ONE HUNDRED DEPRESSIVE PSYCHOSES TREATED WITH ELECTRICALLY INDUCED CONVULSIONS.

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[Received March 23, 1943.]

Introduction.

Since the introduction of the electrically induced convulsion by Cerletti and Bini the history of this procedure has become too well known to record again; but certain clinical data have come to light that are worth noting, of which the most important is the now recognized fact that this treatment is of more value in the affective psychoses than in schizophrenia, for which it was early introduced. Most writers, e.g., Elfield, Metcalfe and Paul, are agreed upon this, and it would therefore seem worth while to examine the results of this therapy in one hundred such cases. Depressions are so much commoner than manias that it would take a long time to collect a sufficient number of the latter for reliable conclusions to be drawn. These remarks are thus confined to the depressive states.

Material.

All of this series of depressive psychoses were severe enough to be admitted to a mental hospital. They are consecutive, and the only selective factor involved is the type of case admitted to St. Ebba's Hospital. They are all females, because these are the only ones to which the routine method described below was applied. The legal status of the case is of no importance for our purpose.

All psychiatric cases admitted to St. Ebba's Hospital have been previously seen by experienced psychiatrists, and the hospital is designed primarily for the treatment of those whose prognosis is good. It will be noted that neither the duration nor the severity of the condition is a prominent guide in the choice of material.

Method.

Therapy is administered to each patient twice a week, and on no occasion was a subconvulsive dose used, for either the voltage or the operational time of the current was increased until a fit resulted. The reason for insisting on a fit was that such cases seemed to do better than those only subjected to subconvulsive doses. The patient is fasting at the time of treatment, and apart from the cleansing of the skin at the site of the application of the electrodes with methylated ether no other preparation is used. This has been found quite satisfactory, and removes the necessity of both more prolonged cleaning and the application of pastes or jellies; good conduction invariably results.

The patient lies on an ordinary " theatre " trolley upon which is placed a fitted mattress. She is then covered with a six-foot sheet of strong material, to the sides of which are sewn straps, six feet in length, at the level of the shoulders, hips, knees and ankles. Each strap is tied to its opposite beneath the trolley, whilst the arms are placed into six-foot sleeves, crossed and fastened beneath the trolley. The patient is thus firmly but not uncomfortably held. A special chin-strap made of soft leather passes over the head to prevent dislocation of the jaw. It has an ordinary buckle, but without a fastener, and is steadied during the convulsion by holding that portion of the strap which passes through the buckle. The sides of this chin-strap are made of " artificial limb " elastic, which permits of some movement of the temporo-mandibular joint, but prevents excess. When the patient is in position the current is passed.

Other workers either use manual restraint or merely support the limbs, but the above method justifies itself, as the only accidents to be noted are the loss of three

https://doi.org/10.1192/bjp.89.375.289 Published online by Cambridge University Press

loose teeth and a bruised hand; about 900 convulsions have been given in this series alone. No fractures have occurred. The method is exceptionally quick, and the average time taken for each patient from the moment of her getting on to the trolley to being placed in bed is less than two and a half minutes. This means that ten cases are dealt with in 25 minutes at each session, and on each occasion the whole affair occurs within the well-known post-convulsive retrograde amnesic phase.

Results.

In assessing the results of this treatment a difficulty at once arises as to how the cases shall be classified. So much debate has taken place about the validity of any classification that it might almost be disregarded altogether. The type adopted here follows that of the usual clinical groups, but a note as to definition is perhaps not out of place. Before this, however, we will examine the results as a whole and then subdivide them into their various groups. Our aims will be not simply to know the percentages of successes or failures, but to endeavour to extract from the results the reasons for these figures. It is to this end that some sort of clinical classification is necessary.

Table I.

Total number of cases . .	100
Success percentage . .	87 per cent.
Failure percentage . .	13 ,, including one death and two cases still having treatment.

The two noted as still undergoing treatment are put in the failure column so that no bias in favour of this therapy shall arise. Success in this table means that the depression and accompanying symptoms have disappeared. It is not judged by the discharge of the patient from hospital, because present conditions so often have disintegrated home life that even on recovery it has not always been possible for the patient to return to her former environment or a new one found for her, but it may at once be said that no less than 74 per cent. of the total have left hospital to resume their usual existence. This figure of successes agrees with Gonda, and is better than the favourable report by Hauser and Barbato. Sogliani had an 81 per cent. recovery-rate, and Myerson gives it as 88·8 per cent., but he only had 24 cases.

Classification.

The simpler this is the easier it is to see the results and so the following has been adopted:

(a) *First attack.*

This refers to those whose illness has been preceded by no other psychotic episode, and which on clinical grounds have not been put into section (d).

(b) *Recurrent cases.*

In this are included all cases known to have had a previous depressive illness, irrespective of their present age or symptomatology.

(c) *Manic-depressive group.*

Here are put only those known to have had at least one former manic illness.

(d) *Menopausal type.*

This has been based on an illness occurring at the menopausal period and with the usually accepted symptomatology. They are essentially first attacks.

(e) *The senile class.*

This has been limited to people of 60 or over and includes a mixture from the other groups. They have been separated off because the question of age and cardiovascular lesions in electric convulsion therapy has been raised and requires special reference.

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A. *First attacks.*

TABLE II.

Total number of cases	28
Success percentage	96·5 per cent.
Failure percentage	3·5 ,,
Average number of induced fits	6

It is not surprising that a high recovery-rate should be found in this type of case, since even without the treatment under discussion they do well. But it is interesting to note that the average length of stay in hospital following the last induced convulsion is only 4·4 weeks. This may well be compared or rather contrasted with the duration of hospital stay before this treatment was used. It will be seen that the total stay in hospital of this group including their treatment time is approximately eight weeks. The average stay of nearly 200 recovered cases prior to this treatment was 40 weeks, and St. Ebba's Hospital was admitting the same type of patient during each period. If the maintenance-rate be taken as 30 shillings a week it will at once be evident that there is a financial saving of about £45 per patient.

B. *Recurrent cases.*

TABLE III.

Total number of cases	49
Success percentage	87·8 per cent.
Failure percentage	12·2 ,,
Average number of induced fits	8

Again the average stay in hospital after the last treatment is four weeks, but again this class tends to do well at all times.

C. *Manic-depressive group.*

The manic-depressive psychosis as defined above is not so common as the text-books would have us believe, and it is not surprising that the figures are small.

TABLE IV.

Total number of cases	5
Success percentage	40 per cent.
Failure percentage	40 ,,
Deaths	20 ,,

The number is obviously too small for any reasonable deduction to be made, but the lack of success may be remarked *en passant*. The death in this table will be noted at greater length later.

D. *Menopausal type.*

TABLE V.

Total number of cases	18
Success percentage	88·9 per cent.
Failure percentage	11·1 ,,
Average number of induced fits	9

The average duration of their hospital stay after the last treatment is 2·5 weeks. When it is realized that this type of incapacity has, in the past, often been measured in years, the significance of this treatment becomes all the greater. We can now review the last group.

E. *Senile group.*

TABLE VI.

Total number of cases	9
Success percentage	88·9 per cent.
Failure percentage	11·1 ,,
Average number of induced fits	6

This type differs from the others in that the time of the hospital stay after the last treatment is rather longer than in the other groups, i.e. six weeks. This is

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probably accounted for by the sociological factors that we have already referred to. From time to time cases have arrived at this hospital with the considered opinion that their age or frailty render them unsuitable for the more drastic forms of therapy. Impastato and Almansi, for instance, rejected people over 50. The above table shows that this is wrong, for they react as satisfactorily as any other type, and it is not in this group that any of the mild accidents previously noted occurred. This is true, not only from the purely physical side of the question, but also from the point of view of their illness. It surely shows that arteriosclerosis is no adverse factor in prognosis, for this type gives as good results as depressions as a whole; and they do not require more fits than others, in fact rather less than the menopausal group.

Age alone, however, may not be so important as the blood pressure during the convulsion. When this is raised—and, as is well known, it rises even higher during the muscular paroxysms, as has been noted by Hemphill and Walter, Gonda and Sogliani—it might be thought that there was a grave risk of an intracranial or other catastrophe. Amongst the 100 cases here there are six with a systolic pressure of over 200 or a diastolic of over 100. Five belong to the recurrent type and one to the menopausal. All have responded satisfactorily to therapy and are considered recovered. The average number of fits required to obtain this was six, but one with a blood pressure of 190/110 had twelve, and another with a reading of 210/105 needed ten. In the light of this it must be doubted that hypertension is a contra-indication to treatment. It may, however, be argued that, if these cases were all essential hypertensives and non-symptom-producing, the raised blood pressure was having no great physical effect, and so was not of great importance. The following example seems to dispose of this, since it is one in which the hyperpiesia was producing its own symptoms and signs apart from those of the psychosis proper. It is worth a short record by itself.

F. G—, aged 55; widow. Admitted September 12, 1942.

Diagnosis.—Recurrent depression + hypertension.

History.—Suffered from hypertension for an indefinite period. 1935: A short depressive illness.

Condition on examination.—Physically: Heart—slight enlargement to left; apex beat thrusting; aortic second sound sharp and high pitched. B.P. 190/90. Fundi—blurred disc edges but no marked arterial changes.

Mentally: Depressed and overconcerned with her physical state. Mild agitation and loss of interests. These symptoms are of about two years' duration.

Course.—After 17 weeks' rest in hospital no improvement was seen. Both relatives and patient begged for electric convulsion therapy, although the risks were fully explained. B.P. at commencement of therapy 230/110. Six fits were given and the patient's depressive symptoms disappeared.

The only further point to note is that after one seizure she developed a bruise of one hand. It is no doubt true to say that it was fortunate a vessel in the hand and not the brain gave way, but without treatment she was probably due for an illness of prolonged duration at the best.

These few cases might reasonably be taken to show that the rise in the blood pressure during the convulsion is not so serious a hazard as might be supposed, and this conclusion is supported by the experimental work of Cleckley, Hamilton, Woodbury and Volpito, who showed that not only was there a rise in the blood pressure during metrazol convulsions, but also a rise in the intragastric pressure which was transmitted to the cerebro-spinal fluid. Since these two are the same there is no increased stress on the cerebral arterial tree, but in the case of the electric convulsion these two figures are not so approximate for the blood pressure exceeds the intragastric pressure, the difference being a measure of the added strain placed on the vascular system during the paroxysm, and this cannot be judged by the rise in blood pressure alone. It may be as well at this stage to refer to the one death that has occurred. Whether this death was directly attributable to treatment or not cannot be decided, but it certainly happened shortly after one such session. There is no proof of a relationship of cause and effect between treatment and death, but on the other hand there is no proof to the contrary. An open mind must be kept until further evidence comes to hand. An outline of the cases is now given:

N. C—, aged 54. Admitted 12.x.39.

Diagnosis.—Manic-depressive psychosis.

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Condition on examination.—Typically manic.

Course.—26.i.41: Arrangements made for her to go to an after-care home, but cancelled as depressive symptoms were coming on.

April, 1942: Electrically-induced convulsions started. Only two fits given, the latter on 22.iv.42. B.P. 180/85 at this time.

28.iv.42: Complained of feeling unwell. Temperature 102°.

29.iv.42: Signs of pneumonic consolidation at the right pulmonary base.

1.v.42: Acutely ill and delirious in spite of sulphapyridine. Urine unobtainable.

2.v.42: Urine showed albumen ++ and granular casts +++. Died this day.

Post-mortem.—Broncho-pneumonia and chronic nephritis.

This patient was apparently in good health prior to her final illness, in which the pneumonia seems to be the last phase of a uraemic episode. The question is, could this have been avoided if therapy had been withheld? It is impossible to answer this, and it is probably best simply to consider it as an associated death rather than anything more definite as yet.

Failures.

So far we have reviewed the cases mainly from the success point of view if we exclude the death just mentioned. We can now turn to the failures. These may be classified as partial and total. The latter term is self-explanatory; under the former are put all those which require a further course of treatment after apparent recovery. Maintenance doses, which are an accepted part of this therapy, vary from one or two convulsions to a second complete series of seizures. All examples must be included, because it is patently foolish to give any patient further fits unless some degree of relapse is present, and electricity cannot be used prophylactically because we can never foretell what the interval between any two attacks may be. The following table shows a summary of these:

Table VII.

Case.	Type.	A.	a.	B.	b.	C.	c.	D.	d.	E.	e.	F.	f.	Result.
1. A. A—	M.	4	8	4	1	16	1	..	..	..	..	..	..	*
2. L. C—	R.	20	11	26	1	..	..	..	..	..	..	..	..	*
3. R.G—	M.	80	8	6	3	9	5	..	..	..	..	..	..	†
4. E. G—	F.	4	7	1	1	..	..	..	..	..	..	..	..	*
5. Ev. G—	R.	26	3	1	3	6	2	..	..	..	..	..	..	*
6. B. B—	F.	20	10	4	7	3	6	..	..	..	..	..	..	*
7. L. H—	M.	24	7	21	2	..	..	..	..	..	..	..	..	*
8. B. H—	F.	100	5	1	8	..	..	..	..	..	..	..	..	*
9. E. M—	R.	20	5	3	2	7	2	5	1	..	..	..	..	*
10. E. S—	R.	20	9	3	7	3	4	4	5	2	6	2	4	†
11. D. W—	R.	12	5	2	4	5	2	3	2	5	2	..	..	†
12. A. M—	M-D.	16	7	14	2	18	4	..	..	..	..	..	..	*
13. R. H—	R.	5	8	23	2	..	..	..	..	..	..	..	..	*

M. = Menopausal.
R. = Recurrent.
F. = First.
M-D. = Manic-depressive.
* = Recovery.
† = Failure.

A = Time in weeks from onset of original illness to first treatment.
Other capitals = Time in weeks from previous treatment to relapse.
a, b, c, etc. = Number of fits given on each occasion to produce a remission.

The main points of interest brought out in this survey are:

i. The relapse-rate for all cases is 13 per cent.

ii. In this classification there occur six recurrent cases, three menopausals, three first attack type, and one manic-depressive.

iii. This group shows a comparatively high percentage of failures, i.e. three cases, whereas there are only 13 in the complete series.

iv. The severity of the relapse is shown by the number of fits necessary to overcome it. Usually this is less than for the original attack, but sometimes a second relapse needs more treatment than the first.

v. The interval between the original illness and the first relapse is usually short. In four cases only is this interval a fairly long one, i.e., 26, 21, 14, and 23 weeks; the three longest might even be considered as second attacks rather than relapses.

vi. One relapse only in five cases.

vii. Two relapses only in five cases.

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viii. Three relapses only in one case.
ix. Four relapses only in one case.
x. Five relapses only in one case.

These relapse cases taken in conjunction with those that failed to respond at all to treatment may be put together to illustrate what might be called the electrically resistant depressions; ultimate recovery does occur in some, however. Another type of resistance is also encountered which has nothing to do with the psychosis at all, but is physical in origin.

Physical Resistance in Electric Therapy.

In this type of person the psychosis may react in the usual way to the induced fit and excellent recovery result, but the resistance is shown by the difficulty encountered in producing a fit at all. When the current is passed it is the normal course for the convulsion to follow almost immediately. Most workers will have encountered the case that requires the passage of the current twice or perhaps three times before a seizure appears. These are the slightest and commonest examples of exaggerated physical resistance. At the other end of the scale is the individual who needs many more attempts before success is reached. The résumé of one patient's treatment set out below illustrates this. That it is an extreme and rare happening will not be doubted, and it might be thought that the fault was not in the patient but in some item of the technique. Against this is the fact that all others treated on the same days and in the same way behaved normally, and it will be noted that on no occasion was a fit readily produced in this person. It would seem improbable that the same error could recur each time she was due for treatment. There was no physical abnormality to account for it and she eventually left hospital recovered. No explanation can be offered.

B. B—, aged 53. An extremely agitated melancholic.

Date of treatment.	Number of times current was passed before a fit resulted.
10.xi.42	6
14.xi.42	26
17.xi.42	7
20.xi.42	18
24.xi.42	9
28.xi.42	5
1.xii.42	7
5.xii.42	11
8.xii.42	5
12.xii.42	10
15.xii.42	10

It may be repeated that the method described under that heading was adopted throughout this case; the voltage or the time was increased after each attempt until a seizure was obtained. That this case also demonstrates the safety of this treatment is self-evident.

Prognosis.

When we note that almost 90 per cent. of all depressions react favourably to electrically induced convulsions, it follows that the surest way of making a prognosis is to wait and see how any particular case is responding. This will of course become clear after the first few fits. The only other factor to be considered is that 13 per cent. of all cases relapse. It might be thought that some help could be obtained from the symptomatology, but a careful examination of those that cleared after a few fits—four being taken as the criterion—and those that needed a larger number revealed no particular that is found constantly in one lot or the other. The time factor, i.e. the duration of the illness before treatment, is interesting, and in the next table are put 13 cases in which symptoms were present for two or more years before treatment was started. The longer of these were already in hospital before this therapy was instituted.

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TABLE VIII.

Name.	Age.	Type.	Duration before treatment (in weeks).	Number of fits.	Result.
1. H. B—	46	F	260	9	*
2. F. G—	56	R.	121	6	*
3. J. H—	47	F.	130	8	*
4. A. H—	37	R.	440	9	†
5. F. H—	58	M.	208	2	*
6. E. K—	31	R.	156	10	†
7. A. P—	42	R.	336	7	*
8. W. P—	39	R.	104	7	*
9. L. R—	59	R.	105	6	*
10. E. S—	58	M-D.	250	17	†
11. E. U—	47	M-D.	104	13	*
12. M. W—	52	R.	304	10	*
13. A. W—	63	M-D.	136	10	*

Symbols are the same as those in Table VII.

It will be seen that 10 of the 13 have recovered. The only other important point to note is that the average number of fits needed is higher than in the other depressions, although in this selection it is only 9. It can be concluded that chronicity by itself does not preclude a patient from recovery. This constitutes one of the great advantages of this therapy.

MODUS OPERANDI OF THE TREATMENT.

We may now turn our attention to the most difficult part of all. There is no known explanation of how electricity brings about its results. It may be advantageous to review the more recent theories that have been put forward. First there is the suggestion of Fetterman that depression is a downward course in the mood with an inherent tendency to reverse itself after a varying interval. The unconscious phase of the treatment is supposed to bring about this reversal and so hasten recovery. Flescher, on the other hand, attributes the resulting success to the seizure itself and not to the loss of consciousness. He thinks that it is a means of unloading the huge amounts of energy that the depressive directs to death and destructive drives in an individually and socially harmless manner.

In opposition to these psychological interpretations we find that there are various physiological details which are not explained by the above. Grinker states that in metrazol convulsions the diencephalon is exploded, basing this idea upon the fact that the amnesia that follows the convulsion may be considered as a disruption of association pathways. An amnesia also follows electrically induced fits. Apart from these hypotheses it might not be out of place to look at some of the changes that can be observed during the treatment. Undoubtedly the most dramatic of these is the fit, but besides we also find (*a*) marked dilatation of the capillaries which is most readily seen on the face because this is the region where they are most profuse, and this is not limited to the area covered by the electrodes alone. Milch reports the same phenomenon in the retinal vessels, but they go into a state of contraction later; (*b*) dilatation of the pupils at the beginning of the effect—Gonda refers to this, and it can be easily seen by overcoming the spasm of the lids, but it quickly disappears; (*c*) salivation, which is most marked when the current is passed more than once; (*d*) slowing of the heart rate; Hemphill and Walter have drawn attention to this. Rhythm abnormalities have also been described as in the article by Bellet, Kerschbaum and Furst, whilst Wender and Jezer showed that in the case of metrazol all the cardiac arrhythmias fell into the increased vagal influence type.

It will be seen that all the above factors are due to stimulation of the parasympathetic nervous system and they are fairly constantly observed. Can this vagal stimulation be the cause of the improvement? It is an attractive theory, but it must be admitted that confirmation is lacking, and it is not logical to infer that because signs of vagal stimulation accompany the treatment these necessarily account for its success. Although further research is necessary it is as satisfactory a suggestion as any of the preceding ones.

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Histological Changes after Electric Therapy.

Finally we must examine the reports of the histologists on the changes following this treatment as seen in the experimental animal. Impastato and Almansi quote Cerletti as saying that the experimental dog shows an acute cell reaction without grave irreversible changes, whereas Bini found acute injury to the nerve cell of a reversible and irreversible type. There was retraction and hyperchromatosis of the cytoplasm and nucleus, with staining and tortuosity of the cell processes, i.e. " chronic cell disease " in the deeper layers of the cerebral cortex. More recently Alpers and Hughes examined the brains of 30 cats after shock had been given. Fourteen of these showed subarachnoid haemorrhages, usually mild, but sometimes more extensive in type; others showed haemorrhages in the cortex, white matter, cerebellum and third ventricle region usually punctate in size. And lastly Neubuerger, Whitehead, Rutledge and Ebaugh studied the results with twelve dogs. Their remarks are interesting in that they found the lesions were more numerous in the pathway of the current and greater in the cortex than the underlying grey matter. The cells revealed tigrolysis, paleness, swelling and vacuolation with a slight glial proliferation. Vascular dilatation and minute haemorrhages were seen in the cortex, meninges and around the ventricles. They thought that these changes were definite but not serious, and were due partly to the effect on the brain and partly to the effect on the vessels. It was also said that the changes were less than had been seen in similar metrazol cases. Other organs of the body were congested.

Summary.

1. A method for the administration of electrically-induced convulsions has been described, especially with reference to speed and safety.
2. The results in 100 depressive psychoses have been examined and classified.
3. The relation of this therapy to age and blood pressure has been discussed.
4. Factors influencing prognosis have been outlined, particularly the question of chronicity.
5. The relapse-rate and failures have been considered.
6. A physically resistant type has been noted.
7. Recent theories of the *modus operandi* have been examined, with references to some physiological changes.
8. A *précis* of the known histological changes is appended.

I have to thank Dr. Wootton for permission to use this material.

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https://doi.org/10.1192/bjp.89.375.289 Published online by Cambridge University Press