Current concepts on the efficacy of electroconvulsive shock therapy in the therapy of depression

David F. Hazuka

University of Nebraska Medical Center

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Current Concepts on the Efficacy of Electroconvulsive Shock Therapy in the Therapy of Depression

By
David Francis Hazuka

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Until the mid-1930's, only psychotherapy and a variety of relatively unsuccessful pharmacotherapeutic and physical treatment methods were available for the treatment of depression. Heinz E. Lehman summed up the therapies of depression at that time in the following thoughts. He said that the effectiveness of psychotherapy was almost entirely limited to reactive depressions. Drug treatments for depression were even less effective. These included tincture opii, which for many years was the treatment of choice for depression, photosensitizing agents, amphetamines, steroid hormones, nicotinic acid, and a host of other substances.

Several physical procedures were suggested and proved even more unsuccessful than the use of the above agents. These included the artificial induction of anoxia and X-ray irradiation. Lehman stated that hypoglycemic coma therapy, convulsive shock treatment, and prefrontal lobotomy then appeared in brief succession between 1935 and 1940. These treatments proved to be potent therapeutic agents for schizophrenia and depression. Convulsive shock treatment and prefrontal lobotomy have retained places in the therapeutic regimen for depressions which are overwhelmingly severe or those which are treatment resistant. Hypoglycemic coma therapy used mainly for schizophrenia has been almost entirely replaced by pharmacotherapeutic agents.

Klerman and Cole then noted that while R. Kuhn was testing imipramine, a tricyclic compound, for its antipsychotic properties, he noticed its property as a mood elevator. It was in 1957 that the MAO inhibitors and the
tricyclic compounds were almost simultaneously introduced. Since these two families of drugs have entered the clinical scene, the question has arisen whether electroconvulsive shock therapy (ECT) still has a place in the therapeutic regimen of depression today. It is the purpose of this paper to answer this question by explaining studies comparing the effectiveness of ECT with that of the tricyclic compounds and MAO inhibitors in relieving depression. Newer methods of administering ECT with the purpose of minimizing side effects will also be discussed. Finally, the current thoughts on predicting the response to ECT will be examined.

Concerning the last point, it was argued that patients with endogenous depression responded much more favorably to ECT than did patients with reactive depression as early as the 1940's. Recent reports have tended to confirm these claims. Mendels and Cochrane stated that in three of these studies, however, there was an overlap between endogenous and reactive depression groups as far as presence or absence of symptoms necessary to place patients in either group.

Mendels and Cochrane summarized early opinions on whether there is a true qualitative distinction between reactive or neurotic depression and endogenous or psychotic depression or whether there is simply one depression with one continuum of severity. In 1896 Kraepelin was of the former opinion while in 1926 Mapother was of the latter. Then Mendels and Cochrane quoted the opposition to Mapother's views which they state were based primarily on impression and opinion.
The view that psychotic depression was qualitatively distinct from neurotic depression was advanced on the grounds of spontaneous remissions, heredity, presence of remorse, personality differences, no response to psychotherapy, no relationship between environmental events and mood, the absence of precipitating factors, the absence of insight, the presence of diurnal variation, detachment from reality, autonomic and physical disturbances, fatigability and psychomotor sluggishness.

Perhaps it was these previous opinions which have led modern researchers to find one or more factors whose presence or absence in the symptomatology of a patient might allow the physician to predict the outcome of response to ECT. These studies have employed factor analytic techniques which have been well described by Mendels and Cochrane. They explain, "The factor analytic mathematical model furnishes a method of deducing the different processes necessary to explain correlations between variables." Factors basically are the particular symptoms which the clinician might consider present in an endogenous or exogenous depression. The variable might be the response to ECT, and the analysis yields an estimate of how much a variable is influenced by a given factor (the variables "loading" on a factor). A loading can vary from +1.00 to -1.00. A high loading (+1.00) would mean that there is a strong inverse relationship. A reading of 0.0 would mean little significance in the relationship of the factor to the variable.
The loadings might be initially found by running a prospective study as was done by Mendels in 1965. His study consisted of 50 inpatients referred for ECT. The patients were rated by the Hamilton scale for depression at the time of admission and at one and three months after ECT was begun. They were also examined for the presence or absence of 25 clinical symptoms at the time of admission and at one and three months. Then "the mean score of the patients in whom the factor was present was then compared with the mean score of those patients in whom the factor was absent in order to ascertain whether the difference between the two mean was significant or not." Then Mendels stated that if there was a significant difference, there was the implication that the therapeutic outcome was different in those patients in whom the feature was present as compared to those in whom the feature was absent. He found that only four individual factors were positively associated with the outcome at both one and three months. All were associated with a poor response to treatment. These factors were inadequate or ill-adjusted personality, emotional lability, precipitating factors, and neurotic traits in adulthood. Mendels later used the loadings found in this study in a retrospective study of 100 inpatients receiving ECT. The computer read out the score above which a patient would do poorly responding to ECT. Looking back at the series of patients, he found that for those who scored below 6.999, ECT would
have been given to 66 patient and withheld from 34. He states that of the 66 patients who would have received ECT, 56 responded by greater than 50 percent improvement. Of the 34 patients who would not have received ECT, only four did in fact improve by more than 50 percent. This, he states, would have provided and 86 percent prognosis.

Then Mendels correlated the response of ECT with this diagnoses of endogenous or exogenous depression. He found that there was a 70 percent chance of getting a favorable outcome by using the diagnosis of endogenous depression as a prognosticating means. However, he found a great deal of overlap between the symptoms of endogenous and exogenous depressions, and that the favorable response was correlated with a small group of features considered in the reactive group. An attempt was made in the above examples to show how factors can be used to predict response to ECT. It was not mentioned that factors can be correlated among themselves by computers to find the frequency of symptoms occurring together or patterns of symptoms. In other words, some studies have been used to find the so called "endogenous factor" or a pattern of symptoms that are commonly found in a series of depressed patients that can be indentified as the endogenous factor.

Mendels and Cochrane reviewed seven such studies, which attempted to find the "endogenous-reactive factor." Agreement between studies was examined and two studies were said to agree if both showed either significant
plus loadings, significant minus loadings or insignificant loadings. It was found that perfect agreement characterized "the endogenous patient as being retarded, deeply depressed, lacking in reactivity to environmental changes, showing a loss of interest in life and having visceral symptoms."\textsuperscript{10} Smaller loadings but perfect agreement was found for "lacking a precipitating stress, having a middle-of-the-night insomnia and as not showing self pity."\textsuperscript{10}

Fair agreement (75 percent of studies and only minimal disagreement) existed for symptoms or factors of the endogenous depressive patient as "being older, having a history of previous episodes, showing weight loss, having early morning awakening, showing self-reproach or guilt, and as not showing personality features suggestive of hysteria or inadequacy, suicidal thoughts, threats, or attempts\textsuperscript{10} also characterized the endogenous factor.

Studies disagreed on these factors or items: obsessional personality, depression worse in the evening, agitation, hypochondriasis, variability of illness, and initial insomnia.\textsuperscript{10} Mendels and Cochrane\textsuperscript{10} concluded that the endogenous factor may be simply measuring a pure or classic depression picture and that while there are a number who present with this picture, there are many others with "features of hysteria, character disorder (inadequacy), anxiety and other non-depressive symptoms. They state "the endogenous factor may represent the core of depression while the reactive factor manifests other psychiatric disorders which
contaminate the depressive syndrome.10

Although using diagnosis of endogenous depression to predict a favorable response to ECT may be debated, Carney6 and others stated that their analysis shows that outcome can be correlated with the diagnosis, but that one may better predict response by examining weights or loadings predicting ECT response rather than diagnostic weights. However, Mendels7, Rose9, and Carney's6 studies were in agreement that endogenous depression does have a significantly better response to ECT than exogenous depression. And therefore, by employing the findings discovered above in the factor analytic studies which identify the symptoms commonly found in an endogenous depression, one's task of choosing patients for ECT that will have a favorable response may be facilitated.

Mendels7 then discusses his findings on several particular factors and compares these to others in the literature. First, he describes findings on inadequate or ill-adjusted personality. He states that the response to ECT is directly related to the adequacy of the premorbid personality. This, he says, confirms the views of Roth9, Hobson,20 and Rickles.21

Concerning obsessional personality, at 3 months following initiation of therapy, Mendels7 found a significant positive association in response. This coincides with Hobson's20 findings. However, he states that obsessional may at times almost be interchanged with the adequate personality description.
Mendels found a highly significant association between emotional lability and a poor response to ECT. Hobson found the same association.

When neurotic traits are present in adulthood, Mendels found a poor response to ECT. In the literature this was the same finding of Hobson but Hamilton and White found no such association. Mendels stated that this was possibly due to the fact that Hamilton and White were dealing with an entire population that was severely depressed.

Considering precipitating factors, Mendels found an association of poor response to ECT and the presence of precipitating factors. This contradicts the findings of Hobson, Hamilton and White, and Ottoson. However, he stated that possibly their definitions included coincidental events and problems arising from depression while Mendels' definition included only the stress factors themselves.

In Mendels' study, those past 50 years of age found significant improvement at 3 months. In the literature, little association between age and response to ECT was found by Hamilton, Huston, and Tillotson. One study indicated a worsening of prognosis with advancing age.

Previous ECT was significantly associated with a good response at the one month followup by Mendels and at the three month period when considered as a group of clinical factors. He stated that the reason might be that if there was previous success with ECT, the patients are more likely
to be referred again for therapy.

Mendels found no association between the presence of previous depressive illness and the response to ECT. This was in agreement with Hobson, Hamilton and White, and Ottosson.

Mendels found no association between the duration of depression and the response to ECT. Three authors, Ottosson, Huston, and Kalinowsky agreed with Mendels while Hobson and Hamilton and White disagreed. Hobson felt that the outcome was worse in those ill for more than one year and Hamilton and White found the outcome worse from the fifth month onward.

When Mendels considered the course of the illness, he found no significant association between either a steady or fluctuating course and response to ECT. Hamilton and White were in agreement.

Mendels and Hamilton and White found no association of diurnal variation of symptoms and the response to ECT.

Mendels stated that he found no association of ECT response with sleep disturbance although Kalinowsky stated that this may be an indication for ECT. Earlier in this paper, several articles were cited which did connect sleep disturbance with endogenous depression.

Therefore, it seems apparent that, although there are many contradictions in the literature as to what criteria to use in predicting the outcome to ECT treatment,
endogenous or psychotic depressives respond most favorably to ECT. Those patients with neurotic symptoms, even though seemingly they are depressed, do not respond well to ECT.

Since ECT has been shown to be of value in cases of psychotic depressions, is it of value enough to still hold a place in the therapeutic regimen of depression considering the innovations of the tricyclic drugs and MAO inhibitors in the late '50's? Heinz E. Lehman\(^1\) stated that in comparison to ECT, pharmacological agents have the advantages of being "the simplest, most easily available, and most flexible of all treatment approaches. Unlike ECT, pharmacotherapy does not require special equipment, can be self administered by the patient, and does not produce confusion and memory disturbances."\(^1\) However, he does admit that ECT has certain advantages including effectiveness, ability to use at times of acute suicidal danger, and when waiting two to three weeks for drug effect to take place would be inadvisable. And about effectiveness of treatment, Lehman\(^1\), based "on considerable clinical experience and a very careful study of the world literature on the subject,"\(^1\) rated ECT's effectiveness with the effectiveness of the tricyclic or imipramine-like substances and the monoamine oxidase inhibitors. He stated that the most reliable antidepressant drugs are effective in only 60 to 70 percent of all depressed patients. Considering the fact that 25 percent of depressed patients show considerable improvement in 3 weeks after being hospitalized
without any specific treatment and that this proportion can be increased to 50 percent if a placebo is administered, then the net effect or gain of antidepressant medication may be only 10 to 20 percent. He stated that ECT is effective in about 85 percent of depressed patients. Therefore, patients who have not responded to drugs in two to three weeks can gain an additional ten to twenty percent chance of improvement by receiving ECT. Lehman stated that as a general routine in severely depressed patients, he would use as a trial first the tricyclic compounds, then the MAO inhibitors, and last ECT in treating depressive illnesses.

There are a number of studies in the literature that have recently compared the effectiveness of the MAO inhibitors and tricyclic compounds with that of ECT. Those which showed ECT to be more effective than pharmacotherapy included those of Greenblatt, Fahy, Bratfos and Haug, and Zung, Wittenborn and Ravn considered pharmacotherapy equal in effectiveness to ECT. Only one study by Langsley and Siirdma showed pharmacotherapy to be superior to ECT in effectiveness.

In Greenblatt's study, patients included were in the severely depressed category and consisted of diagnoses of manic depressive reaction, depressed type (27%), schizophrenic reaction, schizoaffective type (20%), and involutional psychotic and psychoneurotic depressed reaction with 18% each. A mixed residual made up 16%. The study was
double-blind in nature and the medications were generally: 
1) Imipramine 200 mg. per day; 2) Nardil 60 mg. per day; 
3) Marplan 40 mg. per day; and 4) ECT a minimum of 3 treatments per week for 3 weeks. The treatment period lasted eight weeks and patients were rated during this time by means of psychiatric assessments, symptom ratings by means of rating scales, ward observations, study of side effects, and lab findings and the collection of an extensive social history. Ratings were on a three point scale showing marked improvement—patient is practically symptom free and can function in the community; moderate improvement—some improvement but not enough to leave the hospital; treatment failure—no improvement or deterioration. Results at the end of eight weeks showed that considering both marked and moderate improvement ECT showed improvement in 92% of cases, imipramine 74%, Nardil 79%, placebo 69% and Marplan 56%. Number of cases in each group were ECT 63, Tofranil 73, Nardil 38, Marplan 68, and placebo 39. When one considers just marked improvement, ECT produced 76%, imipramine 49%, Nardil 50%, placebo 46%, and Marplan 28%.

Greenblatt examined the percentage markedly improved by diagnosis and treatment and found that psychoneurotic depressive reactions showed improvement greater than 70% no matter what the treatment. Possibly this indicated spontaneous improvement of these patients. When treated with ECT, involutional psychotics showed the greatest improvement or 85% and schizophrenic reaction depressed was the
lowest at 50%. Generally speaking, Greenblatt found that the antidepressant agents had the greatest effect (excluding psychoneurosis) among manic-depressives and the least success with schizoaffectives. It should be stated that the mean pretreatment depressive scores were nearly even at the beginning of the study for the different treatment methods. From this study, it appears that ECT showed a significantly greater improvement than all of the pharmacological agents except Nardil, and that imipramine and Nardil exhibited a significantly greater improvement than Marplan.

Peter Fahy of Birmingham England in 1963 carried out a controlled comparison of ECT and imipramine on sixty inpatients considered to be endogenously depressed. He stated that the patients had the clinical findings of moderately severe depression not reactive to any environmental situation, sleep disturbance, concentration difficulties, and "endogenous" mood features, such as diurnal mood variation. Cases were included only if they were considered to be in need of ECT. They were assessed in two ways: by a weekly progress assessment from a doctor's interview and by a weekly note which included the observations by the nursing staff, occupational therapists, relaxation therapist and any other staff member who observed the patient. Patients also reported any subjective changes. Treatment groups were chosen randomly. The first group received ECT twice a week for three weeks
for a total of six treatments. The second group was given imipramine by intramuscular injection 50 mg. twice daily for three weeks. The third group, used as a control, received biweekly intravenous injections of 0.5 gram sodium thiopentone for three weeks. A five point scale was used for rating change in the patients' depression. 3+ meant the patient had recovered; 2+-minor symptoms only; 1+-improvement; 0-no change; -1-worse. In the final analysis, there were seventeen cases on ECT, sixteen on Tofranil, and seventeen on thiopentone. There were different ratings weekly between the doctor and the staff with the doctor generally feeling more improvement came about with ECT than that reasoned by the staff. In the final rating by the doctor there was a 70% improvement on ECT, 62% on imipramine, and 47% improvement in the control group receiving thiopentone sleep injections. Fahy stated that the numbers in the study were not great enough to say that ECT was significantly more effective in relieving depression than imipramine.

Bratfos and Haug\textsuperscript{32} of the University of Oslo in 1965 published a study comparing ECT and MAO inhibitors and the tricyclic compounds. Patients receiving treatment were manic-depressive, depressed type. ECT was given to 127 cases twice a week for a variable number of treatments (5 to greater than 11). Each sex was represented almost equally for the number of cases. Drugs were administered to 133 patients and consisted of Marsilid 75-100mg;
Nardil 45-90 mg. per day, Niamid 75-150 mg. per day, Imipramine 125-250 mg. per day, amitryptiline 125-250 mg. per day, and protryptiline 30 - 40 mg. per day. The preparations were given to 25, 32, 2, 94, 32, and 3 patients respectively. The treatment groups were not significantly different except that there was a preponderance of women in the drug group. Severity of depression was rated with presence of "pERSISTANT IDEAS OF PERDITION" and strong suicidal tendencies or attempted suicide prior to admission placing the patient in the deep depression class, and the absence of these features placing the patient in the moderately depressed class which represented 60% of patients in both groups. Patients were graded upon discharge as either recovered—no subjective or residual symptoms, improved—symptomatic improvement to a greater or lesser extent, or unchanged—approximately the same symptoms as on admission.

Results showed that 61% of the ECT group were classed as recovered, 29% as improved, and 10% as unchanged. Of the drug group, 25% were recovered, 30% improved, and 45% unchanged. The total of treatment periods for ECT was 127 and for drugs 188. In 61 cases out of the 89 that were drug treatment failures, ECT was administered, and 56% were discharged as recovered, 26% improved, and one patient unchanged. These figures are about the same as if ECT had been given initially. The effects of the different drugs were not compared to each other. Hospitalization for the ECT group averaged between 5 to 8 weeks while
drug treated patients stayed between 9 to 12 weeks follow-
ing admission. The authors stated that the response to
ECT or antidepressant drug gives no definite cue as to
how the same patient will react to the same treatment
at a later attack according to their studies. They also
found that the difference in frequency of relapse between ECT
and drug treated groups was not significant in their studies
and, therefore, the stability of the two methods the same.

William Zung of Duke University in 1968 described a
retrospective study attempting to evaluate ECT and anti-
depressant drugs in the hospital treatment of depressed
patients. Zung used his Self-Rating Depression Scale as
a measure of severity of illness. Patients receiving
ECT in Zung's study numbered 28, and 33 were placed on
drugs. Clinical management included whatever seemed most
efficacious for a patient's health. Patients on drugs re-
ceived tricyclic antidepressant compounds (imipramine,
amitryptiline, or nortriptyline) with total daily doses
of 75 to 100 mg. ECT usually consisted of one treatment
daily for three days followed by one treatment every
other day as needed. ECT's numbered from 6 to 12 in total
with a mean of nine treatments. Treatments rarely went
beyond the third week's end.

The Self Rating Depression Scale consisted of 20
items based on clinical diagnostic criteria most common-
ly used to characterize depressive disorders. Studies
have shown that the Scale correlates well with the MMPI
"D" scale and clinical diagnoses. Also studies have shown that results were not influenced by age, sex, marital status, or school grades, income, intelligence. Basically, items are phrased as sentences with the patient rating himself on each item as to frequency of times with a scale from 1 to 4; eg, a little of the time, some of the time, a good part of the time, all of the time. However, 10 items were worded symptomatically positive and 10 negative. The raw score is multiplied by a factor of 1.25 to get the SDS index and scores had the following ranges: normal 25 to 43; mild and moderate depression 50 to 59; moderate to severe depression 60 to 69; severe depression greater than 70 in score. Patients were tested within 48 hours of admission, at the end of each week of treatment, and within 48 hours prior to discharge.

Those patients receiving ECT had a mean index of 70 although ranges varied from 50 to 84. Drug patients had a mean index of 63 with a range from 44 to 85. Both groups of patients had the same amount of affective complaint on admission, but ECT patients had greater complaints about physiological and psychological disturbances than those in the drug group. Patients selected for ECT chose 9 items as present a good part or most of the time and included diurnal variation, sleep disturbances, decreased appetite, decreased libido, confusion, psychomotor retardation, indecisiveness, emptiness and dissatisfaction. Those on drug therapy had only three items present with
the same severity and included psychomotor retardation, hopelessness, and indecisiveness. Therefore, looking back retrospectively, one may reason that doctors chose patients for ECT who had a greater number of biological symptoms.

Findings showed that at the end of the third week patients on ECT had a mean index of 40 while those on drugs had an index of 53 which proved significant by the t-test. Improvement appeared to have been equally effective for both treatment groups in the affective, biological, and psychological symptom groups. Of the ECT group at the end of the first week, 24% were in the severely depressed category as compared to 15% in the drug group. 30% of ECT patients were in the normal range after one week as compared to 9% of drug patients. At the end of three weeks no patients were in the severely depressed range of the ECT group while 9% of the drug group were in this category. 48% of ECT patients were classed as normal at 3 weeks while 25% of drug group patients were in this range. At discharge, 82% of ECT patients were in the normal range while only 54% of drug patients were in this range. While only 4% of ECT patients were borderline at discharge and 14% depressed minimal to moderate, drug group patients showed 13% borderline and 33% in the minimal-moderate group.

Zung concluded that patients on ECT recover faster and at discharge have less depression. However, the
length of stay for ECT and drug groups were 53 and 55 days respectively, or insignificant in difference. He also concluded that the choice of patients for ECT may be influenced by age, specific symptomatology and overall severity as ECT patients were older, more severely depressed and had more biological symptoms. However, he said that patients probably were not selected for ECT because they were older, but because the older had more biological symptoms for which ECT success may have been predicated.

In 1965, a study was run by the British Clinical Psychiatry Committee which also agreed with the above studies that ECT response is greater and quicker than drug response. Severely depressed patients were chosen randomly for ECT and drug treatment. Four treatments were employed including ECT, imipramine, phenelzine, and placebo. Results showed that 84%(N=58) of ECT patients, 72%(N=58) of imipramine patients, 38%(N=30) of phenelzine patients, 45%(N=51) of placebo patients were classed as being improved.

More recent studies finding ECT and antidepressant drugs equivalent are those by Havn in 1966 and Wittenborn in 1962. Wittenborn's study comprised women under 45 years of age. The women were free of any schizophrenic symptoms and organic complications. The only problem of his study is that very few were severely depressed and most would be considered neurotic depressions.
Therefore, the validity of comparing this study to the preceding is debateable. Nevertheless, its description shall be included. The patients were "unbiasedly assigned in such a way that two-thirds were placed on imipramine, one-sixth placebo, one-sixth ECT. Various parameters were tested and were the degree of depression by the Wittenborn Psychiatric Rating Scales, MMPI, the Clyde Mood Scale, cognitive and perceptual aspects by the WAIS similarity and digit symbol substitution and Numerical Ability Subtest of the DAT series.

Motor retardation was judged by the latency of responses. Dosage level of drugs did not exceed 200 mg. per day. Treatment was carried out until discharge which was a maximum of ten weeks. Findings were that imipramine showed a much shorter latency period than ECT, but that imipramine and ECT were equivalent in relieving depression.

Jorgen Ravn's study published in 1966 included 180 female patients with pure endogenous depression. These were divided in six groups of 30 each. Of these groups, 4 were treated with nortriptyline, amitryptiline, imipramine, and MAO inhibitors respectively. The fifth group was treated with ECT alone and a sixth group consisted of patients treated prior to 1937 with agents such as opium, barbiturates, and bromides. The MAO inhibitors were Marsilid (25 patients) and Marplan (5 patients).

Dosages of amitriptyline and imipramine ranged from 75 mg. daily to 225 mg. per day. Nortriptyline was
was given in an initial dose of 150 mg. per day. Marsilid was given in the range of 150 to 300 mg. per day while Marplan was in the 20 to 60 mg. dosage range. ECT was administered twice weekly for 3 to 4 weeks. The average age in the treatment groups was similar.

The findings were that in the first five groups the average duration of in-patient treatment was from 62 to 84 days. Patients treated with amitriptyline spent the least time in the hospital while those on ECT therapy spent 81.3 days in the hospital or no less than the others. Those in the prior-to-1937 group had an average hospital stay of 313 days.

There were three ratings used: satisfactory, fairly good, and no result. About equivalent results were achieved with ECT and imipramine with a satisfactory rating in about 25 of 30 patients. Other groups averaged about 20 out of 30 with satisfactory results. No information was mentioned on how patients were rated or placed in their particular groupings.

The only study found which showed a possible superiority of drugs over ECT was that by Langsley and Siirdma in 1965. They judged only the length of hospitalization in their study. They found that drug-treated patients (N=81) stayed a mean of 36 days, while ECT patients (N=49) had a mean stay of 60 days.

Thus, in this survey, it seems that the majority of studies are on the side of ECT being quicker acting and a stronger agent for alleviating depressive illness of the psychotic type.
It was mentioned earlier in this paper that Lehman stated that ECT had more serious side effects than MAO inhibitors and tricyclic compounds including effects such as retrograde amnesia and severe confusion states. However, in a review of the literature comparing newer methods of administering ECT (unilateral therapy) with older methods (bilateral application of electrodes on the skull), it seems apparent that there is quite a significant lessening of amnesia and confusion with the unilateral method.

Lancaster, Steinert, and Frost in 1957 published their paper which summarized the results of unilaterally induced, bilaterally induced generalized convulsions, and focal convulsions. In their introduction they cited several sources in the literature which told of EEG changes, finger agnosia, agraphia, disturbances of right and left laterality, and gross amnesia which may last several years following bilaterally induced generalized convulsions.

The method of applying the electrodes consisted of the following. The non-dominant side of the skull or the same side as the "handedness" was chosen for placement of the electrodes. The lower electrode was midway between the lateral angle of the orbit and the external auditory meatus and one and one half inch above this line. The upper electrode was 3 inches higher than the lower and slightly posterior at a 70 degree angle to the line.
Atropine and pentothal plus Brevidil E were used as adjuncts to the ECT.

Assessors measured the undesirable side effects by having patients memorize a short sentence with four items and attempting to have the patient recall the sentence within 15 minutes. They also measured how long it was after the current was passed before the patient would recall name, place, and date. Finally, they measured the time that commenced before swallowing and breathing reappeared.

The findings were that only one patient of 39 in the bilateral group recalled the sentence while the results were 19 of 31, 27 of 33, 24 of 32 in the unilateral general, unilateral focal, and unilateral subshock groups respectively. Although patients in the unilateral induced generalized group commenced to swallow and breathe a few seconds slower than the bilateral group, they recalled name, time, and place 3, 5, and 6 minutes sooner respectively. Generally, the orientation in all three spheres returned in order of quickness in the following order: subshock earliest, unilaterally induced focal, unilaterally induced generalized, and bilaterally induced generalized convulsion last.

Patients were also assessed for lessening of depressive symptoms. They were rated prior to treatment for 10 depressive symptoms on a scale of severity 0 to 3. The doctors did not know the type of ECT administered.
Findings were that there was no statistically significant difference in improvement caused by bilaterally induced generalized fits and unilaterally induced generalized fits. There was the clinical impression, however, of slightly better improvement and more complete remission with the bilateral shock. Subconvulsive therapy showed considerably less improvement.

S.M. Cannicott\textsuperscript{39} published a study in August of 1962 in which he studied three different groups of patients. The first group was a retrospective study of 51 patients who had received 265 bilateral treatments the year before, compared with a group of 40 patients receiving unilateral treatment. The unilateral treatment was applied as described in the preceding article. The author felt that there was a great deal of bias in the retrospective study; but allowing this, he reported a significant reduction in the confusion and amnesia produced in cases of unilateral treatment. He found no significant difference in treatment response.

The second group was a controlled prospective study with random sampling, bilateral ECT as a control, and a double blind assessment. The patients were rated according to 20 different depressive symptoms on a scale from 0 to 2 the day before and the day after treatments. The patients were chosen on the basis that they were severely enough depressed to receive ECT.

30 patients received 209 unilateral treatments while 20 received 133 bilateral treatments. Post ECT confusion
incidents were reported in 75% of those following bilateral treatment and in only 15% of unilateral cases. Both groups showed no significant difference in lessening of depression.

The third group considered were 87 outpatients receiving ECT. 13 of these were going to discontinue treatments because they had confusion and amnesia complaints. When they were subsequently administered unilateral ECT, no complaints of confusion or memory loss occurred.

Martin and associates in May of 1965 published a study comparing unilateral and bilateral ECT. Patients were included in the test only if they were of the diagnoses involitional psychosis or depressed type, manic depressive. Random selection was used with 20 patients in each treatment group. Degree of depression was determined by 17 symptoms of depression graded 0 to 2 for severity of each symptom. Each patient was tested by the Weschler Memory Scale Form I before the 1st treatment and Form II the day after the tenth treatment. EEG's were given before the 1st and the day after the last treatment. Unilateral treatment was administered as demonstrated by Lancaster and associates previously. Martin found that depression scales improved on the average of 11.7 points for those treated unilaterally and 10.4 points for those treated bilaterally. Those receiving bilateral therapy had their memory quotients reduced 16.4 per patient after the 10th treatment while those on unilateral therapy had quotients improved by 7.0 per patient. This improvement
was explained by the author as due to the fact that the patients did not have the preoccupation with depression following their treatment. Martin found that high voltage slow wave activity was present bilaterally in the bilateral group and on the side of electrode placement in the unilateral group. Therefore, it seems from this study that unilateral ECT causes the same degree of improvement as bilateral ECT but with no memory loss in this study.

Cannicott in February of 1967 published his second study which was more intricate for testing memory loss after ECT therapy. Patients selected were those considered seriously enough depressed to receive ECT. Ten patients received a series of 5 unilateral ECT treatments applied to the nondominant hemisphere while a control sample of 14 patients received bilateral treatments of 5 per patient. It was not mentioned how patients were chosen for each group. Patients were administered the tests 48 hours prior to their first treatment and no less than 48 hours following the fifth treatment. Tests were usually administered, however, within one hour prior to the first treatment, and final testing within 2 hours after the fifth treatment.

The tests included in the study were those testing immediate memory, memory for recent events, verbal concept formation, and visual-motor functioning. Immediate memory was tested by having the patient memorize four items (a vegetable, color, person's name, and a street)
immediately prior to each treatment. Recall of these items was attempted within thirty minutes following a treatment. Testing of recent memory consisted of measuring recall of ten items of information the patient would have had to acquire in the past several years. Verbal-concept formation was tested on concrete, functional, and abstract-conceptual levels by the Weschler-Bellevue Similarities subtest. Visual motor function was tested by the Weschler-Bellevue Block Design subtest, as dysfunction in this area had been suggested from previous ECT.

Analysis of data showed that unilateral treatment had no significant effect on immediate memory while bilateral therapy significantly impaired this. For instance, the unilateral group recalled a mean of 3.77 words of 4 following a treatment while the bilateral group could recall only 1.8 of 4.0 words.

There was a significant improvement for memory of recent events in the unilateral group, while in the bilateral group, there was a significant impairment.

Visual-motor functioning was insignificantly improved in both treatment groups. Conceptual abilities were insignificantly improved in the unilateral group while there was insignificant impairment for this feature in the bilateral ECT group.

Perhaps, one might say that memory loss was less in the unilateral application because there was simply less electrical stimulation to the brain than in the case of
bilateral therapy. In other words, application of the electrodes could be on either the dominant or non-dominant side of the hemispheres with the same amount of memory disturbance. Zamora and Kaelbling in 1965 attempted to disprove this theory. Patients used as controls were those who received unilateral ECT on their dominant hemisphere which is in contrast to using bilateral ECT as in previous controls. 30 patients were randomly split among dominant and non-dominant application groups. Dominance was tested by the use of a special test battery to establish the referred laterality for hand, leg, and eye. 9 of 12 items positive for one side was necessary for dominance. All patients were found to be clearly right handed. Memory was tested before the 1st and after the 5th treatment by the Weschler Memory Scale.

Other qualifications were that patients were aged 20 to 64, had no ECT in the last year, and had no evidence of cerebral impairment. Patients were allowed no drug intake during the study.

Zamora found that there was no significant difference in scores before ECT was administered. However, the second test showed a decrease of 8.1% in score in the group receiving ECT on the dominant side while the patients with electrode placement over the nondominant hemisphere had an increase in memory score of 10.6%. Zamora concluded that placement of electrodes over the dominant hemisphere is an important factor in producing memory disturbance.
In conclusion, the literature on ECT was surveyed including the following areas. First, the possibility of predicting response of patients to ECT by examining their symptomatology. Secondly, the efficacy of ECT in relieving depression was compared with that of the MAO inhibitors and tricyclic compounds. Thirdly, newer methods of administering ECT in order to prevent confusion and memory disturbances was discussed.

Although there is still a controversy about whether endogenous or psychotic depression is qualitatively distinct from exogenous or reactive depression, factor analysis of symptoms in patients and a preponderance of studies lean toward this conclusion. Also, the majority of studies show the effectiveness of ECT in endogenous depressions.

From the majority of studies comparing ECT with tricyclic compounds and the MAO inhibitors, there is agreement that ECT is from 10 to 20% more effective than drug treatment. Also, most of the studies conclude that ECT evokes a much quicker response.

Finally, the amnesia and confusion side effects of ECT so commonly feared can be greatly softened as shown by studies with application of electrodes to the non-dominant hemisphere or to the hemisphere the same side as the "handedness" of a person. As a matter of fact, many of the studies showed some memory improvement after therapy with unilateral application to the non-dominant side.
Therefore, from a review of the literature, it is apparent that ECT still is a valuable part in the treatment regimen of severe depressions.
References


