LEFT-HANDEDNESS AND STUTTERING AS SIGNS DIAGNOSTIC OF EPILEPTICS.

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Introduction.

Perhaps most clinicians experienced in mental hospital work suspect, at least, that left-handedness and stuttering occur relatively frequently among hospitalized epileptics. However prevalent this impression may be, it remains to be tested systematically. There has been little study of dextrality among the different diagnostic groups. Defects of speech among some groups have been studied considerably, among other groups very little.

Downey (1927), summarizing the few studies of handedness, comments that the percentage of left-handedness among inmates of institutions for the feeble-minded and the psychopathic is much higher than the estimated incidence of 4 to 8 per cent. among normal individuals. Downey does not report the incidence of left-handedness among epileptics, nor have we found published articles relating to the problem. Neither do such authorities as Henderson and Gillespie (1950), Jelliffe and White (1935), Lennox (in Hunt, 1944), Noyes (1935), and Strecker and Ebaugh (1931) list left-handedness among the signs diagnostic of epileptics. Speech defects among epileptic patients have long been listed among the symptoms, however. Most authorities emphasize scanning speech and plateau speech, rather than stuttering *per se*, as characteristic of epileptics.

Gens (1950), in a study of the speech of 1252 epileptics, found only 40 cases of plateau speech. Dysrhythmia, however, was present in 132 (10·5 per cent.) of the cases, placing this defect second in the order of frequency among the speech defects exhibited by the epileptics who talked at all. (Speech was absent in 205 cases; dyslalia occurred in 203.) Certainly dysrhythmia occurs frequently among epileptics. But existing studies do not tell us whether it occurs significantly more often among these patients than among other large diagnostic groups.

Hence, we have attempted an exploratory investigation intended to determine whether stuttering and left-handedness constitute clinically useful minor signs diagnostic of epileptics. The incidence of these two deviations among epileptics is compared to that among oligophrenics, hebephrenic schizophrenics, and paranoid schizophrenics.

Subjects.

Availability of co-operative subjects, while a most important consideration, was not the only factor influencing our choice of diagnostic groups for com-

parison with the epileptic group. For instance, the frequent coexistence of mental deficiency and convulsive seizures led us to exclude from the mentally deficient group those oligophrenics who had the secondary diagnosis of epilepsy. Left-handedness is said to occur relatively often among the variously psychopathic, but we do not know whether it is particularly characteristic of epileptics. Likewise, speech defects, including stuttering, occur more frequently among the mentally defective than among the normal. However, it is uncertain whether stuttering is more frequently associated with convulsive disorder than it is with uncomplicated oligophrenia. Hence, we used only mental defectives without convulsive seizures.

It would be theoretically ideal to have had as additional subjects a similar number of patients from each of the common functional psychotic and neurotic categories. This, however, proved to be impracticable because of the insufficient number of available patients in some of the less prevalent disorders. Paranoid, catatonic, and hebephrenic schizophrenics were abundantly available, but the catatonics were excluded because of their poor performance as subjects. That left only the paranoid and the hebephrenic schizophrenics to represent the functional disorders included in this study.

We used 76 each of patients who had been diagnosed at the hospital staff conference as follows: epilepsy ("with psychosis" in 68 cases); mental deficiency (with psychosis designated in 68 cases); hebephrenic dementia praecox or hebephrenic schizophrenia; and paranoid dementia praecox or paranoid schizophrenia. Seventy-one subjects in each group were Caucasians, 10 in each main diagnostic group were negroes. Thirty-three in each group were men, 43 women. The number of available epileptics set the limit on the number of subjects in the other groups. Cases of traumatic epilepsy, those who were crippled in either hand, those who did not talk, and those otherwise insufficiently co-operative were excluded. The oligophrenics and schizophrenics were chosen at random from the patients' card file. The average ages in years are as follows: epileptics 47·6; oligophrenics 44·9; hebephrenics 49·9; paranoid schizophrenics 50·2.

Procedure.

Each patient was visited on the ward and engaged in conversation for several minutes. Questions were phrased so as to encourage the subject to talk. Emotionally toned topics were deliberately introduced: e.g., the frequency of seizures, the presence of hallucinations or delusions, the duration of the illness, the duration of hospitalization, the question of going home. In this way a fair sample of each co-operative patient's speech was obtained. The patient was then taken through the tests for handedness.

The criteria for stuttering.—The occurrence twice or more of convulsive repetition of sounds or of intermittent blocking of speech with the usual evidence of tonic or clonic spasm was considered stuttering. Cases in which the phenomena were clearly apparent were designated as stutterers, while similar impediment of mild degree falling short of the severity qualifying as frank stuttering received the designation "slight stutter."

The examination for handedness.—Each subject was seated before a table or a desk. A blank index card and a pencil were placed directly in front of him, but yet far enough away so that he had to reach forward for the articles. He was instructed as follows: (1) "Write or draw something on the card." (2) "Now do it with the other hand." (3) "Show me how you throw a ball." (4) "Show me your handiest or best hand." Further explanation or encouragement was provided as needed.

The subject's compliance with these instructions permitted the examiner to observe these features: the hand used for reaching for objects; whether the objects were transferred from one hand to the other; the hand used for writing; the degree of skill or awkwardness in writing with the less-favoured hand; the degree of confidence which the patient exhibited when he demonstrated throwing and chose his best hand; and the degree of consistency between his various acts. The instructions often drew comments or protests from the subjects. When results were doubtful the testing process was repeated. Judgments as to the preference of one hand or the other, or the absence of it, necessarily are based as much upon qualitative as upon quantitative features of the behaviour observed. Right-handed writers were classified as left-handed if the other activities observed indicated greater use and skill of the left hand, and vice versa.

Compared to some of the long questionnaires and other highly detailed procedures used by some investigators our tests of dextrality are quite unrefined. But a large proportion of our subjects were capable of handling only simple tests. The results suggest that our tests are sufficiently discriminating to lend themselves to practical application in the clinical situation.

Results.

The percentages of the total number of cases in each category exhibiting a trait under consideration appear in Table I. *T*-ratios of differences (between epilepsy and each other category) are written below the values for oligophrenia, hebephrenia and paranoid schizophrenia when the ratio indicates reasonable statistical significance.

Table I.—*Incidence of Left-handedness and Stuttering among Epileptics Compared to that among Oligophrenics, Hebephrenic Schizophrenics and Paranoid Schizophrenics.*

	N.	Left-handedness.		Ambi-dexterity.		Frank stuttering.		Slight stuttering.	
		n.	Percentage of Total *N.*	*n.*	Percentage of Total *N.*	*n.*	Percentage of Total *N.*	*n.*	Percentage of Total *N.*
Epileptics	76	11	14·48	2	2·63	10	13·16	6	7·89
Compared to—									
Oligophrenics	76	3	3·94 (*t* 2·29)	3	3·94	6	7·89	7	9·21
Hebephrenics	76	4	5·26 (*t* 1·93)	0	0·00	10	13·16	3	3·94
Paranoid schizophrenics	76	3	3·94 (*t* 2·29)	2	2·63	2	2·63 (*t* 2·45)	5	5·26

Preference for the left hand, as judged by our criteria, was found in 14·48 per cent. of our epileptics, in 3·94 per cent. of the oligophrenics, in 3·94 per cent. of the paranoid schizophrenics, and in 5·26 per cent. of the hebephrenic schizophrenics. The *t*-ratios of the differences are at the reasonably significant level for the oligophrenics and the paranoid schizophrenics, while the ratio for the difference between the epileptics and the hebephrenics implies possible significance. The differences for ambidexterity are statistically insignificant.

Frank stuttering was found to occur in 13·16 per cent. of the epileptics, in 7·89 per cent. of the oligophrenics, in 13·16 per cent. of the hebephrenic schizophrenics, and in 2·63 per cent. of patients suffering from paranoid schizophrenia. Only the difference between the rate of frank stuttering among epileptics and that among the paranoid schizophrenics is of reasonably significant magnitude.

Very mild stuttering phenomena occurred in all four diagnostic groups too infrequently or at too nearly the same rates to raise any question of significant differences.

Obviously, for practical and theoretical reasons, a comparison of the frequency of any detectable sinistrality among the groups should be attempted in a study of this kind. Hence we combined the percentages of left-handedness and ambidexterity for each class, made comparisons, and then did tests of statistical significance. The results imply that the tendency towards left-handedness is significantly greater among epileptics than among hebephrenics and paranoid schizophrenics (*t*-ratios 2·37 and 2·04, respectively). The percentage (left-handedness and ambidexterity) for oligophrenia is not significantly less than that for epilepsy (7·89 and 17·11 per cent., respectively).

Since for present purposes any detectable stuttering should be taken into account, values for the two degrees of stuttering are combined and treated in the same manner as was left-handed tendency. Stuttering, noticeable or mild, occurred almost as frequently in oligophrenia and hebephrenia (in 17·11 per cent. of the cases of each group) as among epileptics (21·05 per cent. of the cases). It occurred less often among paranoid schizophrenics (7·89 per cent.) than among epileptics, the difference yielding a *t*-ratio falling near the 2 per cent. level of confidence.

Further analysis of the data revealed that 31·25 per cent. (5 of 16 cases) of the epileptic stutterers are left-handed or ambidextrous, while only 14·58 per cent. (7 of 48) of all other stutterers are so inclined. This difference of coincidence is at the lower limit of the range of reasonable significance (*t* 2·02). Values for coincidence of ambidexterity and stuttering are not significant.

Discussion.

To recapitulate, our epileptic subjects exhibited significantly more left-handedness than the oligophrenics, hebephrenics, or paranoid schizophrenics. The epileptics stuttered more often than the mentally deficient subjects, and significantly more often than the paranoid schizophrenics. Significantly more epileptics than patients in the other three categories showed coexisting

sinistrality and stuttering. These findings seem to answer in part our primary question: Do epileptics more often exhibit left-handedness and stuttering than other mental hospital patients?

The possible connection between handedness and stuttering which might be inferred from our findings is a long-recognized and debated one. It brings to mind the neurological theory of stuttering as propounded by Travis (1931). This theory, it will be recalled, holds that stuttering is caused by a lack of dominance of one cerebral hemisphere over the other and over lower neural levels. Integrated action of the bilaterally innervated pairs of speech muscles can be secured only by one-sided cerebral dominance. Absence of such unilateral dominance permits conflicting impulses from the two hemispheres to reach the speech organs at the same instant, precluding integrated functioning of the speech mechanism.

If most of the stuttering we encountered in this study was due to lack of cerebral dominance, then the highest incidence of ambidexerity should have been among the epileptics. But such was not the case. Probably ambidexterity, or the tendency, exists in considerably greater degree throughout the epileptic group than is apparent, just as it does among normals. Our method for determining handedness is an unrefined one. While it serves to determine gross aspects of handedness, it is not expected to reveal much in the way of relatively obscure trend. Therefore, it is true that hidden ambidexterity may be present in greater degree among epileptics than it is among the other diagnostic groups in this study, and accounts for the epileptics' tendency to stutter. But our data do not give any real support to the neurological theory of stuttering. Strong preference for the left hand, as we determined it, coexisting with stuttering was found more often among the epileptics than among the other patients, but not significantly more often. Cases showing both deviations occur so infrequently that one should have much larger samples than ours for conclusive results. Further, it is noteworthy that among our hebephrenic subjects, who often stuttered, we found clear preference for one hand or the other the rule.

Actually, the neurological theory of stuttering is no longer widely held. It is now commonly agreed that stuttering is a manifestation of a personality disorder. The personality disturbance present in epileptics may be as often the cause for stuttering among those patients as any common neurological basis for seizures and speech dysrhythmia. Likewise, the severe mental disorganization among hebephrenics may be the main cause of their high rate of stuttering. Our data are essentially neutral on the question of connection on a neurological basis between epileptic seizures, left-handedness, and stuttering.

Summary.

Seventy-six hospitalized idiopathic epileptics and a like number each of non-epileptic mental defectives, hebephrenic schizophrenics and paranoid schizophrenics were examined for stuttering phenomena of any detectable degree and for handedness.

Left-handedness occurred more often among the epileptics than among any of the other three groups, with reasonable statistical significance indicated for all differences except the one for hebephrenia, which is of suggestive magnitude.

Stuttering occurred significantly more often among epileptics than among paranoid schizophrenics. Stuttering occurred significantly more often among hebephrenic schizophrenics than among paranoid schizophrenics.

Coexisting left-handedness or ambidexterity and stuttering occurred significantly more frequently among the epileptics than among the other patients.

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