TREATMENT OF EPILEPSY BY ELECTRICALLY INDUCED CONVULSIONS

A PRELIMINARY REPORT*

BY

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Modern views on epilepsy lay stress on an underlying cerebral dysrhythmia as being the essential feature of the disease. This disturbance of the electrical equilibrium of the brain leads to the occasional accumulation of an excessive quantity of energy, and the epileptic fits can be regarded as a discharge mechanism whose function it is to disperse this energy whenever it exceeds a certain threshold value.

An epileptic's chief disability lies in the fact that his fits are rarely predictable, and may occur at any awkward moment or in situations involving considerable danger. The idea has therefore been developed of replacing these spontaneous fits by electrically induced convulsions which can be produced under controlled conditions of time and place. It is not intended that this therapy should supersede the pharmacological methods of combating the fits, but rather that it should be an accessory treatment in those cases in which fits occur despite full dosage of anticonvulsant drugs. The present paper is a preliminary report on the results of an investigation being undertaken in Cefn Coed Hospital. Publication at this early stage has been decided upon in order to stimulate criticism and to interest other workers in the subject.

Material.—Fifteen male epileptics have been under treatment for periods ranging from three to nine months. One is an out-patient, and has been in regular employment during the last six months. The others have been chosen from among the in-patients of this public mental hospital. The only factors governing the choice were that they should be having at least 2 to 3 fits a month despite full doses of anticonvulsants, and that they should be in good general physical condition. Nine cases are being treated with phenobarbitone, five with epanutin, and one with a combination of both drugs. All the in-patients are suffering from psychosis associated with the epilepsy; five are voluntary patients and the rest are certified.

Technique.—The convulsions are electrically induced before breakfast either once or twice a week. The frequency is varied according to the reactions of the individual patient, and no general rule as to the optimum has as yet been formulated. The apparatus in use is a simplified lightweight machine which has been built to my design by Mr. E. L. Turner, a Swansea radio engineer. It has a range of 35 to 135 volts, and the time switch can be set to limit the current to from 0.1 to 0.5 second. The output has varied between 0.25 amp. and 1.3 amp. This machine has been found to be perfectly safe and reliable, and because of its handy size is very easy to use. Large numbers of patients can be treated rapidly at the same session—the 15 epileptics can be treated comfortably in 20 minutes. In all cases except one the usual pharmacological treatment has continued unchanged.

The Convulsion.—The induced convulsion is ushered in by a sudden mass flexion movement, which coincides with the passage of the electric current, and is probably produced by the local stimulation of the cortical cells. This is followed by the usual tonicoclonic seizure, the details of which vary from patient to patient: one man flings his arms outwards in the tonic phase, another throws them forwards; the fingers in one case are extended, in another they are flexed into a claw shape, etc. The picture of the tonicoclonic episode is an unvarying one in each individual patient, and is exactly the same as his behaviour during a spontaneous epileptic fit. The seizure is followed by a short period of coma with stertorous breathing, and this leads on to a stage of confusion lasting from 5 to 30 minutes. The last stage is usually of shorter duration than that occurring after an epileptic fit, and is rarely accompanied or followed by headache.

Illustrative Case Records

Case 1.—B. I., a merchant seaman aged 25, under treatment as an out-patient, has suffered from epilepsy for 4 years. He had received all the usual pharmacological treatment, and had lately been

on epanutin 1½ gr. b.d., and pot. brom. 20 gr. t.d.s. Despite this treatment he had never suffered less than an average of 5 grand-mal fits a month. His fits usually came on in the mornings, and were followed by headache and drowsiness, which incapacitated him for the rest of the day. On March 29, 1944, electrical convulsion treatment (E.C.T.) was started, and he was given a convulsion once a fortnight. His fits immediately ceased, and he did not have one until April 22. He had a second fit a month later. The convulsions were then increased to once weekly, and since June 30 he has been coming up to the hospital every Friday morning for treatment, and leaving an hour afterwards to go back to work. He had given up his work as a seaman because of the frequent fits, and shortly after starting electrical treatment he had obtained employment as a builders' labourer, which job he has kept. His bromides were gradually cut down and then discontinued, but the epanutin has been carried on. In the last 6 months he has had 3 further fits, but they have not been followed by the usual post-epileptic confusion and headache. The patient himself is delighted with the treatment. He has regained his self-confidence, and has recovered from the depression and hopelessness into which his disability had precipitated him.

Case 2.—O. P., a tin-worker aged 45, was admitted as a certified patient on July 4, 1942. He has suffered from epilepsy since 1919. On admission he was confused, restless, suspicious, and violently combative. He quieted down within a few weeks, but had remained irritable and quarrelsome, interfering and complaining, and liable to sudden outbursts of violence. He was treated at first with sodium phenobarbitone 1 gr. t.d.s., and since March 9, 1943, with epanutin 1½ gr. t.d.s., but his fits had averaged 6 grand-mal attacks a month. On Aug. 29, 1944, he began electrical treatment, and since that date has had only 2 spontaneous fits. He was started with a convulsion once weekly, and later this was increased to two a week. His behaviour has greatly improved; he is now friendly and no longer aggressive, his irritability has disappeared, he is working well in the ward, and is going out regularly on visits to his relatives, who report that his conduct outside is exemplary.

Case 3.—M. T., a tin-plate worker aged 30, was admitted as a voluntary patient on Sept. 14, 1943. He is a feeble-minded man who has suffered from epilepsy since 1942. On admission he was dull and confused, incontinent of urine, dirty and untidy in dress, and barely volitional. He deteriorated rapidly, and, having lost volition, was certified on Nov. 15, 1943. Since then he had remained more or less unchanged—dirty, untidy, asocial, unoccupiable, and depraved in habits. He had been treated with phenobarbitone 1 gr. t.d.s., but had averaged 9 grand-mal fits a month. He began E.C.T. on Aug. 22, 1944, and since then has had a total of 10 spontaneous fits—i.e., an average of 2 a month. He began his treatment with one convulsion a week, and on Sept. 13 this was increased to two a week. His behaviour has improved out of all recognition. He has become clean and tidy; he has begun to converse, though only in a simple manner; he is working well in the ward and showing some initiative; and his former irritability has disappeared.

Case 4.—C. A., a colliery labourer aged 42, was admitted as a certified patient on April 25, 1933. On admission he was clearly orientated, but showed a considerable amount of retardation. His behaviour was fairly good, but he was subject to sudden attacks of irritability and combativeness. With the passage of time he had become more dull and retarded, and his periods of quarrelsomeness and violence had increased in severity and in frequency. He took little interest in his surroundings, and refused to do any work. He was treated with sodium phenobarbitone, 1 gr. t.d.s., until March 9, 1943, when this was changed to epanutin 1½ gr. t.d.s. He had averaged 4 grand-mal attacks a month during most of his period in hospital. He was put on E.C.T. on Aug. 29, 1944, and since then has not had a single major fit. He started treatment with one convulsion a week, and when this was increased to twice weekly he began to develop some confusion, so he was put back to his previous dose, and the confusion has cleared. His behaviour remains exactly the same as previously.

Results

Table showing Effect of E.C.T. on Frequency of Fits

Patient :		B. I.	O. P.	M. T.	I. H.	E. C.	C. A.	C. W.	W. W.	W. M.	A. N.	E. B.	J. H.	A. W.	J. M.	R. S.
Average number of grand-mal fits in a month	Before E.C.T.	5	6	9	3.5	4	4	2	8	4	4	3	2.5	14	2	9.5
	Since E.C.T.	0.5	0.5	2	1	1.5	0	0.25	3	3	1.5	2.3	0.8	14	0	9

Effect on the Fits.—Eleven patients have shown a marked reduction in the frequency of their grand-mal attacks. In the other four cases there has been no great change. The fits, in addition to being less frequent, seem in many cases to be less severe, though this is of course only a clinical impression based

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on the testimony of the nursing staff. Certainly there has been some improvement in the length and intensity of the post-epileptic confusion, and this has been very pronounced in five cases. Only one patient in the series suffers to any great extent from minor fits, and these have shown a definite reduction since starting treatment.

Effect on Behaviour.—All the in-patients are severe psychotics of poor prognosis, who have been a constant source of worry to the nursing staff. The effect of the new treatment on their behaviour has been very interesting. Seven of them have shown no change, but in the others there has been a remarkable and welcome improvement. They are less irritable and quarrelsome, they are no longer liable to outbursts of violence, they have become less confused and more co-operative, and they are taking more interest in the ward and have become useful workers. One patient used to have frequent furors, but these have now ceased. One patient suffers from psychic equivalents which take the form of periods of aggressiveness and bad temper lasting several hours, and which are not controllable by means of drugs. Since starting E.C.T. five months ago he has had only one of these attacks, and this was immediately terminated by a single convulsion, induced as an emergency measure.

Complications

No severe or alarming complications have so far been experienced.

Increase in Frequency of Fits.—In four cases there was an increase in the frequency of fits on beginning the electrical treatment, but this did not last longer than the first month, and was followed by a reduction in number.

Increase in Confusion.—In a few cases the patients have gradually become more confused, especially when being given treatment twice weekly. This confusion always disappeared when the number of induced convulsions was subsequently decreased.

Discussion

Kalinowsky and Kennedy (1943) have reported on the value of artificial convulsions as a means of breaking up an epileptic cloudy state. During the course of their investigation on the electrical convulsive threshold of epileptics they were successful in keeping two patients free from fits for some months by induced convulsions, but were of the opinion that "no practical value can be attributed to such a procedure." Robinson (1943) has reported a case of psychosis of a schizophrenic type in an epileptic girl which was improved as a result of two short courses of E.C.T. Her fits were not decreased by the treatment.

Apart from these papers the literature contains no direct references to the value of E.C.T. in epilepsy. The idea of replacing epileptic fits by electrically induced convulsions as a therapeutic measure is therefore a new one; but the preliminary results of the present investigation show that it is not without promise, and that the method is one which merits further study.

A problem which immediately arises is that of choosing the right type of case for the treatment. The material on which the present study is based is obviously not very suitable, consisting as it does mainly of demented psychotics. It would be interesting to investigate the effect of the convulsions on more out-patients of the type of Case 1, especially those who show some definite rhythm in the periodicity of their fits. On the other hand, a treatment which helped to diminish the irritability and aggressiveness of epileptic psychotics would be very useful if criteria could be laid down as to the type of patient likely to benefit.

A second problem to be solved is whether the treatment has any lasting effect and so can be given in short courses, or whether its results are so transient that it must be given continuously as a form of "replacement therapy."

Many other problems present themselves for solution, and it is hoped that some of them may be made the subject of future communications.

Summary

The possibility is suggested of replacing epileptic fits, which may occur anywhere at any time, by convulsions electrically induced under controlled conditions of time and place.

The treatment of 15 cases of epilepsy by this method is described and a preliminary report is made on the results.

In 11 cases the fits have been materially diminished.

In 7 cases the symptoms of an associated psychosis have been ameliorated.

The value of an induced convulsion as a means of terminating a dangerous psychic equivalent has been illustrated.

No serious or alarming complications have been experienced.

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FRACTURES OF THE ZYGOMA BONE

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Fractures of the zygoma or malar bone are always due to direct violence, the direction of violence determining the displacement. The bone is usually driven backwards and medially into the maxillary antrum and impacted there. The fracture is often comminuted and may have extension along the floor of the orbit into the orbital plate of the maxilla.

The zygomatic bone is a strong bone resting on four fragile supports, one or more of which are the sites of fracture, where it unites with: (1) The maxilla directly above the infraorbital foramen, the two bones forming the inferior orbital margin. (2) The zygomatic or lateral angular process of the frontal bone, forming the lateral margin of the orbit. (This margin is, in rare cases, cut by a second suture where the malar bone consists of two pieces—"mala bipartita" or "os japonicum" (Whitnall).) (3) The zygomatic process of the temporal bone forming the zygomatic arch. (4) The anterior wall of the maxillary antrum.

Diagnosis

Diagnosis can often be made at sight. Many or all of the following signs and symptoms are present: (1) "Black eye," subconjunctival haemorrhage; (2) unilateral epistaxis; (3) flattening of contour and lack of expression on the affected side (depression may be masked by oedema and ecchymosis); (4) irregularity and depression of the inferior orbital margin, or zygomatic arch just anterior to the ear; (5) pain and tenderness over one or more of supports previously mentioned; (6) pain on and difficulty in mastication; (7) numbness in the region supplied by the infraorbital nerve; (8) mobility and crepitus usually absent.

Confirmation is made by radiographs, the chin-nose position being the most suitable in our experience; this reproduces the orbital margins and any irregularity very clearly, although Stone recommends a mento-vertex view, which shows up the zygomatic arch and any inward displacement of the zygoma. The degree of violence may be almost insignificant and the fracture missed.

Complications

Ocular.—Persistent and vertical diplopia, due to (a) lack of support of the floor of the orbit, or (b) damage to the ligament of Lockwood (ligamentum suspensorium oculi), the eyeball being displaced downwards, with consequent hypotropia or hypophoria, or (c) orbital haemorrhage and organization of the clot interfering with the action of the inferior oblique and inferior rectus muscles, or (d) injury to the nerve supply of these muscles.

Nasal.—Infected haematoma of the maxillary antrum necessitating drainage.

Others.—Permanent loss of sensation in the region supplied by the infraorbital nerve. Mechanical obstruction to jaw movements due to pressure of in-driven fragments of the zygoma in the coronoid process of the mandible.