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Lumbar Air Encephalography in Chronic Schizophrenia: A Controlled Experiment

By P. B. STOREY*

Introduction

The lumbar air encephalogram (L.A.E.G.) was introduced by Dandy in 1919, and in 1929 the first report of its use in schizophrenia was published by Jacobi and Winkler. Since then numerous papers have appeared, most of which have claimed to demonstrate cerebral atrophy in chronic schizophrenic patients. All these studies have suffered from the fact that no adequate series of normal controls has yet been collected. Most of the authors concerned made no attempt to use controls, nor did they consider the possibility of observer error or of the bias which may exist when the reporting radiologist knows the diagnosis and is looking for abnormalities.

Notwithstanding these and other objections, an impressive amount of evidence has been collected. In particular Huber (1957) produced the most convincing support for the theory, and this study was planned as a direct result of his monograph. In it care has been taken to include a control series, to exclude bias, and to assess observer error.

Review of the Literature

Thirty-two papers have been found which have appeared on this subject, and twenty-nine have supported Jacobi and Winkler in their original contention: that chronic schizophrenics show cerebral atrophy. Only the most important will be mentioned here.

Lemke (1936) studied 100 cases, rating ventricular size on a five-point scale; and using, as controls, patients with epilepsy, migraine, hysteria and psychopathy. Of the schizophrenics 85 per cent. showed cortical atrophy, and 50 per cent. dilated ventricles; of the controls only 20 per cent. were similarly affected. The most severe changes were in those with the most severe defect. As some of his cases had been studied by Jacobi and Winkler eight years before and showed no increase in the degree of atrophy, he concluded that in some patients there was an inborn cerebral anomaly which adversely affected the schizophrenic process.

Huber (1957), in a detailed monograph, describes his findings in 190 schizophrenics. They were an unselected series of cases who had had little or no somatic treatment, and who showed no evidence of brain damage. He rated them for defect on a scale based essentially on social competence, and found that the degree of atrophy was proportional to the severity of defect. He emphasized in particular the importance of broadening of the third ventricle; and also found that the different clinical types of schizophrenia showed varying degrees of atrophy. Groups of patients were effectively matched for age, and the author gave the necessary technical details and measurements. By demonstrating differences within the series he partly overcame the lack of outside controls, but the absence of "blind" assessment of the films and of any statistical evaluation are drawbacks of this work.

Recently there have been two negative studies, both as a result of Huber's work. Peltonen (1962) compared the films of 644 patients from a Finnish mental hospital, of whom eighty-six were schizophrenic. The films were examined in ignorance of the diagnosis, and only the third ventricle was measured. It was shown conclusively that the schizophrenics did not differ from the other patients—depressive, epileptic, neurotic and psychopathic.

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Ansink *et al.* (1963) examined the films of forty-three chronic schizophrenics using the same criteria as did Huber, and found anomalies in only ten. They suggest that his results stem from technical factors, such as injecting too much air and thus inflating the ventricles. Huber did, in fact, consider this possibility, but it seems unlikely as he only used 30–40 ml. of air in most of his cases.

The Encephalogram after E.C.T.

It has been considered unlikely that E.C.T. can cause cerebral atrophy. The subject is reviewed in the handbook by Bellak (Bellak, 1958). In addition a number of histopathological studies have been published which fail to support the idea: Rowland and Mettler (1949); Peyton *et al.* (1949); and Corsellis and Meyer (1954). Many of the papers describing cerebral atrophy in schizophrenics were, of course, written before the introduction of E.C.T.

The Present Study

Ethical considerations

Encephalography is considered safe in the absence of raised intracranial pressure, but it remains a painful procedure in many cases, even though the modern fractional techniques are less distressing than the older methods. It was thought to be justified to submit patients to this if both they and their relatives knew that it was only an investigation, and gave permission independently. The patients were all referred by the consultant in charge as being both indubitably schizophrenic and likely to understand the proposal. Letters were then sent to the next of kin seeking approval, and if this was forthcoming the patient was interviewed. It was explained in simple terms as e.g. "trying to find out more about the cause of your illness"; the lumbar puncture was described (many patients knew what these were already), and they were warned to expect headache and several days in bed. No attempt was made to persuade unwilling relatives or patients. Out of fifty-four relatives approached, forty-nine gave consent; and of the forty-nine patients interviewed eighteen agreed to the procedure.

Selection of Patients

The patients had to meet the following criteria:

1. they should be considered to have chronic schizophrenia in the opinion of both the referring consultant and the author, and to have spent at least two years in hospital. (Illustrative cases are included in Table VIII.)
2. they should be not more than 45 years old, to minimize the age effects.
3. they should have no clinical evidence of brain damage; and have had no leucotomy.

By any normal standards these patients were severely affected, although the most severe cases had to be excluded on ethical grounds, but attempts were made to distinguish varying grades of severity. They were rated on two scales devised by Wing (1960 and 1961), in one of which the Sister or Charge Nurse rates patients on behaviour on the ward which indicates "socially embarrassing" and "socially withdrawn" behaviour; in the other the psychiatrist rates them on four symptoms: flatness and incongruity of affect; poverty of speech; incoherence of speech; and the expression of coherent delusions. The diagnostic categories of paranoid, hebephrenic, and catatonic were also used.

Selection of Controls

These were taken from the records of the radiological department. They were the first eighteen found, from patients under the age of 45 years, which had been reported as "normal" in the course of the routine work of the department. So far as was known these patients had not been shown later to have any serious intracranial disease. The provisional diagnosis of these patients for which they had had the encephalograms included "epilepsy", "recent transient giddiness" and "severe migraine". The provisional diagnosis did not affect selection as a control. They are approximately matched for age with the patients (see Table III).

Radiological technique was the same as for the experimental subjects.

Radiological Technique

After premedication and local anaethesia the lumbar route was used. 10 ml. of C.S.F. and 40 ml. of air were the approximate maxima exchanged, using a fractional technique. Films were taken of the standard Lysholm positions at a focus-film distance of 36 inches (90 cm.). Potter-Bucky and iris diaphragms were used.

Measurement and Assessment of the Films

Comparison of the results obtained by different workers in this field has been hampered by the use of different standard measurements and indices, as well as by varying radiological techniques (Bruijn, 1959). The subjective nature of the assessment of the films, apart from measure-

ment, is another problem. Features such as rounding of angles, or pooling of air over the cortex, are of great importance in the skilled examination needed; but it is in these that observer error and bias are most likely to appear.

It was therefore decided to have two independent observers, and to use a blind technique. Only one subjective judgment was made—that of normality/abnormality—and three measurements. These were: the maximum breadth of the third ventricle in the antero-posterior view; and the breadth of the bodies of the lateral ventricles. They were measured using a transparent rule on an illuminated screen.

The films of patients and controls were mixed, and then examined separately by two radiologists, A and B, who did not know which films were which. After correlation of these observers' readings, all the films were re-examined by A. He was told which measurements were in dispute, and his final reading was taken as the "agreed score" for the comparison of patients and controls.

It was apparent to the author, who watched both radiologists, that in cases where the difference was more than 2 mm. they were measuring from slightly different parts of the ventricles, and that errors of less than 2 mm. were inherent in the technique used.

Results

These are in three main groups: the correlation of the observations of the two radiologists; the comparison of patients and controls; and differences between patients.

(1) Observer Correlation

For this the total of 36 A.E.G. is used (Table I).

(*a*) *Third Ventricle Breadth*

Mean breadth measured by A—6·47 mm. (S.D. 1·96). Mean breadth measured by B—5·97 mm. (S.D. 1·76). The product moment correlation coefficient=0·6. In 27 out of the total 36 there was agreement within 1 mm., and in 32:36 there was agreement within 2 mm. The correlation coefficient therefore tends to minimize the agreement reached in practical terms.

(*b*) *Lateral Ventricle Breadth*

To avoid "averaging out" any abnormality, only the larger of the two ventricles is considered here. Mean breadth measured by A—18·74 mm. (S.D. 2·81). Mean breadth measured by B—17·32 mm. (S.D. 3·01). The product moment correlation=0·74. In 23:36 there was agreement within 1 mm., and in 29:36 agreement within 2 mm.

It is clear that *inter*-observer agreement in these measurements is very good.

(*c*) *Use of the Description "Abnormal"*

A. had reported previously on all these films; the controls two to three years previously, and the patients over the preceding year. He had described all the controls as "normal", and two of the patients as "abnormal". In the re-assessment for this study he considered one of the controls to be "abnormal", but did not change his opinion on any of the patients. His own observer reliability is therefore high. (No measurements had been made at those earlier examinations.)

B. used the description "abnormal" much more often; in fact 4:18 controls and 7:18 patients.

The use of χ^2, with Yates' correction, shows that the difference between the two observers is significant at the 5 per cent. level. ($\chi^2=4{\cdot}346$, with one degree of freedom.) The difference found by B between the patients and controls does not reach significance.

2. Comparison of Patients and Controls

For this the "agreed score" is used, as described above (Table I).

(*a*) *Third Ventricle*

Mean breadth for patients—6·8 mm. (S.D. 1·92). Mean breadth for controls—5·9 mm. (S.D. 1·73). This difference is not significant. (t=1·37.)

(*b*) *Lateral Ventricle*

Again only the larger of the two ventricles is considered here.

Mean breadth for patients—18·3 mm. (S.D. 2·8). Mean breadth for controls—18·6 mm. (S.D. 2·20). This difference is not significant. (t=0·34.)

(*c*) *Abnormalities as Described by Radiologist B*

Of the four controls considered abnormal by B, one showed cortical atrophy and three

TABLE I(A)

Name	Radiologist A			Radiologist B			Patients Agreed Score		
	3rd V.	R.	L.	3rd V.	R.	L.	3rd V.	R.	L.
H.C.	9	18 *22* (normal)		10	*16* 15 (normal)		9	16	*20*
R.S.	6	* *21* (normal)		6	* 20 (abnormal)		6	*	*21*
G.H.	5	* * (normal)		5	17 15 (normal)		5	*17*	15
P.P.	5	18 *18* (normal)		5	18 *20* (abnormal)		5	18	*19*
E.K.	6	20 * (normal)		7	* * (abnormal)		6	*20*	*
F.E.	6	* *17* (normal)		6	15 *16* (normal)		6	15	*17*
D.C.	6	15 *17* (normal)		6	*15* 15 (normal)		6	15	*16*
E.D.	10	20 *20* (abnormal)		6	*19* 19 (abnormal)		9	19	*20*
J.M.	10	* * (abnormal)		10	* * (abnormal)		10	*	*
L.M.	7	19 *22* (normal)		8	20 *21* (normal)		7	20	*21*
A.W.	7	18 *20* (normal)		8	20 *20* (normal)		8	19	*20*
J.T.	5	*15* 13 (normal)		4	*14* 13 (normal)		5	*14*	13
G.M.	8	18 *22* (normal)		5	15 *17* (normal)		7	17	*18*
G.D.	7	20 *20* (normal)		6	*16* 13 (normal)		6	20	*20*
E.T.	6	16 *16* (normal)		4	*15* 15 (normal)		5	16	*16*
P.B.	8	14 *14* (normal)		7	16 *17* (normal)		7	15	*17*
B.D.	5	15 *15* (normal)		5	15 *15* (abnormal)		5	15	*15*
M.S.	10	*20* 19 (normal)		6	19 *20* (abnormal)		10	19	*20*

Figures in italic represent the larger of the lateral ventricles, and were the figures used on the comparisons.

* Indicates that no satisfactory measurement could be made.

ventricular dilatation. Of the seven patients three were thought to show ventricular dilation and five cortical atrophy. One patient showed both abnormalities. Some details are given in Table II and it can be seen that no relationship exists between the presence of the abnormalities and the duration, severity, or clinical type of illness.

3. DIFFERENCES WITHIN THE SERIES OF PATIENTS

(*a*) *Repeat Encephalogram*

One patient had had an encephalogram performed three and a half years previously, at the start of her illness. These earlier films were obtained, but no differences could be demonstrated between the two sets.

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TABLE I(B)

Name	Radiologist A.			Radiologist B.			Controls Agreed Score		
	3rd V.	R.	L.	3rd V.	R.	L.	3rd V.	R.	L.
1.	4	*17* 16 (normal)		5	*16* 16 (normal)		5	*17*	16
2.	6	* 18 (normal)		3	* * (normal)		5	*	*19*
3.	10	*22* 19 (normal)		10	18 *20* (abnormal)		10	*22*	19
4.	5	17 *17* (normal)		7	*16* 16 (normal)		6	*17*	16
5.	7	* *23* (normal)		7	* *22* (normal)		7	*	*23*
6.	6	16 *19* (normal)		7	15 *18* (normal)		6	16	*18*
7.	5	11 *15* (normal)		7	10 *14* (normal)		6	10	*15*
8.	4	16 *17* (normal)		4	12 *15* (normal)		4	16	*17*
9.	10	*26* 23 (abnormal)		7	22 *24* (abnormal)		9	*25*	22
10.	4	18 *21* (normal)		4	16 *16* (normal)		4	18	*18*
11.	3	*16* 13 (normal)		4	11 *11* (normal)		3	*16*	12
12.	5	18 *18* (normal)		5	16 *18* (normal)		5	17	*18*
13.	5	* * (normal)		5	* * (abnormal)		5	*	*
14.	9	13 *17* (normal)		4	*12* 11 (normal)		9	13	*16*
15.	5	* *21* (normal)		5	20 *22* (normal)		5	20	*22*
16.	7	*17* 15 (normal)		7	*15* 13 (normal)		7	*16*	14
17.	7	17 *18* (normal)		6	*19* 19 (abnormal)		7	18	*19*
18.	5	17 *18* (normal)		4	18 *18* (normal)		4	18	*18*

(*b*) *Age of Patient and Duration of Illness*

The relationship between these factors and ventricular size is shown in Table IV. It is clear that neither factor is of importance.

(*c*) *Severity of Illness*

Table V shows that using the two rating scales devised by Wing, which were described above, there is no increase in size of ventricles in the more disturbed patients. On the mental state rating in fact, the third ventricle mean breadth is greater in the less severely affected, at the 1 per cent. level of confidence.

(*d*) *Type of Schizophrenia*

The mean third ventricular breadth in the paranoid patients was greater than in the hebephrenics at the 5 per cent. level of con-

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TABLE II
Patients Considered Abnormal by Radiologist B.

Name	Age	Reason	Measurements	Type of Schizophrenia	Duration	Mental State Rating	S.E. Rating	S.W. Rating
R.S.	27	Lateral ventricles sl. enlarged (generalized)	3rd V. 6 mm. Lat. V. 20 mm.	Hebephrenia	3 yrs.	Sub-group 2	−7	−4
P.P.	31	Lateral ventricles enlarged: sl. bilat. generalized cortical atrophy	3rd V. 5 mm. Lat. V. 19 mm.	Hebephrenia	14 yrs.	1 (b)	0	−10
E.K.	31	Sl. R. cortical frontal atrophy	3rd V. 6 mm. Lat. V. 20 mm.	Unclassified	5 yrs.	1 (b)	−3	**−7**
E.D.	45	Cortical atrophy, mod. generalized	3rd V. 9 mm. Lat. V. 20 mm.	Paranoid	12 yrs.	1 (a)	−15	−6
J.M.	35	Frontal atrophy with ventric. dilation. Sulci normal	3rd V. 10 mm. Lat. V. *	Paranoid	6 yrs.	2	−6	−14
B.D.	32	Sl. bilat. cortical frontal atrophy	3rd V. 5 mm. Lat. V. 15 mm.	Catatonic	6 yrs.	5	−2	−11
M.S.	30	Patchy post-frontal cortical atrophy		Hebephrenic	7 yrs.	2	−9	−11

Mean age of this group: 33 years. Mean duration of this group: 7·6 years.
Mean age of whole series: 31·2 years. Mean duration of whole series: 7·8 years.
6 out of 7 of this group fall into the "less severely disturbed" subgroup.
No relationship demonstrated between "abnormal" encephalogram and age, duration, or severity.

TABLE III
Age of Patients and Size of Ventricles

Age	Number	Mean Third Ventricle	Mean Lateral Ventricle
19–25	4	5·3 mm.	15·8 mm.
26–30	3	7·7 mm.	19·7 mm.
31–35	7	6·7 mm.	18·0 mm.
36–40	3	7·3 mm.	20·3 mm.
41–45	1	9·0 mm.	20·0 mm.

Age of Controls and Size of Ventricles

Age	Number	Mean Third Ventricle	Mean Lateral Ventricle
(17)–25	4	6·5 mm.	20·0 mm.
26–30	3	3·7 mm.	16·6 mm.
31–35	6	6·0 mm.	18·2 mm.
36–40	2	6·5 mm.	16·5 mm.
41–45	3	7·0 mm.	19·0 mm.

fidence. (Respectively 8·2 mm. and 6·4 mm. $p = < 0{\cdot}05$.) There were no other significant differences (Table VII).

(e) *E.C.T. and Insulin Coma Therapy*

Almost all the patients had been in several different hospitals, and the total amounts of treatment they had had was not known accurately. However, a group of seven was formed who were known for certain to have had at least thirty E.C.T. or insulin comas. Most had had considerably more, as is shown in Table VI.

The mean values of the ventricular measurements of this group were very slightly less than those for the series as a whole. Third vent. 6·7 mm.; and lat. vent. 17·3 mm.; compared to 6·8 mm. and 18·3 mm. for the series.

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TABLE IV

Severity Ratings on the Wing Scale (Mental State) — *I. less severe subgroups 1(a), 1(b) and 2*
— *II. more severe subgroups 1(c), 3, 4 and 5*
Duration Grouping — *6− = 2–6 years*
— *6+ = more than 6 years*

I. Less Severe					II. More Severe				
Patient	Age	Duration	3rd Vent.	Lat. Vent.	Patient	Age	Duration	3rd Vent.	Lat. Vent.
E.D.	45	6+	9 mm.	20 mm.	J.T.	23	6−	5 mm.	14 mm.
G.M.	30	6−	7 mm	18 mm.	L.M.	40	6+	7 mm.	21 mm.
H.C.	37	6+	9 mm.	20 mm.	E.T.	23	6−	5 mm.	16 mm.
E.K.	31	6−	6 mm.	20 mm.	P.B.	35	6+	7 mm.	17 mm.
J.M.	35	6−	10 mm.	*	B.D.	32	6−	5 mm.	15 mm.
P.P.	31	6+	5 mm.	19 mm.	D.C.	22	6−	6 mm.	16 mm.
A.W.	32	6+	8 mm.	20 mm.					
G.H.	19	6−	5 mm.	17 mm.					
G.D.	36	6+	6 mm.	20 mm.					
R.S.	27	6−	6 mm.	21 mm.					
M.S.	30	6+	10 mm.	20 mm.					
F.E.	34	6−	6 mm.	17 mm.					

Mean age: 32·2 years.
Mean 3rd vent. breadth: 7·2 mm.
Mean lat. vent. breadth: 19·3 mm.

Mean age: 29·2 years.
Mean 3rd vent. breadth: 5·8 mm.
Mean lat. vent. breadth: 16·5 mm.

(*=no measurement possible)

It is obvious that, using this scale of severity, there is no increase in size of the ventricles in the more severely ill patients, and that in fact the mean values for Group I are greater than for Group II. The difference in the means for the third ventricles (but not the lateral ventricles) is significant at the 1 per cent. level of confidence ($t=3{\cdot}06$ $p=<0{\cdot}01$).

TABLE V

Rating on the Socially Embarrassing Behaviour (S.E.) and Social Withdrawal (S.W.) Scales

Those five patients who show the most extreme scores on the two scales have been selected.

S. E.				S. W.			
Name	Score	3rd Vent.	Lat. Vent.	Name	Score	3rd Vent.	Lat. Vent.
E.D.	−15	9 mm.	20 mm.	J.T.	−14	5 mm.	14 mm.
G.M.	−16	7 mm.	18 mm.	J.M.	−14	10 mm.	*
L.M.	−20	7 mm.	21 mm.	G.H.	−16	5 mm.	17 mm.
E.T.	−13	5 mm.	16 mm.	A.W.	−11	8 mm.	20 mm.
D.C.	−18	6 mm.	16 mm.	B.D.	−11	5 mm.	15 mm.
	Mean	6·8 mm.	18·2 mm.		Mean	6·6 mm.	16·5 mm.

* Measurement impossible.

The means of the whole series of patients are 6·8 mm. (S.D. 1·73) for the 3rd ventricle and 18·3 mm. (S.D. 2·20) for the lateral ventricle. It is apparent that these scores do not deviate significantly from each other or from the whole series.

TABLE VI

E.C.T., Insulin Coma Therapy, and the Encephalogram

"Heavily Treated Patients"

The following list is of patients who are known to have had at least the stated number of treatments.

Name	E.C.T.	Insulin	Third Ventricle	Lateral Ventricle
E.D.	30	113	9 mm.	20 mm.
G.M.	34	30	7 mm.	18 mm.
J.T.	35	38	5 mm.	14 mm.
P.P.	4	77	5 mm.	19 mm.
B.D.	45	30	5 mm.	15 mm.
M.S.	7	35	10 mm.	20 mm.
D.C.	1	55	6 mm.	16 mm.
		Means	6·7 mm.	17·3 mm.
		Mean for series	6·8 mm. (S.D.1·73)	18·3 mm. (S.D.2·20)

There is no indication from these admittedly imperfect data that somatic treatments are associated with ventricular dilation.

TABLE VII

Type of Schizophrenia and Ventricular Age

Paranoid		
Name	Third Ventricle	Lateral Ventricle
H.C.	9 mm.	20 mm.
F.E.	6 mm.	17 mm.
L.M.	7 mm.	21 mm.
E.D.	9 mm.	20 mm.
J.M.	10 mm.	*
	Mean 8·2 mm.	Mean 19·5 mm.

*Measurement impossible

Mean for series 6·8 mm. (S.D.1·73) 18·3 mm. (S.D. 2·20)

Hebephrenic		
Name	Third Ventricle	Lateral Ventricle
R.S.	6 mm.	21 mm.
G.H.	5 mm.	21 mm.
P.P.	5 mm.	19 mm.
P.B.	7 mm.	17 mm.
M.S.	10 mm.	20 mm.
G.M.	7 mm.	18 mm.
G.D.	6 mm.	20 mm.
E.T.	5 mm.	16 mm.
A.W.	8 mm.	20 mm.
J.T.	5 mm.	14 mm.
D.C.	6 mm.	16 mm.
	Mean 6·4 mm.	Mean 18·0 mm.

The difference between the third ventricle measurements for the paranoid and hebephrenic groups is significant at the 5 per cent. level of confidence. ($t=2·15$ $p=0·05$).

DISCUSSION

Unfortunately a review of the literature on the subject of air encephalography and cerebral atrophy in chronic schizophrenia does not lead to any firm conclusions about its value. Most of the earlier work published has had such obvious drawbacks that it cannot carry much weight, and the more careful studies of Huber (1959) on the one hand, and Peltonen (1963) and Ansink *et al.* on the other, are contradictory.

The present study was planned in the hope that some aspects could be clarified; and in the sections dealing with agreement and disagreement between observers a certain amount has been achieved. The agreement between the two radiologists is high when they are measuring, but falls when they are asked to make subjective assessments of abnormality. It is clear that the results obtained by B—seven out of eighteen showing cerebral atrophy—are in keeping with many of the earlier papers published. It is not possible to say which of these observers is more nearly right, and the lack of a good control series is likely to remain a stumbling block for all such studies. The controls used here were derived from patients submitted to encephalography for diagnostic reasons, and it is possible that they would have larger ventricles than would a randomly selected series. The converse, however, could be true: that the radiologist in his search for abnormalities might have interpreted large ventricles as evidence of disease, and thus caused our controls to have smaller ventricles than normals. The former seems more likely, but cannot be established.

In a large series worthwhile comparisons can be made within it, comparing groups of different severity for example. With only eighteen

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TABLE VIII

Sample Case Protocols

D.C. aet. 22. Duration 5 years.
Increasing withdrawal aet. 14, auditory hallucinations and ideas of persecution followed. Complains of interference with her thoughts, and of inability to think clearly. Has changed little over the last few years, except for a lessening in the frequency of screaming bouts, and increased incongruity of affect. *Diagnosis:* Hebephrenic schizophrenia.

Ratings—Medical, Subgroup	3
Nursing ..	SE(−18)
	SW(−10)
Third ventricle ..	6 mm.
Lateral ventricle (larger)	16 mm.
Radiologists A. and B.	normal

E.D. aet. 45. Duration 12 years.
Onset with "queer mouth movements", incoherent speech, passivity feelings, and delusions of persecution. Very hostile to her parents, and at times violent. Frequent bouts of terror associated with auditory hallucinations in the earlier years. At present comparatively well in hospital, but relapses on going home. *Diagnosis:* Paranoid schizophrenia.

Ratings—Medical, Subgroup	1(a)
Nursing ..	SE(−15)
	SW(−6)
Third ventricle ..	9 mm.
Lateral ventricle ..	20 mm.
Radiologists A. and B.	abnormal
Cortical atrophy, moderate, all areas.	

J.M. aet. 35. Duration 6 years.
Gradually increasing suspiciousness and withdrawal at onset. Delusions of persecution with a strong homosexual flavour and auditory hallucinations developed later. Marked feelings of passivity, ideas of reference and some incongruity of affect. *Diagnosis:* Paranoid schizophrenia.

Ratings—Medical, Subgroup	2
Nursing ..	SE(−6)
	SW(−14)
Third ventricle ..	10 mm.
Lateral ventricle	no measurement
Radiologists A. and B.	abnormal
Frontal atrophy with ventricular dilation.	
Sulci normal.	

patients this is less valuable, particularly as so many of the variables cannot be accurately assessed. Using the factors which are well established—age of patient and duration of illness—we find that they are not associated with encephalographic changes. The others—severity of illness, type of schizophrenia, and amount of physical treatment—are much less reliable. Only one statistically significant finding is made: that paranoid patients have broader third ventricles than do hebephrenics. The series is small, and the finding unlikely, it can probably be safely dismissed. With regard to the severity of the illness it should be said that all these patients were markedly affected by any criteria, and previously published work would have led one to expect quite severe abnormalities. This study provides no support for the existence of cerebral atrophy in schizophrenic patients.

The most effective method of further research in this field would probably be for those workers already in possession of large numbers of well documented cases to reassess both the encephalograms and the clinical state of the patients, using independent observers and a blind technique. As far as possible they should rely on simple and objective measurements, keeping subjective judgments to a minimum. Further developments in echo-encephalography may enable large numbers of normal controls and patients to be simply and painlessly examined.

SUMMARY

The literature on the encephalographic demonstration of cerebral atrophy in chronic schizophrenic patients is briefly reviewed. The absence of adequate control series is discussed.

Eighteen patients and eighteen controls were examined by lumbar air encephalography. The controls were films previously described as "normal" following diagnostic L.A.E.G. for various reasons. Two observers examined the films independently using a blind technique. When measuring, their correlation was good; but they differed significantly in their subjective assessments of abnormality. No significant differences were found between patients and controls. No relationship was found within the patient series which linked the size of the ventricles and such factors as: age, duration of the illness, severity of illness, or amount of somatic treatment. Paranoid patients were found to have broader third ventricles than had hebephrenics, but this is dismissed as being probably accidental.

Some suggestions for further research are made.

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P. B. Storey, M.B., M.R.C.P., D.P.M., *Senior Lecturer in Psychiatry, St. George's Hospital, London, S.W.1*

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