

HALLUCINOGENIC DRUGS AND CEREBRAL DEFICIT

L. D. ACORD, Ph.D.¹ AND D. D. BARKER, A.B.

Fifteen Ss who had used hallucinogenic drugs were compared with 15 similar Ss who had not, on three tests, shown to be sensitive to cerebral impairment. It was found that the drug Ss performed consistently poorer, and, on two of the tests, significantly poorer than did the nondrug users. It was suggested that hallucinogenic drug use may be causally related to cerebral deficit.

Although the use of hallucinogenic drugs appears to be tapering off somewhat in favor of the "harder" drugs (heroin, cocaine) it is still a major factor in the so-called drug scene. In addition, although many people have stopped using the hallucinogens, the possible long range effects on those who have used them in the past become of increasing interest relative to the acute effects (9). Although there have been literally hundreds of case reports and subjective commentaries published regarding the effects of hallucinogenic drugs on the personalities of a wide range of subjects, relatively little objective research has been attempted, especially with the "average" user of hallucinogens, the young person who obtains his drugs on the street through illicit channels. There are, of course, quite valid reasons for the lack of research in this area. These have been enumerated elsewhere (1, 5) and are, briefly, lack of knowledge of pre-drug-use factors, difficulty in attributing effects to a specific drug or combination of drugs, the impossibility of adequate follow-up of subjects, the unknown identity and purity of drugs obtained through illicit channels, and the unreliability of self-reports by drug users as to the nature, potency, effects, and incidence of use.

¹National Naval Medical Center, Bethesda, Maryland 20014.

The opinions and assertions contained herein are the private ones of the author and are not to be construed as official or as reflecting the views of the Navy Department or of the naval service at large.

Although the above problems may seem, and in reality probably are, insurmountable at this time, some investigators have continued in an attempt to evaluate the possible harmful effects of these drugs, even though the evaluation cannot satisfy the requirements of precise scientific research. McGlothlin *et al.* (5), using the Halstead Battery with 32 Ss, concluded that there was evidence of moderate impairment of abstract ability among their 16 LSD Ss which was not evident in their 16 control Ss. Von Zerssen and his associates (11), using the echoencephalographic technique, and Campbell *et al.* (3), using pneumoencephalography, both concluded that there was a significant dilation of the third ventricle when drug users were compared with normal control Ss. The former did not specify which drugs were used, although the latter did specify LSD usage in their experimental Ss. The present study was undertaken as part of a continuing attempt to evaluate these and other findings (1) and the clinical impression of many medical and mental health professionals that the use of hallucinogenic drugs has detrimental effects on the cerebral cortex (2).

METHOD

Experimental subjects (Ss) were selected from the inpatient and outpatient services and staff of a large military hospital. Volunteers were solicited and staff psychiatrists and neurologists were requested to provide male Ss who met all of the follow-

TABLE 1

Test	Control	Experimental	<i>t</i>
TMT-B	56.00 Seconds	88.53 Seconds	1.47*
TPT-L	5.80 Designs	3.40 Designs	2.89†
CAT	35.47 Errors	49.80 Errors	2.85†

* Not significant at .05 level.

† $p < .01$

ing criteria: 1) self-report or validated objective evidence of at least one ingestion of an hallucinogenic drug (LSD, MTA, STP, *N,N*-dimethyltryptamine (DMT), mescaline, or psilocybin) obtained through illicit channels (for the purposes of this study marijuana was not considered an hallucinogenic drug, although every experimental subject reported at least one use of it); 2) no evidence of intracranial pathology; 3) freedom from the use, effects, and side effects of medically prescribed drugs during the testing procedure; and 4) no evidence of psychopathology other than character and behavior disorder with drug abuse as a symptom. (Inpatient Ss represented no psychiatric diagnoses other than character and behavior disorder with drug abuse as a symptom.) Control Ss were selected in the same manner. The majority of the control Ss had used marijuana but all denied the use of hallucinogenic drugs. In this way some 30 Ss were obtained—15 who presumably had used hallucinogenic drugs and 15 who had not. Essential characteristics of the drug Ss were: age, 21.53 years; education, 13.07 years; and Navy General Classification Test scores, 57.27. For the control Ss the corresponding values were: 22.67 years, 13.37 years, and 61.60. There were no significant differences between experimental and control Ss on these characteristics.

Procedure. In a previous study (1), the Indiana Neuropsychological Battery (6, 7, 10) had been administered. Since it had been found in that study that three of the tests within the battery appeared to be most sensitive to the cerebral deficit suspected in users of hallucinogenic drugs, only

these three tests were administered to the Ss in this study. The tests were: the Tactual Performance Test, Localization (TPT-L); the Trail Making Test, part B (TMT-B); and the Category Test (CAT).

RESULTS

The mean scores obtained by the experimental and control Ss, with corresponding *t* values, are presented in Table 1. As can be seen from this Table, those Ss who had used hallucinogenic drugs performed significantly less well than did those Ss who had not used such drugs on two of the three tests. It seems useful also to note that, using Halstead's (4) and Reitan's (8) cutoff scores, all of the drug Ss scored in the brain-damaged range on at least one of the three tests, whereas only 7 (47 per cent) of the control Ss did so. Eight of the drug Ss (53 per cent) scored in this range on at least two of the tests, while only one (7 per cent) of the control Ss did, and two (13 per cent) of the drug Ss exceeded the cutoff scores on all three of the tests while none of the control Ss did so. The lack of a significant difference on TMT-B may have been related to the extreme variability of the drug Ss on this test—SD = 83.94 seconds, range = 33 to 357 seconds.

DISCUSSION

The deficiencies inherent in studying the effects of hallucinogenic drugs which were discussed earlier must, of course, limit the confidence in any conclusions drawn from the findings of the present study. While the performance of the drug Ss were, with the exception of TMT-B, significantly poorer than those of the normal Ss, in only one case (TPT-L) did they exceed the cutoff scores established by Halstead (4) and Reitan (8), although on the CAT and TMT-B scores they very nearly did so. It should be noted that the original criterion groups from which the cutoff scores were established were, on the average, over twice the age of the Ss in this study. In any case, the

consi
sitive
on wl
most
bral
that
sugge
to th
quite
It
tics a
bral
CAT
what
straci
funds
(p. 1
to fa
feel t
volv
the b
becor
distor
inade
could
funct
proce

Th
previ
lines,
cereb
findir
more
cereb
partic
tively
indica

consistent finding that those tests most sensitive to cerebral impairment are also those on which hallucinogenic drug users perform most poorly suggests some degree of cerebral deficit. If this finding is coupled with that of Campbell and his associates (3), the suggestion of some cerebral damage related to the use of hallucinogenic drugs becomes quite strong.

It is well established that abstract abilities are more impaired by generalized cerebral damage than are other abilities. The CAT and TPT-L are highly loaded with what Halstead (4) labels an "A," or abstraction factor, which he felt was "... the fundamental growth principle of the ego" (p. 147). The TMT has not been subjected to factor analysis, although Reitan does feel that it is a relatively complex task involving symbolic processes. If one examines the behavior of the "acid heads" it readily becomes apparent that many of them (time distortions, loss of motivation, withdrawal, inadequate interpersonal relationships, etc.) could easily be ascribed to impaired ego functioning and deficits in higher cognitive processes.

SUMMARY

The results of the present study, and of previous studies conducted along similar lines, do not establish the presence of gross cerebral pathology. However, the consistent finding that hallucinogenic drug users score more poorly on tests especially sensitive to cerebral damage than do nondrug users, and particularly on those tests requiring relatively high level abstraction abilities, does indicate that the use of hallucinogenic drugs

involves some risk to higher cognitive functioning. In addition, the findings from entirely different approaches—pneumoencephalogram (3), echoencephalogram (11), neuropsychological testing (1, 5), and the current study—at least begin to indicate that there may be a causal relationship between the use of hallucinogens and brain damage.

REFERENCES

1. Acord, L. D. Hallucinogenic drugs and brain damage. *Milit. Med.*, **137**: 18-19, 1972.
2. Blacker, K. H., Jones, R. T., Stone, G. C., and Pfefferbaum, D. Chronic users of LSD: The "acidheads". *Am. J. Psychiatry*, **125**: 341-351, 1968.
3. Campbell, A. M. G., Evans, M., Thomson, J. L. G., and Williams, M. J. Cerebral atrophy in young cannabis smokers. *Lancet*, **2**: 1219-1224, 1971.
4. Halstead, W. C. *Brain and Intelligence*. Univ. Chicago Press, Chicago, 1947.
5. McGlothlin, W. H., Arnold, D. O., and Freedman, D. X. Organicity measures following repeated LSD ingestion. *Arch. Gen. Psychiatry*, **21**: 704-709, 1969.
6. Reitan, R. M. Investigation of the validity of Halstead's measures of biological intelligence. *Arch. Neurol. Psychiatry*, **73**: 28-35, 1955.
7. Reitan, R. M. Psychological assessment of deficits associated with brain damage in subjects with and without subnormal intelligence. In Khanna, J. L., Ed. *Brain Damage and Mental Retardation: A Psychological Evaluation*. Charles C Thomas, Springfield, Ill., 1967.
8. Reitan, R. M. The relation of the Trail Making Test to organic brain damage. *J. Consult. Psychol.*, **19**: 393-394, 1955.
9. Ungerleider, J. T. The psychiatric emergency. *Arch. Gen. Psychiatry*, **3**: 593-601, 1960.
10. Vega, A. and Parsons, O. A. Cross-validation of the Halstead-Reitan tests for brain damage. *J. Consult. Psychol.*, **31**: 619-625, 1967.
11. Von Zerssen, D., Fliege, K., and Wolf, M. Cerebral atrophy in drug addicts. *Lancet*, **2**: 313, 1970.