the initiation of the response[3]. It is an important parameter representing the integration of sensory, motor and co-ordination system of the body[4]. Defects in nerve conduction and central processing may occur early in course of diabetes mellitus[5]. Hence there is need for tests to identify neurological deficits before development of serious complications like cognitive disabilities and diabetic foot. Thus, reaction time can be taken as low- cost, non-invasive sensitive indicator of early nerve damage which may help in early diagnosis of diabetic neuropathy before signs and symptoms appear and may help to reduce neuropathy related morbidity.

MATERIAL AND METHODS

This cross- sectional study was conducted on 120 individuals aged 18-25 years of which 60 were cases of

How to site this article: Snehalata B Mali, Sayeeda Afroz, Sushma Jadhav. The study of auditory and visual reaction time in patients of Type-1 diabetes mellitus as compared to healthy individuals. *MedPulse – International Medical Journal*. November 2016; 3(11): 941-943. http://www.medpulse.in (accessed 18 November 2016).

diagnosed type 1 diabetes mellitus of either sex who were taking regular treatment and 60 were age and sex matched nondiabetic healthy individuals. The subjects included were non-smokers, non-alcoholics, non-hypertensive with normal vision. They were not suffering from any psychiatric disorders affecting their psychomotor abilities.

Study Protocol

The study was approved by institutional ethical committee. A written informed consent was taken from every individual prior to conduction of the study. The detail history was taken, general and systemic examination of each subject was carried out. Acuity of vision for near vision was tested by Jaeger's chart and distant vision was tested by Snellen's chart. Test for colour blindness was carried out by Ichihara chart. Acuity of hearing was tested by audiometry. All subjects were thoroughly aquainted with the operation of the apparatus. Four practice trials were given each time before reading was taken[4]. The audiovisual reaction time was measured by a simple machine, ''Response analyser'' by INCO, Yantra Shilpa system, Pune[6]. This machine provides audio (low and high pitched) and visual (red, green and yellow colours) stimuli. The response is given by pressing a soft touch key with a thumb of dominant hand. It provides display range of 9.999 sec with an accuracy of 1 millisecond. The reaction time was recorded in an isolated, adequately illuminated, noise free room between 10 am -12 pm. It was ensured that the location and direction of instrument as well as the subject is constant, so also the distance between them.

Statistical Analysis

Statistical analysis was done using unpaired t-test with the use of Software IBM SPSS(Version 21.0). p value <0.05 was considered as significant.

RESULTS

Table 1: Comparison of audiovisual reaction time (AVRT) in controls and type 1 diabetics

Parameter		Group		t value	p value	Significance
Reaction time Mean± SD(msec)		**Control**	**Type I DM**			
ART – H	Male	138.68 ±5.68	147.03 ±5.42	8.23	<0.001	Highly significant
	Female	139.43 ±5.73	148.33 ±5.71	8.52	<0.001	Highly significant
ART-L	Male	140.37 ±5.63	149.10 ±5.93	8.26	<0.001	Highly significant
	Female	140.41 ±5.63	149.38 ±5.87	8.54	<0.001	Highly significant
VRT-R	Male	147.83 ±4.88	158.17 ±5.86	10.5	<0.001	Highly significant
	Female	148.68 ±5.19	159.53 ±7.55	9.17	<0.001	Highly significant
VRT-G	Male	149.71 ±5.68	159.43 ±5.89	9.2	<0.001	Highly significant
	Female	149.40 ±5.67	160.35 ±7.36	9.12	<0.001	Highly significant
VRT-Y	Male	150.42 ±5.23	161.16 ±5.63	10.72	<0.001	Highly significant
	Female	151.52 ±5.43	162.20 ±5.76	10.45	<0.001	Highly significant

Table 1 shows that Audiovisual reaction time among patients of type 1 DM is significantly prolonged as compared to controls (P value <0.001) by unpaired t-test.

Table 2: Comparison of audiovisual reaction time(AVRT) in males and females of control group

Parameter	Male	Female	t value	p value	Significance
Reaction time Mean± SD(msec)					
ART - H	138.68 ±5.68	139.43 ±5.73	0.72	>0.05	Not significant
ART-L	140.37 ±5.63	140.41 ±5.63	-0.04	>0.05	Not significant
VRT-R	147.83 ±4.88	148.68 ±5.19	0.35	>0.05	Not significant
VRT-G	149.71 ±5.68	149.40 ±5.67	0.76	>0.05	Not significant
VRT-Y	150.42 ±5.23	151.52 ±5.43	0.01	>0.05	Not significant

Table 3: Comparison of audiovisual reaction time(AVRT) in males and females of type 1 diabetic group.

Parameter	Male	Female	t value	p value	Significance
Reaction time Mean± SD(msec)					
ART - H	147.03 ±5.42	148.33 ±5.71	0.2	>0.05	Not significant
ART-L	149.10 ±5.93	149.38 ±5.87	0.79	>0.05	Not significant
VRT-R	158.17 ±5.86	159.53 ±7.55	0.52	>0.05	Not significant
VRT-G	159.43 ±5.89	160.35 ±7.36	0.47	>0.05	Not significant
VRT-Y	161.16 ±5.63	162.20 ±5.76	0.71	>0.05	Not significant

Table 2 and 3 show that males react faster than females however the results are not statistically significant.

DISCUSSION

The study results suggested that the audiovisual reaction time in patients of type 1 diabetes mellitus is significantly prolonged as compared to controls. Our results are supported by similar findings in the studies conducted by: Prabhjot Kaur *et al*[1], N. Parekh *et al*[7], Holmes CS *et al*[8]. Males reacted faster than females however the results are not statistically significant. Structural changes in diabetes like axonal degeneration of both myelinated and unmyelinated nerve fibers, thickening of basement membrane, segmental demyelination**,** disruption of the myelin sheath are responsible for delayed nerve conduction velocity which leads to prolonged reaction time[5]. The absence of insulin leads to hyperglycaemia in patients of insulin dependent diabetes mellitus group in the target tissue[5,9]. Excessive glucose metabolism causes decrease in nitric oxide which may lead to constriction of blood vessels supplying nerves. It also causes accumulation of sorbitol and depletion of myoinositol that causes impairement of nerves ability to transmit signals[1]. Eliasson[10] showed that diabetes was associated with defective incorporation of acetate and glucose into nerve lipids, a fact which may possibly affect the thickness and quality of the myelin sheath. It is obvious that a decrease in nerve conduction velocity in diabetics occur earlier than clinically demonstrable signs of nerve damage[11,12]. Therefore, prolonged reaction time in diabetic patients can be taken as low cost, non-invasive, sensitive indicator of early nerve damage even before signs and symptoms of nerve damage appear.

CONCLUSION

It can be concluded that audiovisual reaction time is significantly prolonged in type 1 diabetics as compared to controls. Delayed reaction time can be an early manifestation of diabetic neuropathy. Thus, reaction time measurement can be used as a routine test in diabetic patients for early diagnosis of neuropathic changes and prevent further complications.

REFERENCES

1. Prabhjot Kaur *et al*: Auditory and visual reaction time in athletes, healthy controls, and patients of type I diabetes mellitus: A comparative study, Int J DiabDevCtries, Sept. 2006, Vol. 26, Issue3,112-115.
2. Lal. S.K. *et al*: Motor nerve conduction velocity in diabetic neuropathy, Neurol. India, 1970:18:189-191.
3. Barry L. Johnson, Jack K. Nelson: Practical measurement for evaluation in physical education. Subject Publication 3rd edition, 1988.
4. Dr. Pagar *et al*: Effect of caffeine on alertness of young healthy adults , Vol. 13, Issue 7, Ver. I (July 2014), 14-16.
5. Madan Mohan, Thombre DP, Das AK: Reaction time in clinical diabetes mellitus, Indian J. Physiology and Pharmacology, 1984:28:311 – 314.
6. Jensen AR. Learning and Reaction time – Educability and Group differences. Harper and Row. New York 1973 : 69-90.
7. N Parekh *et al*: The study of auditory and visual reaction time in healthy controls, patients of diabetes mellitus on modern allopathic treatment, and those performing aerobic exercises: JIACM 2004: 5(3): 239-243.
8. Holmes CS *et al*: Blood glucose control and visual and auditory attention in men with insulin dependent diabetes, Diabet Med, 1988 Oct; 5(7):634-639.
9. Lamontage Albert, Bhuchthal Fritz. Electrophysiological studies in diabetic neuropathy. J Neurol, Neurosurg Psychiatry 1970; 33: 442-452.
10. Eliasson S.G. and Hugler A.H.(1960,1964): Cholesterol and fatty acid synthesis in diabetic nerve and spinal cord, Neurology, ,10:143.
11. Lawrence D.G. and Loke S.: Motor nerve conduction velocity in diabetes, Arch. Neurol., 1961, 5: 483.
12. Mulder D.W.*et al*: The neuropathies associated with diabetes mellitus. A clinical and electromyographic study of 103 unselected diabetic patients, Neurology, 1961, 11: 275.

Source of Support: None Declared
Conflict of Interest: None Declared