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tubs and the guard house, and now fully restored and transformed into men capable of enjoying life and doing their work, will no longer question the great value of the therapy.

22. EXPERIMENTAL RESEARCHES ON EPILEPTIC ATTACKS INDUCED BY THE ELECTRIC CURRENT

L. BINI [1]

Prominent among the recent methods of treating schizophrenia are those in which the action is based on violent and more or less transitory upsets of the normal functioning of the nervous system, with eclipse of consciousness. One of the most typical manifestations of such therapeutic methods and perhaps the most effective therapeutically is the epileptic attack. Since this type of therapy gives today the greatest hope of obtaining good results, it is logical that the efforts of physicians be concentrated on the search for new methods which would be better and better adapted to the desired end, either because the technique is simpler or because a given dosage produces an effect of constant intensity and duration, or because it is possible to foresee or avoid the dangers inherent in such methods of treatment.

Studies have therefore been made of the biological method of the insulin shock therapy, of the chemical method with cardiazol, and of the prolonged-sleep therapy. And recently Fiamberti has succeeded in producing epileptic seizures by injecting vaso-dilator substances into the cisterna magna by suboccipital puncture.

We have set ourselves the problem whether it is possible to introduce into this category of therapeutic methods some others based on physical effects, which should offer to some extent at least, the advantages mentioned above. This idea seemed to us *a priori* far from absurd.

Even at the end of the last century Blasius and Schweizer, Hermann and Matthias, then, in 1902 on the basis of more complete experiments, Leduc called attention to the possibility of provoking by means of the interrupted direct electric current great alterations in the functioning of the nervous system, which would be com-

[1] R. Clinic for nervous and mental diseases. Rome.

pletely reversible, such as narcoses and states of stupor. In 1903 Zimmermann and Dimier, later Battelli succeeded in producing characteristic epileptic attacks in animals by using an interrupted galvanic current. Thereafter numerous authors confirmed the possibility of obtaining at will, by varying the intensity and character of the current, the form of the electrodes, and their point of application: narcosis (Neergaard 1922, Zimmermann 1929), epileptic attacks (Battelli and Prévost 1907; Bikeles and Zbyzewski 1920; Viale 1929, Chiauzzi 1934), catatonic and cataleptic states (Kok and Sack 1931, Gentile 1933, v. Harreveld and Kok 1934, Gullotta 1934).

These experiments have so far been conducted almost exclusively on animals. We therefore wished, in our first attempts to solve the problems we have announced, to undertake experimental researches on the action of these physical methods and above all on the nature of possible alterations provoked by them in the nervous system.

We have so far employed exclusively the method of Viale, which consists of passing the street current (120 volts) for a very short time (1/15 to 1/20 second) through the entire body of the animal with one of two electrodes (carbons from a voltaic arc) in the mouth and the other in the rectum.

With this method we succeeded in producing constantly typical epileptic attacks in dogs. During the passage of the current the animal howls and has a violent tonic spasm with opisthotonus which lasts several seconds after the circuit is opened. Then there appear frequent and violent generalized tonic and clonic convulsions with foaming at the mouth, biting of the tongue, and incontinence of urine and feces. The duration of this second phase varies from 1-2 minutes. There follows a comatose state with complete muscular relaxation, absence of corneal and pupillary reflexes and sterterous breathing. In a short time the animal returns to its normal state, so that after a few minutes new seizures may be induced.

The alterations found by us in the nervous systems of these dogs were widespread and severe. Besides acute injury to the nerve cells of both reversible and irreversible types, there were especially in the deeper layers of the cerebral cortex alterations designated as "chronic cell disease" (marked retraction and hyperchromatosis of the cytoplasm and nucleus, staining of all the cell

processes for a great distance and tortuosity of these processes). Less serious, it seems to us, are the alterations of the glia and of the mesenchymal tissues.

Without entering into further particulars at present concerning our discoveries, we wish only to emphasize that with the method we have tried not only functional but also anatomical changes can be induced. On the other hand, the importance of the alterations we have met with so far in our animals does not permit us to exclude the possibility of applying these physical methods in human therapy. There are still many technical points to be worked out. Moreover we must keep in mind that in the insulin shock therapy, animals killed during the prolonged coma, that is under conditions analogous to those of the dogs we have examined, were found by many authors (and in our clinic too) to have very severe and irreversible alterations in the nervous system. These very alterations may be responsible for the favorable transformation of the morbid psychic picture of schizophrenia.

For this reason we feel that we are justified in continuing our experiments without abandoning the hope that they may lead to results directly or indirectly useful in pursuing the objectives we have set before ourselves.

23. CRITIQUE AND INDICATIONS OF TREATMENTS IN SCHIZOPHRENIA

By F. HUMBERT and A. FRIEDEMANN [1]

We are grateful to Sakel and von Meduna, not only for having given us their methods of treatment, but also for having provoked thereby discussions which open new horizons with regard to the mechanism of the cure of schizophrenia.

We do not mean to deny—the contrary is the truth—the existence of modifications due to the insulin coma, but we do not believe that the physical element is the only factor responsible for the change in the mental process; on the contrary, in our estimation, in all the recent therapeutic procedures, none of which pretends to have any causal therapeutic effect, psychological factors play a role; these factors, closely related to each other, constitute a common denomi-

[1] Asylum at Bellelay (Berne). Director: F. Humbert.