LATENCY OF OCULAR MOVEMENT IN CEREBRAL DISEASE

by

MAURICE W. VAN ALLEN, M. D.*

(Iowa City)

ABSTRACT

Oculomotor reaction time was studied in patients with cerebral disease and in control patients. Reaction time in the latter group was quite comparable to previous normative findings on manual reaction time in a comparable group of control patients. The patients with cerebral disease were significantly slower than controls, their mean oculomotor reaction time being 98 msec. (45 per cent) higher than that of the controls. There was a substantial positive correlation between reaction times to the left and reaction times to the right in both groups of patients. The findings support the concept that oculomotor reaction time, like other forms of reaction time, reflects cerebral status. Further study is required to determine its relationship to size and locus of cerebral lesion.

Reaction time, the latent period from appearance of a stimulus to a detectable response, has been the subject of measurement and analysis for almost a century (OBERSTEINER, 1874). Slowing of reaction time has been well documented as a general effect of the presence of a cerebral lesion (BLACKBURN & BENTON, 1955) and the measurement of simple reaction time of the hands has been shown in our laboratories to have some pragmatic value in detection of disease of the brain (DEE & VAN ALLEN, 1971, 1972). A natural extension of our interest in reaction time in cerebral disease has been the study of reaction time of eye movement.

* From the Department of Neurology and the Neurosensory Center, College of Medicine, University of Iowa. The Neurosensory Center is supported by NINDS Program-Project Grant No. NS03354. Neurosensory Center Publication No. 249.
EQUIPMENT AND PROCEDURE

Change in the corneo-retinal potential resulting from eye movement and recordable through skin electrodes placed on either side of the eye has been used as the correlate of eye movement in these studies. A movement of 40° in visual axis commonly gives a potential change of about 1 mv between electrodes. The potential change was amplified by a D. C. Preamplifier Model 7 P1B in the Grass Polygraph Model 7B. Deflection of the pen was adjusted to a common standard for each patient. A timer unit controlled the alerting and stimulus tones and lights, provided an automatic randomization of delay between alerting stimulus and reacting stimulus and measured the latency of reaction on a digital display with an accuracy of ± 1 msec.

The timer started with presentation of the stimulus and was stopped when the potential change reached 10 per cent of its final value as determined on preliminary runs and adjusted to a common standard. The timer unit sampled and stored the baseline of the recording just prior to stimulus onset so that it responded only to a change in potential between the electrodes. The corneo-retinal potentials were also monitored on the ink writer of the polygraph. The patient was seated with his chin in a chin rest one meter from a horizontal frame which carried the fixation and stimulus lights at eye level. Both eyes were open but recordings were made only from the right eye moving from central fixation to either right or left toward a stimulus light. The subject was alerted by a 1000 Hz tone from a loud speaker and the appearance of a fixation light (neon) in the frame center. After a random delay of 2.0, 2.2 or 2.4 sec. the stimulus tone of 500 Hz was presented. The conditions of experiment were designed to be simple and to correspond to the design of other simple reaction time determinations using the hand and foot.

The alerting tone and central fixation light were presented simultaneously as was a light at approximately 40° to either right or left. After a random period, the stimulus tone was presented and the patient, having been instructed to do so as rapidly as possible, turned his gaze to the lateral light in two blocks of 15 trials each, one involving movement to the left and the other involving movement to the right. The sequence of these two blocks of trials was alternated for successive subjects so that approximately half of each group of subjects were given the 'movement to the left' sequence first and half were given the 'movement to the right' block first. The median reaction time for all 30 trials and for each block of 15 trials separately was computed for each subject.

The control subjects were 32 hospitalized patients of sex and age range comparable to the brain-damaged patients. They were ambulatory patients hosp-