A STUDY OF GNOSIS, PRAXIS AND LANGUAGE FOLLOWING SECTION OF THE CORPUS CALLOSUM AND ANTERIOR COMMISSURE*

LT. COMDR. ANDREW J. AKELAITIS, MC-V(S), U.S.N.R.
Department of Medicine, Division of Psychiatry, University of Rochester School of Medicine and Dentistry, and the Clinics of the Strong Memorial and Rochester Municipal Hospitals, Rochester, New York
(Received for publication January 3, 1944)

In a series of papers on the corpus callosum, evidence has been presented that commissural systems other than the corpus callosum probably play a large role in activities that require the coordination of the two hemispheres. In such unilateral activities as writing with the subordinate hand, the recognition of written symbols and wooden letters in the subordinate side and possibly also of letters in the subordinate homonymous field after complete section of the corpus callosum points strongly to the presence of subcallosal commissural systems between the dominant and subordinate hemispheres. The anterior commissure is, next to the corpus callosum, apparently, the most important interhemispheric commissural system.

The present paper is concerned with a detailed study of the higher integrative activities of two patients, one with section of the anterior commissure one year after complete section of the corpus callosum, and the other with simultaneous section of the anterior commissure and the anterior half of the corpus callosum. The essential problem consists of an evaluation of the rôle of the anterior commissure in interhemispheric connection after partial or complete section of the corpus callosum.

METHODS OF INVESTIGATION

Since the various tests have been described in detail elsewhere, only a brief résumé will be given. Laterality, including handedness, footedness, and eyedness, was studied by the method described by Smith and Akelaitis. The study of the higher visual functions in each homonymous field included absolute and relative orientation, absolute and relative discrimination of size, and the recognition of color, objects and letters. Praxis was studied in detail. Auditory gnosis included the study of sound localization, the recognition of familiar sounds and the appreciation of music. Tactile gnosis included detailed study of the sensory system (tactile, pain, temperature, position, vibration, localization, deep pressure, two-point discrimination, weight discrimination, appreciation of shape, size, texture and consistency)

* This study was aided by grants furnished by the Ernest L. Woodward Fund and the John and Mary R. Markle Foundation.

The opinions contained in this paper are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.
and stereognosis. Temporal-spatial gnosis was studied. Language functions were studied unilaterally and included the receptive aspects, such as visual and tactile lexia, and the expressive aspects, such as graphia.

CASE REPORTS

Case 1 (Hospital Unit #131559). G.E., a white married farmer, aged 35, was admitted to the Strong Memorial Hospital May 2, 1940 and April 19, 1941.

Personal History. As a child he stuttered; this disappeared in adolescence. At 14 he had poliomyelitis which left him with a residual weakness of the right leg. In 1933, at the age of 28, an osteomyelitis of the right tibia and lower femur developed, necessitating a mid-thigh amputation in 1938.

Present Illness. In August 1937 he began to have convulsions associated with a progressive right-sided paralysis and expressive form of aphasia. Dr. W. P. Van Wagenen drained an abscess in the left frontal lobe beneath an osteomyelitis of the skull on September 3, 1937. The hemiplegia cleared up almost completely except for a slight weakness in the right arm. His speech returned but the stutter reappeared and he has noticed occasional difficulty in thinking of the proper word when writing or talking. The grand-mal seizures have continued. They are associated with an aura of "something going to happen" and in the seizure the right arm thrashes about more than the left. Following each generalized seizure he is aphasic for two or three hours and the right arm is paralyzed and feels numb for several hours. Petit-mal attacks occur about once a day.

Physical Status. This was good except for the right mid-thigh amputated stump.

Neurologic Status. Except for an exaggeration of the tendon reflexes in the right arm the examination was negative. Laterality studies revealed right-handedness and right-eyedness. Before amputation he had used his right foot in kicking. Left cerebral dominance was well illustrated by the association of aphasia with a right hemiplegia in 1937.

Special Studies of Praxis, Gnosis and Language Functions. These were normal except for the stutter and a mild expressive form of aphasia. He had difficulty in spelling simple words and when asked to write out the alphabet he was troubled by the letters "t," "u," "v," and "z." He was able to write with either hand (Fig. 1A). When he was aphasic three years ago he had no difficulty understanding what was said to him and what he read. He remembered that he was unable to write with his left hand at that time.

Laboratory Studies. Examination of blood, urine and feces gave normal results. Electroencephalographic studies revealed delta waves in all leads but of greatest amplitude over the left side of the scalp. Ventriculograms disclosed a dilatation of the ventricular system most marked on the left side and a shift of the pineal shadow to the left. These findings suggested cortical atrophy most marked on the left side.

First Operation. On May 17, 1940 a mid-line frontal incision was carried out along the former incision and extended into the right temporal region. The right frontal lobe was easily retracted away from the falx and the corpus callosum was sectioned completely. A scar approximately 2 cm. in diameter was seen over the right superior frontal gyrus (area 8 of Brodmann).

Course. The postoperative course was uneventful. Except for an increased biceps reflex on the right the neurologic status was normal. He had no difficulty using his crutches to walk. The stutter and dysphasia continued unchanged.

On June 5, 1940 a detailed study of praxis, gnosis and language functions was made with findings identical to those found preoperatively. There was no visual agnosia or alexia in either homonymous field, auditory localization in the median plane was intact, stereognosis and tactile lexia remained intact in each hand, and no disturbance of body image was noticed. Study of time-space relationships including the clock test gave normal results. No evidence of dyspraxia was observed at this time or at any time following operation. He was able to write with either hand with eyes open or when blindfolded.