

Impact of epilepsy characteristics and behavioral problems on school placement in children

Sandra El Sabbagh^{a,*}, Carmen Soria^a, Sylvie Escolano^a, Christine Bulteau^{a,b},
Georges Dellatolas^a

^a *Institut national de la santé et de la recherche médicale (INSERM), U780, Villejuif, France*

^b *Service de neurochirurgie, Fondation Rothschild, Paris, France*

Received 11 May 2006; revised 1 August 2006; accepted 3 August 2006
Available online 12 September 2006

Abstract

Children with epilepsy are known to be prone to educational underachievement as a result of learning and behavioral problems. This cross-sectional study evaluated the effects of the characteristics of epilepsy and behavioral problems on school placement. One hundred eighty-five children aged between 3 and 16 years with nonoccasional epileptic seizures were included; 82 were mainstreamed in regular schools and 103 were in specialized medical and educational institutions for children with epilepsy. Gender distribution and age were comparable for the two groups. Logistic regression analysis indicated a statistically significant effect for age at onset, generalized non-idiopathic epileptic syndromes, number of antiepileptic drugs and behavioral problems, as dominant factors explaining the type of school placement. No significant effect was found for the state of seizure control. By use of a parent-rated behavior questionnaire, children in special institutions were shown to have significantly more problems in the hyperactivity/attention deficit and sociability domains. Later age at onset of epilepsy was related to more depression/anxiety.

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Keywords: Epilepsy; Children; Behavior; Schooling

1. Introduction

Epilepsy in children provides major management challenges for it is frequently associated with learning and behavioral problems, increasing the risk of educational underachievement. Aldenkamp et al. [1] have proposed a model demonstrating that educational retardation in children with epilepsy is affected predominantly by the type of epilepsy syndrome, children with refractory localization-related epilepsies and symptomatic generalized epilepsies being at greater risk of educational delay through global cognitive impairment with a significantly lowered intelligence level (IQ). However, in many cases, the schooling situation is not completely explained by the IQ, and the

child may be excluded from mainstream education because of the severity of the disease and/or behavioral disorders [2,3].

In a study by Oostrom et al. [4], children with newly diagnosed idiopathic or cryptogenic epilepsy were perceived by parents and teachers to have more behavioral problems than control subjects, despite similar intelligence and educational background. Moreover, Rapport and colleagues [5] examined the relationship among internalizing behavior problems, intelligence, and later scholastic achievement. They found that anxiety/depression and withdrawal contributed to prediction of classroom performance over and above the effects of intelligence. In children with recent-onset seizures, McNelis et al. [6] have demonstrated that despite academic achievement in the average range, academic performance was related to child adaptive competency (i.e., how hard the child is working, appropriate

* Corresponding author. Fax: +33 1 45 59 51 69.
E-mail address: sandrasabbagh@yahoo.com (S.E. Sabbagh).

behavior, overall happiness, and how well the child is learning).

Various behavioral problems have been associated with epilepsy, including hyperactivity, aggression, autistic features, depression, and low self-esteem [7–10]. Behavioral problems can affect social outcome profoundly and may be correlated with many different factors, including the type of epileptic syndrome, an underlying condition, the epileptiform discharges, and medical or surgical treatment [9]. In addition, in a prospective study by Keene et al., children with significant cognitive difficulties were at increased risk of behavioral problems [11].

This cross-sectional descriptive study was designed to evaluate the effect of characteristics of the epilepsy and the presence of behavioral problems on school placement (regular school vs specialized institution). These two groups are then compared with respect to the wide spectrum of behavioral problems.

2. Method

This cross-sectional descriptive study was realized over a 1-year period. Patients were recruited from four specialized institutions for children with epilepsy and two hospital neuropediatric departments. Children selected for this study were from 3 to 16 years of age and had been diagnosed with epilepsy based on clinical history (at least two epileptic seizures) and EEG data. Patients with febrile seizures only or occasional seizures were excluded.

The neurologist in charge of the child completed a medical data sheet, based on the medical record and designed for this study. It included details about epilepsy features such as age at onset, seizure frequency, etiology, type of epileptic syndrome, physical exam, antiepileptic medication, EEG and imaging findings, and physician's impression of the presence of learning or behavioral difficulties and special rehabilitation needs.

Contact was made with parents or legal caregivers by the treating neurologist or the specialized institution's staff. They were sent an envelope containing an explanatory letter and a questionnaire labeled with the patient's study number without any nominative mark. They were asked to return the informed consent and the completed questionnaire. To ensure confidentiality, no reference to the patient's name was made, and all the data were entered into the database by use of the patient's study number.

The questionnaire included general questions (about the family's and the child's situation, medical and educational difficulties, and needs) and a behavior questionnaire. The latter included a set of 47 items selected mainly from Goodman's Strength and Difficulties Questionnaire (SDQ) [12], with additional items from the Child Behavioral Checklist [13] and the Conners scale [14]. This selection of items was chosen to cover different behavioral problems of children with epilepsy (i.e., hyperactivity, attention deficit, emotional troubles, conduct and social problems, relational difficulties with peers, anxiety/depression, and aggressive behavior). There were three modalities for each item: "true," "sometimes true," and "false," coded 2, 1, and 0, respectively.

According to the French educational system, the school placement of each child was classified in two categories: ordinary school and specialized institution. Within ordinary schools, children could be in a normal or an adapted classroom. Adapted classrooms are for small groups of children with general learning disabilities not involving any medical care. Specialized institutions are restricted to children whose disabilities require medical care. Assignment to special education in medical institutions requires the agreement of a special education commission, the decision of which is based on medical and educational assessments. Intelligence quotient (IQ) is not a major variable in special institution placement.

We compared the two groups of children (ordinary school vs specialized institution) with respect to all medical and behavioral data using Student's *t* test for means and the χ^2 test for percentages. Statistical analysis was performed using SAS 9.1 software. As school placement was a binary variable, a logistic regression procedure was used to examine the specific effect of multiple explanatory variables (i.e., age at onset, epileptic syndrome, behavioral problems). Factor analysis of the behavior questionnaire was used to generate scores quantifying different aspects of behavioral problems. The relationship between physician's report of behavioral problems and parents' report of behavioral difficulties was also examined.

3. Results

One hundred eighty-five children (105 boys, 80 girls) were included, and for 133 children (72%), parents completed the questionnaire. There was no statistically significant difference in the medical data between children whose parents completed the questionnaire and those whose parents did not. Eighty-two children (44%) were in regular school and 103 (56%) were in specialized medico-educational institutions for children with epilepsy. The percentages of parents who completed the questionnaire for children in institutions and in regular school were about the same (70 and 73%). These two groups were not significantly different with respect to age and gender distribution. The characteristics of the two groups are summarized in Table 1.

Compared with the special institution group, the regular school group was characterized by a later onset of epilepsy (57 months vs 31 months, $P < 0.0001$). In addition, children in regular school had mainly partial seizures; generalized seizures, status epilepticus, and infantile spasms were rare in this group ($P < 0.0001$).

Seizure frequency at the time of inclusion did not differ between the two groups. However children in special institutions were taking a larger number of antiepileptic drugs (AEDs; mean number of AEDs: 2.6 vs 1.4, $P < 0.0001$). Type of epilepsy syndrome was found to be significantly different ($P < 0.0001$). Idiopathic epilepsies (partial and generalized) were extremely rare (2.8% vs 35.3% in the regular school group), with a clear dominance of nonidiopathic generalized epilepsies (58.3% vs 13.4%).

General psychomotor development before the onset of epilepsy was reported by physicians as normal in 72% of the regular school group, but only 45.1% of the special institution group ($P < 0.0001$). At the time of this study, none of the children in the special institution group was considered to have normal psychomotor development, in contrast to 42.7% of the regular school group ($P < 0.0001$).

As reported by physicians, learning difficulties of varying degree and significant behavior problems were reported more frequently in the special institution group (99% vs 71.9%, $P < 0.0001$; and 54.9% vs 30.5%, $P = 0.0009$, respectively). For children in regular schools, learning disabilities referred mainly to attention problems or low processing speed compared with their classmates. Objectively, 20.7% of the children in regular schools were in

Table 1
Population demographics and epilepsy characteristics^a

	Regular school	Special institution
<i>N</i>	82	103
Age	10.9 (3.8)	11.2 (3.0)
Sex (% boys)	54%	59%
Age at onset of epilepsy		
Age in months	56.9 (37.6)	31.4 (28.9)
0–1 year (%)	16.9	37.4
1–3 years (%)	15.6	26.3
3–6 years (%)	37.7	29.3
>6 years (%)	29.9	7.1
Maximal seizure frequency (%)		
>1/day	42.6	51.5
1/day–1/week	22.1	23.8
1/week–1/month	14.7	12.9
1/month–1/trimester	5.9	6.9
<1/trimester	14.7	4.9
Actual seizure frequency (%)		
>1/day	6.4	6.9
1/day–1/week	15.4	10.8
1/week–1/month	8.9	13.7
1/month–1/trimester	7.7	16.7
<1/trimester	61.5	51.9
Seizures type (%) ^{b,c}		
Generalized	36.6	55.3
Partial	76.8	59.2
Status epilepticus	6.1	21.4
Infantile spasms	2.4	15.5
Etiology (%)		
Idiopathic ^b	35.3	2.8
Unknown	34.1	57.3
Cerebral malformation	14.6	10.7
Neuroectodermal abnormalities	1.2	4.8
Anoxia–ischemia/stroke	8.5	9.7
Sequel of CNS infection	1.2	3.88
Metabolic disease	0	1.0
Brain tumor	2.4	2.9
Chromosomal abnormality	0	2.9
Other	2.4	6.8
Number of AEDs ^b	1.4 (0.8)	2.6 (1.2)
Normal development (%)		
Before epilepsy onset ^b	72.0	45.1
After epilepsy onset ^b	42.7	0
Learning difficulties (%) ^b	71.9	99.0
Behavioral problems (%) ^b	30.5	54.9
Epilepsy syndrome ^b		
Idiopathic generalized epilepsy	15.8	1.9
Nonidiopathic generalized epilepsy	13.4	58.3
Idiopathic partial epilepsy	19.5	0.9
Nonidiopathic partial epilepsy	47.6	33.0
Unclassified	3.7	5.8

^a Values are means or means (SD).

^b $P < 0.0001$.

^c Because the child could have presented with more than one type, the sum of our percentages is not 100%.

adapted classrooms within regular schools and 51% had failed at least one grade.

Logistic regression with school placement as the dependent variable indicated that when all the explanatory variables were taken into account and submitted to a backward selection procedure, only four variables remained

significantly related to school placement: age at onset, generalized nonidiopathic epileptic syndrome, number of AEDs, and presence of behavioral problems.

This model demonstrated that the earlier the onset of epilepsy, the higher the probability of the child being excluded from regular school ($P = 0.0003$). In addition, the probability of special institution placement was higher when the child had generalized nonidiopathic epilepsy ($P < 0.0001$), when the child was taking more than one AED ($P = 0.004$), and when significant behavioral problems were observed by the treating neurologist ($P = 0.007$). In fact, with only one exception, all children with generalized nonidiopathic epilepsy starting before the age of 4, taking multiple antiepileptic drugs, and experiencing behavioral problems ($n = 17$) were in specialized institutions. To the contrary, children not meeting any of these four criteria ($n = 21$) were all in regular schools.

Univariate item-by-item analysis of the behavior questionnaire (Table 2) suggested that, according to their parents, children in special institutions had significantly more difficulty relating to peers than to adults. They also presented more often with serious distractibility, overactivity, lack of self-confidence, and compulsions or repeated gestures.

Factor analysis of the behavior questionnaire (Table 2) suggested the presence of three factors: hyperactivity/attention problems, depression/anxiety, and sociability. These three factors explained 39% of the total variance. The reliability of each score was good, as demonstrated by Cronbach's α coefficient: 0.87, 0.85, and 0.78 for hyperactivity/attention, depression/anxiety, and sociability scores, respectively, thus allowing computation of three scores (i.e., sum of the scores of the corresponding items; criterion for the selection of an item: loading > 0.50).

Comparison of the two groups with respect to these behavioral scores (Table 3) indicated that they differed significantly only on the hyperactivity/attention and sociability scores, with the children in regular school having better scores in these domains (i.e., lower hyperactivity/attention difficulties and higher sociability). There was no significant difference with respect to the depression/anxiety score.

The behavior scores were not significantly related to epilepsy characteristics, including type of epileptic syndrome, seizure frequency, and number of AEDs. There was only one significant relationship between the depression/anxiety score and age at onset of epilepsy: the later the onset of disease, the greater the depression/anxiety problems (Pearson correlation coefficient $r = 0.25$, $P = 0.007$). Finally, we examined the relationship between physician's report of behavioral problems and parents' report of behavioral difficulties. For cases in which the physician reported the presence of behavior problems, the parents reported more hyperactivity/attention difficulties ($P = 0.003$), more depression/anxiety features ($P = 0.02$), and less sociability ($P = 0.002$). In multivariate analysis (i.e., logistic regression with the three scores in the model and the physician's report as the variable to be explained), only sociability

Table 2
Behavioral questionnaire

	Univariate analysis			Factor analysis ^a		
	Regular school (%) N = 60	Special institution (%) N = 73	P (χ^2)	Factor 1	Factor 2	Factor 3
1. Restless, overactive, cannot stay still for long	13.2	30.6	0.02	0.73	−0.07	0.05
2. Often has temper tantrums or hot temper	28.3	40.8		0.66	0.14	−0.02
3. Constantly fidgeting or squirming	34.0	47.8		0.54	−0.03	−0.05
4. Often fights with other children or bullies them	5.6	8.5		0.63	0.11	−0.12
5. Easily distracted, concentration wanders	52.8	78.9	0.002	0.58	0.23	−0.21
6. Often disobedient at home or school	11.1	17.6		0.68	0.01	−0.13
7. Has strange behaviors	15.1	25.7		0.55	0.36	−0.34
8. Constantly moving, overactive	30.8	50.0	0.03	0.68	−0.06	−0.03
9. Often aggressive	5.6	11.0		0.53	0.26	−0.14
10. Shouts a lot	16.7	21.1		0.55	0.11	−0.31
11. Often disturbs other children	3.8	11.6		0.66	0.28	−0.17
12. Has difficulties finishing his/her homework	44.4	62.7	0.04	0.58	0.26	0.06
13. Picked on or bullied by other children	20.4	15.7		0.03	0.55	0.03
14. Often nervous, anxious, or tense	44.4	38.4		0.27	0.62	−0.02
15. Many worries, often seems worried	37.0	27.5		0.01	0.75	0.02
16. Often feels worthless or inferior	25.9	18.2		0.11	0.76	0.03
17. Can't help having obsessions or persistent thoughts	28.3	29.4		0.17	0.57	−0.45
18. Easily discouraged	38.9	40.6		0.14	0.70	0.04
19. Often unhappy, downhearted, or tearful	16.7	15.5		0.36	0.51	−0.10
20. Often sad, depressed	11.3	8.7		0.15	0.71	−0.20
21. Feels guilty easily	13.0	3.0	0.04	0.10	0.53	−0.04
22. Often inactive, lacks energy	16.7	12.5		−0.08	0.53	−0.35
23. Often complains of headaches, stomachaches, or sickness	31.5	21.4		0.05	0.44	−0.03
24. Rather solitary, tends to play alone	25.9	23.6		−0.15	0.43	−0.28
25. Nervous or clingy in new situations, easily loses confidence	13.2	38.3	0.002	0.11	0.47	−0.39
26. Gets on better with adults than with other children	27.8	50.7	0.009	0.19	0.21	−0.39
27. Many fears, easily scared	15.1	29.0		0.12	0.41	−0.31
28. Destroys things belonging to the family or to other children	1.8	8.3		0.41	0.04	−0.43
29. Excessively attached to the adults or too dependent	22.2	43.7	0.01	0.27	0.11	−0.38
30. Does not feel guilty after a bad behavior	13.0	16.4		0.41	0.17	−0.22
31. Prefers to play with children younger than his/her age	38.9	53.6		0.13	0.34	0.08
32. Has strange ideas	3.7	13.4		0.32	0.35	−0.34
33. Often inattentive	24.5	43.1	0.03	0.47	0.14	−0.27
34. Rarely communicative, keeps problems to himself	24.1	30.3		0.01	0.42	−0.44
35. Repeats some gestures many times, compulsions	9.4	40.3	<0.001	0.34	0.09	−0.49
36. Doesn't get along well with other children	3.7	16.9	0.02	0.34	0.39	−0.44
37. Often alone, avoids contact with others	13.0	19.2		0.08	0.49	−0.57
38. Has at least one good friend ^b	9.4	24.3	0.03	−0.06	0.01	0.52
39. Generally liked by other children ^b	3.8	15.5	0.03	−0.35	−0.30	0.52
40. Kind to younger children ^b	0.0	4.2		−0.18	0.11	0.66
41. Considerate of other people's feelings ^b	16.7	14.9		−0.11	0.03	0.52
42. Often volunteers to help others ^b	5.7	16.2		−0.06	−0.03	0.63
43. Shares readily with other children ^b	7.4	12.7		−0.15	−0.09	0.61
44. Helpful if someone is hurt, upset, or feeling ill ^b	5.7	17.1	0.05	0.01	0.06	0.73
45. Sees tasks through to the end, good attention span ^b	43.5	51.4	0.04	−0.35	−0.22	0.20
46. Thinks things out before acting ^b	22.2	37.3		−0.36	−0.14	0.26
47. Generally obedient, usually does what adults request ^b	5.6	4.2		−0.49	0.06	0.13

^a Factor 1: hyperactivity/attention problems; Factor 2: anxiety/depression problems; Factor 3: sociability.

^b Percentage not true.

Table 3
School placement and behavior scores^a

Score	Regular school	Special institution	P
Hyperactivity/attention	9.2 (5.4)	12.9 (5.3)	0.0005
Depression/anxiety	8.9 (4.9)	8.0 (4.6)	0.32
Sociability	10.8 (2.9)	9.0 (3.6)	0.005

^a Values are means (SD).

remained significantly related to physician's report ($P = 0.03$).

4. Discussion

The purpose of this study was to identify variables associated with placement of children with epilepsy in

special institutions. Our results indicate that exclusion of the child from mainstream education was strongly correlated with early age at onset of seizures, type of epileptic syndrome (particularly generalized nonidiopathic syndromes), treatment with multiple AEDs, and presence of behavioral problems as reported by the physician. The former three variables are consistent with previous studies that reported educational underachievement is related to the type of epilepsy syndrome mediated by a significant cognitive impairment with lower intelligence scores [1,3].

Seizure frequency was not related to school placement. In our cross-sectional study, it is difficult to evaluate the impact of seizure frequency fluctuations on learning difficulties over different periods of seizure history. However, in a prospective study, Bourgeois et al. [15] demonstrated that difficulty in seizure control is significantly correlated with the number of AEDs taken simultaneously. Our finding that the number of AEDs was significantly correlated with school placement would suggest that difficulty in controlling seizures is likely to affect school placement. It is also possible that school placement has an impact on the physician's choice of type and number of AEDs.

Many previous studies have suggested that behavior problems are common in children with epilepsy and are related to type of epilepsy [9,16], type of medications [17–21], underlying neurological disorder [8,22], family environment, parenting behaviors [7,23], and the presence of significant cognitive problems [11]. However, studies evaluating the impact of behavior problems on the educational level and need for placement in specialized institutions of children with epilepsy are lacking. One major finding was that behavior problems are strongly related to special institution placement. This finding is supported by behavior questionnaire scores, with higher “hyperactivity/attention” and “social problem” scores significantly more prevalent for children in special institutions. However, although school placement was shown to be related to both epilepsy characteristics and behavior problems, behavior scores did not correlate with epilepsy variables. This lack of association was unexpected, suggesting that special institution placement by itself could play a role in parents' perception of their children's behavior. It could also be argued that modifications of the environment and school situation may reveal or aggravate behavior problems, but such hypotheses of causal inferences need to be proven by prospective survey of behavior changes during disease evolution and special school placement.

The “depression/anxiety” score was significantly correlated with late onset of epilepsy. Several factors may account for this observation. Early age at onset of epilepsy is known to be associated with poor cognitive outcome [3,24–26], suggesting that these younger children are less aware of their disorder and, thus, less affected by the limitations it imposes. Moreover, previous studies have suggested that children with seizure onset after 5 years of age typically display behavioral problems more often than

cognitive deficits [27]. It could be argued that the later the onset of seizures, the greater is the child's perception of the changes in his or her daily life induced by the recurrence of seizures and the difference from peers.

Limitations of this study include possible selection bias with overrepresentation of learning and behavioral problems in the regular school group. This is due to the fact that these children were referred to neuropediatric departments, which may account for the lack of cases of benign idiopathic epilepsy without associated problem; however, this selection bias would tend to mask the difference between the two study groups rather than increase it.

Another limitation is the lack of IQ data or cognitive measures. As shown by many previous studies, cognitive impairment is a major factor contributing to educational underachievement in children with epilepsy [1,3]. Thus, a strong relationship between IQ and special institution placement is expected. However, IQ results may depend on learning opportunities (i.e., schooling), and the suitability of a comparison of IQs between children in regular schools and children in special institutions may be questionable. This is the first study to evaluate the impact of medical and behavioral factors associated with special institution placement. This impact may be completely masked by the IQ or cognitive measures, if taken into consideration, because IQ itself is strongly associated with epilepsy variables [3] and could also be related to behavioral problems. In fact, intellectual difficulties have been reported to be associated with increased risk of psychopathology [28,29], and significant cognitive impairment to be correlated with elevated behavioral scores [11]. A possible explanation would be that limited IQ could affect the adaptation of the child to seizures and limit the range of coping behaviors available to her or him.

In conclusion, special institution placement and exclusion from mainstream education of children with epilepsy are related to epilepsy characteristics (age at onset, type of epilepsy syndrome, polypharmacy) and to the presence of behavioral problems independently of epilepsy variables. These behavioral aspects are often not identified or taken into account and are often overridden by more pressing medical problems associated with the disorder; however, it may be a significant problem for the child and family. Findings from this study justify using early behavioral assessment to identify children with epilepsy who may be at risk for academic achievement problems.

Acknowledgments

This study was supported by the Direction Générale de la Santé of the French Ministry of Health (RMCO409L-LA) and the Fondation Française pour la recherche sur l'épilepsie. We thank the staff of the following institutions: Parc de l'Abbaye, Léopold Bellan, Arc en Ciel, Toul-Arc'hoat, and SESSAD L'Essor. We also thank the staff of the Kremlin-Bicêtre Hospital and the Centre Hospitalier

Intercommunal-Créteil and the parents of the children for their contributions to this study.

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