SOME EFFERENT CONNEXIONS OF THE HUMAN FRONTAL LOBE

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The principal source of anatomic information on the frontothalamic and thalamofrontal connexions have been the experimental studies made on laboratory animals. The information obtained has been useful especially with preparations stained by the Marchi method to determine the course of the myelinated fibers.

A detailed communication on these connexions in human material, with a study of 7 cases of leucotomy and 1 of lobotomy, was made by Meyer, Beck and McLardy in 1947.

During the last several years various investigators have been using different techniques of silver impregnation for the study of degeneration of fibers and terminations of the central nervous system. Meyer, in 1949, for the first time analysed human leucotomized brains with the silver impregnation technique of Glees, in order to demonstrate the course of the corticofugal fibers up to the terminations of the cortical nuclei. Beck, in 1950, studied a selected material of 5 cases of leucotomy with Glees' technique and demonstrated that the prefrontopontine bundle originates in the dorsal part and lateral convexity of the prefrontal region. Beck, Meyer and Le Beau, in 1951, in 2 cases of cortical resections in human material, studied the efferent connexions of agranular frontal cortex and described a direct frontohypothalamic pathway terminating in the ventromedial and lateral hypothalamic nuclei; the authors employed the silver impregnation technique of Glees.

Recently, Vaz Ferreira, in 1952, used the sixth formula of Cajal in experimental studies of degeneration of thalamocortical fibers in rats.

According to Meyer, Beck and McLardy, the location of the operation in lobotomy or leucotomy does not have any importance in examining the brain. They state: "An operation on human beings producing a brain lesion unpredictable in precise location and extent is from a purely anatomical point of view an unqualified boon, since each case, and often each hemisphere, presents as it were a separate experiment."

The present paper is based on histological studies of the corticofrontal pathway in 2 cases only: one of bilateral topectomy of area 32 and part of areas 8, 10 and 24 of Brodmann, and the other, a unilateral circumscribed resection of the cerebral cortex and white substance of the frontal lobe in areas 46 and 10.

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MATERIAL AND METHODS

The autopsies were made personally. In Case 1 the brain was removed 5 hours after death. The body was maintained at 0°C. before the autopsy was performed, so that autolitic changes were regarded as unimportant. In Case 2, the brain was removed 1 hour after death.

The brains were fixed without delay by suspension in 15 per cent formalin for 8 hours. Then sections were made and photographed. Blocks which included the thalamus, lentiform, caudate, putamen, and, in Case 2, the brain stem were selected. Each block was refixed in fresh 15 per cent formalin for a week. The thalamus, caudate, lentiform and putamen were divided in six parts and prepared in semiserial frozen sections of 50 to 70 μ. Each section was stained by a slight modification of the method of Gros. That is to say, the sections after having been treated with 96 per cent alcohol for half an hour or more were put into 20 per cent silver nitrate, using a quarter or a fifth capsule with a 1 per cent dilution of formalin, before proceeding with the ammoniacal silver nitrate method of Gros. In the same manner controls of normal material of a woman aged 41 years, who died of heart failure and without significant changes in the brain, were prepared of the thalamus and brain stem. According to a previous large experience, this method supplies a uniform staining, and particularly satisfactory is the control of the intensity of impregnation.

For the description of the topography of the cerebral cortex injuries the scheme of Brodmann was used. The sections, which demonstrate the degeneration of the fibers quite well, were drawn by camera lucida and each sketch depicts the altered interrupted fibers. The “boutons terminaux” are indicated by crossed lines. Each section is accompanied by a corresponding photomicrograph showing details of the degeneration of the fibers or terminations.

DESCRIPTIONS

Case 1. Observation No. 6627. N.C.C., a woman 22 years of age, had had epilepsy with serious mental confusion since childhood. She died 14 days after operation.

Autopsy. The brain was of normal size and weight. A resection of the cortex,