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Psychiatric disorder and cognitive function in children with epilepsy in Kerala, South India

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The cognitive and psychiatric associations of childhood epilepsy have not been studied in developing countries. Children with epilepsy were identified during a population-based epidemiological study of 1403 8- to 12-year-old children in Kerala, South India. They were compared with age-, sex- and social class-matched controls on measures of reading, vocabulary, non-verbal reasoning and school performance. In addition, psychiatric symptoms were measured using standard questionnaires and the presence or absence of psychiatric disorder was established by interview. Patients performed as well as controls on the non-verbal test, but performed worse on tests of vocabulary and reading, suggesting a specific disadvantage in the area of education. Psychiatric disorder was more prevalent in the children with epilepsy. It was concluded that epilepsy in the population studied is accompanied by a significant burden of cognitive and psychiatric disorders which need recognition and adequate service provision.

Key words: epilepsy; psychiatric disorder; cognitive impairment; developing country.

INTRODUCTION

The experience of seizures constitutes only part of the burden of epilepsy; the social, educational and psychological consequences of the disorder may be at least as disabling. Burgeoning populations in the developing world and the high prevalence make epilepsy a matter of public health importance. The reason for the elevated prevalence is under-researched but may lie in the adverse physical conditions that characterize poorer countries. The intellectual and psychiatric consequences of epilepsy in these countries have received even less attention but unless studied, the case for diverting scarce medical and educational resources to this group of patients cannot be made.

In the West, many studies of psychiatric disorder and cognitive impairment in epilepsy have been conducted either in specialist clinics or on representative samples derived from populations or birth cohorts. Clinic studies have differed widely in the prevalence and associations of psychiatric and cognitive impairments. For instance, Stores[2,3] found an association between left temporal lobe seizures and both behaviour problems and impaired reading. However, Austin[4], Whitman[5] and Hoare[6] failed to demonstrate an association between seizure type and psychological disturbance, and Giordani[7] actually found that adult patients with partial epilepsy performed better on a selection of cognitive tests than those with generalized epilepsy. Further disagreements include the effect of antiepilepsy medication on behaviour[4,6], though its effect on cognition is less in dispute[8]. These contradictions probably arise from the selection factors used. Referral to a specialist epilepsy clinic may be as a result of associated behaviour or learning difficulties as much as the seizures themselves. Geography and physician factors could further bias these samples of children and confound the search for associations, as could the choice of controls.

The study of children with epilepsy identified in population studies removes the effect of selection and they generally show a benign cognitive outcome for epilepsy unaccompanied by brain damage[9,10]. However, Rutter[11] found an excess of reading retardation and Ross and colleagues[12] found deficits in reading comprehension, mathematics and school attendance in children with epilepsy in the National Child Development Study. There is, however, general agreement

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between these studies that children with epilepsy are at greater risk of psychiatric disorder, particularly if the epilepsy is accompanied by intellectual deficits. Rutter[11] and Britten[9] found that evidence of brain damage was associated with psychiatric disturbance. The former identified a variety of social and neurological associations with psychiatric disturbance, suggesting an interaction between these factors, and reflecting the findings of Pond's early general practice-based study[13]. Pond presented evidence for the importance of home environment in behaviour disorders and heredity in cognitive impairment associated with epilepsy and emphasized that these patients are subject to the same influences as individuals without epilepsy; the seizure disorder exaggerating their vulnerability to environmental influences.

No population studies have examined these questions in developing countries, although Epir[14] in Turkey, a middle income country[15], found excess psychiatric symptoms and impaired drawing ability, but normal verbal function, in a child population with a high prevalence of epilepsy.

We report findings of cognitive impairment and psychiatric disorder in children with epilepsy in a particularly deprived Indian population characterized by exposure to the adverse medical, nutritional and economic conditions of a developing country.

MATERIALS AND METHODS

Multi-stage random cluster sampling was conducted using all the households in two rural local government areas, Calicut District, Kerala State, as a sampling frame. During the door-to-door screening stage a sample of 1403 8- to 12-year-old children was assembled. The screening interview was administered to the carer of every subject and included demographic data, parents' expectation of children's participation in household tasks, a measure of child psychiatric disturbance (Malayalam version of Rutter's A2 questionnaire[16]) and items indicating the social impact of the child's disorder (adapted from the Ontario Child Health Study[17]). Social class was defined by the father's occupation and the education of each parent (the age at which their formal education ended). A poverty score was constructed from eight equally-weighted items including house construction, house size, water supply, sanitation, electricity supply, access to media, type of children's footwear and family transport. All parents were asked whether their child had had to repeat a school year (indicating failure in annual exams), how many days school he had missed in the previous 6 months and how long they expected their child to remain in education.

The teachers of 95% of the sample completed a Malayalam version of Rutter's B2 child behaviour questionnaire[16].

The first 1192 children were visited at home by an epileptologist (RJH) who took a detailed seizure history and administered the Modified Oseretsky Test of motor incoordination[11]. At the same time, a psychologist (PB) administered Raven's Coloured Progressive Matrices[18] and the Malayalam Vocabulary Test (MVT) and the Malayalam Graded Reading Test (MGRT)—two new tests constructed by the Department of Malayalam, Calicut Teacher Training College (available from the authors). The MVT requires the child to explain the meaning of 23 words of ascending difficulty, scored using standard criteria. The MGRT consists of 70 words of increasing difficulty presented on flash cards which the child has to pronounce correctly.

Epilepsy was classified according to criteria designed for developing countries[19].

All children scoring above 12 on Rutter's parent questionnaire, and a random sample scoring above 8 on the teacher's questionnaire, as well as a random sample scoring below cutoff underwent detailed psychiatric assessment by a child psychiatrist fluent in Malayalam (LH). She administered Rutter's Isle of Wight schedule[20]. Diagnoses were made according to ICD10 research criteria[21].

Analysis used the SPSSpc program. Four controls were matched with each epilepsy case for age (to within 3 months), sex, mother's education (to within 2 years) and either social class, father's education (to within 2 years) or poverty score (to within 2 points). Cases and controls were compared using *t*-tests for parametrically distributed variables, the Mann–Whitney test for ordinal variables and the chi-squared test for categorical data. Verbal-performance discrepancy was calculated by subtracting the percentile vocabulary score from the Progressive Matrices percentile score for each subject. The small number of cases found precluded statistical examination within the sample of epileptic children.

RESULTS

Twenty-six children conformed to the definition of epilepsy. Compared with matched controls they were significantly impaired in vocabulary, reading ability and motor coordination and more of them had failed annual school exams. However, their Raven's matrices score was similar to controls (Table 1).

The parents of epileptic children had lower expectations, only 50% expecting them to continue education beyond 16 years compared with 77% of controls ($\chi^2 = 6.83$, $P = 0.009$). School attendance was also significantly lower. The expectation that epileptic children would carry out domestic tasks did not significantly differ from controls but there was a consistent

Table 1: Intellectual associations of epilepsy.

	Epilepsy		Control			
	Mean	SD	Mean	SD	t	P
Age (years)	10.7	1.4	10.5	1.5	0.70	0.487
Vocabulary	12.1	4.2	17.1	6.6	4.79	0.0001
Oseretsky score	30.8	8.9	34.8	7.7	2.22	0.028
Raven's score	18.5	4.8	18.5	5.1	0.01	0.991
Reading score median (IQR)	61	(37–69)	66	(58–70)		0.031
Verbal-performance difference median (IQR)	22	(-17–43)	0	(-21–21)		0.0028
School absence in past 6 months (days) median (IQR)	6	(3–20)	2	(0–6)		0.001
Repeat school year (%)	50		26	$\chi^2 = 5.26$		0.0218

trend towards lower expectations across all the household function items.

Children with epilepsy were significantly more disturbed on the Rutter (parent) questionnaire; the mean (SD) score being 14.9 (8.2) in cases compared with 8.1 (5.3) in controls, $t = 4.21$, $P = 0.0001$ (Table 2). There was no significant difference between Rutter teacher questionnaire ratings (mean (SD) cases 6.6 (7.4), controls 5.3 (5.2)). Of the cases who underwent detailed psychiatric assessment, 6 (23%) had ICD10 psychiatric diagnoses compared with 8.1% of the controls (uncorrected for false negatives), $\chi^2 = 4.95$, $P = 0.026$.

Table 2: ICD10 psychiatric diagnoses of epilepsy cases.

ICD10 psychiatric diagnosis	n
Hyperkinetic conduct disorder	2
Socialized conduct disorder	1
Separation anxiety disorder	1
Other childhood emotional disorder	2
No psychiatric disorder	11
No psychiatric assessment	9

Significantly more parents of children with epilepsy reported the child being a cause of arguments within the family, the child having problems with schoolwork or getting on badly with their teacher, feeling unable to take the child out in public or worrying about the child's future (Table 3).

DISCUSSION

Surveys in developing countries encounter methodological problems unfamiliar to Western researchers. Parents commonly fail to recognize non-convulsive seizures as a medical problem, and when they do they often consult indigenous practitioners or even religious authorities. As a consequence, useful medical records usually do not exist. Illiteracy among parents necessitates face-to-face interviews. As these can only be done at home, researchers have to walk considerable distances, which limits the size of sample that can be assembled and the number of cases ascertained. Similar constraints apply to the examination of children as their poor school attendance, particularly among those with epilepsy, means that they too have to be seen at home. The absence of pre-existing reading and vocabulary tests in Malayalam meant that we had to construct our own and conditions for testing were far from ideal. Inevitably, the uncertainties that surround the diagnosis of epilepsy, even in well-equipped Western institutes, were amplified in the present study where EEG was not available. Surprisingly, the survey-naive population we studied was generous with its cooperation, no household refusing a screening interview, and only five refusing psychometric testing.

The main cognitive findings of the study are deficits in the verbal functions of vocabulary and reading but preserved visuospatial function indicated by scores on Raven's Coloured Progressive Matrices. Although the index of verbal-performance difference can be criticized because individual verbal and visuospatial tests would generate less stable indices than batteries of tests, the greater discrepancy observed in children with epilepsy confirms the impression of verbal deficits. Children with epilepsy were also more likely to fail annual exams than controls. Interpretation is helped by the finding of worse school attendance in children with epilepsy. If schools play a major part in the acquisition of verbal skills, while visuospatial function is more independent of education, then it is arguable that these findings are due to reduced educational opportunity. The lower academic expectations that parents had for these children would then be self-fulfilling[22]. It is likely that the careful matching for social class and parents' education limited their confounding effects. The finding of worse motor coordination in children with epilepsy suggests the contribution of neurological dysfunction.

The finding of greater psychiatric disturbance in children with epilepsy is congruent with previous Western

Table 3: Comparison of epilepsy cases and non-cases on Ontario Child Health Study items.

	Epilepsy	Controls	χ^2	*P*
Causes family arguments	26	4	29.56	0.00001
Avoids relatives or friends	0.1	0	0.02	0.873
Affected school work and relationship with teachers	12	1	35.67	0.00001
Parent cannot go out in public with child	26	1	94.33	0.00001
Parent worried about child's future	23	4	20.84	0.00001
Child's behaviour prevented relatives/friends visiting	0.1	0.2	0.05	0.821
Complaints from neighbours, teachers, police about child	8	3	3.17	0.204

studies. As well as parents reporting more psychiatric symptoms in these children and a higher prevalence of psychiatric disorder identified on detailed assessment, the impact of epilepsy and its associated psychiatric symptoms on the family (Table 3) was considerable. Numbers did not permit us to examine whether psychiatric disturbance was closely related to cognitive impairment.

We have found evidence that epilepsy severely affects the psychiatric well-being and cognitive and academic performance of children in this South Indian population and these, in turn, affect the children's families. If the increased prevalence of epilepsy in this population (unpublished data) is due to the medical effects of living in an impoverished environment, our findings suggest that if the cognitive impairments of epilepsy persist, these children will be less able to provide a materially secure and healthy environment for their own children. Not only would they hand on a genetic predisposition to epilepsy, but their own children would be exposed to a greater risk of brain insults resulting from the adverse environment.

Child psychiatric services and special education are undeveloped in South India but recognition of the problem would provide an impetus to increase provision. Finally, a campaign should be mounted to change the negative public attitude towards epilepsy.

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