Clinical Applications of Studies on Stereotactically Implanted Electrodes in Temporal-Lobe Epilepsy*

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The clinical manifestations of discharges of seizures now termed temporal-lobe epilepsy, have been recognized since the article of Jackson in 1888. That the origin is in the uncinate region was reported by Jackson and Colman in 1898. The development of electroencephalography was necessary to provide a confirmatory test and a reliable means to distinguish these states of seizures. Jasper and Kershman observed in 1941 that patients with psychomotor episodes usually had sharp waves and rhythms of 6 per sec., often synchronous bilaterally, and sometimes localized in the frontotemporal regions. It seemed clear to them from the nature of these disturbances that the temporal lobe and subjacent structures in the archipallium were the regions involved primarily. The first clear correlation of the clinical features and the foci of anterior-temporal spikes either unilaterally or bilaterally, as well as their detection by recording during sleep, came from Gibbs et al. in 1948.

With the identification of states of focal seizures in the temporal regions some afflicted patients who were not relieved by anticonvulsant medication were given surgical therapy by Penfield and Flanigin in 1950 and by Bailey and Gibbs in 1951. Subsequent long-term follow-up studies and confirmation of similar results by numerous other surgeons have established this method of treatment for clearly focal temporal epilepsy. The consensus of results is that at least two-thirds of patients have complete or very good relief from seizures and other disabilities caused by this condition. Improved surgical results, as well as a substantial contribution to the knowledge of the pathological lesions, were achieved by the en bloc resections developed by Falconer et al. in 1955.

It has been amply documented in all reported series that best results of surgical treatment are obtained in cases of clearly unilateral seizures. In the first large group of surgically treated cases Jasper et al. found 34 per cent of temporal epilepsy to be unilateral. Of 26 patients considered for surgical treatment at the University of California Medical Center in Los Angeles since 1956, after many scalp and basal electroencephalograms, only 4 with unilateral temporal epilepsy were found. The interpretation of bitemporal activity of several types of seizures is most important at present since bitemporal seizures are the great majority. Even though recurrences after temporal lobectomy are more common in bitemporal epilepsy, enough patients are benefited to lead one to suspect that more extensive diagnostic investigations might yield more successful courses of treatment.

The authors have been dissatisfied with the reliability of electroencephalographic techniques, necessary for the precise analysis of the complex subcortical epileptogenic activity in bitemporal epilepsy before surgical treatment. This report concerns our investigations with depth electrodes implanted stereotactically into the medial structures of the temporal lobes in selected patients. Frequent prolonged recordings were made in the normal alert state, asleep, with Metrazol activation, and with electrical stimulation of these structures.

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Rationale for Direct Recordings with Depth Electrodes

The reasons for finally resorting to direct recordings from the epileptogenic structures are founded in our own experience and in that of others on the problems of lateralization and determination of number and characteristics of the foci of seizures.

Lateralizing Clinical Manifestations. The clinical features are very helpful in diagnosis of a condition as being of possible temporal origin, but seldom help to determine lateralization of the disorder.

The 26 patients with temporal-lobe epilepsy who underwent surgical intervention at the UCLA Medical Center since 1956 are representative of those seen in usual clinical practice. They were selected after many examinations, prolonged treatment with medications, and careful evaluation by the Neurology Clinic. There were 17 males and 9 females, 5 of whom were adolescents. The oldest patient was aged 52, the youngest, 14. There was only 1 patient with a psychiatric disorder severe enough to confine him temporarily to a mental hospital. The average duration of seizures before the surgical intervention was 12.1 years.

The patients in the group had one or more of the following symptoms, which are commonly attributable to temporal-lobe epilepsy. The frequency of the types of preceding auras were as follows: epigastric (6), visual or psychical illusions (5), gustatory (4), olfactory (2), auditory (2), vestibular sensations (1), fear (3), and palpitation (1). All of the patients had automatisms characterized by episodic lapses of awareness accompanied by staring (14), smacking, chewing, or swallowing (11), repetitive mumbling speech (8), semipurposeful movements (5), laughing spells (1), circling ambulation (3), midline cephalic sensations (4), unilateral numbness (2), wandering aimlessly (3), grimacing (2), and urination (1). There were 8 patients who also suffered from generalized convulsions in addition to the above attacks. There were 2 patients who had attacks of unilateral contraversive deviation with or without tonic or clonic movements. Ten patients had complete amnesia for their attacks, and probably more had amnesia for some of their attacks. Most of the patients were observed in spontaneous seizures or during a Metrazol-induced seizure, and their symptoms were recorded by a physician.

All of the above manifestations can be regarded as strong clinical evidence for a temporal origin of the seizures, but there is little of value for lateralization of the activity, with the exception of the unilateral contraversive attacks or unilateral distal numbness in the limbs, and they are definitive only if other than temporal origins for these attacks can be excluded. There were 3 patients who had defects of the superior homonymous sector or quadrant that were of lateralizing value. In our experience some neurological findings such as facial asymmetry or weakness, episodes of arrest of speech or transient aphasia were difficult to be certain of detection and liable to be misinterpreted. In the radiological examination there were 2 patients who had intracerebral calcification, 1 caused by hemangioma calcificans, and 1 by astrogliosis. Abnormalities were revealed at pneumoencephalography in 2 patients and at angiography in 1.

Lateralizing Pathological Changes. It has been shown by Meyer that a large proportion of epileptics with temporal-lobe seizures have pathological lesions. It has also been claimed that preoperative lateralization of the pathological process to indicate the side for lobectomy increases the chances of success for the operation. Pampiglione and Kerridge have used absence of the fast response to barbiturates found in connection with a generalized fast response in the electroencephalogram as indicative of the locale of the pathology. The reliability of this has not been confirmed yet. In our series, radiological studies were not too helpful in locating the pathological changes of these disorders. Although a large proportion of these patients have pathological lesions, focal, circumscribed pathological changes are in the minority and diffuse changes are more common. Of our 20 patients with en bloc temporal lobectomies who were examined systematically, there were 17 with pathological