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Psychiatric problems in children with hemiplegia: cross sectional epidemiological survey

Robert Goodman, Philip Graham

Abstract

***Objective*—To examine the prevalence and predictors of psychiatric problems in children with hemiplegia.**

***Design*—Cross sectional questionnaire survey of an epidemiological sample with individual assessments of a representative subgroup. The questionnaire survey was repeated on school age subjects four years later.**

***Subjects*—428 hemiplegic children aged 2½-16 years, of whom 149 (aged 6-10 years) were individually assessed.**

***Main outcome measures*—Psychiatric symptom scores and the occurrence of psychiatric disorder.**

***Results*—Psychiatric disorders affected 61% (95% confidence interval 53% to 69%) of subjects as judged by individual assessments and 54% (49% to 59%) and 42% (37% to 47%) as judged from parent and teacher questionnaires, respectively. Few affected children had been in contact with child mental health services. The strongest consistent predictor of psychiatric problems was intelligence quotient (IQ), which was highly correlated with an index of neurological severity; age, sex, and laterality of lesion had little or no predictive power.**

***Conclusion*—Though most hemiplegic children have considerable emotional or behavioural difficulties, these psychological complications commonly go unrecognised or untreated. Comprehensive health provision for children with chronic neurodevelopmental disorders such as hemiplegia should be psychologically as well as physically oriented.**

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Introduction

Previous clinical and epidemiological studies have shown that children with chronic cerebral disorders such as cerebral palsy have a substantially increased rate of emotional and behavioural difficulties—an increase far greater than that seen in chronic non-cerebral disorders that result in comparable disability and social impact.[1-3] About one in every 200 children in the general population has a psychiatric disorder in association with unequivocal brain disorders (primarily cerebral palsy, epilepsy, and severe mental retardation).[1] In many instances, the psychiatric problems result in more handicap and distress for the child and family than the physical or cognitive disabilities. A better understanding of brain-behaviour links may lead to improved treatment or prevention strategies.

Childhood hemiplegia may provide a particularly useful model for studying brain-behaviour links in childhood. Thus hemiplegia affects up to one child in 1000 and provides the opportunity to examine whether psychiatric consequences vary with the laterality of lesion or the age at onset (which ranges from the prenatal period to later childhood). As most affected children are of normal intelligence and attend mainstream schools, it is possible to examine psychiatric problems that are not secondary to intellectual impairment or segregated schooling. Finally, the relatively minor motor disability does not bar the use of ordinary psychiatric assessment techniques. When assessing hyperactivity, for example, it is no harder to ask about overactivity and fidgetiness in a hemiplegic child than in any ordinary child, whereas it would make little sense to ask the same questions about a child with athetoid cerebral palsy who was restricted to a wheelchair.

Subjects and methods

SUBJECTS

The London Hemiplegia Register used multiple sources to ascertain a representative sample of 458 London children with hemiplegia (plus three hemiplegic children who lived just outside the Greater London boundary).[4] The present study involved the 428 children who were aged 2½ to 16 years at the time of first assessment.

MEASURES

Questionnaire measures of psychiatric caseness were used for the entire age range,[5-8] with detailed individual psychiatric assessments being carried out on a representative subsample of the 6 to 10 year olds. Questionnaire measures of psychopathology corresponded well with comparable measures derived from individual assessments.[8] In the initial cross sectional survey, questionnaires completed by parents were obtained for 90% (386/428) of the sample,[5 8] and questionnaires completed by teachers (or other preschool professionals) were obtained for 89% (381/428),[6 7] with at least one questionnaire being obtained in all 428 cases. Because cross sectional data cannot be used to distinguish between age and cohort effects, additional longitudinal data are presented from a follow up of the same sample an average of four years later using the same parent and teacher questionnaires. A total of 328 children were eligible for follow up, being aged between 2½ and 12 years at the time of the initial survey and therefore still of compulsory school age four years later; parent questionnaires were obtained for 84% (276/328) of the

sample, and teacher questionnaires were obtained for 85% (278/328), with at least one of these being obtained for 90% (296/328).

A subgroup of 149 children aged between 6 and 10 were individually assessed an average of six months after the original questionnaire survey; they were representative of hemiplegic children of their age in this study as judged from demographic, medical, cognitive, and behavioural measures.[4] The individual psychiatric evaluation drew on three standardised measures: a semi-structured interview with parents,[9] a teacher questionnaire,[7] and an interview with the child.[10] Scores for conduct problems, hyperactivity, and emotional symptoms were derived from interviews with the parents and summed to generate a total parent based symptom score. All items on the teacher questionnaire were summed to generate a total teacher based symptom score. Information from all sources was combined to categorise each child as having a psychiatric disorder or not—a distinction that could be made reliably and validly on our population with identified cases having a level of symptoms comparable with those of attenders of child psychiatric clinics.[11] For ease of comparison our symptom scores were scaled such that the mean was 1.0 for children who were free from psychiatric disorder.

The intelligence quotient (IQ) of the individually assessed children was judged from a full version of the revised Wechsler intelligence scale for children,[12] except in the case of 19 children with severe cognitive impairments whose IQs were calculated from their mental ages.[13] All 149 children were neurologically examined. Five neurological variables—relating to degree of hemiparesis, presence and type of seizure disorder, presence of any signs of bilateral involvement, head circumference, and time of onset—were combined to generate a neurological severity index.[13] A family adversity index was generated by summing four z transformed items: a questionnaire rating of maternal psychiatric morbidity (malaise inventory)[14] and three standardised interview based ratings covering parental criticism of the child, lack of parental warmth for the child, and poor parental child management skills,[9] prorating the total score when data were missing for one item.

STATISTICAL ANALYSIS

For the individually assessed children the significance of the group differences presented in table 2 was established with χ^2 tests, t tests, and analysis of variance. Significant univariate predictors of psychiatric problems were entered into stepwise multiple regression analyses to assess independent predictive power, with the standardised regression coefficients for significant effects presented to facilitate comparisons of effect sizes.

Results

Among the children aged less than 5 the rate of psychiatric caseness was 51% (40/78) as judged by parent questionnaire[5] and 35% (23/66) as judged from a questionnaire completed by preschool professionals.[6] Among the 5 to 16 year olds, the comparable rates were 55% (168/308) as judged by parent questionnaire[8] and 43% (137/315) as judged by teacher questionnaire.[7] When the two age bands were combined the rates were 54% (95% confidence interval 49% to 59%) and 42% (37% to 47%) as judged from parents and teachers (or other preschool professionals), respectively. As can be seen from figures 1 and 2 there were no consistent trends with age. There was some evidence, however, that different cohorts within our sample maintained fairly constant rates of parent based caseness over time—for example, the children who were 5 or 6 at the time of the initial survey had a particularly high rate of disorder initially and also when reassessed aged 9 or 10 at the time of the follow up.

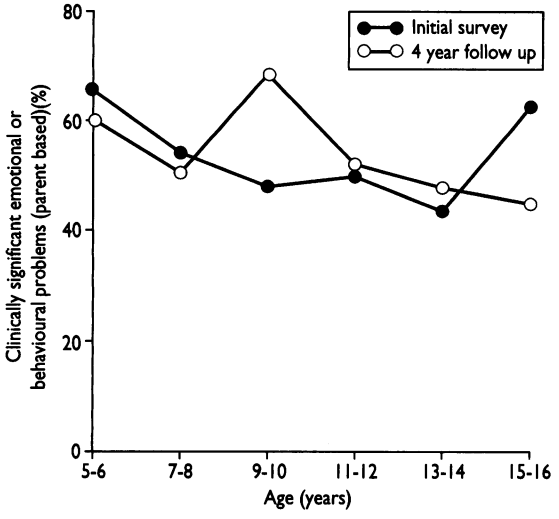

Fig 1—*Degree of emotional or behavioural problems in children with hemiplegia as seen by parents according to child's age*

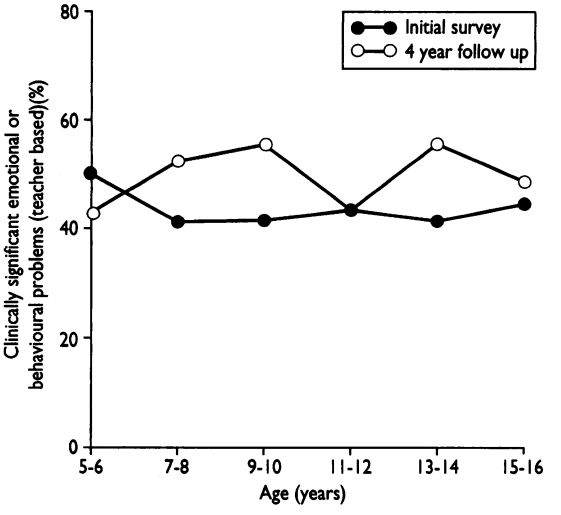

Fig 2—*Degree of emotional or behavioural problems in children with hemiplegia as seen by teachers according to child's age*

Psychiatric disorders were present in 91 (61%; 95% confidence interval 53% to 69%) of the 149 individually assessed children with hemiplegia. In 75 instances the psychiatric disorder resulted in substantial social impairment for the children; though not socially impaired, the 16 remaining children either had emotional symptoms that resulted in substantial distress or conduct problems that resulted in substantial disruption for others. The proportion of children who had ever been in contact with child mental health services was 18% (16/91) for the children with current psychiatric disorders and 2% (1/58) for children currently free from psychiatric disorders (continuity adjusted $\chi^2=6.6$, df=1, $P<0.01$).

Conduct, emotional, and hyperactivity disorders predominated (table 1). Conduct disorders were typically dominated by irritability and oppositionality rather than by deliberately antisocial behaviours such as stealing or bullying. Emotional disorders usually involved anxieties and fears; depression was uncommon. Pervasive and situational hyperactivity are reported separately because, although pervasive hyperactivity is recognised as a disorder by both the major contemporary systems of classification,[15 16] situational hyperactivity is currently recognised as a disorder only by the American system.[16]

Psychiatric problems were associated with greater neurological severity, lower IQ, special schooling, and

Table 1—*Types of psychiatric disorder in 149 intensively studied children*

Disorder	No (%) of children*
Emotional disorder	37 (25)
Conduct disorder	35 (24)
Pervasive hyperactivity	15 (10)
Situational hyperactivity	20 (13)
Autistic disorder	4 (3)
Other disorder	7 (5)

*Numbers add up to more than 91 because some children had multiple diagnoses, with comorbidity being most evident for conduct disorder and pervasive hyperactivity.

family adversity (table 2). No measure of psychopathology was significantly influenced by whether the birth occurred prematurely or at term.

Table 3 shows variables that independently predicted psychiatric problems in multivariate analyses. The most consistent predictor of psychiatric problems was IQ. Once this had been taken into account the neurological severity was not a significant predictor of psychiatric problems. As the correlation between IQ and the index of neurological severity was −0.73 it is not surprising that when IQ was omitted from the regression analyses, neurological severity took the place of IQ as the most consistent predictor of psychiatric problems.

Though some subgroups had particularly high rates of psychiatric problems, it is noteworthy that even children with a "good prognosis" were still at substantial psychiatric risk. For example, the rate of psychiatric disorder was still 39% among the 28 individually assessed children who attended a normal school, had an IQ over 90 (mean 108), had never had a seizure, and had a mild hemiparesis with no hint of bilateral involvement.

Discussion

Psychiatric problems were extremely common in our large and representative sample of children with hemiplegia. Over half of the children studied individually had psychiatric disorders. The measure of psychiatric disorder that we used selected children with a level of psychiatric problems equivalent to that of children attending a psychiatric clinic[11]; the rate of comparable psychiatric disorders in the general child population assessed by using similar methods is unlikely to exceed 15%.[17,18] It is particularly striking that the rate of psychiatric disorder was 39% even among the most mildly affected children who were of normal intelligence and attended mainstream schools. This increased psychiatric risk is far greater than that seen in chronic non-cerebral disorders that are at least as disabling and stigmatising,[1-3] strongly suggesting direct and powerful brain-behaviour links.

Table 2—*Psychiatric disorders and symptoms in children aged 6-10 years with hemiplegia*

Variable	No of children	No (%) with psychiatric disorder	Mean (SD) for psychiatric symptom score†	
			Parent interview	Teacher report
Sex:				
Male	91	56 (62)	1.6 (0.9)	1.6 (1.2)
Female	58	35 (60)	1.6 (0.9)	1.5 (1.2)
Age (years):				
6 or 7	76	56 (74)	1.9 (0.9)	1.7 (1.1)
8 to 10	73	35 (48)**	1.4 (0.9)**	1.4 (1.2)
Side of hemiplegia:				
Right	88	58 (66)	1.6 (0.8)	1.5 (1.2)
Left	61	33 (54)	1.8 (1.1)	1.7 (1.1)
Neurological severity:				
Mild	43	19 (44)	1.3 (0.9)	1.3 (0.9)
Moderate	53	28 (53)	1.6 (0.9)	1.3 (1.0)
Severe	53	44 (83)***	2.0 (1.0)**	1.9 (1.1)*
Intelligence quotient (IQ):				
<50	19	15 (79)	2.4 (1.4)	1.9 (1.2)
50-69	34	29 (85)	2.0 (0.8)	2.0 (1.0)
70-99	68	39 (57)	1.5 (0.8)	1.4 (1.2)
⩾100	28	8 (28)***	1.1 (0.7)***	0.9 (0.8)*
Schooling:				
Ordinary class	107	56 (52)	1.5 (0.8)	1.4 (1.1)
Special unit or school	42	25 (83)***	2.1 (1.1)***	2.0 (1.1)**
Paternal occupation:				
Non-manual	74	42 (57)	1.6 (1.0)	1.2 (0.9)
Other	75	49 (65)	1.7 (0.9)	1.8 (1.3)**
Family adversity:				
Low	49	14 (29)	0.9 (0.5)	1.1 (1.0)
Medium	51	36 (71)	1.8 (0.8)	1.7 (1.1)
High	49	41 (84)***	2.2 (1.0)***	1.7 (1.3)**

†Scores scaled so that mean = 1.0 for children without psychiatric disorder.
*P<0.05; **P<0.01; ***P<0.001 (χ^2, *t* test, or analysis of variance).

Table 3—*Significant predictors in multivariate analyses (6-10 year olds), values are standardised regression coefficients (95% confidence intervals) for significant effects*

	Predicting from:		
	Intelligence quotient (IQ)	Family adversity	Age
Predicting to:			
Psychiatric disorder	−0.25 (−0.11 to −0.39)***	0.37 (0.23 to 0.51)***	−0.22 (−0.08 to −0.35)**
Symptoms reported by parent	−0.27 (−0.13 to −0.40)***	0.44 (0.30 to 0.57)***	−0.17 (−0.04 to −0.30)*
Symptoms reported by teacher	−0.30 (−0.15 to −0.46)***		

Significant independent predictive power: *P<0.05, **P<0.01, ***P<0.001.

PREDICTING PSYCHIATRIC PROBLEMS

In this sample, greater neurological severity was a powerful predictor of lower IQ. Once this effect had been allowed for, however, neurological severity was not an independent predictor of psychiatric problems. An association between lower IQ and more psychiatric problems has been a consistent finding of studies of neurologically impaired and normal children.[1 3 19-21] Consequently, the simplest explanation for the brain-behaviour link in hemiplegia is that neurological damage leads to lower IQ, and this in turn is the primary reason for the children's greater psychiatric vulnerability (fig 3). Against this explanation, however, is the fact that the rate of psychiatric disorder in our sample was substantially higher than would be found in controls matched for IQ. For example, a 29% rate of psychiatric disorder among hemiplegic children with above average intelligence is probably at least three times higher than would be expected among similarly

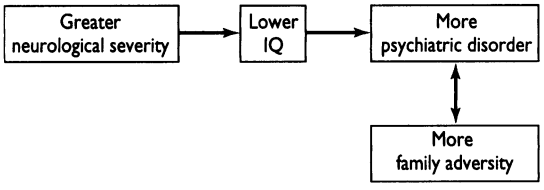

Fig 3—*One causal model of psychiatric problems in children with hemiplegia*

intelligent children in general; and the same applies to the rate of 57% among hemiplegic children with normal but below average intelligence. This leads us to conclude that IQ is primarily a marker for underlying neurobiological factors that influence psychopathology rather than being the main risk factor in itself (fig 4).

There was no compelling evidence that age, sex, or laterality influenced liability to psychopathology. The rate of psychopathology was high from the age of 2½ to 16. The apparent influence of age in the intensively studied sample seemed, as judged from the longitudinal data, more likely to be due to random variation between successive cohorts than to a true age effect. The lack of an effect of sex is in line with the results of previous studies of children with congenital and acquired brain lesions,[1 22] but in contrast with the greater psychiatric vulnerability of boys in the general population.[14 17] Though the rate of psychiatric disorder in the intensively studied sample was higher in children with right hemiplegia, the trends were in the opposite direction for the two other measures of psychopathology. The lack of a consistent effect of laterality is in line with previous findings from large and representative samples of children.[23]

Psychiatric problems in hemiplegic children were associated with adverse family factors such as parental depression or a high level of parental criticism of the child. In the absence of longitudinal and intervention studies there is no justification for concluding that

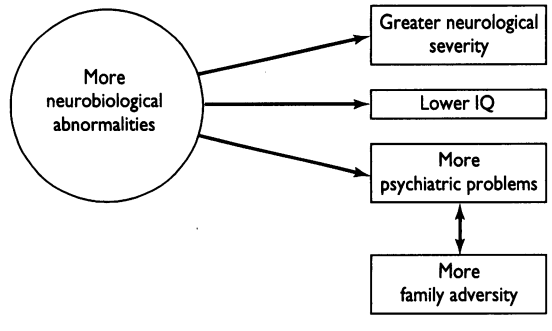

Fig 4—*Alternative causal model*

Key messages

- Substantial emotional or behavioural difficulties affect half of all hemiplegic children irrespective of sex or age
- They are almost equally common accompaniments of left and right hemiplegias
- They are best predicted by IQ, possibly as a marker for underlying neurobiological abnormalities
- These difficulties often go untreated, compounding the child's other difficulties

adverse family factors caused the child's problems. It is equally plausible that the child's difficulties have resulted in parental criticism or ill health; or that the problems in parents and children have a shared origin.

UNRECOGNISED NEEDS FOR TREATMENT

The psychiatric disorders that accompany childhood hemiplegia have rarely been identified and treated. This is regrettable as in our experience these disorders are often helped by specific treatments ranging from cognitive therapy to medication and from family work to individual counselling. In addition, parents are often relieved to hear that their child's problems are similar to those of many other hemiplegic children; the consequent reduction in the parents' sense of guilt and isolation can be very therapeutic for the entire family. Support and information is also available from Hemi-Help, the parents' organisation that grew out of the present study.

We thank Carole Yude, Bob Adak, Suzanne Pemberton, and Judith Elliott for their parts in the project and the children, parents, and teachers who gave so willingly of their time. The telephone number of Hemi-Help for further literature and help is 0181 672 3179.

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Conflict of interest: None.

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Randomised study of n of 1 trials versus standard practice

Jeffrey Mahon, Andreas Laupacis, Allan Donner, Thomas Wood

Abstract

***Objective*—To compare outcomes between groups of patients with irreversible chronic airflow limitation given theophylline by n of 1 trials or standard practice.**

***Design*—Randomised controlled study of n of 1 trials versus standard practice.**

***Setting*—Tertiary care centre outpatient department.**

***Subjects*—31 patients with irreversible chronic airflow limitation who were unsure that theophylline was helpful after an open trial.**

***Interventions*—n Of 1 trials (single patient randomised multiple crossover comparisons of theophylline against placebo) followed published guidelines. For standard practice patients theophylline was stopped and resumed if their dyspnoea worsened; if their dyspnoea then improved theophylline was continued. For both groups a decision to continue or stop the drug was made within three months of randomisation.**

***Main outcome measures*—Exercise capacity as measured by six minute walking distance, quality of life as measured by the chronic respiratory disease questionnaire at baseline and six months after randomisation, and proportions of patients taking theophylline at six months.**

***Results*—26 patients completed follow up. 47% fewer n of 1 trial patients than standard practice patients were taking theophylline at six months (5/14 versus 10/12; 95% confidence interval of difference 14% to 80%) without differences in exercise capacity or quality of life.**

***Conclusions*—n Of 1 trials led to less theophylline use without adverse effects on exercise capacity or quality of life in patients with irreversible chronic airflow limitation. These data directly support the presence of a clinically important bias towards unnecessary treatment during open prescription of theophylline for irreversible chronic airflow limitation. Confirmation in a larger study and similar studies for other problems appropriate for n of 1 trials are needed before widespread use of n of 1 trials can be advocated in routine clinical practice.**

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Introduction

In their usual form n of 1 trials are randomised, double blind multiple crossover comparisons of an active drug against placebo in a single patient.[1-3] They limit the biases of standard practice or open before and after trials of treatment. These biases are thought to lead to false conclusions that the treatment is effective and include the placebo effect, the tendency for physicians and patients to want the treatment to work, and the effect of regression to the mean.[1,2] We hypothesised that the objectivity of n of 1 trials in determining treatment in a single patient would lead to a better outcome over standard practice—including the use of less medication—when n of 1 trials are used in groups of patients. Randomised studies confirming this hypothesis would support the wider use of n of 1 trials. At present n of 1 trials are rarely used despite their suitability for many problems.[2-17] We report a randomised study of n of 1 trials versus standard practice for theophylline for irreversible chronic airflow limitation.

Patients and methods

We chose to study treatment with theophylline for irreversible chronic airflow limitation because the disease is common and the treatment and disease meet prerequisites for n of 1 trials.[1] Specifically, chronic airflow limitation is comparatively stable; theophylline acts and, once withdrawn, stops acting quickly; and theophylline does not change the natural course of the disease. In addition, though the efficacy of theophylline for irreversible chronic airflow limitation has been established in conventional randomised controlled trials, its efficacy in individual patients is often in doubt.[18,19]

PATIENT CHARACTERISTICS AND ETHICS

Patients were recruited from a chronic airflow limitation clinic and the outpatient practice of a general physician. Irreversible chronic airflow limitation required a forced expiratory volume in one second <70% of predicted and a ratio of forced expiratory volume in one second to forced vital capacity <70% of predicted on two occasions within two weeks. Twenty five of 31 randomised patients had forced expiratory volumes in one second that did not increase by more than 15% (or 200 ml) after inhaled salbutamol. The other six patients (four randomised to n of 1 trials, two randomised to standard practice) did not have spirometry before and after salbutamol at entry but were judged clinically to have non-significant reversibility.

All patients had taken theophylline for one to five years before entry with a dosing schedule established clinically and by monitoring blood concentrations of the drug, and all but two were taking the drug at the time of recruitment. These two patients (one randomised to n of 1 trials, the other randomised to the standard practice group) had stopped theophylline within three months before first contact by study personnel because of lack of apparent benefit. For both patients an open trial of theophylline was given for two weeks at the previously used dose and a predose theophylline concentration determined to be in the therapeutic range (50-110 μmol/l). All patients were uncertain that theophylline was helpful while taking it openly. This was established by the patient not answering yes to the question, "Are you certain that theophylline is helping you?" Patients fulfilling the entry criteria were randomised by coin toss to either n of 1 trials or standard treatment by a person unaware of their baseline characteristics.