

EVALUATION OF COGNITIVE EFFECTS OF ECT (PRELIMINARY OBSERVATIONS)

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SUMMARY

The aim of present double blind controlled study is to evaluate the effects of ECT in Schizophrenia and Depression. 20 depressed and 20 schizophrenic patients of either sex, in the age group 18 to 65 years fulfilling the inclusion and exclusion criteria were taken for study. The psychiatric evaluations were carried out before the treatment, and at the end of 3, 6, 8 and 10 treatments. Cognitive test battery was administered before the treatment and 48 hours after the last treatment. No Post ECT cognitive deficit was observed on the test battery though some patients did complain of forgetfulness subjectively.

Electroconvulsive therapy has become controversial in recent times and is used less frequently in western countries. Post-ECT memory deficiency is one of the important reasons for non-acceptance of ECT. But in India and other developing countries ECT is used commonly because of rapid improvement and more economical. It is used quite commonly to treat depression and schizophrenia, as well as mania. A double blind controlled study has been conducted to re-evaluate the effects of ECT in schizophrenia and depression. The present report on cognitive side effects of ECT is a part of this ongoing project.

MATERIAL AND METHOD

Depressed and schizophrenic patients of either sex, in the age group 18 to 65 years from our psychiatric O.P.D. at the K.E.M. Hospital, Bombay were taken up for study. A detailed psychiatric history, mental status and physical examination were carried out and recorded in a pro-forma devised for the purpose. Only

those patients in whom diagnosis was agreed upon by two consultant psychiatrists through independent evaluations and those who fulfilled the inclusion criteria were taken up for study.

The inclusion criteria for depression were (i) clear primary depression of non-organic cause, (ii) a score of at least 16 on Hamilton's Rating Scale for Depression (consisting of 17 items) and (iii) a score of at least 12 points on Beck's Self Inventory for depression (short-form).

The inclusion criteria for schizophrenia were (i) An illness of at least one month's duration, (ii) Presence of delusions, hallucinations or irrelevant verbal production with clear consciousness and (iii) Absence of depressive or manic symptoms sufficient to qualify for schizoaffective or affective illness.

The exclusion criteria were treatment within previous three weeks with anti-depressant and antipsychotic drugs, within previous eight weeks with ECT or Insulin

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therapy, organic brain syndrome, convulsive disorder, and any physical illness.

A double blind randomized technique was used in two parallel groups of patients. The depressed patients were assigned either to group A which received ECT and placebo or group B which received simulated ECT and imipramine as treatment. The schizophrenic patients were assigned to group A which received ECT and placebo or group B which received simulated ECT-chlorpromazine treatment.

To administer ECT each patient was anaesthetized with (i) Atropine 0.6 mg. i.v. (ii) Thiopentone 250 mg. i.v. and (iii) Succinylcholine 50 mg. i.v. Convulsion was induced by an electrical stimulus of 110 volts A.C. for approximately 0.5 sec. using bilateral bitemporal electrode placement. Patients were supported by artificial ventilation and oxygenation before and after electric stimulus. Exactly same procedure was used for simulated ECT except that no electrical stimulus was given. Three treatments, ECT or simulated ECT were given in the first week and two per week thereafter. The consultant psychiatrist who was blind to the mode of treatment evaluated the patients and advised on the number of treatments to be given.

The drugs used were imipramine 25 mg. tablet for depression, chlorpromazine 100 mg. tablet for schizophrenia and calcium lactate 300 mg. tablet as placebo. The initial dose of 3 tablets per day was gradually increased to 6 tablets per day at the end of one week. Thereafter the dose was maintained, increased or decreased after evaluations by the consultant psychiatrist who was blind to the mode of treatment. Chloral hydrate as a hypnotic

and chlordiazepoxide to control anxiety/agitation in depressed patients were used whenever required.

Following psychiatric evaluations were carried out before the treatment and at the end of 3, 6, 8 and 10 treatments— (1) Hamilton's Rating Scale and Beck's Self Inventory for Depression, (2) Brief Psychiatric Rating Scale for Schizophrenia, (3) Clinical Global Assessment and (4) Clinical and subjective evaluations of side effects.

The Cognitive Test Battery was administered before the treatment and 48 hours after last treatment. It consisted of Koh's Block, Recognition and B.G. tests for the nondominant hemispheric functions and Arithmetic, Immediate memory (digits), Sentence Repetition, Remote memory and recent memory tests for the dominant hemispheric functions.

SAMPLE

Thirty-five depressed and thirty-three schizophrenic patients were initially included in the study. Fifteen depressed patients and thirteen schizophrenic patients were excluded for following reasons—irregular attendance, non-compliance in taking drugs in adequate dose and discontinuation of treatment. The drop out rate was similar both in ECT and simulated ECT groups. The data from 20 depressed (10 in ECT and Placebo group and 10 in simulated ECT and Imipramine group) and 20 schizophrenic (12 in ECT and placebo group and 8 in simulated ECT and Chlorpromazine group) patients who completed the entire study form the basis of this paper.

RESULTS

Demographic variables

The number of female patients was more in Depression (ECT-placebo) group. There was no significant difference in the groups with regard to age, marital status,

The standard RDC (Research Diagnostic Criteria) recommend at least six months duration. As about 50% of the Schizophrenic patients attending our clinic are ill for less than six months, this criteria was modified to make the study sample more representative of the clinic population.

education, per capita income, duration of episode, total number of episodes and total duration of illness.

ECT Variables

One depressed patient was administered 8 ECT's. Rest of the depressed patients were administered 6 ECT's or simulated ECT. 6 schizophrenics were administered 6 ECT's and 3 each were administered 8 and 10 ECT's. 3 schizophrenics were administered 6 simulated ECT's, 3 received 8 simulated ECT's and 2 received 10 simulated ECT's.

Drug Variables

All the depressed patients on simulated ECT received up to 150 mg. of imipramine per day. 2 patients on ECT and 4 patients on simulated ECT required chlordiazepoxide (20-40 mg/day) to control their anxiety or agitation. One schizophrenic patient on simulated ECT was advised 900 mg. of chlorpromazine per day. All other patients received up to 600 mg. of chlorpromazine per day.

Effects on Cognitive Functions

Cognitive side effects of ECT and simulated ECT are presented in terms of mean percent change in the pretreatment and post-treatment scores on each of the 8 tests of the cognitive battery in the four groups, i.e. (1) Depressed patients receiving ECT and placebo. (2) Depressed patients receiving simulated ECT and imipramine, (3) Schizophrenic patients receiving ECT and placebo and (4) Schizophrenic patients receiving simulated ECT and chlorpromazine.

Depression : ECT and Placebo Group (Table 1)

There is improvement in the post-treatment score on all the tests of cognitive battery except arithmetic test (Reduced score on B.G. test denotes improvement). The improvement in the Koh's Block Design test is significant ($p < 0.01$).

TABLE No. 1—*Depression—ECT and Placebo Group*

	N	Mean		t value
		Percent Change	S.D.	
A. Koh's Block Design Test ..	9	52.22	50.39	2.93*
B. Picture Recognition test ..	10	1.8	11.12	0.48
C. B.G. Test ..	9	-4.67	39.04	0.03
D. Arithmetic Test	10	-2.2	14.79	0.04
E. Immediate memory	10	6.2	16.48	1.13
F. Sentence Repetition Test ..	10	29	61.06	1.42
G. Remote memory	10	0	0	0
H. Recent memory	10	5.3	11.58	1.37

* $p < 0.01$.

Depression : Simulated ECT and Imipramine Group (Table 2)

There is improvement in the post-treatment scores on all the tests of cognitive battery except Arithmetic test. Both the improvement in the Koh's Block Design test and the deterioration in the arithmetic test are significant ($p < 0.05$).

TABLE No. 2—*Depression—Simulated ECT and Imipramine Group*

	N	Mean		t value
		Percent change	S.D.	
A. Koh's Block Design Test ..	10	44.08	48.43	2.77*
B. Picture Recognition Test ..	10	6.9	22.58	0.92
C. B.G. Test ..	10	-7.8	19.13	1.22
D. Arithmetic Test	10	-10.3	11.36	7.72*
E. Immediate memory	10	0.2	10.77	0.05
F. Sentence Repetition Test ..	10	4.2	14.59	0.86
G. Remote memory	10	5.8	13.37	1.41
H. Recent Memory	10	0	0	0

* $p < 0.05$.

Schizophrenia : ECT and Placebo Group (Table 3)

There is improvement in the post-treatment scores on all the tests of cognitive battery except sentence repetition test. The improvement in Koh's Block Design test is significant ($p < 0.05$).

TABLE No. 3—Schizophrenia—ECT and Placebo group

	N	Mean Percent change	S.D.	t value
A. Koh's Block Design Test ..	10	38.5	33.2	3.47*
B. Picture Recognition Test ..	10	66.2	123.06	1.61
C. B.G. Test ..	11	-7.91	24.60	1.06
D. Arithmetic Test	12	11.17	18.00	2.06
E. Immediate memory	12	10.33	18.83	-1.82
F. Sentence Repetition Test ..	10	-0.9	28.92	0.09
G. Remote memory	11	24.18	39.31	1.94
H. Recent memory	12	16	47.13	1.13

* $p < 0.05$.

Schizophrenia : Simulated ECT and Chlorpromazine Group (Table 4)

There is improvement in the post-treatment scores on all the tests of cognitive battery. The improvement on Koh's Block Design test is significant ($p < 0.05$).

Comparison between ECT and Placebo group and Simulated ECT and Drug Group

Both in the depressed and schizophrenic patients (in the improved as well as unimproved) there was no significant difference as regards the scores on cognitive test battery.

Comparison between the test scores of dominant and non-dominant hemispheric functions revealed no significant difference.

Forgetfulness as Subjective Complaint (Table 5)

Forgetfulness was complained by 5 schizophrenics who received ECT. 2 of the

TABLE No. 4—Schizophrenia—Simulated ECT and Chlorpromazine Group

	N	Mean Percent change	S.D.	t value
A. Koh's Block Design Test ..	6	20.1	15.8	2.65*
B. Picture Recognition Test ..	8	6.25	17.2	1.03
C. B.G. Test ..	8	-3.37	33.9	0.28
D. Arithmetic Test	8	20.13	22.98	2.32
E. Immediate memory	8	17.35	30.55	1.50
F. Sentence Repetition Test ..	8	16.12	22.14	1.94
G. Remote memory	7	16.71	39.05	1.05
H. Recent memory	8	3.12	8.84	0.93

* $p < 0.05$.

TABLE No. 5—Forgetfulness as Subjective Complaint—Schizophrenia Group

	ECT Group		Simulated ECT Group	
	No. of ECT	No. of ECT	No. of ECT	No. of ECT
Clinical Improvement present ..	2	1	0	0
No Clinical Improvement	0	0	2	0

Depression Group

Forgetfulness was complained by 1 patient who had clinically improved after 6 ECT.

patients had no clinical improvement after 10 ECT. Of the other three patients with forgetfulness, 2 had improved after 6 ECT and 1 had improved after 8 ECT. Forgetfulness was complained by 2 schizophrenics who had received simulated ECT. Both had received 8 simulated ECT treatments, one of them had improved and the other had no clinical improvement. One depressed patient complained of forgetfulness. He received 6 ECT and had

improved clinically. The forgetfulness was regarding inability to recall messages, telephone numbers, names, etc. which were learned in past few days.

No deficit in the scores of the cognitive test battery was present in any of the patients who complained of forgetfulness. As a group, their scores were not significantly different than the patients who did not complain of forgetfulness.

DISCUSSION

In the present study no cognitive deficit in the tests administered was observed after ECT; moreover there was significant improvement in the scores on Koh's Block design test. Fink (1977), Hamilton *et al.* (1979) and Weeks *et al.* (1980) have also reported lack of cognitive deficit after ECT. Weeks *et al.* (1980) have suggested a bidirectional response to explain this observation of impaired cognitive functions in schizophrenia and depression, improve subsequent to the clinical improvement produced by ECT. This effect may mask the deterioration produced by the effect of ECT *per se*. The improvement in the cognitive functions is more evident on performance tests, which reveal greater initial impairment. Summers *et al.* (1979) have postulated that like ECT, psychotropic drugs also exhibit a bidirectional response.

In spite of lack of memory impairment on the test battery, 20% of the patients did have a subjective complaint of forgetfulness. Similar observations were made by Fink (1979) who noted that learning is improved after ECT and retention is impaired. Recognition is least affected and recall after an interpolated delay is worst affected (Squire, 1977). The subjective forgetfulness was regarding inability to recall material learned in the past few days; which generally did not interfere in interpersonal, social or vocational functions. Further work needs to be done to find out objective parameters of the subjective for-

getfulness.

In the present study, 40% of schizophrenics who received ECT complained of forgetfulness as against 10% of depressives who complained of forgetfulness after ECT. This could be related to the psychopathology. The hall mark of schizophrenia, primary thought disturbance is last and least to improve after any treatment including ECT. The complaint of forgetfulness observed in them may be a subjective attempt to explain the schizophrenic thought disturbance. Psychomotor retardation and slowness of thinking observed in depression, a primarily affective disorder would disappear completely when depression improves. Thus the complaint of forgetfulness would be uncommon.

In one of our earlier studies (Bagadia *et al.*, 1980) 62.8% depressed patients had complained of forgetfulness when 6 unmodified ECT, were administered every alternate day without any artificial ventilation and oxygenation. In a subsequent study, where artificial ventilation and oxygenation was not used but adequate spacing was given, 20% of the depressed patients complained of forgetfulness after 6 unmodified ECT (Bagadia *et al.*, 1980). In the present study where both adequate spacing as well as artificial ventilation and oxygenation was used, 10% of depressives complained of forgetfulness. It appears that spacing the treatments and oxygenation reduces the complaint of forgetfulness.

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REFERENCES

- BAGADIA, V. N., DAVE, K. P. AND SHAH, L. P. (1970)
A Comparative Study of Physical Treatments in
Schizophrenia. *Indian J. Psychiat.*, 12, 190.

- BAGADIA, V. N., GADA, M. T., MUNDRA, V. K., SIMON, S., DOSHI, J. M., PRADHAN, P. V., SHAH, L. P. AND SHETH, U. K. (1980). A Double Blind Trial of Piracetam (UCB 6215) and Placebo in cases of Post ECT Cognitive deficiency. *Journal of Postgraduate Medicine*, 26, (2), 116.
- BAGADIA, V. N., ABHYANKAR, R. R., DOSAI, A. B., GANDHI, M. H., AYYAR, K. S., BARHALE, V. L. AND SHAH, L. P. (1980). Electroconvulsive Therapy: Analysis of 1315 cases. Under publication.
- FINK, MAX (1977). Myths of Shock Therapy. *Am. J. Psychiat.*, 134, 9, 991.
- FINK MAX (1979). *Convulsive Therapy, Theory and Practice*. Raven Press: New York, p. 107.
- HAMILTON, M., STOCKER, M. J. AND SPENCER, C. M. (1979). Post ECT Cognitive Defect and Elevation of Blood Pressure. *Brit. J. Psychiat.*, 135, 77.
- SUMMERS, U. K., ROBINS ELI AND REICH THEODORE. (1979). The Natural History of Acute Organic Mental Syndrome after Bilateral Electroconvulsive therapy. *Biol. Psychiat.*, 14, 905.
- SQUIRE, L. R. (1977). ECT and Memory Loss. *Am. J. Psychiat.*, 134, 9, 997.
- WEEKS, D., FREEMAN, C. P. L. AND KENDELL, R. E. (1980). ECT: III: Enduring Cognitive Deficits. *Brit. J. Psychiat.*, 127, 26.