Relation of Amobarbital Test to Clinical Improvement in Electroshock

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While many theories about the mode of action of electroshock therapy have been offered, the relationship among neurophysiological and psychological factors remains poorly understood (1,2). Although changes in brain function may be demonstrated on electrical recording, such evidence of impaired function has not been correlated with the degree of psychiatric improvement. Similarly, although memory defects and impaired learning ability are common manifestations following the administration of electrically induced convulsions, their severity is not an index of therapeutic outcome. It would appear that the results of ordinary clinical and laboratory procedures and psychological tests do not furnish adequate criteria for a correlation of the alterations of behavior with the changes in brain function.

In previous studies (3) it has been suggested that the therapeutic action of electroshock therapy was related to the production of a milieu of brain dysfunction in which denial of illness (anosognosia) might occur. A concept of anosognosia was advanced which included not only denial of hemiplegia and blindness but denial of many other aspects of illness and problems of living. It was indicated that anosognosia was not explicable as a focal deficit but was, rather, a manifestation of a reorganization of perceptual symbolic function in which the patient represented his problems in an altered language pattern. In the verbal sphere these language patterns included explicit denial, disorientation for place and time, reduplication (reduplicative paramnesia), paraphasia, and confabulation. The patient's feelings about his illness and incapacities could also be manifested in nonverbal aspects of behavior, such as selective

withdrawal, inattention, and muteness (akinetic mutism), altered sexual behavior, and euphoric, manic states. The particular form of symbolic adaptation that was used was closely related to features of the premorbid personality.

These changes in behavior were found commonly with infiltrating neoplasms, with acute vascular lesions, particularly when associated with subarachnoid bleeding, and following lacerating brain injury. The electroencephalographic records showed diffuse slow-wave rhythms, and it appeared that the lesions affected the diffuse projection systems rather than any specific discrete projection area. Similar forms of behavior may appear after the operation of prefrontal lobotomy and, in more transitory form, after the administration of electroshock convulsions. When the degree of brain damage was insufficient to permit the elicitation of explicit denial and disorientation on ordinary clinical examination, these phenomena might be observed when the patient was interviewed after the intravenous administration of amobarbital (Amytal) sodium. This observation furnished the basis for the "Amytal test" for brain damage, in which the persistence of certain patterns of denial and disorientation are considered as evidence of impaired function (4,5,6,7).

It was reported that in some patients receiving electroshock treatment for intractable pain, the amobarbital test, which was previously negative, became positive after a number of convulsions. Others received as many as 18 shocks without change in the results of the amobarbital test. It was noted that in patients who gained

relief from their complaints of pain, the amobarbital tests became positive, whereas in those patients who continued to complain of pain the amobarbital tests remained negative. The purpose of the present paper is to determine the relationship between the clinical response to electroshock treatment and the results of the amobarbital test in patients hospitalized for psychiatric illness.

METHOD

Each patient was given a series of amobarbital tests. In this test, the patient is asked a standard group of questions pertaining to orientation and the awareness of illness. The drug is then administered intravenously in a 0.5% solution at a rate of 0.05 gm. (1 cc.) per minute until nystagmus, slurred speech, drowsiness, and errors in counting backward are noted. The same questions are then repeated. The following changes, when persistent, are called "positive" and are deemed indicative of cerebral dysfunction.

1. Complete denial of illness.
2. Denial of major aspects of illness, such as attributing entry into hospital to a trivial or past illness.
3. Misnaming the hospital, either its proper name or in terms of some euphemism, such as "rest home".
4. Displacement of the location of the hospital, such as to another city.
5. Confabulated journey.
6. Reduplication of the hospital, such as the patient's stating that he is in another hospital of the same or similar

name.

7. Disorientation for time of day with confusion of day and night.
8. Gross misidentification of the examiner, such as calling him a "lawyer" or an "entertainer".
9. Disorientation for year.

The patient was given his first test prior to treatment and was retested at weekly intervals. All patients in the series had negative amobarbital tests prior to the initiation of therapy. Treatments were administered three times a week, so that the patients were generally tested after every third treatment. A test was given two days after a treatment and was continued at weekly intervals after the termination of therapy until the result had become negative.

Electroencephalographic records and standard tests of memory and learning ability were also given, but will not be considered in detail in this paper.

POPULATION

Twenty-four patients at Hillside Hospital receiving electroshock with the Reiter Electrostimulator were studied. The patients were not selected by us but were taken on the basis of consecutive referrals by the clinical staff. Some patients were necessarily excluded because their treatment was terminated or interrupted before they were adequately studied. Another patient was omitted because he had manifestations of brain disease and a positive amobarbital

test prior to electroconvulsive therapy. The number of treatments varied from 9 to 33. Patients who showed clinical improvement tended to receive fewer treatments. Some of this variability could also be ascribed to differences in the inclination of the resident psychiatrists to use this form of treatment. One patient decided for himself that he had had enough treatment and eloped. Diagnostically, the patients consisted of 14 with depressive reactions, 9 with schizophrenia, and 1 with manic reaction. There were 15 women and 9 men, and the ages ranged from 24 to 68, with a median of 47 years.

Evaluation of Response to Electroshock Therapy: All patients were observed for at least eight weeks after completion of treatment. Determination of the patient's response to electroshock was made on the basis of the resident psychiatrist's impression, staff opinion, the nurses' notes, and the clinical evaluation of one of us (M. F.), who supervised the treatments but was not aware of the amobarbital test results. On this basis the patients were divided into three groups.

A. Markedly Improved: The 11 cases in this group were regarded as showing recovery or marked improvement. These patients no longer showed the symptoms which brought them into the hospital; their doctors felt they were better, and the nurses noted them as being able to sleep without medication, eating better, getting along with the other patients, and participating in hospital activities.

B. Moderately Improved: The six patients in this group showed some improvement but continued to manifest indications of mental

illness. These patients typically showed symptomatic relief; i.e., acute depressive features might be gone, but the dramatic change, so evident in the first group, was not apparent. Each patient continued to show some noticeable disturbance, such as obsessional thinking, paranoid ideas, or somatic preoccupation.

C. Minimally Improved or Unimproved: In this group was placed seven patients in whom change was not clearly noticeable or who showed only equivocal or transient improvement. Some showed fluctuations in behavior, at times appearing somewhat improved. But the change was not sustained, so that by the end of treatment they appeared much as they did before.

We are aware of the difficulties in evaluating improvement. Others may have differed in the estimates of changes in these patients. In any case, by using this threefold classification, the differences between the first and the third group will be distinct.

OBSERVATIONS

A. Distribution of Positive Reactions: The number of amobarbital tests given to each patient during the course of electroshock ranged from 3 to 13, depending on how long treatment was maintained. In Table 1 the data are shown for the number of tests given during treatment and the number and percentage positive for all the patients in each group. The markedly improved patients showed many more positive reactions than the unimproved group, with the moderately improved patients between these groups. Every markedly improved patient had at least one positive amobarbital reaction during

treatment. On the other hand, one of the moderately improved patients and five of the unimproved patients never showed a positive result. A comparison of the results in each group, using the χ^2 test, is statistically significant at better than the 1% level of confidence.

B. Positive Reactions at Each Stage of Treatment: In the Figure the groups are compared for the percentage of patients in each group who had positive results at each stage of treatment.

Almost half the markedly improved patients had positive reactions after only three treatments, and all had positive reactions after seven to nine treatments. In the unimproved cases, on the other hand, the number of positive reactions was small and there was no consistent increase during the course of treatment. Again, the moderately improved group tends to fall between the other two.

Fig: Percentage of positive amobarbital test reactions occurring in each group at different stages of treatment.

Although some patients received more than 15 treatments, the data are not presented beyond this point because the number in each group became too small for purposes of comparison. Four of the unimproved patients received more than 20 treatments, with consistently negative amobarbital test results. One of the moderately improved patients received over 30 treatments, with only an occasionally positive reaction.

C. Duration of Positive Reactions: There were variations in the persistence of positive reactions from week to week. With at least two consecutive positives as the criterion of persistence, nine of the markedly improved, two of the moderately improved, and only one of the unimproved group showed persistent positives. After the termination of treatment all patients but one had negative amobarbital reactions nine days after the last convulsion. The remaining patient developed a negative test during the second week after treatment.

D. Factor of Age: Since the patients in the markedly improved group tended to be older persons suffering from depressive reactions, it is conceivable that the difference in amobarbital test results may be related solely to age and only coincidentally to clinical improvement. Underlying this is the assumption that the older person is more likely to show signs of altered brain function when given electroshock. In Table 2 the mean age for each group is shown.

It is apparent that the first two groups were older than the unimproved patients. Yet, while the mean age of the moderately improved patients is slightly higher than that of the markedly improved group, these patients still had significantly fewer positive reactions.

In Table 3 the number of positive reactions during treatment is shown for each group when the analysis is limited to patients more than 40 years of age. In this Table the relationship of positive reactions in the different groups remains unchanged from that when

the groups are considered as a whole.

OTHER ASPECTS OF BEHAVIOR

Apart from explicit denial of illness and disorientation, there were changes in behavior that occurred both under the influence of the drug and clinically during the course of treatment in significantly progressive fashion in those patients who improved. These aspects may be divided into verbal and nonverbal communication.

A. Changes in Verbal Language: These changes consisted of denial expressed in evasion, in negative expressions, and in the use of a syntactical pattern involving the third and second persons. When asked about their symptoms, patients gave such answers as "It's hard to say", or "I forgot", or "I don't know; I've been waiting for the doctors to tell me." The change in syntactical pattern is illustrated by such remarks as "It's what they call a depression", or "I'm afraid somebody will get hurt", or answering the question "What is your main trouble?" with "What is your main trouble?" Sometimes patients would talk of a relative who was sick.

In patients who improved there was a notable development of such patterns in a nondrug interview. One such patient, for example when asked prior to the start of treatment what his main trouble was, said, "I'm depressed." After two treatments he answered the question with "I don't get along well with my mother-in-law." After five treatments he said, "I don't get what you mean"; after eight, "I get sick; that's all I know." After 10 treatments he said, "Right now, it's that I don't see my wife," and after 11 treatments he said,

"In what way do you mean?" and "I don't know how to explain it." At the termination of treatment, his main trouble was given as "I want to get home", followed by an account of how "good" his wife was.

In the unimproved group, on the other hand, the increased use of these language patterns did not occur. They were not present in some and were minimally or inconsistently noted in others. In some of the unimproved patients there were actually fewer such language patterns under the effects of the drug than there had been in the preamobarbital interview.

B. Changes in Nonverbal Behavior: Euphoric reactions occurred in both clinical and drug interviews most frequently in the markedly improved group, less often in the moderately improved group, and least often in the group which were considered unimproved. In the unimproved patient classed as manic, euphoric behavior was present in his clinical behavior and was not changed by amobarbital.

Changes in sexual behavior appeared during the amobarbital interviews of four of the markedly improved patients but in only one patient in each of the other categories. This took the form of trying to hug or caress the examiner, making remarks with sexual content, or engaging in masturbatory activity. A patient in the unimproved group showed this behavior both during pre-drug interviews and under the influence of amobarbital.

Withdrawal or "selective inattention" was shown by 9 of the 11 markedly improved patients, particularly during the drug phase of the

amobarbital interview. This behavior consisted of failure to answer the questions about illness and hospitalization or responding in dysarthric and cryptic fashion. This reaction under the drug occurred only once in each of the other groups. It was of interest that two patients in the unimproved category who appeared withdrawn before the test became more responsive under the influence of the drug.

COMMENT

The results of the amobarbital tests in these patients indicate that there is a relation between clinical improvement and the production of brain damage or an altered state of brain function as determined by this particular method of examination. In patients who improve, the amobarbital test becomes consistently positive early in the course of treatment. In moderately improved or unimproved patients there are fewer positive reactions and their frequency does not increase with more treatments. With other methods of evaluating brain function such close correlation was not present, as all patients showed abnormalities in the electroencephalographic record and impaired learning was found as frequently in patients who improved as in those who do not. The significance of this relationship may be more clearly appreciated by a consideration of the changes in symbolic function that occur in states of altered brain function.

It has been useful in studying the behavior of patients with alterations in brain function to distinguish between defects in the formation of symbol patterns and changes of language patterns which

indicate a shift in the mode of interaction in the environment. In the first category may be included many types of memory defects, dyscalculia, topographical disorientation, and aphasia. A patient with such a memory defect cannot select elements of experience, classify them into significant units, and arrange them into a temporal pattern. These defects are observed with diffuse cortical lesions and probably occur universally after shock treatments in transient fashion. They are, however, related very remotely, if at all, to therapeutic outcome. Alterations in the mode of interaction in the environment are exemplified in the various patterns of disorientation and denial and in the amnesias that are noted with lesions of the diffuse projection systems, in chronic barbiturate intoxication, and following electroshock convulsions. Here there is no defect in memory, awareness, or perception as such, but the patient selects or rejects certain aspects of the environment for the expression of his own motivations. In disorientation for place, for example, the misnaming and mislocating of the hospital serve as symbolic representations of the patient's feelings about his incapabilities and problems -- often as the manifestation of his need to be well and go home. It is not that the patient is unaware of his problems and does not know where he is in an absolute sense. He commonly "remembers" the name of the hospital and expresses "awareness" of his difficulties in other contexts of language. The unawareness is, rather, of the far greater degree to which he is expressing his own motivations in his perception of the temporal,

spatial, personal, and somatic aspects of the environment.

In considering what constitutes therapeutic improvement, it is evident that the evaluation that is commonly made by a hospital staff depends in large part on the particular types of symbolic adaptation and defensive operations that are used. If the patient denies that he has any problems or that he is troubled by them, or if he cannot recall any, he is rated as improved. Such patients characteristically appear affable and uncomplaining, their manner reinforced by cliches and banalities, themselves adaptive forms of language. Many studies (8,9,10,11,12) have shown that general memory impairment does not persist after electroshock but that there is a selective "forgetting" of traumatic material in the patient's life. This does not mean that he has developed a better understanding of his interpersonal relationships or has acquired "insight". The observation is also significant in explaining why, although electroshock may have a short-term beneficial effect, evaluation of long-term results shows little difference between treated and untreated cases. Also, the fact that therapeutic improvement did not result in patients with negative amobarbital tests suggests that methods of administering electroshock by minimally affecting brain function, such as a unilateral seizure, will not prove generally efficacious. From the immediately practical standpoint, the amobarbital test given after the third or fourth treatment may be of prognostic value.

The amobarbital test is not in itself a direct index of brain

damage in that it measures some particular modality of dysfunction or brings out a specific defect. Rather, under the conditions in which it is given, one deduces impaired neural function by reason of the change in the organization or pattern of language in which the patient expresses himself. A positive result requires not only that a certain degree and type of impairment of brain function exist but that the patient employ verbal denial and disorientation as adaptive mechanisms. It would be expected that among patients with equivalent degrees of brain damage the highest incidence of positive amobarbital tests would occur among those who characteristically use denial as an adaptive mechanism in stress.

In relating these findings to the mode of action of electroshock and other somatic therapies, several considerations seem of importance. There is a combination of an added stress and a change in brain function. The milieu of brain function determines the pattern or organization of the adaptive behavior which can be most clearly formulated in terms of language. These include not only verbal patterns of denial and disorientation, elicited with the aid of the drug, but changes in syntactical patterns indicative of an altered relationship of the self in the environment. There were also indications that in the improved patients there were more changes in all types of symbolic adaptation, nonverbal as well as verbal. Thus, a patient who appeared withdrawn both in the predrug and in the drug interview had a poorer prognosis than the patient who became withdrawn only under the effects of the drug. The

patient who showed altered sexual behavior under the effects of the drug had also exhibited this behavior during the clinical questioning as well and did not improve with treatment, whereas the four patients manifesting sexual behavior only under effects of the drug did improve. It is likely that the faculty of changing symbolic patterns regardless of content is a factor in therapeutic improvement.

SUMMARY

Twenty-four patients referred consecutively for electroshock treatment were given amobarbital (Amytal) tests before and at regular intervals during and following the course of treatment.

There was a close relationship between the short-term response to treatment and the results of the amobarbital tests. The much improved patients showed early, persistent, and increasingly positive reactions during the course of treatment. Unimproved patients showed no positive reactions, or showed them infrequently and inconsistently. An intermediate group, who showed moderate clinical improvement, showed more positive reactions than the unimproved group but fell far short of the much improved group in the incidence of positive reactions.

Changes in language and nonverbal forms of behavior related to denial were most consistent and pronounced in the improved group, even in interviews not employing drugs.

These observations indicate that clinical improvement in electroshock requires the creation of conditions of altered brain function in which new patterns of symbolic adaptation can be maintained.

TABLE 1

Distribution of Positive Amobarbital Tests

During Treatment

	No. of Tests Given During Treatment	No. Positive	% Positive
Markedly improved (11)	50	38	76
Moderately improved (6)	39	15	38
Unimproved (7)	45	6	13

TABLE 2

Relationship of Clinical Improvement

To Age

	Mean Age, Yr.
Markedly improved (11)	47.64
Moderately improved (6)	50.00
Unimproved (7)	35.29

TABLE 3

Distribution of Positive Amobarbital Tests

in Patients More Than 40 Years of Age

	No. of Tests Given During Treatment	No. Positive	% Positive
Markedly improved (10)	46	35	76
Moderately improved (5)	34	15	45
Unimproved (3)	17	0	0

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While many theories about the mode of action of electroshock therapy have been offered, the relationship among neurophysiological and psychological factors remains poorly understood.* Although changes in brain function may be demonstrated on electrical recording, such evidence of impaired function has not been correlated with the degree of psychiatric improvement. Similarly, although memory defects and impaired learning ability are common manifestations following the administration of electrically induced convulsions, their severity is not an index of therapeutic outcome. It would appear that the results of ordinary clinical and laboratory procedures and psychological tests do not furnish adequate criteria for a correlation of the alterations of behavior with the changes in brain function.

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Observations

A. Distribution of Positive Reactions.—The number of amobarbital tests given to each patient during the course of electroshock ranged from 3 to 13, depending on how long treatment was maintained. In Table 1 the data are shown for the number of tests given during treatment and the number and percentage positive for all the patients in each group. The markedly improved patients showed many more positive reactions than the unimproved group, with the moderately improved patients between these groups. Every markedly improved patient had at least one positive amobarbital reaction during treatment. On the other hand, one of the moderately improved patients and five of the unimproved patients never showed a positive result. A comparison of the results in each group, using the χ^2 test, is statistically significant at better than the 1% level of confidence.

B. Positive Reactions at Each Stage of Treatment.—In the Figure the groups are compared for the percentage of patients in each group who had positive results at each stage of treatment.

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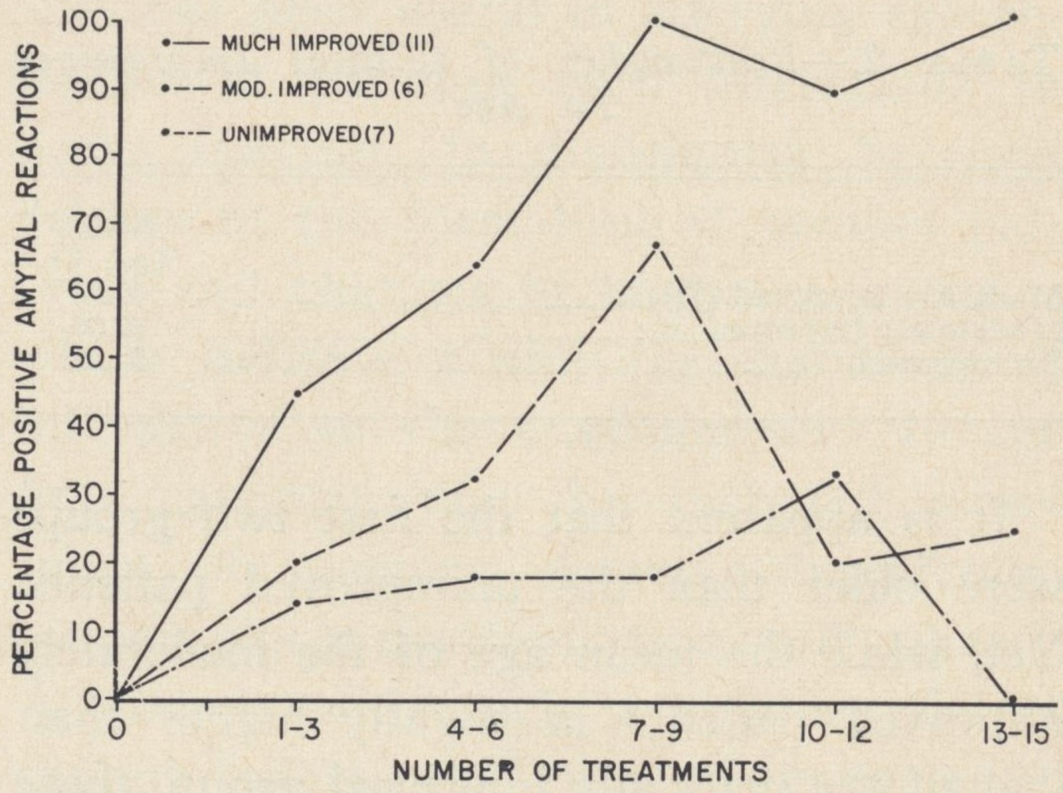

Percentage of positive amobarbital test reactions occurring in each group at different stages of treatment.

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D. Factor of Age.—Since the patients in the markedly improved group tended to be older persons suffering from depressive reactions, it is conceivable that the difference in amobarbital test results may be related solely to age and only coincidentally to clinical improvement. Underlying this is the assumption that the older person is more likely to show signs of altered brain function when given electroshock. In Table 2 the mean age for each group is shown.

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Unimproved (7)	35.29

It is apparent that the first two groups were older than the unimproved patients. Yet, while the mean age of the moderately improved patients is slightly higher than that of the markedly improved group, these patients still had significantly fewer positive reactions.

In Table 3 the number of positive reactions during treatment is shown for each group when the analysis is limited to patients more than 40 years of age. In this Table the relationship of positive reactions in the different groups remains unchanged from that when the groups are considered as a whole.

Other Aspects of Behavior

Apart from explicit denial of illness and disorientation, there were changes in behavior that occurred both under the influence of the drug and clinically during the course of treatment in significantly progressive fashion in those patients who improved. These aspects may be divided into verbal and nonverbal communication.

A. Changes in Verbal Language.—These changes consisted of denial expressed in evasion, in negative expressions, and in the use of a syntactical pattern involving the third and second persons. When asked about their symptoms, patients gave such answers as "It's hard to say," or "I forgot," or "I don't know; I've been waiting for the doctors to tell me." The change in syntactical pattern is illustrated by such remarks

TABLE 3.—*Distribution of Positive Amobarbital Tests in Patients More Than 40 Years of Age*

	No. of Tests Given During Treatment	No. Positive	% Positive
Markedly improved (10)	46	35	76
Moderately improved (5)	34	15	45
Unimproved (3)	17	0	0

as "It's what *they* call a depression," or "I'm afraid *somebody* will get hurt," or answering the question "What is your main trouble?" with "What is *your* main trouble?" Sometimes patients would talk of a relative who was sick.

In patients who improved there was a notable development of such patterns in a nondrug interview. One such patient, for example, when asked prior to the start of treatment what his main trouble was, said, "I'm depressed." After two treatments he answered the question with "I don't get along well with my mother-in-law." After five treatments he said, "I don't get what you mean"; after eight, "I get sick; that's all I know." After 10 treatments he said, "Right now, it's that I don't see my wife," and after 11 treatments he said, "In what way do you mean?" and "I don't know how to explain it." At the termination of treatment, his main trouble was given as "I want to get home," followed by an account of how "good" his wife was.

In the unimproved group, on the other hand, the increased use of these language patterns did not occur. They were not present in some and were minimally or inconsistently noted in others. In some of the unimproved patients there were actually fewer such language patterns under the

effects of the drug than there had been in the preamobarbital interview.

B. *Changes in Nonverbal Behavior.*—Euphoric reactions occurred in both clinical and drug interviews most frequently in the markedly improved group, less often in the moderately improved group, and least often in the group which were considered unimproved. In the unimproved patient classed as manic, euphoric behavior was present in his clinical behavior and was not changed by amobarbital.

Changes in sexual behavior appeared during the amobarbital interviews of four of the markedly improved patients but in only one patient in each of the other categories. This took the form of trying to hug or caress the examiner, making remarks with sexual content, or engaging in masturbatory activity. A patient in the unimproved group showed this behavior both during pre-drug interviews and under the influence of amobarbital.

Withdrawal or "selective inattention" was shown by 9 of the 11 markedly improved patients, particularly during the drug phase of the amobarbital interview. This behavior consisted of failure to answer the questions about illness and hospitalization or responding in dysarthric and cryptic fashion. This reaction under the drug occurred only once in each of the other groups. It was of interest that two patients in the unimproved category who appeared withdrawn before the test became more responsive under the influence of the drug.

Comment

The results of the amobarbital tests in these patients indicate that there is a relation between clinical improvement and the production of brain damage or an altered state of brain function as determined by this particular method of examination. In patients who improve, the amobarbital test becomes consistently positive early in the course of treatment. In moderately improved or unimproved patients there are fewer positive reactions and their frequency does not increase with more treatments. With other methods of evaluating brain function such close correlation was not present, as all patients showed abnormalities in the electroencephalographic record and impaired learning was found as frequently in patients who improved as in those who do not. The significance of this relationship may be more clearly appreciated by a consideration of the changes in symbolic function that occur in states of altered brain function.

It has been useful in studying the behavior of patients with alterations in brain function to distinguish between defects in the formation of symbol patterns and changes of language patterns which indicate a shift in the mode of interaction in the environment. In the first category may be included many types of memory defects, dyscalculia, topographical disorientation, and aphasia. A patient with such a memory defect cannot select elements of experience, classify them into significant units, and arrange them into a temporal pattern. These defects are observed with diffuse cortical lesions and probably occur universally after shock treatments in transient fashion. They are, however, related very remotely, if at all, to therapeutic outcome. Alterations in the mode of interaction in the environment are exemplified in the various patterns of disorientation and denial and in the amnesias that are noted with lesions of the diffuse projection systems, in chronic barbiturate intoxication, and following electroshock convulsions. Here there is no defect in memory, awareness, or perception as such, but the patient selects or rejects certain aspects of the environment for the expression of his own motivations. In disorientation for place, for example, the misnaming and mislocating of the

hospital serve as symbolic representations of the patient's feelings about his incapabilities and problems—often as the manifestation of his need to be well and go home. It is not that the patient is unaware of his problems and does not know where he is in an absolute sense. He commonly "remembers" the name of the hospital and expresses "awareness" of his difficulties in other contexts of language. The unawareness is, rather, of the far greater degree to which he is expressing his own motivations in his perception of the temporal, spatial, personal, and somatic aspects of the environment.

In considering what constitutes therapeutic improvement, it is evident that the evaluation that is commonly made by a hospital staff depends in large part on the particular types of symbolic adaptation and defensive operations that are used. If the patient denies that he has any problems or that he is troubled by them, or if he cannot recall any, he is rated as improved. Such patients characteristically appear affable and uncomplaining, their manner reinforced by clichés and banalities, themselves adaptive forms of language. Many studies ‡ have shown that general memory impairment does not persist after electroshock but that there is a selective "forgetting" of traumatic material in the patient's life. This does not mean that he has developed a better understanding of his interpersonal relationships or has acquired "insight." The observation is also significant in explaining why, although electroshock may have a short-term beneficial effect, evaluation of long-term results shows little difference between treated and untreated cases. Also, the fact that therapeutic improvement did not result in patients with negative amobarbital tests suggests that methods of administering electroshock by minimally affecting brain function, such as a unilateral seizure, will not prove generally efficacious. From the immediately practical standpoint, the amobarbital test given after the third or fourth treatment may be of prognostic value.

The amobarbital test is not in itself a direct index of brain damage in that it measures some particular modality of dysfunction or brings out a specific defect. Rather, under the conditions in which it is given, one deduces impaired neural function by reason of the change in the organization or pattern of language in which the patient expresses himself. A positive result requires not only that a certain degree and type of impairment of brain function exist but that the patient employ verbal denial and disorientation as adaptive mechanisms. It would be expected that among patients with equivalent degrees of brain damage the highest incidence of positive amobarbital tests would occur among those who characteristically use denial as an adaptive mechanism in stress.

In relating these findings to the mode of action of electroshock and other somatic therapies, several considerations seem of importance. There is a combination of an added stress and a change in brain function. The milieu of brain function determines the pattern or organization of the adaptive behavior which can be most clearly formulated in terms of language. These include not only verbal patterns of denial and disorientation, elicited with the aid of the drug, but changes in syntactical patterns indicative of an altered relationship of the self in the environment. There were also indications that in the improved patients there were more changes in all types of symbolic adaptation, nonverbal as well as verbal. Thus, a patient who appeared withdrawn both in the predrug and in the drug interview had a poorer prognosis than the patient who became withdrawn only under the effects of the drug. The patient who showed altered sexual behavior under the effects of the drug had also exhibited this behavior during

‡ References 8-12.

the clinical questioning as well and did not improve with treatment, whereas the four patients manifesting sexual behavior only under effects of the drug did improve. It is likely that the faculty of changing symbolic patterns regardless of content is a factor in therapeutic improvement.

Summary

Twenty-four patients referred consecutively for electroshock treatment were given amobarbital (Amytal) tests before and at regular intervals during and following the course of treatment.

There was a close relationship between the short-term response to treatment and the results of the amobarbital tests. The much improved patients showed early, persistent, and increasingly positive reactions during the course of treatment. Unimproved patients showed no positive reactions, or showed them infrequently and inconsistently. An intermediate group, who showed moderate clinical improvement, showed more positive reactions than the unimproved group but fell far short of the much improved group in the incidence of positive reactions.

Changes in language and nonverbal forms of behavior related to denial were most consistent and pronounced in the improved group, even in interviews not employing drugs.

These observations indicate that clinical improvement in electroshock requires the creation of conditions of altered brain function in which new patterns of symbolic adaptation can be maintained.

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