

relative blood bank.

Dr. C. B. Carr (Greenville): I read somewhere that the antibiotics are present in breast milk of the mother.

Dr. Kover: We routinely take babies off the breast when they have any symptoms of erythroblastosis.

Dr. W. C. Becker (Charlotte): The most difficult thing is to select the babies for treatment. Even Dr. Walker told me at Princeton that 60 per cent recover spontaneously, and the mortality from transfusion procedures is rather high.

Dr. Kover: I don't think the mortality from the transfusion itself is prohibitive. Since it is the antibodies which cause the harm, it seems to me that the procedure of choice is to remove as many of the antibodies as possible.

POLYDIURNAL ELECTRIC SHOCK TREATMENT IN MENTAL DISORDERS

EDWARD A. TYLER, M.D.

HANS LOWENBACH, M.D.

and
DURHAM

The treatment of many mental disorders with artificially induced convulsions is today widely accepted. The mechanism by which convulsive "shock treatment" effects improvement is as obscure today as it was when Meduna, in 1935, introduced metrazol as a convulsive agent, or Carletti and Bini, in 1938, the brief passage of electric current through the anterior part of the skull¹.

The Importance of Confusion Following Electric Shock

Each convulsive treatment is followed by a period during which the patient's intellectual functions are severely impaired. Disorientation and loss of recent and remote memory, of judgment, of many inhibitions, and of initiative are easily demonstrated. At the same time, the patient shows a remarkable lack of concern over this state of affairs, and if anxiety or excitement were part of his psychotic picture, both will disappear for at least this interval².

This period varies greatly from patient to patient, sometimes ending after a few minutes, sometimes extending over several hours. It is impossible to predict, with cer-

tainty, whether a given patient will react to the electric shock with a long or with a short period of confusion. In general, it appears that the period of confusion is longer and more marked if the patient has been ill only for a short time. In contrast, patients with a psychosis of long duration and with symptoms mainly of systematized delusions remain confused only for a short time and quickly exhibit again the psychotic symptoms for which they are being treated. If convulsive treatment is repeated before the confusion of the previous treatment has completely disappeared a cumulative effect takes place and the resulting confusion will be more intensive and will last longer.

We gained the impression that patients who had an extended period of post-convulsive confusion tended to improve more readily than patients in whom this effect was absent. On the basis of this possible correlation between post-shock confusion and ultimate recovery, we began, in January, 1942, to let shock treatments follow each other so closely that extensive and long-lasting confusion resulted. To provoke such confusion patients have to be given up to four electric shocks per day, sometimes for several days in succession.

Possible Dangers of Polydiurnal Shock Treatment

We had to consider the possibility that this form of treatment might not be without harm to the patient. No help, in this respect, could be found in the literature. Most authors seem to favor, without any other reason apparently than that of tradition or inertia, to give treatments two or three times weekly. In a few articles it is suggested that treatments be given daily. For the control of excited and unmanageable patients, treatments more than once daily have been recommended³. Many epileptics have several *grand mal* seizures per day without a greater incidence of fractures, dislocations, or other accidents than among other patients with fewer convulsions. The danger of producing

1. From the Department of Neurology, Duke University Hospital and School of Medicine, Durham, North Carolina. Read before the Section on Neurology and Psychiatry, Medical Society of the State of North Carolina, Virginia Beach, Va., May 11, 1947.

2. A comprehensive review on shock therapy is contained in: S. Stambrook, Ed.: Shock Therapy: Psychologic Theory and Research, Psychol. Bull. 43:216 (Jan.) 1946.
3. Lowenbach, H., and Stambrook, E. J.: Observations on Mental Patients after Electroshock, Am. J. Psychiat. 98: 828-33 (May) 1942.

3. (a) Kevman, E. E.: Electroshock Therapy, with Special Reference to Release and an Effort to Prevent Them, J. Nerv. & Ment. Dis. 107:231-242 (Sept.) 1945.

(b) Lowenbach, H.: Electric Shock Treatment of Mental Disorders, North Carolina M. J. 14:231-238 (April) 1943.
(c) Hopfmitz, R. E., and Wadley, W. G.: The Treatment of Mental Disorders by Electrically Induced Convulsions, J. Ment. Sci. 53:246-255 (April) 1941.

(d) Kabanovskiy, I. B.: Electric Convulsive Therapy, with Emphasis on Importance of Adequate Treatment, Arch. Neurol. & Psychiat. 30:602-609 (Dec.) 1943.

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L. J. Stambrook

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an organic lesion which might later become the focus for spontaneous convulsions could be regarded as negligible. The possibility existed that the confusion might become permanent, or the lasting memory deficit so big that the patient would be equally as handicapped as if he had remained psychotic. In our experience, however, the confusion accidentally occurring after the conventional form of electric shock treatment always disappears, and only certain periods, especially the time of the treatment, cannot be recalled to memory. Similarly, Freeman and Wattson state that prefrontal lobotomy precipitates a period of confusion and loss of initiative which is only temporary and enhances, rather than detracts from, the curative effect of the operation. Finally, as we proposed to treat only those patients whose prognosis was bad and who might otherwise become permanent inmates of a mental hospital, we felt justified in risking a possible partial reduction of intellectual capacity.

Duration of Treatment

The goal of polydiurnal treatment is the production of extensive confusion and not the administration of a certain number of convulsive shocks. Often the four shocks given on the first day suffice to produce confusion which is evident and extensive on the following day. In that case, shocks are repeated only once or twice daily to maintain and to intensify this confusion so that it lasts at least one week.

Classification of Cases

Of the 32 cases reported here, 19 were patients of the Duke University Hospital and 13 were patients of the North Carolina State Hospital at Dix Hill⁶. In tables 1, 2, and 3 the essential data concerning these patients are presented. They have been divided into those living at home and working full time, those living at home but unable to work after a short period free of symptoms, and those living in custodial institutions. The case history of one patient is presented in detail below.

1. Freeman, W. and Wattis, J. W.: Psychosurgery; Intelligence, Emotion, and Social Behavior Following Prefrontal Lobotomy for Mental Disorders. Springfield, Illinois, C. C. Thomas, 1942.

2. The cooperation of the medical and administrative authorities of the North Carolina State Hospital at Dix Hill is gratefully acknowledged.

Case Report

The patient was a 35-year-old white, married man whose illness began about six months before his admission to Duke University Hospital in December, 1945. Toward the end of April, 1945, the patient started to feel "jittery," lost his appetite, and slept badly. In June, 1945, he felt that people were talking behind his back and were referring to his habit of wrinkling his brow when he was thinking. He believed that a friend, previously his boss, was putting him on trial at the shipyard where he was employed. As yet, he was unable to understand the purpose of the trial.

In July, 1945, he believed that a close friend of his had been killed, and this idea produced "a nervous breakdown," during which he had to stop working. He began to feel that radio programs were referring to him. A month later, he had to pay notice to license plates on automobiles and had to repeat their numbers over and over in his mind. He could not control his thoughts, and vulgar terms, predominantly of a homosexual nature, would run through his head. He would think of a name or of a city and feel that he was branding all the people there as homosexual. This habit he somehow connected with the reason for his being involved in a trial. In September, 1945, he heard voices making remarks of a derogatory sexual nature and referring to him in the third person.

At this time he was admitted to a private mental institution and received five electric shocks in two weeks. He was much improved and, for financial reasons, went home.

He remained asymptomatic for only two weeks, when all of his symptoms returned and he came to the outpatient clinic of Duke University Hospital. He was neatly dressed, very cooperative, smiling and friendly. He moved his head about a great deal as if perplexed. He showed some tendency to repeat himself and occasionally groped for words. He was very positive in his complaints, which were those just described. There were occasional glimpses of insight. In addition, he admitted frequent suicidal wishes. The patient was fully oriented and his recent and remote memory was good. His intelligence quotient (Bellvue-Wechsler scale) was 92.

The patient is the third of four children in a rural family. All siblings are alive and well. His birth and early development were normal. The patient was slow to learn, but graduated from high school and has done well as a store clerk. He has always been rather shy but never reclusive. He has many friends, takes an occasional social drink, and smokes a great deal. He is fond of athletic events. He attends the Methodist church regularly.

He began masturbation at the age of 12 with much guilt feeling, and on two occasions practiced fellatio on an older brother. From the age of 16 until he married, he had intercourse every few months with different women. At the age of 29 he married a woman four years his junior and this marriage has been successful. He has one son, now 4 years old.

Neurologic and physical examinations revealed no abnormalities. Serologic tests for syphilis were negative. X-rays of the spine showed a compression fracture of the fourth and of the eighth thoracic vertebrae—possibly a result of the shock treatment received at the other hospital.

The patient could not be admitted at once because no bed was available. While waiting at home for admission, he made a suicidal gesture and was brought in shortly afterwards. Electric shock treatment was started one day later, since the patient had already been examined in the outpatient clinic.

Within seven or two hours he was given thirteen electric shocks, all with major reactions. Except for 0.1 Gm. of secoral on the night of admission and an occasional aspirin, the patient received no drugs while in the hospital.

The patient was in the hospital for a total of twenty-two days. Every night except the third, fourth and fifth nights after electric shock treatment had been started, he slept seven or more hours. During this time he showed much confusion and some nicturnal restlessness. The temperature rose to 37.5 C. at the end of the first five treatments, but was normal again on the next day. The patient lost 15½ kg. (33 pounds) of weight during the first week, but regained it before discharge. The x-ray of the spine taken before discharge showed a doubt-

ful additional compression fracture of the seventh thoracic vertebra.

After each shock the patient had a short period of confusion, but at the end of the first day he was still fully oriented as to time, person and place, and could relate the symptoms given above. At the end of the second day, when he had had nine electric shocks, the patient was oriented only as to person, but could not recall his symptoms. He thought he was 26 years of age, unmarried and childless. It is interesting to note that he still retained some judgment. For example, when asked, "How many children have you?" he replied, "You know I can't have children; I just told you I was not married." At the end of the third day, after thirteen shocks, the patient thought he was 19 and lived on a farm. He

Table 1
Patients at Home, Asymptomatic, Working Full Time

Sex	Diagnosis	Age	Duke Hospital	Duration of Illness	No. of Shocks	No. of Treatment Days	Hospital days after Treatment Ended
M	Paranoid schizophrenia	35	6 months	13	4	18	
F	Paranoid schizophrenia	25	6 months	11	9	13	
M	Catatonic excitement	21	4 days	19	9	19	
F	Hebephrenic schizophrenia	15	11 days	22	11	34	
F	Mixed schizophrenia	20	1 month	12	4	7	
F	Agitated depression	48	2 days	16	8	11	
M	Alcoholic paranoia	31	1 month	8	2	8	
State Hospital at Dix Hill							
F	Catatonic excitement	26	7 months	10	4	30	
M	Mixed schizophrenia	28	21 days	12	3	1½ years*	
F	Agitated depression	48	3 months	7	3	15	

*This patient could not be discharged earlier for domestic, non-psychiatric reasons.

Table 2

Patients at Home Now, Socially Improved, Not Working or Working Part Time

Sex	Diagnosis	Age	Duke Hospital	Duration of Illness	No. of Shocks	No. of Treatment Days	Hospital days after Treatment Ended
M	Depression	35	6 months	10	3	8	
F	Paranoid schizophrenia	24	3 years	9	3	20	
M	Paranoid schizophrenia	27	3 months	12	3	19	
M	Paranoia	48	Several years	15	4	22	
F	Agitated depression	29	8 years	16	6	10	
M	Paranoid schizophrenia	27	3 months	5	3	1*	
M	Depressive stupor	32	3 years	10	3	35	

*This patient did not develop confusion, but improved so much that the family demanded his discharge.

Table 3

Patients Requiring Custodial Care

Sex	Diagnosis	Age	Duke Hospital	Duration of Illness	No. of Shocks	No. of Treatment Days	Hospital days after Treatment Ended
F	Hebephrenic schizophrenia	24	3 years	11	3	11**	
M	Paranoid schizophrenia	39	15 years	12	8	15**	
F	Manic excitement	30	2 months	6	2	22	
F	Hebephrenic schizophrenia	17	18 months	13	5	36	
F	Psychopathic personality	15	5 years	5	3	7	
State Hospital at Dix Hill							
F	Agitated depression	32	1½ years	10	1	—**	
F	Schizophrenia	23	Several years	10	4	—**	
F	Hebephrenic schizophrenia	19	8 months	10	4	—**	
F	Hebephrenic schizophrenia	19	3 years	10	4	—**	
M	Paranoid schizophrenia	31	4 months	12	3	—**	
M	Schizophrenia	25	14 months	12	3	—**	
F	Schizophrenia	24	1 year	6	4	—**	
F	Paranoid schizophrenia	31	14 months	12	4	—**	
F	Agitated depression	40	6 months	10	4	—**	
F	Schizophrenia	29	1 year	12	3	—**	

**The patients at Duke Hospital were discharged into custodial care.

**Temporary improvement lasting not more than a few weeks.

believed that he worked at a previous job. He staggered a great deal and complained of backache. He was oriented only in regard to person.

The fourth day the patient was very much confused and was unable to understand even simple instructions. His speech was thick and slow, and frequently unintelligible. When given food or water, he sat swishing it around in his mouth without swallowing it. He resisted going to the toilet, but he never became ill tempered. He began letting saliva drool from his mouth and voided upon the bedroom floor. He slept only a couple of hours that night, but remained quiet. The fifth day he said he felt better and talked a little spontaneously. He was unable to remember his name when asked, but responded to it when called. He ate well, but slept poorly. The sixth day he got up early, went promptly to the bathroom and started washing his face and hair, but repeated this action until interrupted. He now thought he was in his twenties, unmarried, and working in a grocery store. He began to complain of things whirling about him and would frequently say, "This elevator is going up too fast." That night he would not stay in bed, but roamed about the hall and disturbed everyone. The seventh day, he wandered about the hall trying to unlock doors and spoke of getting ready to go to work in a few minutes. He would now dress spontaneously, but was slow initiating each new action. He begged to be allowed to go out and look for a job. He wanted to make a long-distance call regarding coming to work the next morning.

During the first part of the second week after the shock therapy, his main interest was in playing ping-pong. He gradually remembered being about 30 and being married, but not that he had a child. He was friendly and cooperative with all the attendants and other patients. In the third week, the patient retained most of his memory, except for a period extending back almost one year. He was totally unable to remember having been sick or having worked in the shipyard. In this condition he was discharged on the twenty-first day after the treatment had started.

The patient was seen as an outpatient on April 22, July 17, and December 1, 1946. He had taken his old job at the grocery store on January 11, 1946, and missed no time from work except on the three days when he came to the clinic. He was sleeping well and eating regularly. He again enjoyed going to baseball games, listening to the radio, and taking his wife out for the evening. He had no memory of his illness. He was content to say that he had a "nervous breakdown." He has been told that he had attempted to cut his throat; he was little concerned about that and felt that it was caused by his nervousness. His friends were unable to notice any difference in his behavior from that which he exhibited long before he became ill. Occasionally he is embarrassed by having someone speak to him and not remembering having met him before.

On April 28, 1947, the patient returned for another clinic visit. At this time the Bellevue-Wechsler examination was repeated, and his full-scale intelligence quotient was 108—a gain of 16 points over the rating obtained during his psychotic, pre-shock period.

Discussion

There is general agreement that electric shock treatment is most effective against depression, regardless of origin, and against catatonic schizophrenia of short duration,

and that it is least beneficial to patients suffering from the hebephrenic and paranoid forms of schizophrenia. We had hoped that polydiurnal electric shock treatment might provide a tool with which to help, in many instances, those psychotic patients whose symptoms otherwise are not lastingly affected. Unfortunately, no certain differences seem to exist, in this respect, between the result that we obtained with the intensive treatment and the results that could have been obtained with the conventional form of electric shock treatment, with metrazol, or with insulin shock. All of our patients who had been diagnosed as suffering from hebephrenic schizophrenia showed, with one exception, temporary and only spurious improvement and are today still inmates of a mental hospital. The exception was a girl of 15, and one may well doubt the correctness of the diagnosis in this case. On the other hand, however, one could question whether all of the paranoid schizophrenics whom we treated would have recovered or improved without intensive treatment. Some of them actually had received shock therapy previously in other hospitals without benefit.

One advantage of this method appears when one compares the average number of hospital days for patients under conventional electric shock treatment and for those with polydiurnal treatment. If comparison is made with insulin treatment, the difference is even more impressive. This shortening of the hospital stay is no small advantage when one remembers the shortage of hospital facilities for mentally ill persons and the even greater scarcity of trained professional personnel. The more rapid and effective the method of treatment, the greater the number of patients who can be given a therapeutic trial.

We believe that electric shock therapy, in most instances, could be completed in four or five days and that its effectiveness could be determined in a much shorter time than at present. The patient could be discharged as improved or transferred to enclodial care much sooner, thus freeing a therapeutic bed for another untreated patient. The financial and emotional gains to the patient, his relatives, and the community are obvious.

In accordance with our expectations, the dangers from polydiurnal treatment are not

greater than those of conventional electric shock. The dangers of both methods are much less than those of deep insulin shock. Spontaneous convulsions have not developed in any of our patients, although some of the treatments date back five years. The confusion, often deep and all-pervading, has cleared in all cases, and fine psychologic tests are necessary, as after other shock treatments, to demonstrate permanent impairment. Certainly no significant loss of judgment is exhibited by the patients thus treated if they recover from their mental illness. The difficulties of speech and gait which frequently occur in our patients during polydiurnal treatment disappear even in those patients who remain psychotic.

Our experience has intensified our conviction that confusion is a beneficial and therapeutically desirable effect of electric shock in the treatment of mental disorders other than exclusively depressive states. Polydiurnal shock treatment achieves this aim faster and more effectively than electric shock given at a slower rate, where confusion usually appears first in the third treatment week, and is often much too superficial. The number and the frequency of treatments should not be determined by the magic of numbers, like ten or twelve, but should be governed by the degree of confusion.

Summary

Polydiurnal electric shock—that is, more than one shock per day—was given to 35 psychotic patients. Four major convulsions per day for as many as three days are not more dangerous than the conventional form of electric shock treatment. After following all of these patients for periods varying from one to five years, we find no significant residual impairment of function in intellectual capacity nor any evidence of localized brain damage. The number of patients who recovered was not appreciably different from that found after other forms of shock therapy, and no certain relationship seems to exist between probability of recovery and the pattern with which the shocks are given. However, the period of hospital treatment can be shortened quite considerably by a method of therapy no more dangerous than other shock therapies and requiring less trained professional personnel than deep in-

ulin shock treatment.

Post-convulsive confusion is a beneficial and therapeutically desirable effect of electric shock in the treatment of mental disorders other than exclusively depressive states. The number and the frequency of treatments should be determined by the degree of confusion.

Discussion

Dr. David A. Young (Raleigh): Dr. Tyler and Dr. Lowenbach should be complimented on their work and on their conservative conclusions, with which I am in general agreement. The remarks that I have to make exceed, in some respects, the limits of the paper.

The advisability of any procedure such as this is determined to a considerable extent by the possibilities which might be expected in the individual without treatment or with other forms of treatment which are less serious. The point made in the paper that the treatment should be begun early and that the most satisfactory results were obtained in patients who were treated very early in the course of their disease agrees with the findings of other psychiatrists.

I heartily commend the authors for stating that we should not set any "magic number" as the number of treatments which should be given. In the early days of shock treatment, patients were subjected to a particular number of treatments, called a "course." If they did not recover after this, they were said to need a second or third "course." The number of treatments which constituted a "course" varied greatly from doctor to doctor. I agree with Dr. Lowenbach and Dr. Tyler that the number of treatments should be governed by individual consideration of the effect of shock treatment on the individual, and that another treatment should be given at the time it seems to be needed.

The authors' conclusion that the number of patients who recovered following this form of treatment was not very much greater than the number which might be expected to recover following other forms of shock treatment may tend to dispel a false idea that the effectiveness of shock therapy is in direct proportion to the number and intensity of treatments.

It appears to me that we have in psychiatry at the present time a situation which is quite similar to that in general medicine: the use of electric shock, insulin shock, insulin sub-shock, insulin with electric shock, or insulin with the use of some sedative in certain types of psychiatric disorders is analogous to the trial of penicillin, sulfonamides, penicillin and sulfonamides, or streptomycin in certain infectious diseases. We try first one thing and then another, and the emphasis is placed altogether on treatment. The result may be very good, but the availability of so many methods of treatment unfortunately takes the therapist away, to some extent, from the understanding of the condition he is treating. The psychotherapeutic angle should not be neglected simply because other methods of treatment are available.

I would be interested in any further details which the authors might give in regard to the choice of patients for this special kind of treatment, and also any further elaboration of their reasons for stressing the confusion as such a prominent factor in recovery. I hope that out of such work as this may come a sound practical and theoretical basis for the

whole matter of shock treatment.

Dr. Lowenbach: Since we put together the data for this paper, many more patients have been treated with polydynamal shock with good results. We think it is indicated for patients suffering from schizoid phrenia, especially of the paranoid and hebephrenic type, and for patients with agitated depression. We use it also in patients with other psychoses, if time is an important factor.

The reasons for stressing confusion as a therapeutically valuable factor are derived entirely from experience. It is my impression that the more normally integrated the intellectual and emotional functions of an individual, the stronger will he react with confusion to electric shock. Patients with depression or with another psychosis of relatively short duration show confusion of several hours after a single treatment, while a patient with paranoia, for example, will exhibit his delusional system within a very short period after the end of the convulsion. If one spaces the treatments close together, one can gradually extend the period of confusion in the latter patients also, and achieve improvement which would probably not occur otherwise. Expressed quite primitively, it seems to be necessary to "insult" the central nervous system more intensely if one wants to "reach" pathologic associations of long duration. In patients with simple depression, on the other hand, this is not necessary. However, confusion will usually not harm them and valuable time can often be saved.

psychosis⁶¹. The present study was undertaken to determine the responses of psychotic individuals in different phases of their illness to several specific and non-specific skin-test substances.

Materials and Methods

Subjects

Two hundred and eighty-eight white females at the North Carolina State Hospital in Raleigh were chosen for this study. All subjects had been institutionalized at least one year continuously, had an identical food and water supply, and had had no active therapy—that is, convulsive therapy—which might have altered the course of the psychosis. The ages ranged from 16 to 82 years; the duration of institutionalization, from one to forty years.

These patients were divided into three groups, as follows:

Group I—deeply psychotic. The 147 patients in this group had been removed from the wards and placed in buildings reserved for those violently disturbed.

Group II—mildly psychotic. The 91 patients in this group were allowed to remain on the wards, where a certain degree of cooperation and self-sufficiency is required.

Group III—convalescent. These 50 patients had improved sufficiently to be cared for in a separate building, analogous to a rest home, where a minimum of supervision is required.

Materials

The substances used for skin-testing were:

- (1) Old tuberculin (OT), 1:1000, 0.1 mg. per dose
- (2) Purified protein derivative of tuberculin (PPD), 0.005 mg. per dose
- (3) Histamine phosphate, USP XII, 0.01 mg. per dose
- (4) *Ascaris antigen*⁶², 0.0002 mg. of nitrogen per dose
- (5) *Trichinella antigen*⁶³, 0.002 mg. per dose
- (6) *Coccidioides*⁶⁴, 0.1 mg. per dose
- (7) Lecithin and acacia, 1 mg. of lecithin and 6 mg. of acacia per dose
- (8) Physiologic saline solution, 0.1 cc.

1. Hammett, A.: Correlations between Epidermal Impedance and the Clinical Course in Certain Psychoses. *Proc. Soc. Exper. Biol. & Med.* 12:549-551 (Decy, 1940)

2. We are indebted to Drs. J. T. Smith and N. P. Conant of the Duke University School of Medicine for furnishing us with coccidioidin, and to Lederle Laboratories for the trichinella and ascaris antigens.

SKIN TESTS IN PSYCHOSES

Reactions to Specific and Non-Specific Substances in Institutionalized Psychotic Individuals

JERRY K. AIKAWA, M.D.

JOSEPH ALEXANDER

GEORGE ANDERSON

and

TAYLOR BROOKS, M.D.

WINSTON-SALEM

In the course of a study on trichinella skin tests in patients in psychiatric institutions, the incidence of positive reactions in a small group of individuals with acute psychoses was found to be four times as great as in convalescent patients. This finding suggested the possibility that the skin response to biologic products might be altered in different stages of psychosis. It has been reported that the electrical resistance of the skin varies markedly in the same individual as he recovers from the acute phase of a

From the Department of Internal Medicine, Bowman Gray School of Medicine of Wake Forest College, Winston-Salem, and the North Carolina State Hospital, Raleigh.

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