Quantitative Criteria for the Neurosurgical Treatment of Parkinsonism*

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Although the syndrome of parkinsonism first was described almost a hundred and forty years ago, it has been only within the last decade or so that neurosurgical approaches to the treatment of this disease have been feasible. In the past several years, we have been interested in the development of measures of the disabilities that this disease produces, both in regard to the fundamental problems of neurophysiology and particularly with reference to the development of objective criteria by which the natural course of the disease and the effects of drugs, surgery, and physiotherapy may be studied. The present report is a preliminary study of some of the methods that have been developed for the pre- and postoperative study of parkinsonian patients who have undergone thalamotomy for their symptoms and describes a technique whereby the surgical procedure itself can be monitored.

Neurosurgical approaches to the treatment of parkinsonism in the past have included lesions placed in all levels of the central and peripheral nervous systems.1-3,9,10,12-14,17 In the last few years, most attention has been placed on the development of methods of producing lesions either in the globus pallidus or ventrolateral nucleus of the thalamus, with acceptable rates of mortality and morbidity.10 If properly selected, “good” results have been reported in 80 per cent of subjects under 40 years of age with early symptoms, involvement restricted primarily to one side, and with rigidity and tremor (as opposed to bradykinesia) as main symptoms.10 As the symptoms become bilateral and the patient more elderly, particularly with axial involvement and bradykinesia added to the picture, the results are said to fall to 70 per cent and then to 40 per cent of all patients. It has been estimated that there are at least 266,000 patients with parkinsonism in the United States,11 of which only a small portion fit the criteria of Cooper and others for good results.

There are many unsolved problems in the neurosurgical approach to parkinsonism.

1) The problem of “good results”: definition of terms. It is observed commonly that the disability in parkinsonism varies from person to person and from time to time in the same person. Some patients are able to work with relatively severe symptoms and signs of disease, while others are incapacitated by the mildest objective dysfunction. Moreover, relief of rigidity and tremor has followed an operation which also produced a major psychosis; in another instance, death has resulted from respiratory insufficiency. It is, therefore, not sufficient to separate results into “good” or “bad,” but each symptom must be included and weighed in its own right.

2) The problem of symptoms: the treatment of a syndrome, not a disease state. The symptoms of parkinsonism may be caused by many different etiologic agents, but the surgical approach is based on the premise of a common disturbance in neurophysiology and is directed at a set of symptoms, and not a disease entity. In this sense, it might not be unexpected that relief might be symptomatic and, therefore, uncertain both in degree and in nature.

3) The problem of follow-up: the variation in the postoperative state. The postoperative results are not yet uniform and cannot be predicted with complete confidence at the time of operation. Immediately after thala-
motomy, the symptoms may disappear, only to return in full force after a variable length of time. The reverse also has occurred, in which an operation was apparently a failure only to be followed by the gradual diminution of symptoms and signs over a period of time.

4) The problem of the uniformity of procedure: size, site, and nature. To add to the problem of other uncontrolled variables, there is wide variation among neurologic surgeons as to the ideal size, site, and nature of the lesion to be produced. Lesions have been produced mechanically, chemically, with radioisotopes, and by a variety of electrical or electronic means, including electrocoagulation and radiofrequency currents (primarily producing heat), and physically with ultrasound. The recommended site of the lesion has varied, some authorities suggesting that the lesion be "as large as possible." The ideal site of the lesion is still in dispute, but the current targets of choice are the ventrolateral nucleus of the thalamus, or perhaps, the globus pallidus. No matter what locus is selected, the problem of placement of the lesion still remains. Techniques may range from rather freehand technique, more or less controlled by roentgen rays, to elegant techniques employing stereotactic apparatus and basing the placement of the lesion by relationship to other cranial and intracranial structures. However, because of the wide variation of anatomic structure of the human brain from patient to patient, we have attempted to achieve some type of neurophysiologic correlation so far as the placement of the lesion has been concerned.

5) The problem of contaminated results: drugs and physiotherapy. It would seem obvious that surgical results must be evaluated in their own right; but the effects of surgery usually are measured during a postoperative period of intense physical therapy and/or management with drugs. Neglecting for a moment the profound influence of the operation per se on the symptoms (the "placebo" effect of surgery, as described by Beecher), the results of surgery must at least be equal to, or better than, other forms of treatment in order to justify the procedure. Ideally, the results should not be confused with those of simultaneous treatment with drugs and physical therapy.

6) The problem of disability and candidacy for surgery. We have already alluded to this problem in the average parkinsonian patient, a person with rigidity, tremor, and other disabilities, but who is crippled primarily by a symptom not yielding readily to surgery, that is to say, slowness of movement. The age group of the parkinsonian patient is crowded with other hazards: organic mental changes, affective psychotic disturbances, and the like. In the majority of parkinsonian patients, surgery may or may not be of sufficient benefit to justify the procedure.

To answer these questions, we have proposed that each patient undergoing surgery for parkinsonism be subjected to a careful clinical study before and after operation until at least 6 months have elapsed following the procedure. A detailed neurologic examination should be done, including a clinical rating of each symptom and sign, together with careful mental evaluation. If there is indication for drugs and physical therapy after surgery, this should be noted, so that such subjects are not equated to those not receiving the benefit of such treatment. Measurements of the activities of daily living must also be made. If these data can then be correlated later with the surgical procedure and its results, then a meaningful pattern may eventually evolve to outline the criteria for surgery, as well as for the procedure itself. Our efforts, as have those of other investigators, have evolved in the direction of serial electronic measurements of the various symptoms. Currently, slowness of movement, rigidity, tremor, voice, articulation, respiration, and the psychologic state of the patient are all recorded in permanent and quantitative form, as well as in the usual clinical fashion. In addition to these pre- and postoperative measurements, we have also attempted to monitor the surgical procedure itself, using the most easily recorded sign, the tremor of the limb. Our present system utilizes a variable reluctance acceler-