REACTION TIME IN CLINICAL DIABETES MELLITUS

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Summary : Visual and auditory reaction times were studied in patients suffering from diabetes mellitus and age matched normal control subjects. Auditory reaction times were shorter than visual reaction times in control subjects as well as diabetic patients. In diabetic patients, there was significant prolongation of visual as well as auditory reaction times. Further studies of reaction times for various modalities may provide a better insight into the neurological disturbances in diabetes mellitus.

Key words : reaction time diabetes mellitus

INTRODUCTION

Diabetes mellitus is a common metabolic disorder affecting many organ systems. Neurological complications of diabetes are manifold. Many workers have demonstrated autonomic dysfunction in diabetic patients (1, 5, 6, 11, 12, 18). Impairment of conduction velocity in peripheral motor as well as sensory fibres is also known to occur in diabetes (7, 9, 14, 20, 21). Earlier, Lal *et al.* (16) and Sathiamoorthy *et al.* (19) have reported from our laboratories that there is depression in the conduction velocity of motor and sensory nerve fibres in diabetic neuropathy. But there is no report on the effect of diabetes mellitus on reaction time (RT, i.e. the time interval between the application of a stimulus and the response by the subject). RT has physiological significance and is a simple and non-invasive test for peripheral as well as central neural structures. Diabetes mellitus may involve peripheral nerves as well as central nervous system. Hence, we thought that RT measurements might be useful in studying the neurological deficit in diabetic patients. The present paper reports the results of our observations in this direction.

MATERIAL AND METHODS

Thirteen diabetic patients attending the diabetic clinic of this Institute for the past 1-12 years were selected for the study. They included eleven males and two females aged 21-55 yr(mean 43.46 ± 2.80 SE). Of the thirteen patients, four gave no history of any sensory abnormality, two complained of impaired sensory perception in the extremities.

four reported pain in the limbs, two reduced sensory perception as well as pain in limbs and one subject gave previous history of impaired sensations in the limbs. All the patients were having uncomplicated diabetes mellitus with moderate hyperglycemia. On clinical examination, there was no peripheral neuropathy or muscle weakness. ECG, fundoscopy and urine albumin examination excluded diabetic neurovascular complications. Thirteen healthy subjects aged 26-57 yr (mean 41.61 ± 2.41 SE) formed the control group. RT was measured by asking the subject to open as quickly as he could, a tap key kept in series with a magnetic time marker and a light or sound source. For hand RT the subject lifted his right hand from the key whereas for foot RT, the key was opened by the right foot. The points of application of stimulus and the response by the subject were automatically marked on a fast moving paper (1333 mm/sec.) with the magnetic time maker. Practice trials were administered till we were satisfied that the subjects understood and performed the task as required of them. After the practice trials, the hand and foot RTs for light as well as sound were measured for each subject. Statistical significance was evaluated by student's "t" test.

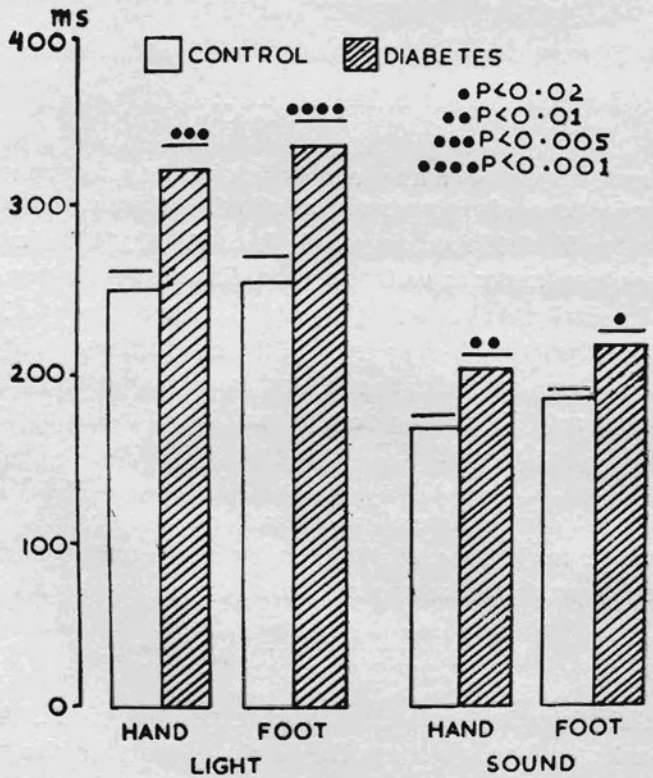

Fig. 1 : Hand and foot reaction times (milliseconds) for light and sound in control subjects and diabetic patients. Horizontal lines above the bars represent SE.

RESULTS

The results are given in Fig. 1. According to Moody *et al.* (17), the intrasubject RT variability is rather large. Hence, we recorded 10 observations for each RT measurement. Mean of these 10 observations was taken as an individual value for the purpose of statistical analysis. In the non-diabetic control group, the visual RT for hand was 249.61±12.63 (SE) msec whereas the visual RT for foot was 254.61± 14.96 msec. The corresponding values for the diabetic group were 321.07±15.20 and 337.61±15.58 msec respectively. The auditory RT for hand was 168.30 ±6.04 msec and for foot it was 186.0±6.28 msec in the control group. The corresponding values for diabetic patients were 204.46±11.21 and 218.0±10.15 msec respectively. In the control group as well as diabetic patients, the auditory RTs were shorter than the visual RTs (Fig. 1).

DISCUSSION

The visual and auditory RTs in our non-diabetic control subjects are similar to the findings of Evarts *et al.* (4) and King and Clausen (15). In the control group, auditory RTs were shorter than the visual RTs and this is consistent with earlier reports (10, 13, 15). In our diabetic patients as well, the auditory RTs were shorter than the visual RTs (Fig. 1).

In comparison to the age matched non-diabetic control group, the diabetic subjects showed a significant increase in all the RTs. The increase was 28.6% ($P<0.005$) for the visual RT for hand, 32.5% ($P<0.001$) for the visual RT for foot, 21.4% ($P<0.01$) for the auditory RT for hand and 17.2% ($P<0.02$) for auditory RT for foot. Earlier studies from our laboratories have shown that in diabetes mellitus, there is an impairment in conduction velocity in motor as well as sensory nerves (16, 19). The present study shows that RT for light as well as sound is significantly prolonged in diabetic patients.

This increase in RT may be due to slowing of conduction velocity in peripheral nerves and/or involvement of central neuraxis. Although the involvement of peripheral nerves, nerve roots and autonomic nervous system is known to be the most common neurologic manifestation of diabetes, the involvement of central nervous system in diabetic patients has not been well documented. De Jong (3) has reported the involvement of spinal cord and parenchymal brain in diabetes. But the text books insist that diabetic neuropathy may affect every part of the nervous system with the possible exception of brain (8). The marked and significant increase in RT can not be explained only on the basis of delay in peripheral nerves. Hence, the present work suggests the involvement of central neuraxis in our diabetic patients. However, further detailed studies are required to throw more light on this point.

RT involves central brain mechanisms and its study is of physiological interest. It is a sensitive, reproducible and inexpensive test and its measurement requires simple

apparatus and set-up. On the other hand, neurological techniques like recording of evoked potentials require special apparatus and great care. Moreover, the interpretation of evoked potentials is uncertain (2). Hence, RT may prove a valuable method for determining the severity of neurological derangement and for assessing the effectiveness of therapy in diabetic patients. Our results suggest the need for further detailed studies to establish the status of RTs for different modalities in diabetic patients.

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