APPLICATION OF RIVOTRIL (CLONAZEPAM) IN SEEG DEFINITION OF EPILEPTOGENIC FOCI

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Stereoelectroencephalography (SEEG) has been developed since 1949 by Talairach and Bancaud in Paris. This method allows precise localization and identification of epileptogenic foci in the telencephalon. SEEG is indicated in treatment resistent severe focal epilepsy; its purpose is to yield optimal information for subsequent neurosurgical intervention, usually it leads to cortectomy or lobectomy.

The radiologic and stereotaxic equipment used in SEEG has been designed and developed for the task of localizing in the cerebral cortex – the usual stereotaxic equipment is not sufficiently precise for this, in fact, it allows only satisfactory localization in subcortical areas such as the basal ganglia. One main feature of the SEEG equipment is the X-ray focus of 4.7 meters. This extraordinarily long source – object distance allows to get life-size X-ray pictures with only negligible magnification.

SEEG investigation is based upon complete neurological and neuroradiological workup including stereotaxic charting of penumencephalogram, bilateral carotid angiogram and ventriculogram. SEEG can only be performed after at least one full conventional EEG record of a spontaneous seizure has been taken. Of course, interval EEGs will be taken in waking and sleeping and activation methods will be used.

The clinical and conventional EEG results are the basis for a preliminary localization or, at least, lateralization.

According to the X-ray findings, a chart is established showing the areas where the probes will be inserted. The probes are needles with a diameter of 2.4 mm and fitted with up to 15 electrode contacts, each of which can pick up potential differences in the immediate vicinity, that is, from a tissue area within a radius of 3 mm all around the contact ring on the probe.

The patient is placed on the special operating table under fluothane general anaesthesia and fitted with the stereotaxic frame; after applying the boreholes, the fluothane is withdrawn, the patient being under a very superficial general anaesthesia from palfium; then the probes are inserted and EEG recordings are taken from as many as 150 intracranial electrode contacts, and the most rewarding ones are selected for the SEEG study, usually 16 channels record from intracranial contacts, 14 from conventional EEG electrodes, one records the EEG and one the respiration rate. The patient, of course, is awake.

After recording a spontaneous seizure from intracerebral leads, the same leads are used for electrical stimulation.

After observation of provoked seizures, the patient is then given Rivotril (Clonazepam) intravenously in order to decrease cortical excitability to a point where only primary epileptogenic activity will respond to stimulation.

The method will be illustrated here briefly by the example of a 26 years old woman from Naples (Italy), who was explored by SEEG in Zurich in June, 1971. She had had focal seizures from age 17. By the time she came to Zurich, she had had repeated status and besides these, a maximum frequency of 72 seizures in 24 hours.

The main problem to be solved by SEEG was the differential diagnosis between a complex sensorimotor Jacksonian epilepsy and a primary and supplementary motor epilepsy. The former diagnosis would imply surgical removal of parts of both pre- and post-central cortex which would inevitably lead to severe loss of sensory control of the left over extremity, and therefore give rise to severe disorder of gait. Removal of primary and supplementary areas would presumably lead to only motor paresis.

Her SEEG recordings showed bilateral seizure activity with a maximum in the motor cortex region of the left foot, that is, with a pseudoisoelectric tracing from the contact points in that area resulting from high frequency low voltage spike or tonic discharge which is too fast to be reproduced by the writing system. After 3 hours recording – native recording can take up to 10 hours – with two spontaneous fits, the stimulation

programme was performed. For verification of somatotopic representation, through the recording electrodes in the motor area of the left lower extremity rectangular pulses of 0.5 to 3 volts and 1 to 3 millisecond and 1 – 3 cps were applied. The somatotopic representation proved to be correct. The same area was then stimulated by 0.5 to 3 volts, 50 cps, 1 msec series of 4 seconds duration. This led to seizures originating from two contact points, namely in the primary motor area of the foot and in the supplementary motor area of the right hemisphere. The clinical picture of the patient's spontaneous seizures as well as the SEEG pattern were satisfactorily reproduced. Stimulation in the primary motor area with 2 volts gave rise to complete clinical and electroencephalographical reproduction of the spontaneous seizure pattern, while in the supplementary motor area a seizure ensued only from stimulation with 3 volts, and there was clinical but not electroencephalographical reproduction of the seizure pattern.

This difference of excitability threshold was interpreted as indicative of the dominant epileptogenic role of the primary motor cortex area of the left foot, and corroborative evidence was obtained by the I.V. application of 2 mg Rivotril. Stimulation of supplementary motor area with 3 volts led to an abortive seizure while stimulation of the primary motor region with 3 volts led to a mitigated but still fully characteristic seizure pattern, both clinically and electroencephalographically. The record after this stimulation shows a failure of the left hemisphere to take part in the seizure activity, contrary to the spontaneous fits. The tonic discharge was significantly slowed down.

These two final observations are indicative of the correctness of the earlier localization and, incidentally, show that Rivotril – as the other benzodiazepine anticonvulsants – has most likely a direct cortical action as well as subcortical one. This has been experimentally demonstrated by H. Petsche.

The diagnosis was: primary motor epilepsy with secondary involvement of supplementary motor area. Two weeks after this SEEG exploration, a cortectomy was done, with excision of the medial parts of the areas 4 and 6 of the right hemisphere. The patient's left lower extremity was severely paralysed but after 10 days she could walk again, and her gait is now entirely normal (whereas she had had a slight paretic dysbasia before the operation). She has been seizure free since the operation, of course under continued antiepileptic medication with Dilantin 100 mg and Luminal 50 mg tds. Her EEG shows neither lesional nor epileptogenic activity. She is now working in her previous job as a Kindergarten supervisor.

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