Brit J. Psychiat. (1984), **144,** 227–237

The Northwick Park ECT Trial
Predictors of Response to Real and Simulated ECT

CLINICAL RESEARCH CENTRE, DIVISION OF PSYCHIATRY

Summary: The clinical characteristics of 70 patients included in the Northwick Park ECT trial of real against simulated ECT were analysed to identify predictors of response to the two treatments. The initial agitated/deluded/retarded substratification, the initial assessment of delusions by PSE, the individual items and factors derived from the Hamilton depression scale were all evaluated, together with six scales previously held to predict response to ECT and the individual items of these scales. The limited size of the sample does not allow firm conclusions, but the most significant and only consistent predictor of response to real ECT appeared to be the presence of delusions. The features of 'endogenous depression' did not in themselves appear to predict response to real ECT. The findings are discussed in relation to the viewpoint that delusional depression may be a specific entity which is relatively resistant to tricyclic antidepressants but responsive to electroconvulsive shock.

The efficacy of ECT in severe depressive illness was established in multi-centre trials in both the United States (Greenblatt *et al,* 1964) and Britain (Medical Research Council, 1965). However, these trials were not blind; and until recently few studies had been conducted which included a group of patients who were anaesthetized but did not receive electroconvulsive treatment. Moreover in the 1970s ECT became the subject of controversy and criticism, particularly in the United States (Friedberg, 1977); in some states it was subject to legal restrictions (APA, 1978; Morrisey *et al,* 1979).

Against this background, we conducted a trial of real versus simulated ECT in patients who conformed to three sets of criteria for endogenous depressive illness and one criterion of suitability for ECT. For ethical reasons the study was conducted on the smallest number of patients that would allow a clear answer to the question of the role of the electroconvulsion in the efficacy of ECT. A sample size of 70 was selected, using a calculation based on the results of an earlier trial of ECT and tryptophan (Herrington *et al,* 1974). Our study (Johnstone *et al,* 1980) demonstrated that real ECT was significantly more effective than simulated ECT, but patients who received simulated ECT also improved greatly. The major question posed by this finding is whether particular sub-groups of severely depressed patients can be identified for whom ECT does provide a substantial benefit.

Our relatively small sample-size was chosen to give a clear answer to a single question: how important is electroconvulsion in ECT? Before randomisation however, the patients were substratified in terms of the presence or absence of *delusions, retardation* or *agitation,* as determined by the Present State Examination (Wing *et al,* 1964), in order to consider subsequently the value of these features as predictors of response to the two treatments. In addition, we conducted a retrospective analysis of the available data with a view to identifying other potential predictors. It is the results of this work that are reported here.

In such an approach many variables are considered in relatively few subjects, and so spurious results are readily produced: our methods of statistical analysis were chosen with a view to minimising this possibility. In assessing the findings we were concerned not so much with formal tests of significance as with plausible clinical gradients: where an effect was noticeable but not necessarily significant we asked whether an increasing response to treatment was associated with an increase in degree in the clinical variable. Throughout the analysis clinical response was assessed in terms of the Hamilton scale (Hamilton, 1967).

Delusions, Retardation and Agitation

Delusions and retardation and, to a lesser extent, agitation have all been thought to predict response to ECT (Hobson, 1953; Carney *et al,* 1965; Mendels, 1967; Kendell, 1968; Hamilton, 1974). The distribu-

TABLE I

Distribution of patients completing the study, in terms of PSE assessment of agitation, retardation or delusions (n=62)

	Deluded	Not deluded
Agitated	6 patients	12 patients
Retarded	8 patients	13 patients
Both agitated and retarded	2 patients	2 patients
Neither agitated nor retarded	6 patients	13 patients

tion of the patients completing our course of eight treatments, in terms of presence/absence of these symptoms, is shown in Table I.

Analysis of the data

In the initial calculation, analysis of variance was used, with a linear model, as described in the GLIM package of computer programmmes (Nelder, 1975). Terms representing the main effect (treatment), age, sex and the presence/absence of delusions, agitation and retardation at the initial interview were assessed for their association with improvement scores for all patients, at the end of the course of treatment, after one additional month, and after six months. Standard analysis of variance incorporating terms in a linear model was used to test for main effects and interactions. The test for an interaction of agitation, retardation or delusions with treatment is an overall test of a differential treatment effect in each of these clinical categories.

Results

Improvement scores were significantly associated with the main effect of treatment (i.e. the effect of real ECT) at the end of the course of treatment ($P < 0.01$) but not at other times. There were no significant interactions with age, sex, delusions, agitation or retardation. However, when the sample was divided in terms of the presence/absence of agitation, retardation and delusions (Table II) improvement scores suggested that the observed advantage of real over simulated ECT was more marked in retarded and deluded patients than in those without these characteristics.

When the improvement scores were expressed as a percentage of the initial scores (Table II) this difference appeared to be due in part to the higher initial scores and therefore greater opportunities for improvement in the retarded and deluded patients; however, when initial scores were taken into account a (non-significant) advantage remained for real over simulated ECT in the deluded and retarded patients by comparison with the non-deluded and non-retarded.

The effects of retardation and delusions were then separated by considering non-deluded patients in terms of the presence/absence of retardation and non-retarded patients in terms of the presence/absence of delusions (Table III). Both delusions and retardation appeared to be associated with an advantage for real over simulated ECT but none of the differences was significant.

We also made up a total delusion score for each patient, based on the number of categories in which delusions occurred and the degree of conviction with which they were held. On the basis of these scores we divided the patients tentatively into non-deluded, deluded and severely deluded groups and calculated the mean improvement on real and on simulated ECT for each group. The result is shown graphically in Fig. 1: the greater the delusions score the more marked was the advantage of real over simulated ECT.

It should be noted that the advantage of real over simulated ECT was short-lived in all clinical categories.

Retrospective Analyses for other Predictive Features

The information we had available, from which we hoped to isolate predictors of response, consisted of:

1. Total and component scores on the criteria used to select our sample—
   a. MRC (1965) criteria of depressive illness.
   b. Feighner *et al* (1972) criteria for primary depressive illness.

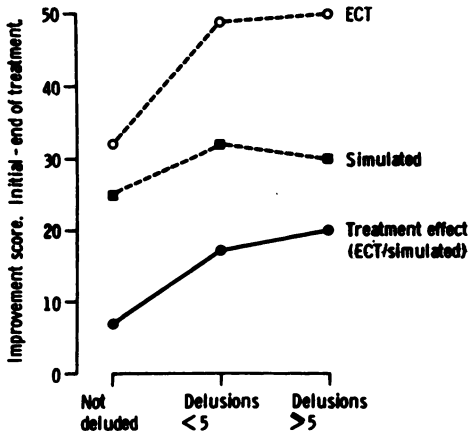

FIG 1.—The difference in improvement following real and simulated ECT, related to initial delusions score.

https://doi.org/10.1192/bjp.144.3.227 Published online by Cambridge University Press

TABLE II

Improvements on real and simulated ECT in terms of presence/absence of agitation, retardation and delusions

Clinical state Real or simulated ECT	Number finishing course of treatment	Improvement scores (Hamilton scale): mean and SD						Improvement scores as percentage of initial score: mean and SD					
		Wk 1	Wk 2	Wk 3	Wk 4	+1 month*	+6 months*	Wk 1	Wk 2	Wk 3	Wk 4	+1 month	+6 months
Agitated													
Real	11	12 ± 11	27 ± 11	35 ± 15	34 ± 17	33 ± 22 (11)	34 ± 15 (11)	24 ± 24	52 ± 24	65 ± 28	65 ± 31	57 ± 31	62 ± 23
Simulated	11	10 ± 11	20 ± 7	23 ± 16	30 ± 17	37 ± 19 (9)	35 ± 18 (9)	17 ± 21	37 ± 11	43 ± 28	53 ± 27	63 ± 23	62 ± 21
Non-agitated													
Real	20	20 ± 12	31 ± 16	34 ± 16	40 ± 16	37 ± 16 (19)	38 ± 17 (19)	38 ± 19	59 ± 25	62 ± 23	75 ± 22	70 ± 23	70 ± 20
Simulated	20	15 ± 13	20 ± 10	24 ± 11	27 ± 15	32 ± 17 (18)	35 ± 12 (18)	30 ± 24	43 ± 21	50 ± 23	54 ± 28	62 ± 31	72 ± 19
Retarded													
Real	13	20 ± 12	37 ± 16	39 ± 15	46 ± 14	46 ± 22 (12)	46 ± 18 (13)	33 ± 19	57 ± 30	66 ± 23	78 ± 21	73 ± 23	74 ± 17
Simulated	12	15 ± 13	21 ± 11	27 ± 15	34 ± 16	46 ± 14 (11)	39 ± 15 (10)	27 ± 23	38 ± 19	50 ± 24	60 ± 24	74 ± 19	64 ± 20
Non-retarded													
Real	18	15 ± 13	25 ± 11	30 ± 16	32 ± 17	29 ± 12 (18)	31 ± 11 (17)	32 ± 25	53 ± 23	61 ± 26	66 ± 28	60 ± 28	63 ± 23
Simulated	19	11 ± 12	19 ± 8	20 ± 12	24 ± 14	27 ± 16 (16)	32 ± 12 (17)	24 ± 25	43 ± 18	46 ± 26	50 ± 29	54 ± 32	72 ± 20
Deluded													
Real	10	14 ± 14	35 ± 15	43 ± 16	50 ± 16	48 ± 23 (10)	48 ± 19 (10)	20 ± 20	53 ± 22	67 ± 25	78 ± 23	73 ± 28	73 ± 23
Simulated	12	12 ± 16	20 ± 8	23 ± 16	32 ± 14	39 ± 18 (11)	44 ± 13 (10)	20 ± 30	39 ± 16	43 ± 29	58 ± 23	68 ± 22	82 ± 13
Non-deluded													
Real	21	18 ± 21	27 ± 14	30 ± 14	33 ± 14	29 ± 12 (20)	31 ± 12 (20)	38 ± 22	58 ± 26	62 ± 25	68 ± 27	61 ± 25	65 ± 20
Simulated	19	14 ± 9	20 ± 9	24 ± 10	26 ± 16	30 ± 17 (16)	29 ± 11 (17)	29 ± 19	42 ± 20	50 ± 23	51 ± 30	58 ± 32	61 ± 19

*Figures in brackets refer to number of subjects assessed at these times.

TABLE III

Improvement in Hamilton depression scores, showing separation of effects of delusions and retardation

Clinical state	Real or simulated ECT	No. of cases	Improvement scores as a percentage of initial score: mean and SD					
			Wk 1	Wk 2	Wk 3	Wk 4	+ 1 month*	+ 6 months*
Not deluded, not retarded	Real	13	38.0±25.4	50.6±25.9	53.2±25.5	57.3±27.6	56.3±24.9 (*n*=13)	59.2±20.8 (*n*=12)
	Simulated	12	28.9±16.9	42.8±18.6	48.2±22.8	46.1±30.2	53.2±38.4 (*n*=10)	64.3±20.2 (*n*=11)
Deluded, not retarded	Real	5	16.2±15.5	57.7±16.5	82.5±14.7	89.7± 6.9	68.4±35 (*n*=5)	70.7±28.5 (*n*=5)
	Simulated	7	16 ±35.1	42.4±17.2	41.5±32.8	56.2±27.5	54.9±18.5 (*n*=6)	85.9± 8.2 (*n*=6)
Retarded, not deluded	Real	7	33.1±19.6	68.9±23.3	73.5±19.2	86 ±13.6	66.3±25.4 (*n*=6)	75.9±13.4 (*n*=7)
	Simulated	8	31.2±22.8	46.0±24.9	56.7±24.4	62 ±28	68.9±19.2 (*n*=7)	58.7±14.4 (*n*=6)

*Figures in brackets refer to the number of subjects assessed at these times.

c. Newcastle criteria (Carney *et al,* 1965) for endogenous depressive illness and responsiveness to ECT.

2. Totals and components of initial and subsequent Hamilton scores (Hamilton, 1967).
3. Data from the PSE (Wing *et al,* 1974) obtained before ECT.
4. Life events scores (Paykel *et al,* 1969) before and after treatment.
5. Details of previous depressive and manic episodes and their treatment.
6. Duration of present episode, and treatment already given.
7. Family history of affective and other psychiatric illness.

Previous history

We found that the tendency for real ECT to produce a better response than simulated ECT was more marked in patients with a previous history of mania, a previous history of ECT, and fewer life events in the last six months. None of these observed trends reached statistical significance.

Items of the Hamilton scale

The individual items of the initial Hamilton scores were used in a variety of calculations designed to find predictors of response.

Firstly: the scores of the first seventeen items were graded as either *mild/severe* or *mild/moderate/severe,* the grading being determined by allocating approximately equal numbers of subjects to each grade. This grading was then examined in relation to the real/simulated improvement differential. A positive gradient in differential was associated with increasing severity for nine items and decreasing severity for six items. The size of the differential ranged from 1.0 to 20.2 and the most marked differentials in favour of real ECT related to *more severe* depression, guilt and middle insomnia and to *less severe* impairment of work and interests.

Secondly: factors 1 and 2, derived by Hamilton from the use of his scale (Hamilton & White, 1959; Hamilton, 1967), can be applied to samples of severely depressed patients. Factor 1 corresponds to severity of depression and factor 2 is a measure of retardation – agitation, agitation having positive scores and retardation negative. We took the following items as components of factor 1:

1. Depressed mood
2. Guilt
3. Suicide
6. Delayed insomnia
7. Impairment of work and interests
8. Retardation

and the following as components of factor 2:

4. Initial insomnia
5. Middle insomnia
9. Agitation
10. Psychic anxiety
11. Somatic anxiety
12. Gastro-intestinal symptoms
15. Hypochondriasis

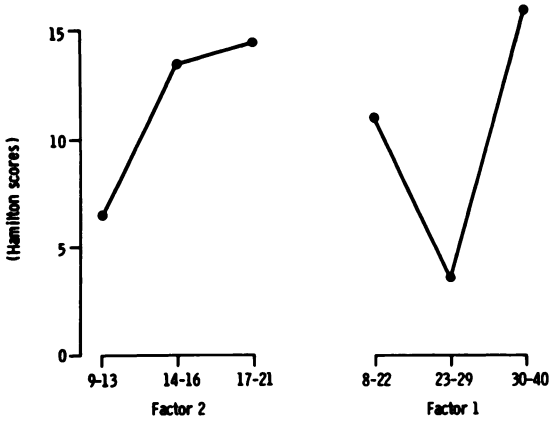

FIG 2.—Mean improvement on real ECT minus mean on simulated ECT, graphed against scores on factor 2 (retardation – agitation) and factor 1 (severity of depression) derived from the Hamilton scale.

We omitted items 14 (loss of libido) and 17 (loss of insight) because although they were always rated their assessment was considered difficult and and uncertain.

There was no interaction in this sample between factor 1 and factor 2. Scores on these factors were placed in three grades and plotted against the difference between real and simulated improvement scores (Fig. 2). A plausible gradient was found for factor 2 but not for factor 1.

In the above analyses we tried to identify characteristics associated with good response to real rather than simulated ECT. Next we looked for items of the Hamilton scale which predicted recovery with *simulated* ECT.

Patients given simulated ECT were divided into three groups according to their improvement scores, and initial scores on individual items of the Hamilton scale were considered in terms of their association with a poor, medium or good response to simulated ECT. Eleven of the seventeen items showed a monotonic gradient: these are illustrated in Fig. 3. The gradient was positive for nine items, and greatest for items 3 (suicide) and 7 (work and interests). Two items—'somatic anxiety' and 'loss of weight'—showed a monotonic negative gradient. The same relationship was also examined by discriminant function analysis. Significant associations were found for 'impairment of work and interests' and for retardation (both $P<0.05$), while 'loss of insight' just missed significance.

Existing predictive scales

A major problem with the approaches described above is that in any study of treatment where outcome has been variable many factors will be associated by chance alone with good and poor outcome. With only one set of data there is no means of verifying the validity of a finding.

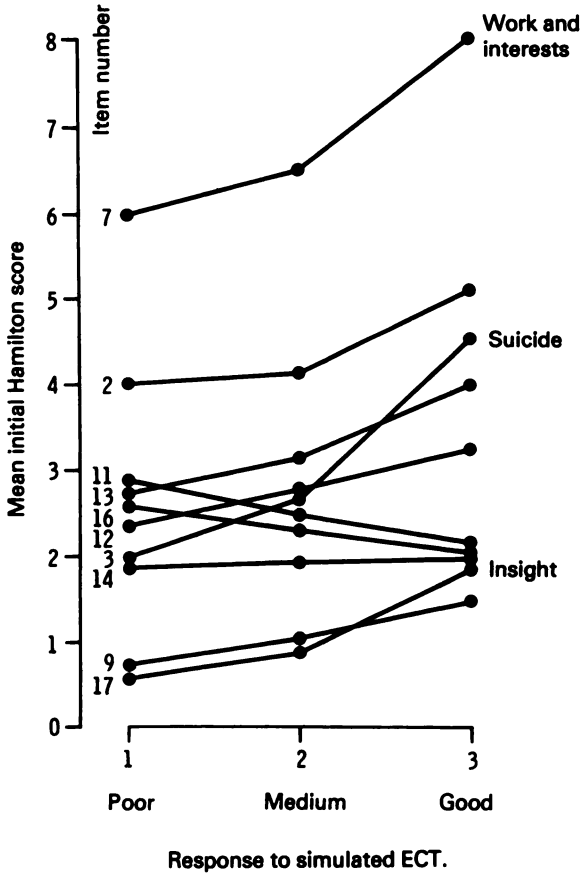

FIG 3.—Response to simulated ECT graphed against mean initial score for individual items of the Hamilton (1967) scale.

An alternative approach is to attempt to test hypotheses. Accordingly, we considered scales which in the past have been held to predict the probability of satisfactory response to ECT. Our choice of scales was restricted to those that could be completed from the information available. Those we looked at are shown in Table IV. The Newcastle scales (Carney *et al*, 1965) had been completed as part of the entry criteria, but the other scales were scored retrospectively. To make the ratings as objective as possible, arbitrary but consistent rules were adopted (copies available from the authors) and the ratings were completed blindly with regard to treatment allocation and clinical scores.

https://doi.org/10.1192/bjp.144.3.227 Published online by Cambridge University Press

TABLE IV

Scales generally used to predict response to ECT

Scale	Sample used to derive scale	Direction of scale and cut-off point in original sample	Score of present sample (mean±SD)
Hobson (1953)	127 patients treated with ECT at Maudsley Hospital	Lower score ⇒ better response to ECT 7.5 ⇒ good response to ECT	4.6±1.8
Roberts (1959)	50 female depressives treated with ECT in Leeds	Lower score ⇒ better response to ECT 5.5 ⇒ good response to ECT	4.3±1.6
Carney *et al.* (1965) *Neurotic/endogenous*	129 depressed in-patients treated with ECT in Newcastle	Higher score (≥6) ⇒ endogenous illness Lower score ⇒ neurotic illness	7.4±1.5
Carney *et al.* (1965) *Suitability for ECT*	129 depressed in-patients treated with ECT in Newcastle	Higher score ⇒ suitable for ECT +1 ⇒ probable good response to ECT	3.8±1.9
Mendels (1967)	100 patients referred for ECT in South Africa	Lower score ⇒ better response to ECT 6.99 ⇒ 80% probability of response 4 ⇒ 100% response	4.06±2.0
Kendell (1968)	476 patients receiving ECT out of 1080 patients classified as ICD 301, 302, 314 (Institute of Psychiatry)	Higher score ⇒ more endogenous ⇒ more likely to respond to ECT M–D depressed (ICD 301) 9.5 melancholic (ICD 302) 9.7 neurotic depression (ICD 314) −1.9	15.2±10.9
Hamilton (1974)	Two samples of about 30 depressed women treated with ECT	Higher score ⇒ better response to ECT Cut-off point not given*	21.5±6.7

* Score contained clinical items only: additional items not described in enough detail for replication.

The scores we obtained (Table IV) indicate that our method of sample selection yielded a population very much within the endogenous range and with a good likelihood of response to ECT on every scale.

Scores on each of these scales were then checked for correlation with improvements in the Hamilton rating scale for patients on real and simulated ECT. As Table V shows, the difference in the correlation between real and simulated groups varied between the scales and indeed the direction of the difference varied. Some scales, and the Kendell (1968) is the best example of this, are indicating response to ECT and others, of which the Hamilton predictive scale is the best example, indicate non-specific response.

Discriminant function analysis was then conducted on the individual items of the Kendell and Hamilton predictive scales with a view to determining which elements contributed to the association of the score with improvement after both real and simulated ECT. The Hamilton predictive scale (Hamilton, 1974) was derived from the items of the Hamilton (1967) score. The present calculation was performed using the complete (Hamilton, 1967) score, to determine which elements in Hamilton's (1974) analysis predicted

TABLE V

Correlations between improvement in Hamilton score and improvement predicted by various predictive scales

Scale	Real or simulated ECT	Correlation coefficient	Probability
Kendell	Real	−0.38	P<0.03
	Simulated	−0.08	P>0.5
Hobson	Real	0.41	P<0.02
	Simulated	0.21	P<0.25
Roberts	Real	0.37	P<0.04
	Simulated	0.28	P<0.12
Carney *(neurotic/endogenous)*	Real	−0.25	P<0.17
	Simulated	0.01	P<0.5
Carney *(ECT suitability)*	Real	−0.24	P<0.19
	Simulated	0.03	P>0.5
Mendels	Real	0.15	P>0.5
	Simulated	0.24	P<0.19
Hamilton *(all cases)*	Real	0.05	P>0.5
	Simulated	−0.29	P<0.11
Hamilton *(females only)*	Real	0.13	P>0.5
	Simulated	−0.44	P<0.033

TABLE VI

Items of Kendell and Hamilton scales associated most closely with improvement after real or simulated ECT, ranked in order of significance in the present study. The sign of the 1st discriminant is derived from our discriminant function analysis

Real or simulated ECT	Rank order	Kendell scale: descriptions, numbers and weights from Kendell (1968)	Hamilton scale: descriptions and numbers from Hamilton (1967) (*Entries in italics: females only*)
Real	1	Abnormal quantity of speech No. 45 Weight +5 1st discriminant +	Suicide 3 1st discriminant — *Suicide 3* *1st discriminant +*
	2	Important precipitating psychological cause No. 25 Weight −5 1st discriminant +	Retardation 8 1st discriminant + *Loss of insight 17* *1st discriminant —*
	3	Abnormal rate of speech No. 46 Weight +5 1st discriminant +	Hypochondriasis 15 1st discriminant + *Middle insomnia 5* *1st discriminant +*
Simulated	1	Obsessional fears and thoughts No. 48 Weight +1 1st discriminant +	Work and interests 7 1st discriminant + *Somatic anxiety 11* *1st discriminant −*
	2	Parent with affective psychosis No. 1 Weight +3 1st discriminant +	Retardation 8 1st discriminant + *Psychic anxiety 10* *1st discriminant +*
	3	Persecutory delusions No. 53 Weight + 4 1st discriminant −	Loss of insight 17 1st discriminant + *Remaining variables failed to meet preset entry criteria*

improvement in this sample. The calculation was performed for the entire sample and also for females separately, as Hamilton used only women. The results are shown in Table VI.

For both real and simulated ECT we divided the patients into three nearly equal-sized groups on the basis of their improvement in Hamilton (1967) score. Discriminant analysis was performed on each component of the Hamilton (1974) and Kendell (1968) scales in a step-wise fashion, choosing first those components which gave greatest separation of the three groups. We chose three groups again so that we could make an assessment of the validity of the results, independent of the tests of significance, by seeking plausible clinical gradients. Thus in Table VI the first component of the Kendell score is 'abnormal quantity of speech' which was more prevalent among patients on real ECT who did moderately well than in those whose response was poor: it was more prevalent still among patients who did well. In the end, because the numbers were small, it is difficult to interpret the results of this analysis. Nonetheless, within the intrinsic limitations of a small data set, this method of analysis can point to possible predictors of response to treatment.

There is some common ground between the factors found in this study and the weights derived by Kendell (1968) (see Table VI) but this is not substantial. For example, 'important psychological cause' is a negative predictor in the Kendell Scale and a positive predictor in this study. Whether or not any circumstance is an important psychological cause of a psychiatric disorder is a question that involves subjective judgement on the part of the rater, and it may be difficult to separate cause from effect. Such problems may underlie the discrepancy between the findings of the present study and those of Kendell.

The factors for response to *simulated* ECT derived from the Hamilton (1967) scale have rather more in

https://doi.org/10.1192/bjp.144.3.227 Published online by Cambridge University Press

TABLE VII

Percentages of patients correctly predicted by discriminant function analysis to improve after real or simulated ECT

Group of patients used for discriminant function	Kendell		Hamilton	
	Simulated	Real	Simulated	Real
Patients on simulated treatment	81% P<0.001	35% n.s.	58% P<0.01	35% n.s.
Patients on real ECT	16% n.s.	74% P<0.001	35% n.s.	71% P<0.05

common with the Hamilton (1974) predictive scale (two out of three in the total and one out of two in the females) than have those for response to *real* ECT (one of three in both females and total) (Table VI) and this would be expected in view of the nature of the association between score on this scale and improvement (Table V).

The Hamilton (1967) improvement scores in three grades were then plotted against three grades of scores derived from the discriminant functions using both Kendell and Hamilton predictive scores. Numbers of patients were allocated to each of the nine cells generated, for simulated and real ECT separately. As would be expected, the predictive scores derived from the discriminant function relate closely and significantly to the improvement scores of their own treatment group; but this relation does not hold for the alternative group (Table VII). This finding confirms the conclusion of the analyses shown in Table VI, that the predictors of response to real and simulated ECT are not the same.

Discussion

The first question to arise out of these analyses is whether or not the findings of the Northwick Park ECT trial (Johnstone *et al,* 1980) can be generalised. A number of authors have been disappointed by the relatively small (although significant) difference in efficacy between real and simulated ECT, and have suggested that this is due either to inadequate convulsive stimulus or to inappropriate selection of cases. We have already presented evidence that the convulsive stimulus was adequate (Johnstone *et al,* 1980; Johnstone *et al,* 1982). From the results of this study it is clear that there is one respect in which the selection of cases could have been more appropriate: if the study had been confined to deluded patients the real/simulated ECT difference would have been substantially increased. However, the criterion of delusions is probably the only one on which any real reliance could be placed; we have identified no other clinical feature by which an ECT-responsive group of patients could have been selected.

It has been suggested that patients were included in this trial who would not normally have received ECT (Kendell, 1981): it is implied that their illnesses were not sufficiently endogenous. These patients did of course fulfil a number of criteria for endogenous depression and would have been predicted as responsive to ECT by previously recommended predictive scales (Table IV), but there is in fact no evidence from the present analysis that endogenous features are associated with response to real rather than simulated ECT. The basis for this criticism of our selection criteria is that only 21 per cent of our trial patients had previously had ECT, in contrast to the 55 per cent in the ECT trial of Freeman *et al,* (1978), 59 per cent in the trial of West (1981) and the 66 per cent in the trial of Lambourn *et al,* (1978). Prior use of ECT can hardly be used as an indicator for its repeated use, but it is presumably implied that the previous history of our sample suggests that they were in some sense less depressed than the samples in those other trials. We have two points to make in response to this argument.

Firstly, our initial description of patient selection (Johnstone *et al,* 1980) is over-concise and it is not made entirely clear that the 109 depressed patients from whom the 70 patients were selected consisted only of those aged 30–69 years who had had no ECT in the previous 6 months. These exclusions are stricter than those in the trials of Freeman *et al,* (1978), Lambourn and Gill (1978) and West (1981). During the 3½ years in which the trial was in progress, 15 courses of ECT were given to thirteen depressed patients who had had ECT in the past 6 months; 9 courses to three depressed patients aged over 70 years, all of whom had previously had ECT; and 3 courses to three depressed patients aged under 30 years, two of whom had previously had ECT. When these patients are considered with the 70 trial cases we find that 37 per cent of patients given ECT had received it before. The clinical features of the excluded patients were not different from those of the trial patients.

A more telling point arises from the present analysis. Of the 22 deluded patients who fulfilled the most relevant criterion for suitability for ECT, in that they

appeared to show a specific response to the real form of treatment, 27 per cent had previously had ECT—a proportion which remains substantially below that in the trials of Freeman *et al,* (1978), Lambourn and Gill (1978) and West (1981). We suggest that the relatively low percentage of our trial patients who had previously received ECT reflects not their inappropriateness for this treatment but the fact that the usage of ECT in the North-West Thames region where Northwick Park is situated is the second lowest in Britain (Pippard & Ellam, 1981).

The second major question addressed in this study is whether or not ECT-responsive patients can be identified within the population of severely depressed patients. Extensive examination of this data did not show clear-cut predictors of response to real *or* simulated ECT, but this was not unexpected in view of the relatively small sample-size. As a result of this analysis we are however in a position to make a number of statements about response to real and simulated ECT.

Firstly; we found little support for our previous suggestion (Crow & Johnstone, 1979) that the predictors of response to ECT are merely the predictors of satisfactory response to treatment or even a generalised tendency to satisfactory outcome. If this were so the predictors of response to real and simulated ECT would be the same. While the results are not clear-cut and contain some contradictions, it appears that the predictors for the two treatments differ.

Secondly; the analysis does not support the view that a predominance of endogenous features is a specific predictor of a response to real ECT. Of course, the sample was selected on the basis of conformity to the endogenous stereotype, and endogenous depressive features are prominent among the various ratings and scales used in the analysis. However, these scales also contain neurotic elements, and there is no evidence that the endogenous elements are better than the neurotic in predicting response to real as compared to simulated ECT.

The most salient predictor of response to real ECT is probably the presence of delusions (see Tables II and III and Fig 1). Retardation may be relevant but it may also be associated with response to simulated ECT. Indeed, the significance of the original results (Johnstone *et al,* 1980), which show that real ECT is a more effective antidepressant than simulated ECT, depends very largely on the presence of 22 patients with delusions. Ten of these received real ECT and twelve the simulated treatment. For deluded patients the real/simulated differential in improvement was significant ($P<0.05$); for the non-deluded it was not.

The implications for psychiatric practice of the Northwick Park trial may be considered from more than one point of view. It could be argued that since no evidence was found that the treatment caused persisting defects of memory (Johnstone *et al,* 1980; Frith *et al,* 1982) and since it is of significant benefit to some severely depressed patients (Johnstone *et al,* 1980), the treatment could be tried on all such patients: it might help and there would be no reason to think that it would harm them. However, ECT is a treatment about which many people have serious disquiet (Kendell, 1981), and the proposed changes in the Mental Health Act are likely to place its use in the United Kingdom under closer scrutiny. Psychiatrists will be required increasingly to justify their practice by scientific evidence. This analysis provides evidence on which to base the selection of deluded patients from the population of severely depressed in-patients, as being specifically responsive to ECT.

To differentiate depressed patients into deluded and non-deluded is not particularly fashionable, although the relationship between the outcome of depressive illness and the presence of delusions was first examined more than 60 years ago (e.g. Hoch & MacCurdy, 1922). It was studied before the introduction of ECT (Strecker *et al,* 1931; Lewis 1934, 1936; Anderson, 1936) and after (Huston and Locher, 1948; Jarvie and Glas, 1950), and after the introduction of the antidepressants (Friedman *et al,* 1961; Angst, 1961; Hordern *et al,* 1963). Many early studies are not easy to interpret because the standards of diagnosis and methodology of the time were different from those which are current now. However, some of these data were re-examined by Kantor and Glassman (1977). They concluded that before the introduction of specific therapies most severely depressed patients recovered, and those who did not were deluded; but after ECT was introduced both deluded and non-deluded patients appeared to improve.

In recent years a number of workers have suggested that delusional and non-delusional depressive illnesses are distinct clinical entities (e.g. Nelson & Bowers, 1978; Charney & Nelson, 1981; Glassman & Roose, 1981). This opinion is based largely upon increasing evidence that delusional depressives are less responsive than non-delusional depressives to tricyclic antidepressants (Glassman *et al,* 1975; Avery & Lubrano, 1979). Such findings suggest that deluded depressed patients should be treated with ECT because they are less likely to respond to antidepressants. The present analysis, by indicating that deluded patients show a particularly good response to the passage of electricity and the resulting convulsion, offers further, positive, grounds for recommending ECT as appropriate treatment for delusional depression.

In addition to these clinical considerations, our results support the view that for research purposes depressed patients should be divided into deluded and non-deluded. Much research endeavour is based upon the idea that the mode of action of therapeutic agents may provide clues to the underlying neurochemical dysfunction. Evidence that there are two types of depressive illness, which respond differently to the two main methods of treatment of depressive illness, suggest the possibility that the neurochemical disturbance in the two types may not be the same.

Acknowledgements

The study on which this analysis is based was conducted under the auspices of the Ethical Committee of Northwick Park Hospital and was carried out according to its rules.

References

ANDERSON, E. W. (1936) Prognosis of the depressions of later life. *Journal of Mental Science*, **82**, 559–88.

ANGST, J. (1961) A clinical analysis of the effects of Tofranil in depression. *Psychopharmacologia*, **2**, 381–407.

APA (1978) *Electroconvulsive Therapy: Task Force Report 14*. Washington D.C.: American Psychiatric Association.

AVERY, D. & LUBRANO, A. (1979) Depression treated with imipramine and ECT: the De Carolis study reconsidered. *American Journal of Psychiatry*, **136**, 559–62.

CARNEY, M. W. P., ROTH, M. & GARSIDE, R. F. (1965) The diagnosis of depression syndromes and the prediction of ECT response. *British Journal of Psychiatry*, **111**, 659–74.

CHARNEY, D. S. & NELSON, J. C. (1981) Delusional and non-delusional unipolar depression: further evidence for distinct subtypes. *American Journal of Psychiatry*, **138**, 328–333.

CROW, T. J. & JOHNSTONE, E. C. (1979) Electroconvulsive therapy—efficacy, mechanism of action and adverse effects. In *Psychopharmacology of Affective Disorders*, eds E. S. Paykel & A. Coppen. Oxford: Oxford University Press.

FEIGHNER, J. P., ROBINS, E., GUZE, S. B., WOODRUFF, A., WINOKUR, G. & MUNOZ, R. (1972) Diagnostic criteria for use in psychiatric research. *Archives of General Psychiatry*, **26**, 57–63.

FREEMAN, C. P. L., BASSON, J. V. & CRICHTON, A. (1978) Double-blind controlled trial of electroconvulsive therapy (ECT) and simulated ECT in depressive illness. *Lancet, i*, 738–40.

FRIEDBERG, J. (1977) Shock treatment, brain damage and memory loss: a neurological perspective. *American Journal of Psychiatry*, **134**, 1010–14.

FRIEDMAN, C., DE MOWBRAY, M. S. & HAMILTON, V. (1961) Imipramine (Tofranil) in depressive states. *Journal of Mental Science*, **107**, 948–53.

FRITH, C. D., STEVENS, M., JOHNSTONE, E. C., DEAKIN, J. F. W., LAWLER, P. & CROW, T. J. (1982) The effects of ECT and depression on various aspects of memory. *British Journal of Psychiatry*, **142**, 610–17.

GLASSMAN, A. H., KANTOR, S. J. & SHOSTAK, M. (1975) Depression, delusions and drug response. *American Journal of Psychiatry*, **132**, 716–19.

—— & ROOSE, S. P. (1981) Delusional depression. A distinct clinical entity? *Archives of General Psychiatry*, **38**, 424–7.

GREENBLATT, M., GROSSER, G. H. & WECHSLER, H. (1964) Differential response of hospitalised depressed patients to somatic therapy. *American Journal of Psychiatry*, **120**, 935–43.

HAMILTON, M. (1967) Development of a rating scale for primary depressive illness. *British Journal of Social and Clinical Psychology*, **6**, 278–96.

—— (1974) Prediction of response to ECT in depressive illness. In *Classification and Prediction of Outcome of Depression*, ed. J. Angst. Stuttgart: Schlattauer Verlag.

—— & WHITE, J. M. (1959) Clinical syndromes in depressive states. *Journal of Mental Science*, **105**, 985–98.

HERRINGTON, R. N., BRUCE, A., JOHNSTONE, E. C. & LADER, M. H. (1974) Comparative trial of L-tryptophan and ECT in severe depressive illness. *Lancet*, **ii**, 731–4.

HOBSON, R. F. (1953) Prognostic factors in electroconvulsive therapy. *Journal of Neurology, Neurosurgery and Psychiatry*, **16**, 275–81.

HOCH, A. & MACCURDY, J. T. (1922) The prognosis of involution melancholia. *Archives of Neurology and Psychiatry*, **7**, 1–17.

HORDERN, A., HOLT, N. F., BURT, C. G. & GORDON, W. F. (1963) Amitriptyline in depressive states. Phenomenology and prognostic considerations. *British Journal of Psychiatry*, **109**, 815–25.

HUSTON, P. E. & LOCHER, L. M. (1948) Manic–depressive psychosis. *Archives of Neurology and Psychiatry*, **60**, 37–48.

JARVIE, H. F. & GLAS, M. B. (1950) On atypicality and the depressive state. *Journal of Mental Science*, **96**, 208–25.

JOHNSTONE, E. C., DEAKIN, J. F. W., LAWLER, P., FRITH, C. D., STEVENS, M., MCPHERSON, K. & CROW, T. J. (1980) The Northwick Park ECT Trial. *Lancet*, **ii**, 1317–20.

JOHNSTONE, E. C., DEAKIN, J. F. W., LAWLER, P., FRITH, C. D., STEVENS, M., MCPHERSON, K. & CROW, T. J. (1982) Benzodiazepines and the effectiveness of ECT. *British Journal of Psychiatry*, **141**, 314–15.

KANTOR, S. J. & GLASSMAN, A. H. (1977) Delusional depressions: natural history and response to treatment. *British Journal of Psychiatry*, **131**, 351–60.

KENDELL, R. E. (1968) *The Classification of Depressive Illnesses*. London: Oxford University Press.

—— (1981) The present status of electroconvulsive therapy. *British Journal of Psychiatry*, **139**, 265–83.

LAMBOURN, J. & GILL, D. (1978) A controlled comparison of simulated and real ECT. *British Journal of Psychiatry*, **133**, 514–19.

LEWIS, A. J. (1934) Melancholia: clinical survey of depressed states. *Journal of Mental Science*, **80**, 277–378.

—— (1936) Melancholia: prognostic study and case material. *Journal of Mental Science*, **82**, 488–558.

MEDICAL RESEARCH COUNCIL (1965) Report by Clinical Psychiatry Committee—Clinical trial of the treatment of depressive illness. *British Medical Journal*, **1**, 881–6.

MENDELS, J. (1967) The prediction of response to electroconvulsive therapy. *American Journal of Psychiatry*, **124**, 153–9.

MORRISSEY, J. P., BURTON, N. M. & STEADMAN, H. J. (1979) Developing an empirical base for psycho-legal policy analyses of ECT: a New York state survey. *International Journal of Law and Psychiatry*, **2**, 99–111.

NELDER, J. (1975) *Generalised Linear Models*. Oxford: Numerical Logarithms Group.

NELSON, J. C. & BOWERS, M. B. (1978) Delusional unipolar depression: description and drug response. *Archives of General Psychiatry*, **35**, 1321–8.

PAYKEL, E. S., MYERS, L. K., DIENELT, M. N., KLERMAN, G. L., LINDENTHAL, L. J. & PEPPER, M. P. (1969) Life events and depression. *Archives of General Psychiatry*, **21**, 752–60.

PIPPARD, J. & ELLAM, L. (1981) *Electroconvulsive Treatment in Great Britain, 1980. A Report to the Royal College of Psychiatrists*. London: Gaskell (Royal College of Psychiatrists).

ROBERTS, J. M. (1959) Prognostic factors in the electroshock treatment of depressive states. I—Clinical features from history and examination. *Journal of Mental Science*, **105**, 693–702.

STRECKER, E. A., APPEL, K. E., EYMAN, E. V. *et al.* (1931) The prognosis in manic-depressive psychosis. *Association for Research in Nervous and Mental Disease, (Royal Society of Medicine)*, **11**, 471–537.

WEST, E. (1981) Electric convulsion therapy in depression: a double-blind controlled trial. *British Medical Journal*, **282**, 355–7.

WING, J. K., COOPER, J. E. & SARTORIUS, N. (1974) *The Description and Classification of Psychiatric Symptoms: an Instruction Manual for the PSE and Catego Systems*. Cambridge: Cambridge University Press.

Clinical assessments and care

T. J. Crow, Ph.D., F.R.C.P., F.R.C.Psych., D.P.M., *Head of Division and Honorary Consultant Psychiatrist*

J. F. W. Deakin, Ph.D., M.R.C.Psych., *Member of Scientific Staff and Honorary Senior Registrar*

Eve C. Johnstone, M.D., M.R.C.P., M.R.C.Psych., D.P.M., *Member of Scientific Staff and Honorary Consultant Psychiatrist*

J. Fiona Macmillan, M.B., B.S., B.Sc., M.R.C.Psych., *Member of Scientific Staff and Honorary Senior Registrar*

D. G. C. Owens, M.B., M.R.C.P., M.R.C.Psych., *Member of Scientific Staff and Honorary Consultant Psychiatrist*

Division of Psychiatry, Northwick Park Hospital and Clinical Research Centre, Watford Road, Harrow, Middlesex HA1 3UJ

P. Lawler, M.R.C.P., F.F.A., R.C.S., *Consultant Anaesthetist, South Cleveland Hospital, Middlesborough; formerly Member of Scientific Staff and Honorary Senior Registrar, Division of Anaesthesia, Northwick Park Clinical Research Centre*

Psychological assessments

C. D. Frith, M.A., Dip.Psych., Ph.D., *Member of Scientific Staff*

Marilyn Stevens, B.A., *Research Officer*

Statistics

K. McPherson, M.A., Ph.D., *University Lecturer in Medical Statistics, University of Oxford*

(Received 24 September 1982; revised 31 March 1983)