EFFECT OF ENCEPHALITIS LETHARGICA ON THE INTELLIGENCE OF CHILDREN.

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I.—INTRODUCTION.

Disturbances of mentality are probably the commonest and most striking of the after-effects of encephalitis lethargica. Duncan⁽⁸⁾ found mental sequelæ in 72% of his patients, Riddoch⁽⁶⁾ in 70%, and Abrahamson⁽²⁰⁾ in 50%. They vary enormously in form and intensity: depression, melancholia, apathy, mania, pathological optimism, mental deficiency, loss of memory, inability to concentrate, change of disposition (which is always for the worse), irritability, bad temper, destructiveness, cruelty, and moral perversity (which usually takes the form of stealing, lying, or swearing) are among the most frequently occurring⁽⁶⁾ ⁽⁸⁾ ⁽¹²⁾ ⁽²⁰⁾. The severity of the disturbance varies from slight loss of emotional control or slowness of mental response to acute dementia or idiocy⁽⁶⁾. It appears to be higher among children than among adults. Duncan⁽⁸⁾ found that the percentage of his cases with mental sequelæ was about the same for all ages, but that children of ages 1 to 10 years were most liable to severe mental after-effects: Purser⁽²⁰⁾, Riddoch⁽⁶⁾, and Auden⁽²⁾ also state that a large proportion of their cases were children and adolescents.

The variability of these after-effects suggests that encephalitis lethargica may disturb any mental function. It is, however, possible that, on account of the absence of objective standard methods of investigating mental characteristics, some of the differences recorded in the literature are due to differences of personal opinion. It is very easy to reach the conviction that a patient's memory is impaired, but when another equally competent observer is just as certain that it is unimpaired—a by no means infrequent occurrence—it is necessary to abandon random casual observation in favour of more careful, precise and systematic observation; further, in order to reach the essential facts, one must guard against basing general conclusions on a small number of cases.

In the examination of mental traits we are still far from the exactness and objectivity which marks the work of the physicist and the chemist, but recently some advance has been made and it is desirable that this progress should show itself in observations on the memory, intelligence, emotional disposition, etc., of patients whose ailments are being subjected to scientific examination. The results of tests like the well-known intelligence tests have an objectivity which is lacking in the opinions of casual observers, however shrewd they may be. These tests consist of a miscellaneous collection of exercises which require for their performance knowledge and

skill that a normal child in a normal environment acquires in fairly well-marked stages, such as writing, reading, and giving the meanings of words. Repeated testing has shown which of these are performed successfully by children of different ages, and they have been arranged roughly in order of difficulty. A child of n years who passes the tests which are passed by average children of x years is said to have a mental age (M.A.) of x years, and, as a bright child reaches mental age x sooner than a dull child, and as the results of these tests have been found to be correlated closely with the most reliable estimates of intelligence, he is said to have an intelligence quotient (I.Q.) or mental ratio (M.R.) of $\frac{100x}{n}$.

These tests have been used in the investigation of the after-effects of encephalitis lethargica, but casually and apparently with some diffidence. Leahy and Sands⁽¹⁷⁾ give the M.Rs. of two of their patients, Hohman⁽¹⁵⁾ of one, Beverley and Sherman⁽³⁾ of two; Shrubsall⁽⁴⁾ mentions two M.Rs. and an M.A. (without the physical age); Kwindt⁽¹⁶⁾ appears to have topped the list, for he applied standard tests to 13 young patients and found six of them normal, four one year behind, and three two years behind.*

II.—AIM AND PROCEDURE.

The purpose of this paper is to record the results of an inquiry into the after-effects of encephalitis lethargica on the intelligence of children as shown by the application of mental tests. The number of cases is not so great nor is the investigation so wide or so detailed as could be wished, but the results seem to be of sufficient interest to merit publication. The investigation forms part of a larger inquiry into the intelligence of sick children which was begun by the late Dr. H. J. Watt for the Medical Research Council under the direction of Professor Leonard Findlay, The Royal Hospital for Sick Children, Glasgow; 1,020 patients in this hospital, mostly children of the labouring and artisan classes, have been tested individually.

The tests used were those of Binet as translated by Burt⁽⁵⁾. They are by no means perfect, but they are well-known and generally accepted, and have been well standardised. Most of them were given by the same observer (J. C. M. C.), which is an advantage, for it practically guarantees uniformity of procedure. They were given usually just before the child was to be dismissed from hospital, and was well enough to be sent home; they were never given in the acute stage. All the tests were given in hospital, in the absence of the parents, and under conditions of absolute quietness and privacy. Four doubtful cases were excluded, leaving 46 which were definitely diagnosed as encephalitis lethargica; of these 29 were tested twice, and of these again eight were tested three times.

* Since this was sent to the Press we have seen in *The Psychological Clinic*, Philadelphia, May-June, 1925, XVI (5 and 6), 166-192, a very interesting paper by Miss D. K. Hallowell, entitled "Twenty-four cases of acute epidemic encephalitis," in which are described the results of applying Binet and other tests to 24 encephalitic patients.

It may be suggested that motor disturbances will seriously affect the results of the tests by slowing down the patient's responses, for Binet set time-limits to some of them. In order to meet this difficulty the time was extended somewhat, when delay seemed to be due to this cause. As a time-limit may increase the difficulty of a test, the only effect of this extension is to raise the mental age of the patient and so improve his estimated intellectual status (which, as we shall see, merely strengthens the conclusions to be drawn from our records). The impression made on the experimenters was that motor disturbances were no handicap, an impression which was confirmed later by a comparison of the cases showing the Parkinsonian syndrome with the others (*see* p. 366). No other modification was made in the standard procedure.

There is another possible criticism. The success of the Binet tests depends largely on the assumption that a normal child in a normal environment will at a given age reach a certain stage of mental development, and that if a child reaches this stage earlier (or later) than the average child, it is because he is of superior (or inferior) intelligence. If the environment be abnormal, *e.g.*, one in which the child is not allowed to read, to count, or to use money, the results of the tests are so far fallacious. Now, it may be objected that a child suffering from the after-effects of encephalitis lethargica will not have the same opportunities as his healthy neighbours, and so his intelligence will be under-rated. This criticism is not so serious as may at first sight appear, for the patients have all the opportunities of a normal life: they go to school, they run about at home and in the streets, go messages, and generally do as other children do; they receive every encouragement from their parents and fellows to return to normality.

III.—OBSERVATIONS AND CONCLUSIONS.

The most convincing evidence of the effect of encephalitis lethargica on the intelligence of children would be provided by tests applied before and after the onset of the illness, but as, for obvious reasons, these must always be rare, and as none of our patients were tested before their illness, we are compelled to collect what information we can from an analysis of the records at our disposal. In making this analysis we shall follow several lines of inquiry. We shall compare (1) the mental ratios of the encephalitic cases with those of the remaining 974 children tested in the hospital, (2) the mental ratios of patients whose illness at the time of the first test was of less than 12 months' duration with those of the other patients, (3) the first and second M.Rs. of patients who were tested twice, (4) the M.Rs. of the encephalitic patients with those of their own brothers and sisters, (5) the M.Rs. of the patients who show the Parkinsonian syndrome with those of the remaining patients, and (6) the M.Rs. of those showing moral and emotional disturbances with those of the other patients.

(1) *M.Rs. of encephalitic and other patients.*

The mean mental ratio of our 46 encephalitic cases at their first test, which was performed at intervals ranging from a few days to five years after the onset of the illness, was 84.63 (*P.E. ± 1.24). The mean mental ratio of the other 974 non-encephalitic hospital children who were tested was 90.53 (P.E. ± 0.32). The difference between these means is 5.90, and the probable error of this difference is ± 1.28 . Whence it follows that the odds against this difference being due to chance are over 500 to 1: in other words, if we took at random a sample of 46 cases out of the total 974, the chances against the mean of these cases differing from the mean of all the cases by ± 5.90 or more are over 500 to 1⁽¹⁹⁾. As our 46 cases differ from the rest, so far as we know, only in being cases of encephalitis lethargica, these figures not only show that, at the time of testing, these patients were of lower intelligence than the rest of the hospital population, but suggest a causal relationship between this disease and diminishing intelligence. If the illness did not produce the deterioration of intelligence, then either we must believe that this is the one chance in five hundred, or we must accept the remote possibility that the encephalitics were of lower intelligence before their illness and that this disease attacks most readily those of meaner intelligence.

(2) *M.Rs. of cases of long and cases of short duration.*

Our 46 cases fall into two numerically equal groups: in 23 of them the interval between the onset of the illness and the performance of the first test was less than 12 months; in the remaining 23 it ranged from 12 months to five years four months. The mean mental ratio of the first group is 89.48 (P.E. ± 1.75); the mean of the M.Rs. of the second group is 79.78 (P.E. ± 1.46). The difference between these means is 9.70, and the probable error of this difference is ± 2.28 , whence it follows that the odds against this difference being due to chance are over 200 to 1. As the outstanding difference between the two groups is in respect of the duration of the illness at the time of the test, we have here strong confirmation of the suggestion made in the last paragraph that encephalitis lethargica adversely affects the intelligence of children.

(3) *Re-tests.*

The indications given by the above lines of inquiry receive further confirmation from a comparison of the mental ratios of the same patient at different periods after the onset of his illness. Thirty of our cases were tested twice at intervals ranging from 7 to 36 months. The results of these re-tests are recorded in Table I:—

* P.E. = Probable Error of the Mean.

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TABLE I.

Patient	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R.D.	87	36	-13	31	-44	-33	2.6	-0.42
A.J.	71	35	-4	25	-29	-17	3.0	-0.16
D.M.	80	35	18	28	-10	-5	3.10	0.64
C.H.	80	34	23	27	-4	-1	4.2	0.85
C.R.	77	32	3	24	-21	-15	2.1	0.14
S.C.	97	32	-2	31	-33	-19	2.1	-0.06
C.E.	81	31	0	25	-25	-14	1.0	0.00
M.A.	110	31	-3	34	-37	-23	0.1	-0.09
S.J.	79	31	19	24	-5	-5	0.1	0.78
S.A.	69	30	-1	21	-22	-11	2.6	-0.05
M.J.	100	29	16	29	-13	-13	0.3	0.55
M.H.	71	28	16	20	4	-6	0.6	0.79
C.G.	98	26	-4	25	29	36	0.0	-0.16
C.P.	91	25	1	23	-22	-17	2.8	0.02
S.H.	82	25	9	20	-11	-9	0.6	0.44
G.T.	97	24	2	23	-21	-16	0.1	0.07
W.A.	91	24	13	22	-9	-15	0.0	0.58
D.H.	98	20	2	20	-18	-11	0.9	0.12
S.R.	89	18	7	16	-9	-6	0.0	0.42
W.T.	75	13	17	10	7	7	5.0	1.74
M.N.	75	13	-4	10	-14	-13	0.0	-0.41
O.J.	99	12	12	12	0	0	0.3	1.01
C.A.	85	11	-1	9	-10	-7	0.0	-0.15
S.N.	110	10	-8	11	-19	-13	0.3	-0.73
F.F.	97	9	3	9	-6	-11	0.5	0.34
R.W.	109	9	-8	10	-18	-15	0.7	-0.82
G.J.	103	9	2	9	-7	-6	1.6	0.22
M.B.	78	8	1	6	-5	-6	0.3	0.16
P.J.	73	7	2	5	-3	-6	2.3	0.47
M.P.	80	7	4	6	-2	-1	1.6	0.71

Column (1): M.R. at first test.

,, (2): time between the two tests (in months).

,, (3): rise in mental age (in months).

,, (4): expected rise in M.A. with normal development, i.e., $(2) \times \text{M.R.}/100$.,, (5): rise above expected level of normal development, i.e., $(3) - (4)$ (in months).

,, (6): increase in M.R.

,, (7): time between onset and first test (in years and months).

,, (8): index of development, i.e., $(3)/(4)$.

In column (7) intervals less than a month are recorded 0.0

The mean of all the mental ratios at the first test is 87.73 (P.E. ± 1.50);
the mean of the M.Rs. of the same 30 patients at their second test is 76.13

(P.E. ± 1.50). The difference between these means is 11.60, and its probable error is ± 2.12 ; whence it follows that the odds against the difference being due to chance are over 4,000 to 1. This is still stronger evidence of the effect of encephalitis lethargica on the intelligence of children.

An examination of the Table yields more detailed information on this subject. The first three columns of the Table show the mental ratio of each patient at his first test, the interval (in months) between the first and second tests, and the rise in his mental age (also in months) at his second test. As the mental age marks the level of mental development reached by the patient, it is obvious from Column (3) that in ten cases there is actual retrogression, but of such slight degree that it amounts practically to stagnation, and that in the remaining 20 cases there is some progress, but in 12 of these it is so small that it is almost negligible. The true meaning of these figures is brought out in the succeeding columns.

The significance of an increase or decrease of mental age depends both on the length of the interval between the tests and on the actual magnitude of the initial mental ratio. An example will make this clear. Suppose two children with M.Rs. 75 and 100 to be re-tested after a year, and suppose that the mental age of each rises by nine months; then the first child is developing normally, for the increase in his M.A. in 12 months should be 75% of 12, which is nine; the other child is actually developing more slowly than he ought, for, as his M.R. was 100, his M.A. should in 12 months increase 100% of 12; he has, in fact, fallen three months below the level of normal development.

We are assuming here that the M.R. of a child remains approximately constant, *i.e.*, that his mental age increases proportionately with his chronological age, or that $\frac{M.A.}{C.A.} = \text{a constant}$. This assumption appears to be on the whole correct: the M.R. does fluctuate slightly, but not sufficiently to invalidate the general argument, *cf.* (22) (11). In his "Intelligence of School Children" (22) Terman has given the M.Rs. of 428 children who were tested twice. The tests used appear to have varied somewhat, which is not surprising as they extended over five years and were made by 33 different examiners. For the purpose of comparing Terman's figures with ours we have calculated from his Table 26 (p. 143) the means of the first and second tests. They are: mean of the first test 104.170 (P.E. ± 0.712); mean of the second tests 105.397 (P.E. ± 0.729). The difference between these means is 1.227, and its probable error is almost as large, *viz.*, ± 1.019 . Hence there is no significant difference between the means of his first and of his second tests.

Making this assumption, then, we can calculate the mental age that a child of given M.R. should reach after a given interval. These values for our cases are shown in Column (4) of the Table. Column (5) gives the actual rise above the expected level of normal development: in every case but two it is negative. There was then in 44 of our 46 cases a drop in the normal rate of development. This is shown in another way in Column (6) which gives the actual increase in M.R.

The figures in Column (8) give a measure of the rate of development and so provide a method of comparing the various cases at a glance. They are the ratios of actual rise in M.A. (shown in Column (3)) to the expected rise with normal development (given in Column (4)). If the actual rise in M.A. be equal to the expected rise, the figure appearing in this column is 1; if there be no increase, it is 0, while if there be retrogression, it is a negative quantity. Of the 30 cases there are only five in which this figure is above +0.75. Two cases are normal, three more are nearly so, two are serious cases of retrogression; the remaining 23 are characterised by seriously retarded or completely arrested development.

The number of cases is small for the calculation of correlations, but it is suggestive that the correlation between (2), the interval between the tests, and (5), the rise above the expected level of normal development, is significant: it is measured by the correlation coefficient -0.55 (P.E. ± 0.08); in other words, the amount of retardation varies with the time between the tests.

With such a dismal picture before us it is gratifying to find that four of the five cases in which the index of development (given in Column (8)) is above +0.75 are of fairly long standing, namely, six years one month, 7:0 years, 2:8 years and 2:10 years at the time of the second test: in the fifth case the illness had lasted 1:3 years at the time of the second test. This suggests that, while arrested development is characteristic of most of our cases during the years following the onset of the illness, yet a few of the older cases show signs of a return to the normal (four of the 14 whose illness was of more than 30 months' duration). This encouraging suggestion receives some corroboration from the results of a third set of tests.

Eight of the patients were tested three times. Their M.Rs., chronological age, and the time between onset and test are shown in the following Table:—

TABLE II.

Patient	First Test			Second Test			Third Test			Fourth Test		
	1	2	3	1	2	3	1	2	3	1	2	3
A.J.	71	3:0	10:9	54	5:1	13:8	65	6:2	14:9			
C.A.	85	0:0	11:10	78	0:11	12:9	73	2:2	14:0			
F.F.	97	0:5	3:6	86	1:2	4:3	92	2:3	5:4			
M.H.	71	0:6	3:7	65	2:6	5:11	53	3:6	7:0			
P.J.	73	2:3	3:11	67	2:10	4:6	59	4:10	6:6	60	6:1	7:9
B.D.	87	2:6	8:2	54	5:6	11:2	60	6:3	11:11			
S.J.	79	0:1	5:5	74	2:8	8:0	84	3:5	8:9			
S.C.	97	2:0	11:9	78	4:9	14:5	72	6:2	15:10			

Column (1): mental ratio.

„ (2): time between onset and test.

„ (3): chronological age.

Four of these cases (A. J., F. F., R. D., and S. J.) show signs of some improvement in mental development at the third test: another (P. J.) shows a slight improvement at a fourth test; but in three of these five cases the M.R. is so far below the borderline of normality that it is doubtful whether the apparent improvement has any significance. In the other three cases the deterioration continues at the third test.

This arrest of mental development, which is probably the most striking of the generalisations issuing from our observations, has already been noticed in the literature. Saunders-Jacobs⁽²¹⁾ remarks of her young patients that "many of them appear to have retained whatever knowledge or skill they had before their illness, but experience great difficulty in learning anything new." Hamel and Merland⁽¹³⁾ are of opinion that in their cases "there is arrest of psychic development with loss of power to acquire further knowledge." Herd⁽¹⁴⁾ formed the same impression from his cases.

This arrested development provides an explanation of the disastrous effects of encephalitis lethargica on very young children. Hall⁽¹²⁾ remarks that his cases of idiocy were practically limited to infants up to 5 years of age. Paterson and Spence⁽¹⁸⁾ report seven cases of idiocy out of 17 at this age. Collin and Réquin⁽⁷⁾, and Ebaugh⁽⁹⁾, find mental backwardness of greater or less severity to be typical psychic sequelæ of encephalitis in infants. Shrubbsall⁽⁴⁾ remarks that "in younger children the rate of mental growth seems to have been seriously retarded and in some of them mental deficiency has followed: this has been most evident in the case of those attacked by encephalitis during pre-school age."

When an attack of encephalitis lethargica stops mental development, the degree of mental impairment it produces will depend on the age of the patient at the time of onset of his illness. Imbecility is a necessary consequence of the arrest of mental development at an early age, for an imbecile is one whose mind remains the mind of an infant, and any child whose mental growth ceases at the age of 3 or 4 must become an imbecile.

Older children show less deterioration because their development is arrested at a higher level: the child of 10 still retains his mental age 10, and so may appear dull, stupid and unable to profit from instruction at school, but he is not reduced to imbecility. A numerical example will make this clear. Suppose three children, of ages 4, 8, and 12 years and M.R. 100, cease to develop mentally, then at the end of three years their M.As. will be still 4, 8, and 12 respectively, but their chronological ages will be 7, 11, and 15, and their M.Rs. 57, 73, and 80; the youngest will be definitely feeble-minded, the second will be on the borderline of deficiency, and the third will be merely dull and backward.

Five of our patients had M.Rs. of not more than 60 at their last test; of these three were less than 5 years old at the onset of their illness: of the 41 with M.Rs. over 60 only seven were then less than 5 years old. Of the

14 with M.Rs. below 71, six were less than 5 years old at the onset of their illness, whereas of the remaining 32 above 70, only five were then of this age. The incidence of mental defect is therefore relatively much higher among the very young than among the older children.

The seriousness of the effects of encephalitis lethargica on the intelligence of children is shown by the fact that of 46 cases 12 (26%) had at their final test mental ratios below 70, while 25 (54%) had M.Rs. below 80. For the normal population the corresponding proportions, calculated from Terman's figures⁽²²⁾, are 3% and 11%; for the other 974 children tested in the hospital (which included several mentally defectives who had been admitted for purposes of observation) they are 6% and 20%.

(4) *M.Rs. of patients' brothers and sisters.*

A final line of inquiry lies in a comparison of the mental ratios of the patients with those of their brothers and sisters. The brothers and sisters of 23 patients were tested in hospital under exactly the same conditions as the sick children. They numbered 27, for in four families we were able to test two healthy children. We selected as far as possible those who were nearest in age to the patients.

The mean M.R. of these 27 brothers and sisters was 96.00 (P.E. ± 1.35); the mean M.R. of the patients at their first test was 85.61 (P.E. ± 1.77); at their second test it was 76.40 (P.E. ± 1.80 ; there were 20 cases). The difference between 96.00 and 85.61 is 10.39; its probable error is ± 2.23 ; hence it is quite significant. The difference between 96.00 and 76.40, *i.e.*, 19.60, is much more so.

Although children in the same family do vary in intelligence it is, therefore, highly improbable that the above difference is a matter of chance. In eight cases the mother of the patient volunteered a comparison between the children, and in six of these it was the patient who was said to have been cleverer or brighter than the other. Such judgments are not of much value, but they support the conclusion that the difference between the intelligence of the patients and that of their brothers and sisters is the result of the illness.

All these lines of inquiry, then, point in the same direction: they indicate that, while in a few cases encephalitis lethargica leaves no serious intellectual after-effects, yet it does on the whole arrest or retard mental development to such an extent that it appreciably reduces the intelligence of the patients, and that the deterioration is greatest in young children, amounting sometimes to imbecility. The importance of this conclusion can hardly be over-estimated, for we are here in presence of mental defect which is not innate: children, apparently sound and developing normally in mind and body have by disease suffered intellectual deterioration in some cases sufficiently grave to necessitate institutional care. Whatever may be our views on innate capacities, we have to acknowledge that by a misfortune of circumstance the growth of these capacities may be arrested or retarded with disastrous effects on mind as well as on body.

It remains to consider this deterioration in relation to the Parkinsonian syndrome and to disturbances of character.

(5) *M.R.s. of patients with the Parkinsonian syndrome.*

Sixteen of our patients developed the Parkinsonian syndrome: it was, therefore, possible to compare their intelligence with that of the others. Their mean M.R. at the first test was 84.90 (P.E. ± 2.0), that of the remaining 30 patients was 84.47 (P.E. ± 1.58). The difference between these averages is 0.43, and its probable error is ± 2.54 : there was, therefore, no significant difference between the two groups at their first test.

In six of the cases the syndrome had not clearly developed at the time of the first test: it seems, therefore, more satisfactory to compare the results of the final tests on the two groups, for the syndrome had then developed in all cases. The mean M.R. of the Parkinsonian group at the final test is 80.56 (P.E. ± 1.74), while that of the other patients is 75.27 (P.E. ± 1.50). The mean of the first group is 5.29 higher than that of the second, but, as the probable error of this difference is 2.30, it is not statistically significant. An examination of the "development ratios" of those who were tested twice gives the same result. Our figures, then, show no significant difference between the intelligence of those who have and those who have not the Parkinsonian syndrome.

It should be remarked that this means only that our observations have failed to show a significant difference: it is still possible that more extensive testing might reveal such a difference. In any case it is clear that our estimates of the intelligence of the Parkinsonian patients do not appear to have been adversely affected by slowness of motor response.

(6) *Defective intelligence and moral disturbance.*

Among the most apparent and most distressing of the mental after-effects of encephalitis lethargica is a change of character and emotional disposition which may vary in degree from a slight intensification of emotionality to maniacal outbursts, from paltry peccadillos to serious criminal offences. Quarrelsomeness, violence, destructiveness, cruelty (especially to younger children), fits of anger, irritability, vicious temper, rage, biting, scratching, screaming, obstinacy, and general unmanageableness are common, as are also stealing, swearing and lying. In some cases there is merely heightened emotionality, shown in immoderate laughing and crying and in general excitability and noisiness. Along with all these disturbances there often goes friendly, affectionate, pleasant good nature. The outbursts frequently seem to be compulsive, *i.e.*, due to some inner urge, but they appear to be somewhat controllable, for they vary with the patient's social environment: a child who is comparatively docile in hospital is sometimes unmanageable at home.

Of our 46 cases 29 showed some sign of emotional or moral disturbance: the remaining 17 appeared to have suffered no change in character or disposition. Comparison of these two groups fails to show any significant difference in mental ratio. The average M.R. of the first (emotionally or morally unstable) group is 84.24 (P.E. ± 1.56); that of the other (emotionally and morally normal) group is 84.82 (P.E. ± 2.20): the difference between these means is only 0.58, while its probable error is ± 2.70 , so that it is not significant. Hence, whatever may be the ultimate explanation of the moral and emotional instability, it does not appear to be due to intellectual deterioration.

Nor do our observations lend any support to the generalisation that "moral imbeciles do not suffer from severe mental defect, while those suffering from severely impaired intelligence do not present psychical and emotional disturbances in any marked degree"⁽¹⁾, or that "the younger children tend to suffer mental impairment rather than moral perversion, while older children show a tendency in the opposite direction"⁽¹⁾. Moral and emotional disturbance is present in children of all ages; four of the five of our patients who were below 5 years of age at their first test were suffering in this way.

IV.—SUMMARY.

1. The average intelligence of 46 children suffering from the after-effects of encephalitis lethargica was significantly lower than that of 974 other hospital patients and of their own brothers and sisters.

2. The mean intelligence of those whose illness had lasted over 12 months was significantly lower than that of the patients whose illness was of shorter duration.

3. The average intelligence of 30 of these patients who were re-tested after intervals varying from 7 to 36 months showed a significant deterioration at the second test.

4. This deterioration appears to be due to arrested mental development.

5. The arrest of development is most serious in very young children.

6. There is definite statistical evidence that encephalitis lethargica does produce intellectual deterioration (as measured by the mental ratio), which may amount to mental defect, in some children, but not in all, who before their illness were presumably normal.

7. Post-encephalitic children with the Parkinsonian syndrome showed a deterioration in intelligence not significantly different from that of the other patients.

8. There was no significant difference between the intelligence of the 29 patients showing disturbances of character and emotionality and that of the remaining 17.

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