Campotomy in Various Extrapyramidal Disorders*

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In 1950 we observed a 74-year-old patient suffering from hemiballismus that was relieved by a mesencephalic lesion. The patient died 5 weeks postoperatively of bronchopneumonia and renal failure. Macroscopically a lesion was found that extended from the tegmentum of the midbrain lateral to the nucleus ruber into the substantia nigra, as illustrated in Part I of Stereoecephalotomy. The histological examination revealed that the lesion produced by us affected the medial part of the substantia nigra and interrupted the mesencephalic part of Forel's field H (Fig. 1). In view of the fact that a major portion of the pallidofugal fibers can be interrupted in Forel's field H by a relatively small lesion, it seemed of interest to study the effect of lesions restricted as far as possible to Forel's field H (campotomy) upon parkinsonian tremor, rigidity, and other so-called extra-pyramidal disorders. The possible importance of this area in the mechanism of tremor was demonstrated by experiments in which it was observed that stimulation of this field, similarly to that of the pallidum, is able to increase a tremor induced by stimulation of the mesencephalic tegmentum (Fig. 2). The report by Strassburger and French also showed that in cats tremor induced by Serpasil could be eliminated by lesions including Forel's field H. Meyers, who concentrated his efforts upon the substantia nigra several years after publication of our observation mentioned above, seemed to have lost some of his enthusiasm for nigral lesions and to have shifted his interest to the fields H, H1 and H2. A brief account of our initial observations on campotomy appeared in the Transactions of the American Neurological Association.

In the present series of patients with extrapyramidal disorders, the lesion was first produced in the mesencephalic part of field H, dorsolateral to the nucleus ruber and ventrolateral to the tegmental area from which we had attempted to influence tremor and rigidity in parkinsonian patients in a previous study. In the course of this work it was found that lesions in the thalamic part of field H are more efficient than those in the mesencephalic part so that in the later phase of our work we produced the lesion anterior and lateral to the nucleus ruber. Lesions of the zona incerta including fields H1 and H2 were not performed in order to avoid injury to the corpus subthalamicum and the danger of producing hemiballismus.

The following fiber systems form, or pass through, Forel's field (Fig. 3):

1. Pallidofugal fibers end partly in the nucleus campi Foreli that sends the prerubral tract to the nucleus ruber, partly the pallidofugal fibers by-pass the nucleus campi Foreli and end in the nucleus ruber, and possibly also in other cell groups of the mesencephalic tegmentum; into the latter degenerating fibers could be traced from lesions in Forel's field. The latter studies suggested that fibers from the ventral thalamus terminate in the reticular formation dorsal to the magnocellular part of the ruber. Martinez also found fibers from the pallidum to the prerubral tegmentum and to the ruber.

2. Rubrothalamic fibers and cerebellothalamic fibers end chiefly in the nucleus ventralis lateralis thalami from where impulses may be continued to the motor and

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premotor region as well as to the globus pallidus. There also may exist direct rubro- and cerebellopallidal fibers. Johnson and Clemente traced from the tegmentum of the midbrain many fibers to the ventrolateral nucleus and a few fibers to the ipsilateral pallidum internum.

3. Corticofugal fibers carry impulses from the motor cortex to the prerubral field; there are also fibers from the prerolandic area to the ruber, from the Sylvian and Rolando opercula to the ruber, and from the superior temporal gyrus, perhaps also from the parietal lobe, to the ruber. Part of these fibers also may reach other cell groups in the tegmentum of the midbrain. The corticofugal fibers from the occipital lobe apparently are located more dorsally. Fibers leaving the pedunculus cerebri, stimulation of which elicits conjugate movements of the eyes (in the cat particularly upward, to the opposite side and rotation), also traverse this area.

4. Some hypothalamofugal fibers ascend anterior to the nucleus ruber, particularly the dorsal hypothalamotegmental tract that connects the ventromedial hypothalamic nucleus and the posterior hypothalamic area with the nucleus mesencephalicus profundus pars dorsalis. Close to the medial aspect of Forel’s field, one finds the mammillotegmental tract that ends in the dorsal tegmental nucleus; by way of the latter nucleus impulses may be transmitted from the mammillary bodies to the dorsal longitudinal fasciculus of Schütz.

Fig. 2. Tremor in the left (L.F) and right foreleg (R.F) induced in a cat by stimulation of the left reticular formation. Additional stimulation of left Forel’s field (L. Forel) increases the amplitude of the right-sided tremor. (Experiment was described previously but not illustrated.)