A STEREOTAXIC INSTRUMENT FOR PALLIDOPTHALAMECTOMY IN PARKINSON’S DISEASE*

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Chemopallidectomy and chemothalamectomy for the treatment of Parkinson's disease and other hyperkinetic disorders have proven to be effective in the majority of our cases. Initially, Cooper employed a transtemporal approach to the pallidum, inserting a polyethylene cannula through which absolute alcohol was injected. This technique was changed in 1957 to a transfrontal convexity approach (described previously by Spiegel and Wycis) for pallidal and thalamic targets. Subsequently, a more elaborate balloon-cannula was developed for chemopallidothalamectomy.

In order to place a balloon-cannula, an electrode, or other lesion-producing devices accurately into either the ventrolateral nucleus of the thalamus or the mesial aspect of the globus pallidus, three basic requirements must be met: 1) adequate visualization of the ventricular system by air or other contrast media; 2) reproduction of identical anteroposterior and lateral skull films at a fixed target distance during the operation; and 3) a stereotaxic instrument, which by simple adjustment can assure accurate placement of the cannula or electrode into the desired subcortical area.

In spite of fulfilling the above requirements, an accurate stereotaxic atlas of the human brain cannot apply necessarily to the specific brain being operated upon. This is so because the size, shape, and position of the thalamic nuclei, globus pallidus, or other nuclear masses or tracts vary from person to person, and even at times from side to side. Nevertheless, the margin of error in reaching specific surgical targets is reduced by using neighboring ventricular landmarks, and by observing the patient's response to temporary blockage following injection of procaine, or to stimulation, or both, of these regions.

The stainless steel Rand-Wells pallidothalamectomy stereotaxic guide, shown in Fig. 1, was designed and constructed in 1958 to fulfill the third requirement. Fortuitously it is similar in principle to one described by McCaul in 1959.

The base of the present instrument (Fig. 1A), made in an oval shape with a \( \frac{1}{2} \)-inch hole in the center, is screwed to the skull over an appropriately placed frontal burr hole. The cannula carrier (Fig. 1B) is then attached to the base and secured tightly with two screws. The arcs of the carrier which are arranged at right angles to each other are carefully aligned in the sagittal and coronal planes of the skull. A cannula or coagulating electrode is then placed in the guide and advanced to lie against the surface of the cortex.

Accurate anteroposterior and brow-up lateral skull films are taken to show the relationship of the surgical target to the cannula and base of the instrument. On these preliminary films, a line is drawn as an extension of the cannula or electrode and then a second line is made from the center of the pallidal or thalamic target to the center of the circle formed by the inferior edge of the base of the guide. This point corresponds to the fulcrum of the coronal and sagittal arcs of the guide. The angular difference between these lines in the anteroposterior and lateral planes is measured, and the appropriate correction is made in degrees on the respective quadrant scale of the carrier. A second set of films for verification of the new position of the cannula is taken. Lines are again projected as extensions of the cannula and should pass through this target area. The cannula

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![Fig. 1. Rand-Wells pallidothalamectomy stereotaxic guide employing coronal and sagittal arcs with their fulcrum at the cortex in order to direct a cannula or electrode accurately and easily into the surgical target.](image-url)
or electrode is then inserted to the proper depth into the pallidum or thalamus under roentgen-ray control. The final position is checked by another set of films.

The dura mater is opened prior to the fixation of the base of the instrument and a No. 28 stainless steel wire is stretched loosely across the burr hole between small drill holes placed through the diploë and the outer table of the skull. At the end of the operation, this wire, which parallels the sagittal plane, is tightened, and the cannula is fixed to it with a silk ligature. This fixation technique has helped measurably in preventing postoperative displacement of the cannula within the brain.

An appropriately sized lesion can be made using either electrolysis or a balloon-cannula technique. The author has preferred the latter with alcohol-Pantopaque mixture injected 4 hours later to produce destructive lesions in the thalamus or pallidum for hyperkinetic disorders.

The stereotaxic guide described herein has been used in over 100 operations since 1958. Reoperation in order to enlarge the lesion can be performed quickly by readjusting the guide to the final angles on the sagittal and coronal arcs determined at the previous operation. In addition, a second lesion adjacent to the first can be made by adjusting the guide to the desired angle using the first lesion and previous air study as reference points.

In recent months, simultaneous thalamic lesions have been made in selected cases by using two such stereotaxic instruments. One thalamic lesion is produced first (Fig. 2A). If immediate and complete cessation of contralateral tremor and rigidity occurs without complication, a symmetrical “marker lesion” (Fig. 2B), using a droplet of Pantopaque, is made in the opposite thalamus. The cannula is withdrawn from the second side and left in place on the first. The marker lesion should also cause immediate cessation of tremor and rigidity; however, this improvement generally does not last long. In the majority of cases, the exacerbation of symptoms is not so severe. The simultaneous bilateral thalamotomy shortens the time between operations, and helps to avoid a pneumoencephalogram at the second stage. The stereotaxic instrument is simply replaced on the second side and the previous measurements are used to realign the cannula. During the performance of unilateral thalamotomy and pallidotomy procedures, depth stimulation and recording have been carried out in some patients. The results of these most recent electrophysiological investigations during bilateral thalamotomy are in preparation for publication (Fig. 3).