A STEREOTAXIC TECHNIQUE IN MAN ALLOWING MULTIPLE SPATIAL AND TEMPORAL APPROACHES TO INTRACRANIAL TARGETS*

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In this paper we describe a method of intracranial localization by precise stereotaxic means, techniques for returning to the same or different targets at later stages, and a method for producing thermal lesions.

A brief history of the development of stereotaxic techniques has already been given by Becker et al.† In the present work a stereotaxic instrument designed by Leksell‡–§ was used. † This is a mechanical instrument which translates the rectangular coordinate system of the localization procedure to the spherical coordinate system used for directing an electrode to a predetermined target (Figs. 1 and 2). An important advantage of this system is that an electrode may be directed to the target from any part of the calvaria through an infinite number of paths. A path may thus be selected to include structures that it may be desired to investigate and to avoid structures that should be left undisturbed.

The current surgical technique involves two or more stages. In the first stage the stereotaxic instrument is attached to the patient’s head; radiographic methods are used to demonstrate reference structures in the patient’s brain and the instrument coordinate system. (The reference structures currently used are the anterior and posterior commissures and the midsagittal plane; these will henceforth be referred to as the reference points.) Relating the roentgenograms obtained to a reference brain, the target is located in terms of the instrument’s coordinate system. In subsequent stages an electrode is directed to the target by one of two methods detailed below, and a thermal lesion is produced.

THE STEREOTAXIC INSTRUMENT

The instrument ‡ (Fig. 1) consists of an inner square frame and an outer semicircular frame bearing an electrode carrier. The inner frame has pro-

† It is our judgment that the Leksell instrument is the most simple, flexible, and accurate yet devised. One of us (B.F.) spent some time with Leksell learning the method he uses. This paper describes the techniques and mechanical devices developed at Mount Zion Hospital and Medical Center, and should not be construed to describe the techniques of Leksell.

‡ Manufactured by Aga Bausch and Lomb AB, Stockholm, Sweden.
Fig. 1. Stereotaxic instrument, showing inner square frame (a) with side-bars (b) in position. Attached to side-bars are tubular supports holding semicircular frame (c), to which is attached electrode carrier (d) with electrode (e). Frame is fixed to skull by tubular blades and drills, one of which (f) is shown. Initial positioning of instrument is facilitated by ear plugs (g). The coordinate systems engraved on the instrument are clearly visible; X, Y, and Z axes are indicated.

Fig. 2. Stereotaxic instrument, showing coordinate systems used for localization and directing electrode to target. Y is the vertical axis, and is set by the position of the side-bars. X is the horizontal axis seen from a lateral view and is set by the position of the semicircular frame’s tubular support bars. Z is the horizontal axis seen from the anteroposterior view, and is set by sliding the semicircular frame along its tubular support bars (note calibration to left of frame). Electrode carrier angle ϕ and semicircle angle θ (see 2B) are set for desired path to target. r is distance from target to any chosen point along electrode path (note scale on electrode carrier). Once X, Y, and Z have been set, electrode will go to the target regardless of values of ϕ and θ.