STUDY OF AUDITORY AND VISUAL REACTION TIME IN DIABETICS
Kedar S. Kulkarni

ABSTRACT

BACKGROUND
Reaction time is the time interval between application of stimulus and the response obtained. It includes the time taken for central delay. It is an important parameter to evaluate nervous system. 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. We wanted to evaluate the effects of diseases like diabetes on reaction time.

METHODS
In the present study, visual and auditory reaction time was studied in 50 diabetics and in 50 normal subjects. There was prolongation of reaction time in diabetes. In diabetes there is involvement of peripheral conduction due to neuropathy, decreased processing of information in central nervous system and decreased attention. Reaction times can be measured by a variety of techniques in the lab. The simplest test is to present a stimulus to a test subject and instruct the subject to press a button as fast as possible after the stimulus is perceived. Responses can be measured by using a response box. Often-used stimuli are either visual (e.g., a coloured dot that pops up at random times on a computer screen), measure the reaction time from stimulus presentation up to the moment the subject presses the button. Hence, obtained response latencies include peripheral sensory processes, central sensor motor processing in the brain, and motor output. We have used response analyser to the measure reaction time.

RESULTS
Visual reaction time in healthy subjects was 184.12 ± 12.19 msec. In diabetics visual reaction time was 224.86 ± 12.5 msec and auditory was 224.1+12.39 msec.

CONCLUSIONS
Reaction time is significantly prolonged in individuals with diabetes mellitus. These differences were statistically significant (p<0.005).

KEYWORDS
Reaction time, Endocrine Disorders, Diabetes

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BACKGROUND
Reaction time is the time interval between application of stimulus and response obtained. It includes the time taken for central delay. It is an important parameter to evaluate nervous system. 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 proves to be an important parameter for assessing the factors which are affecting the reaction time. It is very cheap, non-invasive test as compared to other expensive tests like nerve conduction studies, electromyography etc. The objective of this study was to evaluate the effects of diseases like diabetes on reaction time.

METHODS
The present study was carried out in Dr. Patwardhan's Endocrine Research center, MIRAJ. The reaction time was measured with the help of an instrument called as response analyser. The measured reaction time in 50 healthy subjects was compared with that of reaction time of 50 diabetic subjects. All the subjects were in the age group between 30-50 years and were mails. In the present study, visual and auditory reaction times of RH and LH were recorded in two group. Group 1 comprised of 50 Healthy Males individuals in the age group 30-50 years. Group 2 comprised of 50 diabetic males for not less than 2 years.

RESULTS
The observations were recorded and were tabulated as shown in the observation tables. A total of 100 individuals were screened for reaction time study between the age group of 30-50 years.
Table 1. Mean and Standard Deviation Values in Visual and Auditory Reaction Time of Hands in Normal and Diabetic Group

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normal Right Hand</th>
<th>Diabetics Right Hand</th>
<th>Normal Left Hand</th>
<th>Diabetics Left Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>184.01</td>
<td>244.84</td>
<td>176.00</td>
<td>248.00</td>
</tr>
<tr>
<td>S.D</td>
<td>12.1</td>
<td>12.5</td>
<td>6.0</td>
<td>9.4</td>
</tr>
<tr>
<td>Reaction Time</td>
<td>196.0</td>
<td>237.0</td>
<td>197.6</td>
<td>248.0</td>
</tr>
</tbody>
</table>

Table 2(a). Showing Result of S.E. Test for Visual Reaction Time in Diabetics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Right Hand</th>
<th>Left Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE (X1-X2)</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Z</td>
<td>216.2</td>
<td>16.5</td>
</tr>
<tr>
<td>p Value</td>
<td>&lt;0.005</td>
<td>&lt;0.005</td>
</tr>
</tbody>
</table>

Table 2(b). Results of S.E. Test for Auditory Reaction Time in Diabetics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Right Hand</th>
<th>Left Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE (X1-X2)</td>
<td>2.4</td>
<td>1.5</td>
</tr>
<tr>
<td>Z</td>
<td>17.3</td>
<td>47.6</td>
</tr>
<tr>
<td>p Value</td>
<td>&lt;0.005</td>
<td>&lt;0.005</td>
</tr>
</tbody>
</table>

According to the study it was seen that visual reaction time in healthy subjects was 184.12 ± 12.19 msec. In diabetics visual reaction time was 203 ± 1.69 msec. In diabetics visual reaction time was 224.86 ± 12.5 msec and auditory was 244.1+12.39 msec. All these observations show that reaction time is significantly prolonged in individuals with diabetes mellitus. These differences were statistically significant. (p<0.005). Conclusion because of factors like involvement nervous system reaction time is prolonged in Diabetic mellitus.

DISCUSSION

The observations were recorded and tabulated. The value of reaction time for right hand in case of visual reaction time was 18401 (mean) + 121.1 (S.D.) msec .The value for auditory reaction time for right hand was 203.3±11.69 sec. The value for left hand was 197.6±6.09 But the values for diabetic patients was for right hand 224.1+12.5 msecs. The value for auditory reaction time was 244.86±12.5 msec for right hand and 284.04 ± 4.0 msecs for left hand. Thus, the reaction time is significantly prolonged in diabetic patients and this difference was statistically significant. Out results are comparable to results of Neena Mishra et al. The sample size and instruments used were similar in both cases and criteria for selection of patients was also similar.2 Similar type of study was conducted by Madan Mohan et al in July 1984. In their study they also found that there was increase in reaction time of diabetic subjects of hands and feet and increase was found to be statistically significant.3 Increase in reaction time in diabetic subjects with hearing loss was proved by s. Mukhopadhyay et al by using BAER And by MLR.4 Similar types of studies were done by Sugita et al) 1990,5 and Chen S. S. (1999).6 Assessment of 16 young men who were diabetic and insulin dependent diabetes mellitus with neurophysiological measures of attention, decision making and motor tasks demonstrated decreased attention on visual and auditory reaction time tasks.7 This study was done by Holmes. Holmes Showed that attention and fine motor skills are disrupted at altered glucose concentrations.8 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. 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.9

Paris demonstrated that visual evoked potentials show abnormal responses in newly diagnosed insulin dependent (IDDM) patients. They have also demonstrated impairment of pattern electro radiogram indicating involvement of retinal layers, increased values of retinocortico time indicating delayed conduction in post-retinal pathways.10 Suzuki et al have documented the central and peripheral somatosensory conduction in patients with diabetes as abnormal. The central conduction abnormality is present in diabetes.11 Central motor conduction times obtained by means of magnetic stimulation of the motor cortex and spinal roots were studied in 138 Patients affected by diabetes but with no signs and symptoms of CNS involvement. The study shows that central conduction time was significantly increased in diabetic subjects.12

Toppish demonstrated that patients with diabetes mellitus had a significant reduction in attention. Attention deficit occurs maximally in hypoglycaemia.13 Celler demonstrated that there are possible neurological abnormalities even in the absence of neurological abnormalities even in the absence of neuropathy symptoms taking into account electrophysiological abnormalities for e. g. motor and central nerve conduction abnormalities. There are significant associations between electrophysiological parameters and metabolic control.14 Alexander demonstrated that there is a subclinical involvement of auditory pathway in diabetic patients with normal hearing.15 Kolex has documented early CNS indolent in diabetes mellitus.16 Sartca documented that diabetic impotence is generally due to peripheral neuropathy but a central pathway impairment also has been suggested. Thus, there is prolongation of simple reaction time in patients of diabetic mellitus because of involvement of peripheral and central nervous system. Reaction time has physiological significance and it can be used to assess the involvement of central and peripheral nervous system in patients of diabetes mellitus. It is a simple cheap Non-invasive and sensitive test. On the other hand, neurological techniques like recording evoked potentials require special apparatus and it requires a great care.

CONCLUSIONS

Reaction time is significantly prolonged in individuals with diabetes mellitus. These differences were statistically significant (p<0.005). Reaction time is the interval of time between the application of a stimulus and appearance of appropriate voluntary response in a subject. Being voluntary in nature, the response is primary governed by the ability of an individual to concentrate and establish a muscular attitude of readiness. The reaction time thus indicates the...
time lost between the application of a stimulus and the appearance of its end effect. Different types of stimulus can be tried to elicit a particular response such as touch, cold, sound, heat, light, pain, etc. It varies with the complexity of the reflex and the inter-related sensory pathway associated with the course of the impulse as it travels to the center. Factors which facilitate (speed up) the reaction time are alertness, training, concentration.

REFERENCES