A COMPARISON BETWEEN THE RESULTS OF UNMODIFIED AND MODIFIED ELECTROPLEXY (E.C.T.)

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SINCE the discovery of the therapeutic value of induced epileptic convulsions in mental illness, there have been efforts to make this form of treatment available to those patients whose psychiatric state would benefit from it but whose physical condition contraindicates its use. Modifications have been sought, particularly since the introduction of electrical methods of inducing the fit. The modification of electroplexy takes three main forms—postural, electrical and chemical (Montagu, 1953) and it is with this third type, the use of anaesthetic and relaxant drugs, that this paper is concerned.

The reasons for modification of the convulsion are firstly to enable the treatment to be given to those patients whose physical conditions would otherwise preclude it; curare was the first relaxant drug used by Bennett (1940) to prevent traumatic complications and it has enabled electroplexy to be given to patients with advanced cardiac disease, arthritic deformities and other severe physical illness; and secondly to prevent such complications as skeletal injury. With the introduction of the short-acting relaxants the safety of the method was increased and the use of modified electroplexy became more frequent so that in many hospitals it is now given routinely (Lincoln and Broggi, 1955).

In a recent court case (Bolam *v.* Friern Hospital Management Committee —*Times* Law Report, 1957) the plaintiff alleged that failure to use relaxant drugs was negligent treatment. The Judge, Mr. Justice McNair, stated that a professional man was not guilty of negligence if he acted in accordance with a practice which was accepted by a competent body of professional men skilled in that particular art, but he also mentioned that the jury must not look with 1957 spectacles at what had happened in 1954, suggesting the possibility that failure to use relaxants might now be considered negligent.

Montagu points out that since it is impossible to predict accurately which of the healthy subjects are going to develop complications during unmodified treatment, it follows that any successful method of preventing these catastrophes should be used as a routine, always provided that the balance of risks is in favour of the method rather than of the complications it is designed to prevent. As far as the merits of the method itself are concerned there are two opposing views exemplified by Bennett (1943) at one extreme who says that straight convulsive shock is contraindicated, and more recently Kelleher and Whiteley (1955) who say it is difficult to justify the use of electroconvulsive therapy without muscle relaxants; while Kalinowsky (1949) feels that convulsions are a preformed mechanism which can be safely elicited in any individual while curare is more dangerous than the complications it is supposed to prevent. Whether his views are the same about the shorter-acting relaxants is not known,

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but with these, which are much safer than curare even in comparatively inexpert hands, the question of the results of treatment has also to be included in any consideration of its indications. Maclay (1953) took a serious view of the position concerning the use of relaxants, though this was before the general use of the short-acting group, and suggested that they should be used with caution.

While there have been several papers describing different techniques of administration of relaxant drugs, with or without an anaesthetic (Rietman and Delgado, 1955; Gillie and McNeill, 1955; Kelleher, 1955; Stevens *et al.*, 1954) there have been few references to results obtained compared with unmodified treatment. Fisher and Bannister (1953) and Lincoln and Broggi (1955) mention clinical impressions, without quoting figures, that the psychiatric results of modified E.C.T. are at least as good as those of straight E.C.T. and that patients have not complained about unpleasant sensations and show less tendency to develop apprehension during the course of treatment when modified. Ardis and Wyllie (1953) note that while in general modified E.C.T. has been as effective therapeutically as unmodified E.C.T., in a few cases this was apparently not so. Holmberg *et al.* (1956) found in endogenous depressions that the therapeutic effect tended to be better when muscular relaxation had been employed, and that a smaller number of treatments were given. The difference was not statistically significant, either in respect of therapeutic improvement or in number of shocks given. Rietman and Delgado note that the average number of treatments given is the same whether modified or unmodified and they comment that although vastly reducing the usual complications the relaxant did not inhibit the therapeutic effectiveness of the treatments. However, their use of the word "unmodified" implies only the lack of relaxant, because they mention that light anaesthesia with thiopentone was induced before the shock was administered in their "unmodified" patients.

In contradistinction to these views, it has been the clinical impression at this hospital, both among the medical and nursing staff, that some patients seemed to respond poorly to modified electroplexy, as noted also by Ardis and Wyllie. When a patient had a poorly modified fit due to faulty injection or a similar reason, a typical nursing comment would be "Oh, she's had a good fit, she'll be better now". At first this was felt to show an unawareness of the purpose of modification but enquiry showed that it was the opinion of both experienced nursing staff and doctors that some patients whom they would have expected to respond to electroplexy did not in fact do so when a relaxant was used, or else responded less well. The medical staff also noticed that an occasional patient did not respond to a full course of modified electroplexy but after a short rest period reacted quickly to a course of unmodified treatment. This was first thought to be due to a repetition of treatment, particularly as it was given later in the illness, but a succession of similar experiences suggested the need for investigation of the facts. It was decided to compare the results of modified with unmodified treatment given at this hospital since 1 January, 1954.

METHOD

The first step has been the retrospective examination of the records of female patients discharged from this hospital since 1 January, 1954; this date was chosen because since that date both types of treatment have been regularly used in the hospital, and a considerable number of the treatments have

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been given either by myself or by doctors trained in the same technique, under my supervision. It was unfortunate that a similar examination of the records of male patients was not possible but the filing of treatment records was carried out in a different way and not readily available for this survey. Two Electroplexy machines were in use, the Macphail-Strauss Plexacon and the Ectron.

Unmodified Electroplexy

The patient lies on a firm bed or an examination couch, a nurse on either side supporting the shoulders and pelvic girdle, a rubber gag is placed in the mouth by the Sister who then applies the electrodes to the temples. A diphasic shock of 20 Joules from the Plexacon or one second from the Ectron is given. After the fit the patient is turned on her side and oxygen administered for the first few breaths. Atropine premedication is not given routinely.

Modified Electroplexy

0·2 Gm. thiopentone in 5 per cent. solution mixed with 40–60 mg. suxethonium bromide in 2 per cent. solution or 2·5 mg. decamethonium iodide is used, the dose of thiopentone being constant except in very obese or very small patients and the relaxant dose being estimated by the size of the patient but without accurate weighing, sufficient being given to obtain a considerable degree of relaxation but yet to be sure that a fit has taken place. The solutions are mixed in the same syringe just before administration. After an initial 1 ml. followed by a pause and questioning for pain to see if there is evidence of intra-arterial injection of the thiopentone the injection is completed as rapidly as possible. No premedication is given. The shock, 25 Joules with the Plexacon or 2 seconds with the Ectron, is given as soon as the muscular twitchings have subsided. The jaw is held shut by the Sister, no gag being used, while the doctor gives the injection and then operates the machine. It is not considered necessary to have a qualified anaesthetist present provided that the psychiatrist has knowledge of the principles involved in dealing with an unconscious patient (Mushin, 1955); this applies as much to unmodified as to modified electroplexy. The patient is turned on her side and oxygen is administered by controlled intermittent artificial respiration until spontaneous breathing returns—in a number of timed cases this took from 2½ to 5 minutes from the beginning of the injection to the first satisfactory breath.

Modified treatment was given when there was a definite indication, such as a fracture, but when other patients were referred for electroplexy the method of treatment depended more on the views of the registrar giving the treatment concerning the advantages and disadvantages of the straight and modified types, than on the ideas of the person referring the patient for treatment. This was because there was considerable argument about the value of routine modified electroplexy. Therefore, it is possible to assess the results of the two types of treatment with the likelihood that each group contains a representative sample of all the patients receiving treatment during the period. There would be a tendency for patients who were severely ill to be included in the modified electroplexy group, and where there was an obvious severe physical illness noted this case was excluded from the series since the factors examined, length of stay in hospital and degree of recovery, may be altered by the presence of physical illness. Only cases diagnosed on discharge as Manic-depressive and Recurrent Depression, Involutional Depression, Neurotic Depression and Puerperal Depression were examined. If cases of schizophrenia were included

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it was felt that too many complicating factors were likely to be present, such as concomitant Deep Insulin treatment.

RESULTS

The records were examined from two points of view. Firstly the immediate effects of treatment were assessed and to estimate these the following points were considered:

(*a*) Length of stay in hospital.
(*b*) Number of treatments given.
(*c*) Number of refusals of treatment.
(*d*) Gain or loss in weight.
(*e*) Number of patients discharged "recovered" compared with those discharged "relieved".

Secondly a follow-up survey of all those patients who had been discharged for at least a year was carried out.

Immediate Effects of Treatment

A total of 438 records were examined but since each period of admission if separated by more than one month from the previous date of discharge was counted, there were in all 472 admissions, with 26 patients having two and 4 having three admissions during the period under review. Each of these 472 admissions will be dealt with as a separate case when dealing with the immediate results of treatment. In the four diagnostic groups considered there were 172 cases of manic-depressive psychosis, usually recurrent depressions, 89 of involutional depression, 192 of neurotic depression and 19 of puerperal depression. These diagnostic categories are based on standard psychiatric practice as described in Henderson and Gillespie's *Textbook of Psychiatry* (1956). Of the 472 cases, 328 received unmodified electroplexy and 144 received the modified form of treatment (Table I).

TABLE I

Numbers of Patients Receiving Unmodified or Modified Electroplexy

Diagnosis	Unmodified E.C.T.	Modified E.C.T.
Manic-depressive psychosis	121	51
Involutional depression	59	30
Neurotic depression	137	55
Puerperal depression	11	8
Total	328	144

Length of Stay in Hospital

The average length of stay for all cases who received unmodified treatment is 57·2 days while for those receiving modified electroplexy it is 71·7 days. This difference is maintained in the various diagnostic groups considered separately. In the manic depressive group the unmodified treatment cases were in hospital for an average stay of 65·5 days, the modified treatment group for 69·4 days; in the involutional depressives the unmodified group were in hospital 50·7 days, the modified group for 62·3 days; the neurotic depressive group for

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51·9 and 74·4 days respectively and the puerperal depression group 57·3 and 98·0 days respectively. These results are summarized in Table II.

TABLE II

Average Length of Stay in Hospital

Diagnosis	Treatment: Unmodified E.C.T. Days	Treatment: Modified E.C.T. Days	t-test of Significance
Manic-depressive psychosis ..	65·5	69·4	Not significant
Involutional depression ..	50·7	62·3	Significance at 0·2 level of confidence.
Neurotic depression	51·9	74·4	Highly significant at 0·01 level of confidence.
Puerperal depression	57·3	98·0	Not significant.
All patients	57·2	71·7	Not significant.

In these results, two patients with puerperal depression who received modified electroplexy were in hospital an exceptionally long time, one for 344 days and the other for 214 days, while the total number of cases was 8, so that a false impression is obtained of a marked difference in the average length of stay in hospital when receiving the modified treatment.

This must be borne in mind as a fault of this method of assessment, though it does not necessarily invalidate conclusions drawn from the results. If these two cases are excluded the average stay in hospital for the seven cases of puerperal depression receiving the modified form of treatment was 42·1 days.

Number of Treatments

The average number of treatments given to the unmodified group was 6·2 while the average number of treatments to the modified group was 7·3. In Table III the separate diagnostic groups are shown, and in each case less treatments are required when electroplexy is given unmodified. The manic depressive group require 6·8 as against 7·2 treatments, the involutional depressions 6·1 as against 7·2, neurotic depressions 5·8 as against 6·0 and the puerperal depressions 6·0 against 9·1 (Table III).

TABLE III

Average Number of Treatments Received

Diagnosis	Treatment: Unmodified E.C.T. Average No. of Treatments	Treatment: Modified E.C.T. Average No. of Treatments
Manic-depressive psychosis	6·8	7·2
Involutional depression	6·1	7·2
Neurotic depression	5·8	6·0
Puerperal depression	6·0	9·1
Total	6·2	7·3

t-test shows that the difference between the means is not statistically significant.

Number of Refusals of Treatment

Included under this heading are all those patients who refused to continue the course of treatment at any stage once they had received the first treatment.

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Also included are those who refused at some time during the treatment but who later agreed to continue it. If a patient refused to receive treatment on more than one occasion during a single admission this is counted as one refusal, but if on different admissions, each course of treatment is dealt with independently of the previous ones.

Fourteen patients refused unmodified treatment and 8 refused modified treatment. The ratio of the number of unmodified to modified treatments is 328 : 144 which is 2·28 : 1, while the ratio of refusals 14 : 8 is 1·75 : 1. This result is not significant statistically—thus there is no undue dislike as indicated by refusal of treatment, for unmodified electroplexy.

Gain or Loss of Weight

Following the findings of Altschule *et al.* (1948) that those patients who gained weight after E.C.T. were improved while those who failed to gain showed no striking clinical improvement, the change in weight of all patients during the period in hospital was noted. The average weight gained in the patients receiving unmodified treatment was 2·6 lbs. while in modified treatment the average gain was 1·3 lbs. A t-test showed there was a significant difference between these means at the 0·02 level of probability.

There was thus a significantly greater average gain in weight in those patients receiving unmodified rather than modified treatment. Altschule attributed the gain in weight to retention of extracellular fluid and found that it ushered in clinical recovery in the large majority of cases.

To see if a gain in weight may be considered a good prognostic sign and loss of weight a poor one the results were examined to see what had happened to those patients who gained or lost weight. Of those who gained weight, 210 (63·1 per cent.) were discharged recovered and 123 (36·9 per cent.) were discharged relieved. Of those who lost weight, 87 (66·9 per cent.) were discharged recovered and 43 (33·1 per cent.) relieved. When seen after a year, of those patients who had gained weight in hospital, 202 (75·6 per cent.) remained well, 60 (22·5 per cent.) had relapsed and 5 (1·9 per cent.) died. Of those who lost weight, 71 (71 per cent.) remained well, 27 (27 per cent.) relapsed and 2 (2 per cent.) died. Chi-square tests of significance carried out on these figures did not reach a satisfactory level of significance—thus the gain in weight while n hospital is not a satisfactory guide to prognosis in this series (Table IV).

TABLE IV

State of Patients Who Gained or Lost Weight

	State on Discharge		Follow Up		
	Relieved	Recovered	Remained Well	Relapsed	Dead
Gain in weight in hospital	210 (63·1%)	123 (36·9%)	202 (75·6%)	60 (22·5%)	5 (1·9%)
Loss of weight in hospital	87 (66·9%)	43 (33·1%)	71 (71%)	27 (27%)	2 (2%)

State on Discharge

The last point to be considered in the condition of the patients at the time of their stay in hospital is the condition on discharge. The standard nomenclature of "Recovered", "Relieved" and "Not Improved" has been used and the opinion of the clinician seeing the patient on discharge is that which has been noted. In the Manic Depressive group receiving unmodified treatment,

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64 (52·9 per cent.) were discharged Recovered and 57 (47·1 per cent.) Relieved. In the modified group, 22 (45·0 per cent.) were discharged Recovered and 29 (59·2 per cent.) Relieved. In the Involutional Depression group receiving unmodified treatment, 23 (47·0 per cent.) were discharged Recovered, 24 (49·0 per cent.) Relieved and 2 (4·1 per cent.) Not Improved; while for those receiving modified treatment 12 (40·0 per cent.) were Recovered, 17 (56·7 per cent.) Relieved and 1 (3·3 per cent.) Not Improved. In the Neurotic Depression group receiving unmodified treatment, 35 (25·6 per cent.) patients were discharged Recovered, 97 (70·8 per cent.) Relieved and 5 (3·7 per cent.) Not Improved. Those receiving modified treatment, 6 (11·0 per cent.) were discharged Recovered and 49 (89·1 per cent.) Relieved. In the small group of Puerperal Depressions receiving unmodified treatment, 6 (54·6 per cent.) were discharged Recovered and 5 (45·4 per cent.) Relieved and of those receiving modified treatment, 4 (50 per cent.) were discharged Recovered, 4 (50 per cent.) Relieved.

These results are summarized in Table V; (both in actual numbers of patients and in percentages of the total number of patients receiving the particular form of treatment).

TABLE V

Condition of Patients on Discharge

Diagnosis	Unmodified E.C.T.			Modified E.C.T.		
	Recovered	Relieved	Not Improved	Recovered	Relieved	Not Improved
Manic-depressive psychosis	64 52·9%	57 47·1%	0 0%	22 45·0%	29 59·2%	0 0%
Involutional depression ..	23 47·0%	24 49·0%	2 4·1%	12 40·0%	17 56·7%	1 3·3%
Neurotic depression ..	35 25·6%	97 70·8%	5 3·7%	6 11·0%	49 89·1%	0 0%
Puerperal depression ..	6 54·6%	5 45·4%	0 0%	4 50·0%	4 50·0%	0 0%

The assessment of results was also carried out using age rather than diagnosis as a criterion and a similar series of results were obtained (Table VI).

TABLE VI

Relationship Between Age and Unmodified and Modified E.C.T.

Unmodified E.C.T.

Age	Stay in Hospital (Days)	Average No. of Treatments	State on Discharge		
			Recovered	Relieved	Not Improved
Less than 40 ..	53·8	6·2	39 32·0%	81 66·4%	2 1·6%
40 to 60	57·8	6·2	72 42·6%	94 55·6%	3 1·8%
Over 60	57·8	6·2	15 40·6%	20 54·1%	2 5·3%

Modified E.C.T.

Age	Stay in Hospital (Days)	Average No. of Treatments	State on Discharge		
			Recovered	Relieved	Not Improved
Less than 40 ..	80·9	7·6	5 15·2%	28 84·9%	0 0%
40 to 60	73·4	6·5	22 31·9%	47 68·1%	0 0%
Over 60	65·0	6·4	18 42·9%	23 54·8%	1 2·3%

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Complications of E.C.T.

The commonest complication of unmodified electroplexy is the occurrence of fractures either of the vertebrae or of the long bones, or dislocation of joints. In a review of the problem, Newbury and Etter (1955) point out the difficulties of diagnosis without X-ray before and after treatment and state that clinical examination is not a reliable guide nor is subjective pain a satisfactory indicator. They give an incidence of 0·5 to 35·4 per cent. of fractured vertebrae occurring after unmodified electroplexy in their review of the literature, the variation depending on when X-rays were taken and whether diagnosis was made by a radiologist.

In this series 5 patients were X-rayed after complaining of severe back pain following treatment. Fractures were found in each case, four having mid-thoracic vertebrae fractured and one with the second lumbar vertebra fractured. The fractures were noted after 1, 4, 3, 3 and 2 treatments. Only two of these patients were included in the follow-up survey and neither complained of difficulties resulting from the fractures. Both agreed they would have treatment again if it were indicated.

There were no deaths which were in any way attributable to E.C.T. in this series. Only one patient died while in hospital, of mesenteric thrombosis.

In the modified group, several patients had relatively prolonged apnoea, two of 15 minutes, but no explanation of this was discovered—serum pseudocholinesterase levels were within normal limits. It is possible that of over-enthusiastic ventilation with its consequent removal of CO_2 may be responsible for the occasional prolonged apnoea and must be guarded against by using intermittent ventilation. It was commoner in the earlier days before experience was gained of the optimum amount of artificial respiration.

In three patients there was noticed a transient cyanosis of the fingers of the hand after the injection had been given. This did not occur immediately but was noted after treatment. In one patient it was limited to two fingers, the third and fourth, and in the other two all the fingers, but not proximal to them. The pulse was good, there was no pain, nor anaesthesia, and the condition cleared spontaneously after about an hour. It was considered due to spasm of the digital veins, resulting in slowing of blood flow and consequent cyanosis, and was thought to be due to the thiopentone rather than the relaxant because in the three patients in whom it occurred one was receiving suxethonium bromide and thiopentone, the second decamethonium iodide and thiopentone and the third thiopentone alone.

Follow-Up of Patients

The second stage of the enquiry was the interviewing of those patients who had been discharged from hospital during the period 1 January, 1954 to 31 December, 1955, and had during their stay in hospital been diagnosed as suffering from one of the four illnesses mentioned and had received electroplexy. There was thus a follow-up period available of at least one year when the survey was carried out in February and March, 1957. The interviewing was done by the Psychiatric Social Workers at this hospital to whom I must pay tribute for the exceptionally good result. There were 388 patients to see and they were able to trace all but 32 (8·2 per cent.). It is considered that this high follow-up rate after one to two years is possible because of the static nature and ready accessibility of small provincial communities compared with the bigger cities and this advantage should be borne in mind when planning any long-term

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research. Blair and his co-workers (1957) achieved a similar high follow-up rate (12 per cent. untraced), in the study of out-patient psychotherapy in Plymouth as compared with Mason (1956) in a London hospital where 20 per cent. were untraced and a further 18 per cent. replied by letter only.

The interviewer was asked to assess the patient's condition since discharge and place in one of the following categories:

1. Symptom free.

2. Minor symptoms only. Able to carry on with her usual occupation. Requiring occasional hypnotic or mild sedative only.

3. Definite relapse or recurrence requiring further treatment either as an in-patient or out-patient.

4. Deaths. Tactful enquiry was made to ascertain if the death was due to suicide—not necessarily the verdict of an inquest.

5. No information available.

Results

Three hundred and eighty-eight patients had been discharged from hospital for at least one year at the time of the survey. Information was obtained concerning 356 (91·8 per cent.). Of these 274 had been out of hospital for eighteen months and 206 for two years. These figures, and their division into those who received unmodified and modified treatment are shown in Table VII.

TABLE VII

Number of Patients Interviewed

Period Elapsed Since Discharge	Number of Patients Interviewed		
	Unmodified E.C.T.	Modified E.C.T.	Total
1 year	252	104	356
18 months	199	75	274
2 years	151	55	206

Considering the patients followed up for one year; in the unmodified group, 117 (46·4 per cent.) remained symptom free, 104 (41·3 per cent.) had minor symptoms, 25 (9·9 per cent.) relapsed, 3 (2·0 per cent.) committed suicide and a further 3 (2·0 per cent.) died due to some non-psychiatric illness. In the modified group, 43 (41·4 per cent.) remained symptom free, 45 (43·3 per cent.) had minor symptoms, 13 (12·5 per cent.) relapsed, 2 (1·9 per cent.) committed suicide and one (0·9 per cent.) died of a non-psychiatric cause. For those followed up for eighteen months the figures are as follows: in the unmodified group, 106 (53·3 per cent.) remained well, 74 (37·2 per cent.) had minor symptoms, and 19 (9·6 per cent.) relapsed; in the modified group 36, (48·0 per cent.) remained well, 32 (42·7 per cent.) had minor symptoms, 6 (8·0 per cent.) relapsed and 1 (1·3 per cent.) committed suicide. The two-year follow-up gave the following results: in the unmodified group, 86 (57·0 per cent.) remained well, 51 (33·8 per cent.) had minor symptoms, 12 (8·0 per cent.) relapsed, and 2 (1·3 per cent.) had died of non-psychiatric illness; in the modified group, 26 (47·3 per cent.) remained well, 20 (36·4 per cent.) had minor symptoms, 7 (12·7 per cent.) relapsed and 2 (3·6 per cent.) committed suicide. Summarizing these results, a higher proportion of patients remained symptom free in the unmodified treatment group than in the modified treatment

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group, a smaller proportion suffered from minor symptoms, the proportion of relapses, as measured by the need for treatment in the first year, was lower, though the proportion of recurrences was the same—assessed by considering the figures for further treatment at the eighteen month and two year periods. Less patients committed suicide, only three in the unmodified group as compared with five in the modified group over the whole period (Table VIII).

TABLE VIII

Follow-Up after One Year

Diagnosis	Unmodified E.C.T.				Modified E.C.T.			
	Symptom Free	Minor Symptoms	Relapse	Dead	Symptom Free	Minor Symptoms	Relapse	Dead
Manic-depressive psychosis ..	55 56·7%	33 34·1%	9 9·3%	0 0%	9 28·2%	14 43·8%	8 25·0%	1* 3·1%*
Involutional depression ..	15 31·9%	25 53·2%	5 10·6%	2 4·3%	15 62·5%	7 29·2%	1 4·2%	1 4·2%
Neurotic depression ..	43 42·6%	44 43·6%	10 9·9%	1+3* 1·0%+ 3·0%*	16 39·0%	20 49·0%	4 9·8%	1 2·5%
Puerperal depression ..	4 57·1%	2 28·6%	1 14·3%	0 0%	3 42·9%	4 57·1%	0 0%	0 0%
Total	117 46·4%	104 41·3%	25 9·9%	3+3* 2·0%+ 2·0%*	43 41·4%	45 43·3%	13 12·5%	2+1* 1·9%+ 0·9%*

Numbers * indicate deaths from non-psychiatric causes.

If each diagnostic group is considered separately the results are similar and are summarized both in numbers of patients and percentages of the total number receiving the particular form of treatment in Tables VIII, IX and X. The exception to the general pattern is in the case of patients suffering from involutional depression. In this group more patients receiving modified electroplexy remained symptom free, there are less with minor symptoms and less relapses. This may be explained either by the fact that there are relatively few cases in this group or it may be that the factor which is responsible for the differing results between unmodified and modified electroplexy does not operate in this instance (Tables IX and X).

TABLE IX

Follow-Up after Eighteen Months

Diagnosis	Unmodified E.C.T.				Modified E.C.T.			
	Symptom Free	Minor Symptoms	Relapse	Dead	Symptom Free	Minor Symptoms	Relapse	Dead
Manic-depressive psychosis ..	44 57·2%	23 29·9%	10 13·0%	0 0%	8 36·4%	11 50·0%	2 9·1%	1 4·6%
Involutional depression ..	18 48·7%	14 37·8%	5 13·5%	0 0%	12 66·7%	5 27·8%	1 5·6%	0 0%
Neurotic depression ..	40 51·3%	35 44·9%	3 3·9%	0 0%	13 44·9%	13 44·9%	3 10·4%	0 0%
Puerperal depression ..	4 57·1%	2 28·6%	1 14·3%	0 0%	3 50·0%	3 50·0%	0 0%	0 0%
Total ..	106 53·3%	74 37·2%	19 9·6%	0 0%	36 48·0%	32 42·7%	6 8·0%	1 1·3%

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TABLE X

Follow-Up after Two Years

Diagnosis	Unmodified E.C.T.				Modified E.C.T.			
	Symptom Free	Minor Symptoms	Relapse	Dead	Symptom Free	Minor Symptoms	Relapse	Dead
Manic-depressive psychosis ..	37 61·7%	16 26·7%	6 10·0%	1 1·7%*	5 31·3%	7 43·8%	4 25·0%	0 0%
Involutional depression ..	12 50·0%	10 41·7%	2 8·3%	0 0%	8 57·2%	5 35·7%	1 7·2%	0 0%
Neurotic depression ..	32 53·3%	24 40·0%	3 5·0%	1 1·7%*	10 48·0%	7 33·3%	2 9·5%	2 9·5%
Puerperal depression ..	5 71·4%	1 14·3%	1 14·3%	0 0%	3 75·0%	1 25·0%	0 0%	0 0%
Total ..	86 57·0%	51 33·8%	12 8·0%	2 1·3%*	26 47·3%	20 36·4%	7 12·7%	2 3·6%

Numbers * indicate deaths from non-psychiatric causes.

Patients were also asked whether they would consider having electrical treatment again if there was considered to be a need for it. Of those who had received unmodified treatment, 25 (9·9 per cent.) would not have it again, while of those who received modified treatment, 16 (15·4 per cent.) would refuse it again. Reasons for refusing varied from being frightened of electricity to feeling that it had been of no benefit, and there were several complaints about permanent or long-standing subjective memory impairment. It was not considered possible to differentiate between those who were refusing to have further treatment on grounds of failure to be cured and those who were afraid of the treatment though accepting that they had been helped.

DISCUSSION

Introduction of the short-acting relaxant drugs was welcomed as a safe, simple method of modifying the convulsions of electroplexy, and this was considered to produce only beneficial effects. It reduced the incidence of fractures and enabled the treatment to be given to physically frail or ill patients. It was only after it had been in regular use for a considerable period in this hospital that doubts arose about the results. Some patients seemed not to respond to modified electroplexy but did so to a later course of unmodified treatment, and because of this growing suspicion this survey was undertaken with the results indicated.

These figures show a tendency for patients who receive modified treatment to make a less satisfactory recovery, after a longer stay in hospital, which may be due to a greater number of treatments required, and to relapse more often. Considering first the examination of the records of the patients' stay in hospital, it is seen that the average stay is longer whether considered for the patients as a whole or if each diagnostic group is considered separately. Similarly the average number of treatments is greater. When the patients are discharged from hospital, a higher proportion of patients receiving the unmodified treatment are discharged "Recovered" than those receiving modified treatment; the reverse is true for the category "Relieved". I wish to emphasize that I am comparing the two forms of E.C.T. rather than assessing the results of E.C.T. for different diagnostic groups, with which I am not directly concerned in this survey. I am assuming that as far as each diagnostic group is concerned, the patients receiving modified or unmodified treatment are essentially similar, and any differences will be equally represented in these two groups of patients.

In trying to explain these results two likely possibilities must be considered.

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There may be some patients who are peculiarly resistant to modified electroplexy, and these results produce the artificial appearance of an overall poor effect, or else there is some feature of modified E.C.T. which produces somewhat poorer results in all patients. The evidence available in this paper is insufficient to reach a final opinion on this point but future lines of enquiry are indicated.

Examination of the four diagnostic groups revealed no essential difference in response to the two types of treatment, and a similar examination of the results, this time according to age rather than diagnosis, did not reveal a definite difference.

There was some evidence suggesting that the older the patient, the more similar were the results of the two treatments (see Table V).

These results were subjected to a three factor analysis of variance to determine the relative effects of age, number of treatments, and the type of treatment on the length of stay in hospital. Unfortunately, there proved to be such a large interaction between the three variables that it was not possible to complete the analysis. Inspection of the results suggested a suitable two factor analysis, which was carried out on those patients who had received more than average number of treatments and less than average number of treatments. In the former group, neither age nor type of treatment proved to have a significant effect in determining the different lengths of stay in hospital, but where less than average number of treatments were given the type of treatment was found to affect significantly the length of stay in hospital, modified E.C.T. resulting in the longer stay.

An explanation of this finding is that division of both modified and unmodified treatments groups into those receiving more than average and less than average numbers of E.C.T. is, in fact, also dividing them into straightforward cases and complicated or atypical cases. The average number of treatments given was 6·8. It is usually accepted that the standard course of E.C.T. to cure a straightforward depression is six and this would suggest that the group requiring less than 6·8 E.C.T. would contain most of the uncomplicated cases while the atypical cases would be more likely in the other group. It is therefore noteworthy that it is in the more straightforward group that the difference between unmodified and modified treatment is found significant, at the 0·05 level in respect to age, and when a similar analysis is carried out in respect to diagnosis it is significant at the 0·2 level.

Inspection of the records of patients who had been in hospital for a longer than average period, or received a greater than average number of treatments did not reveal any suggestion that they formed a homogeneous group. It is felt that the most likely explanation of these findings is that modified E.C.T. has less therapeutic effect, although this may only become apparent in a limited number of patients.

When patients were followed up after one year, the results of the unmodified group were better than the modified group when taken as a whole, and also when each diagnostic group was considered separately, with the exception of those patients suffering from involutional depression. In this group those receiving modified E.C.T. fared better than the unmodified group. This may be accepted as a valid finding, which cannot be explained and to which further enquiry must be devoted, or it may be due to the rather small numbers of patients in this group. A chi-square test showed the results could be explained purely on the basis of chance. However, further consideration will be given to the statistical examination of these results.

Similar findings were obtained from eighteen month and two year follow-up

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though the difference between the two groups gradually became less as might be expected, as the E.C.T. effect was lost and the follow-up represented more the prognosis of recovered cases of depression.

Before one can consider why there should be a difference in the results of these two forms of E.C.T. it is necessary to know the mode of action and site of action of the treatment. Many theories, both psychogenic and physiological, have been put forward, and Hill (1954) discusses the relationship between them. He points out that clinical research does not support the view that fear, punishment and assault play a major part in the therapeutic effect of the treatment. In this series fear of the treatment as expressed by refusal of treatment when offered, or subsequently, when the patient was asked if she would be prepared to have it again if it were thought necessary was approximately equal in the two groups, with a rather higher percentage of the modified group refusing than the unmodified group. Thus, modifying the treatment does not seem to remove the anxiety associated with it, nor does there seem evidence that it is this anxiety which is responsible for the difference between the two forms of treatment.

Roth (1952) has suggested the biological efficacy of the epileptic fit as an apparatus for the maintenance of a relatively stable pattern of activities in the brain, and that E.C.T. is a therapeutic reproduction of this action. The action, he suggests, takes place in the upper mid-brain, and he has pointed out that it is in this region that barbiturates have an action. Barbiturates are well-known anticonvulsant drugs and I feel that they may "protect" this region from the therapeutic effects of E.C.T. The epileptic fit certainly takes place when anaesthetic and relaxant are used as shown by Piekenbrock *et al.* (1956) but there may well be something lacking. A recent paper by French workers (Morin and Corriol, 1957) shows one of the effects which are lacking though not suggesting that this is responsible for the lack of therapeutic effect. They had found in animals that a well-marked hypertension develops dependent on the "pressor area of the basal diencephalon" which has to participate in the seizure. This diencephalic activity is inhibited by small doses of anaesthetics or chlorpromazine which do not themselves modify the cortical seizure. The peripheral mechanism of the hypertension was found to be dependent upon neurogenic vasoconstriction which may be accompanied by liberation of adrenaline.

If it is correct that it is the anaesthetic which is at fault, it is logical that treatment should be given without an anaesthetic, but with a relaxant. This has of course been done (Gillie and McNeill, 1955; Impastato, 1956) though results of this treatment have not been compared with those of other methods. However, an ethical point is raised by the use of this method. Vivid accounts have been given of how a volunteer feels when he receives a dose of relaxant without anaesthetic; a feeling of suffocation and of being quite unable to inform those around him of how he feels. Presumably a patient experiences the same discomfort when he is given it prior to E.C.T. but because of the retrograde amnesia produced, does not recall it. Does it do any harm, either by increasing the likelihood of refusals, or by some long-term traumatic effect on the psyche, to undergo a series of painful experiences, even if they are not remembered afterwards? In any case is it ethical to give such treatment even if one knows the patient will not remember it? This difficult question is one which must be left for the individual practitioner to answer. My own feeling is that if the anaesthetic is at fault, another must be found which does not have this "protective" effect. Perhaps the new steroid anaesthetics will provide a solution to this problem.

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If it is the relaxant which is at fault, this suggests that either the relaxant has some undescribed central effect, or that the actual peripheral manifestations of the fit are responsible for its therapeutic effect; in other words, release of lactic acid or other metabolic products into the blood stream. This theory was proposed by Lowenbach and Greenhill (1947) but has not received general acceptance.

The question must be asked whether it is important that a patient receiving modified E.C.T. should spend a few days longer in hospital. To do this one has to weigh up the advantages and disadvantages of the two types of treatment. Unmodified E.C.T. undoubtedly produces a higher incidence of fractures, but is otherwise relatively safe. It is quicker to administer and fewer drugs are necessary, so that less complications are likely. Modified treatment requires a more experienced administrator, some would say an anaesthetist, and there are more drugs given, with dangers of intra-arterial injection, prolonged apnoea, and laryngeal spasm. It is somewhat more time consuming, but these difficulties are not serious, and if results are equally good, I think that modified treatment is to be preferred. However I have indicated that the results are not the same, though in this paper I am unable to say why they should be different. If it is merely a question of a few more days in hospital, one or two more treatments, it would not be important: but I feel these results reflect the fact that some patients respond poorly, if at all, to modified E.C.T., and I do not know how these patients can be recognized, except by failure to respond to treatment. Some patients may be discharged from hospital less well than they should be, and it would appear that a proportion commit suicide. I feel, therefore, that this is not a matter which can be lightly passed by but one on which further investigation is needed.

This enquiry is not considered complete in itself, but rather a pilot study suggesting the need for further investigation by controlled experiment. The method of retrospective examination of records and results has many fallacies, while some of the assumptions made may not be completely valid. Thus, there is the possibility that one doctor would treat all his patients by a long course of modified E.C.T. and keep them in hospital for a long period. Or it may be that only cases with poor prognosis were given modified E.C.T.—perhaps because of concomitant physical disease. As explained earlier, this is probably not so; working at this hospital during the period under observation, I feel that the doctors tended to deal with similar patients in similar ways.

The results given in this paper had applied to them tests of significance where shown. In many cases these results were shown not to reach a satisfactory level of significance. This may be thought to invalidate the findings of the paper except for the fact that all the results show a tendency in the same direction, with the exception of the follow-up results in involutional depression. This uniform tendency of a group of results which are to a large extent independent, makes the conclusions drawn from them more likely to be valid, though requiring further confirmation.

I have shown that patients tend to respond less well to modified E.C.T. although I have not been able to prove this. I have suggested that the anaesthetic is the most likely drug which lessens the therapeutic effect, although the result may be dependent on some factor in the patient, which may make him more susceptible to its action. Finally, further enquiry by controlled trial is desirable to prove this point and also to throw light on the mechanism of action of what is still almost entirely an empirical treatment.

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SUMMARY

1. An examination is made of the results of unmodified and modified E.C.T.

2. This was carried out by retrospective examination of hospital records after discharge and a follow-up at least of one year of all female patients suffering from depression and treated by E.C.T.

3. The results showed that patients who were treated by unmodified E.C.T. were in hospital for a shorter period, received less treatments and were more likely to remain well than those treated by modified E.C.T.

4. The results are discussed and thought to indicate the need for a controlled trial of unmodified and modified E.C.T.

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